Chapter 16

The Fed, Money, and Credit

CHAPTER HIGHLIGHTS

- The Federal Reserve provides the monetary base (bank reserves and currency) upon which the money supply (currency and deposits) is built.
- The primary tool for controlling the money supply is open market purchases, purchases of bonds paid for with newly printed money.
- The Federal Reserve chooses both intermediate and ultimate targets. The key consideration in choosing targets is uncertainty about different kinds of economic shocks.

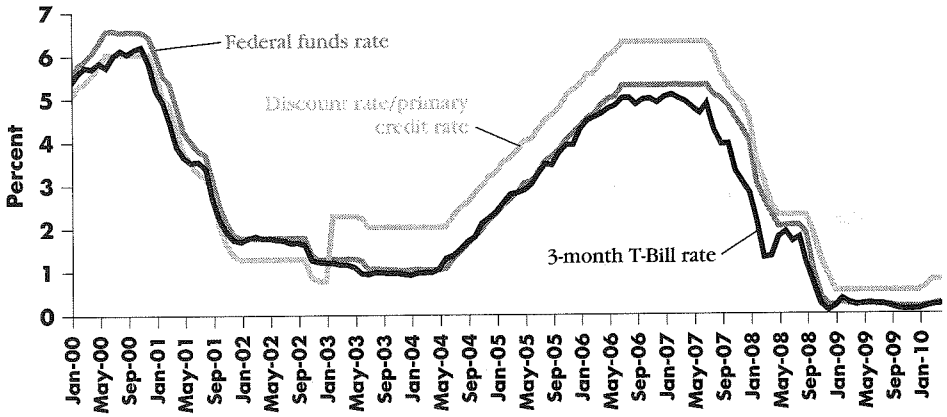

FIGURE 16-1 U.S. INTEREST RATES, 2000–2010.
(Source: Federal Reserve Economic Data [FRED II].)

In the recession of 2001, the Fed cut interest rates repeatedly as can be seen in Figure 16-1. In his semiannual monetary policy report to the Congress, then Federal Reserve Chairman Alan Greenspan affirmed that

> By aggressively easing the stance of monetary policy, the Federal Reserve has moved to support demand and, we trust, help lay the groundwork for the economy to achieve maximum sustainable growth. Our accelerated action reflected the pronounced downshift in economic activity, which was accentuated by the especially prompt and synchronous adjustment of production by businesses utilizing the faster flow of information coming from the adoption of new technologies. A rapid and sizable easing was made possible by reasonably well-anchored inflation expectations, which helped to keep underlying inflation at a modest rate, and by the prospect that inflation would remain contained as resource utilization eased and energy prices backed down.[1]

In the Great Recession of 2007–2009, the Fed cut interest rates even more aggressively. In fact, the Fed drove interest rates just about all the way to zero. What precisely does the Fed do to adjust interest rates?

16-1

MONEY STOCK DETERMINATION: THE MONEY MULTIPLIER

The money supply consists mostly of deposits at banks,[2] which the Fed does not control directly. In this section we develop the details of the process by which the money supply

[1]Testimony of Alan Greenspan before the Committee on Financial Services, U.S. House of Representatives, July 18, 2001.

[2]We refer to all deposit-taking institutions, including savings and loan associations, mutual savings banks, and credit unions, as "banks."

is determined, and particularly the role of the Fed. The key concept to understand is *fractional reserve banking*. In a world in which only gold coins were money and in which the king reserved to himself the right to mint coins, the money supply would equal the number of coins minted. Contrast this with a futuristic cashless society in which all payments are made by electronic transfers through banks and in which the law requires (here's where the "fractional reserve" part comes in) banks to hold gold coins equal to 20 percent of their outstanding deposits. In this latter case, the money available to the public would be 5 times the number of gold coins (coins/.20). The coins would not be used as money. Rather, the coins would form a "base" supporting deposits available through the banking system. The real money supply is determined by a blend of these two fictional systems.

High-powered money (or the monetary base) consists of currency (notes and coins) and banks' deposits at the Fed. The part of the currency held by the public forms part of the money supply. The currency in bank vaults and the banks' deposits at the Fed are used as reserves backing individual and business deposits at banks. The Fed's control over the monetary base is the main route through which it determines the money supply.

The Federal Reserve has direct control over high-powered money, H. We are interested in the supply of money, M. The two are linked by the money multiplier, mm. Before going into details, we want to think briefly about the relationship between the money stock and the stock of high-powered money (see Figure 16-2). At the top of the figure we show the stock of money. At the bottom we show the stock of high-powered money, also called the *monetary base*. As we said, money and high-powered money are related by the *money multiplier*. The money multiplier is the ratio of the stock of money to the stock of high-powered money. The money multiplier is larger than 1. It is clear from the diagram that the larger deposits are as a fraction of the money stock, the larger the multiplier is. That is true because currency uses up a dollar of high-powered money per dollar of money. Deposits, by contrast, use up only a fraction of a dollar of high-powered money (in reserves) per dollar of money stock. For instance, if the reserve ratio is 10 percent, every dollar of the money stock in the form of deposits uses up only 10 cents of high-powered money. Equivalently, each dollar of high-powered money held as bank reserves can support $10 of deposits.

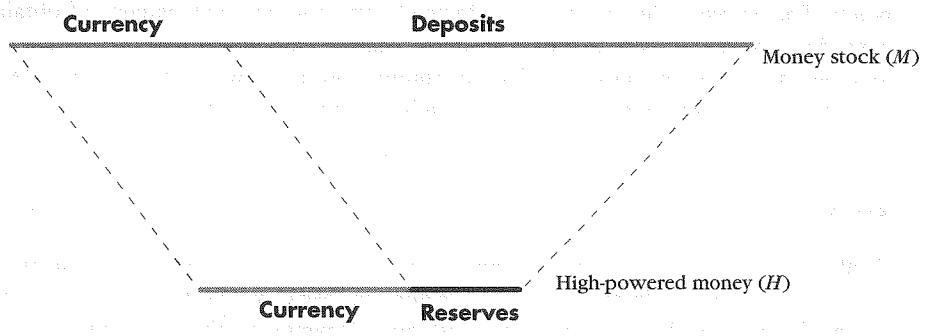

FIGURE 16-2 RELATIONSHIP BETWEEN HIGH-POWERED MONEY AND THE MONEY STOCK.

For simplicity, ignore the distinction between various kinds of deposits (and thus the distinction between different *M*s) and consider the money supply process as if there were only a uniform class of deposits, *D*. Using this simplification, the money supply consists of currency, *CU*, plus deposits:

$$M = CU + D \tag{1}$$

High-powered money consists of currency plus reserves:

$$H = CU + \text{reserves} \tag{2}$$

We summarize the behavior of the public, the banks, and the Fed in the money supply process by three variables: the *currency-deposit ratio,* $cu \equiv CU/D$; the *reserve ratio,* $re \equiv \text{reserves}/D$; and the stock of high-powered money. Rewrite equations (1) and (2) as $M = (cu + 1)D$ and $H = (cu + re)D$. In this way we can express the money supply in terms of its principal determinants, *re*, *cu*, and *H*:

$$M = \frac{1 + cu}{re + cu} H \equiv mm \times H \tag{3}$$

where *mm* is the money multiplier given by

$$mm \equiv \frac{1 + cu}{re + cu}$$

- The money multiplier is larger the smaller the reserve ratio, *re*.
- The money multiplier is larger the smaller the currency-deposit ratio, *cu*. That is because the smaller the *cu*, the smaller the proportion of the high-powered money stock that is being used as currency (which translates high-powered money only one-for-one into money) and the larger the proportion that is available to be reserves (which translates much more than one-for-one into money).

We turn now to the determinants of the reserve and currency-deposit ratios.

THE CURRENCY-DEPOSIT RATIO

The payment habits of the public determine how much currency is held relative to deposits. The currency-deposit ratio is affected by the cost and convenience of obtaining cash; for instance, if there is a cash machine nearby, individuals will on average carry less cash with them because the costs of running out are lower. The currency-deposit ratio has a strong seasonal pattern, being highest around Christmas.

THE RESERVE RATIO

Bank reserves consist of deposits banks hold at the Fed and "vault cash," notes and coins held by banks. In the absence of regulation, banks would hold reserves to meet (1) the demands of their customers for cash and (2) payments their customers make by checks that are deposited in other banks. However, in the United States banks hold

BOX 16-1 Deposit Insurance and Bank Runs

Many banks failed in the 1930s; that is, they were unable to meet the demands of their depositors for cash. If you have a deposit in a failed bank, you cannot "get your money out." Anyone who believes his or her bank may run out of cash will rush to the bank to try to withdraw money before the other depositors. A *run on a bank* occurs when depositors rush to try to withdraw cash because they believe others will also try to do so. There may be good reasons for the running investors to worry about the bank's safety, but it is even possible that a run on a fundamentally sound bank may occur precisely because its depositors believe that a run on the bank is likely to occur.*

Bank runs have both microeconomic and macroeconomic effects. The former takes the form of *disintermediation*. Having lost deposits, banks are no longer able to make loans to support business investment and purchases of private homes. The latter takes the form of an increase in the currency-deposit ratio, *cu*, and, therefore, a drop in the money multiplier. Unless the central bank offsets this by increasing the monetary base, the macroeconomic effect is a drop in the money supply.

The massive bank failures of the 1930s, as a consequence of runs on banks, gave rise to an important institutional reform, the creation of the *Federal Deposit Insurance Corporation (FDIC)*. That institution insures bank deposits, so depositors get paid even if a bank fails. That means there is no reason to worry about losing your money if your bank fails; as a result, bank runs have been rare since the 1930s.† Bank failures virtually disappeared between 1940 and 1979, but in the 1980s they became a more serious problem. During the Great Recession many banks failed, but no ordinary depositor lost any money. The frequency of bank failure today is much lower than in the early 1930s, and—because of the FDIC—the economic consequences are much less serious now.

*The notion of self-justifying runs on banks has both intuitive appeal and historical support. It has been formalized in an ingenious but very difficult article by Douglas Diamond and Philip Dybvig, "Bank Runs, Deposit Insurance and Liquidity," *Journal of Political Economy,* June 1983. A less technical example appears in the movie *It's a Wonderful Life,* with Jimmy Stewart.

†In the 1980s there were runs on thrift institutions in Ohio and Rhode Island whose deposits were not covered by federal insurance.

reserves primarily because the Federal Reserve requires them to.[3] In addition to these *required reserves,* banks hold some *excess reserves* in order to meet unexpected withdrawals. Because reserves earn little interest, banks try to minimize excess reserves. When market interest rates are high, banks try especially hard to keep excess reserves to

[3]During the Great Recession, excess reserves rose massively as banks were afraid to make risky loans. This extremely rare event dramatically changed the money multiplier.

a minimum. So while *re* is mostly determined by regulation,[4] high interest rates do to a limited extent reduce *re*.

Banks have to keep reserves in the form of notes and coins because their customers have a right to currency on demand. They keep accounts at the Fed mainly to make payments among themselves. Thus, when I pay you with a check drawn on my bank account, which you deposit in your bank, my bank makes the payment by transferring money from its account at the Fed to your bank's account at the Fed.[5] Banks can also use their deposits at the Fed to obtain cash; the Fed sends the cash over in an armored truck on request.

16-2

THE INSTRUMENTS OF MONETARY CONTROL

The Federal Reserve has three instruments for controlling the money supply: *open market operations,* the *discount rate,* and the *required-reserve ratio*. As a practical matter, open market operations are nearly always the tool of choice.

AN OPEN MARKET PURCHASE

The method by which the Fed most often changes the stock of high-powered money is an open market operation.[6] We examine the mechanics of an *open market purchase,* an operation in which the Fed buys, say $1 million of government bonds from a private individual. An open market purchase *increases* the monetary base.

The accounting for the Fed's purchase is shown in Table 16-1. The Fed's ownership of government securities rises by $1 million, which is shown in the "Government securities" entry on the assets side of the balance sheet. How does the Fed pay for the bond? It writes a check on itself. In return for the bond, the seller receives a check instructing

TABLE 16-1 Effects of an Open Market Purchase on the Fed Balance Sheet
(Millions of Dollars)

ASSETS		LIABILITIES	
Government securities	+1	Currency	0
All other assets	0	Bank deposits at Fed	+1
Monetary base (sources)	+1	Monetary base (uses)	+1

[4]This is so in the United States. In Canada and the United Kingdom, for example, reserve requirements are not set by regulation.

[5]Many banks, particularly small ones, hold their reserves in the form of deposits at other banks. These *interbank deposits* serve the same function as reserves but are not included in the U.S. measure of reserves. They are excluded from the definitions of the money stock.

[6]A very nice description of the hard details of open market operations is given in M. A. Akhtar, "Understanding Open Market Operations," Federal Reserve Bank of New York *Review,* 1997.

the Fed to pay (the seller) $1 million. The seller takes the check to his or her bank, which credits the depositor with the $1 million and then deposits the check at the Fed. That bank has an account at the Fed; the account is credited with $1 million, and the "Bank deposits at Fed" entry on the liabilities side of the balance sheet rises by $1 million. The commercial bank has just increased its reserves by $1 million, which are held in the first instance as a deposit at the Fed.

The only unexpected part of the story is that the Fed can pay for the securities it bought by giving the seller a check on itself. The eventual owner of the check then has a deposit at the Fed. That deposit can be used to make payments to other banks, or it can be exchanged for currency. Just as the ordinary deposit holder at a bank can obtain currency in exchange for deposits, the bank deposit holder at the Fed can acquire currency in exchange for its deposits. When the Fed pays for the bond by writing a check on itself, it creates high-powered money with a stroke of the pen. The striking result is that **the Fed can create high-powered money at will merely by buying assets, such as government bonds, and paying for them with its own liabilities.**

THE FED BALANCE SHEET

Tables 16-2 and 16-3 show two ways of looking at the balance sheets of the Federal Reserve system. Table 16-2 shows the principal assets and liabilities of the Fed: government bonds and currency. Table 16-3 shows the monetary base and two different ways of looking at reserves. Most reserves are required, and only a small fraction is borrowed at the discount window.

FOREIGN EXCHANGE AND THE BASE

The Fed sometimes buys or sells foreign currencies in an attempt to affect exchange rates. These purchases and sales of foreign exchange—*foreign exchange market intervention*—affect the base. Note from the balance sheet that if the central bank buys gold[7] or foreign exchange, there is a corresponding increase in high-powered money, as

TABLE 16-2 Main Assets and Liabilities of All Federal Reserve Banks, June 14, 2006
(Billions of Dollars)

ASSETS (SOURCES)		LIABILITIES (USES)	
Gold and special drawing rights certificate account	$ 13.24	Federal Reserve notes	$758.10
Total U.S. government securities	766.25	Total deposits	25.17

Source: Federal Reserve Board, *Factors Affecting Reserve Balances*, June 15, 2006.

[7]The Fed's 2002 holdings of gold were about $11.0 billion, valued at $42 an ounce. The market value of the gold is much higher, since the market price of gold is far above $42 per ounce. In the problem set, you are asked to show how the balance sheet would be affected if the Fed decided to value its gold at the free-market price.

TABLE 16-3 Aggregate Reserves of Depository Institutions and the Monetary Base, April 2006 and March 2010
(Billions of Dollars)

	2006	2010
Reserves of depository institutions	$ 44.58	$1,186.30
Required reserves	42.77	65.70
Excess reserves	1.82	1,120.60
Reserves of depository institutions	44.58	1,186.30
Nonborrowed reserves	44.33	1,094.66
Borrowed reserves	0.25	91.64
Monetary base	801.96	2,075.38
Vault cash in excess of required reserves	18.78	13.68
Currency	738.60	875.40
Reserves	44.58	1,186.30

Source: Federal Reserve Board, *Aggregate Reserves of Depository Institutions and the Monetary Base; Money Stock Measures,* June 15, 2006 and May 13, 2010; Federal Reserve Economic Data (FRED II).

the Fed pays with its own liabilities for the gold or foreign exchange that is purchased. Thus, foreign exchange market operations affect the base.[8] However, the Fed frequently pairs foreign exchange purchases with offsetting open market operations precisely to avoid changing the base. Such offset purchases are said to be "sterilized." (For further discussion, see Chapter 20.)

LOANS AND DISCOUNTS

A bank that runs short of reserves can borrow to make good the deficiency. It may borrow either from the Fed or from other banks that have spare reserves. The cost of borrowing from the Fed is the *discount rate.* **The discount rate is the interest rate charged by the Fed to banks that borrow from it to meet temporary needs for reserves.**[9] The discount rate is the explicit cost of Fed borrowing, but there is also an implicit cost, since the Fed frowns on banks that try to borrow from it too often.

The cost of borrowing from other banks is the *federal funds rate.* **Federal funds are reserves that some banks have in excess and others need.** The federal funds rate varies together with other market rates and can be affected by the Fed. Figure 16-3 shows three interest rates: the 3-month Treasury bill rate, the federal funds rate, and

[8]Details of this impact may be complicated by the fact, which we do not pursue, that the Fed and the Treasury usually collaborate in foreign exchange intervention.

[9]In 2003, the Fed changed the name from "discount rate" to "primary credit rate," but people still tend to call it the discount rate, so that's the term we will use. If you are looking for recent data look for "primary credit rate." There is also a "secondary credit rate" and a "seasonal credit rate."

BOX 16-2 The Fed as Lender of Last Resort

An important function assigned to central banks since the nineteenth century is to act as "lender of last resort." When financial panic threatens the collapse of the financial system, swift action by the central bank can restore confidence and avoid a systemwide run on financial intermediaries, a freezing of credit lines, or, worse, a widespread calling in of loans. The Fed does act in this role whenever major financial institutions go under or whenever there is a serious risk of instability, as when the stock market fell 20 percent on one day in the October 1987 collapse and as when financial markets froze in 2008.

The need for a lender of last resort emerges from the following consideration: The credit system is by its very nature *illiquid,* though not *insolvent*—various debtors can repay their loans given time but cannot do so on demand. But many liabilities, for example, bank deposits or large CDs of banks and corporations, have very short maturities. If all creditors ask for their assets, many of the debtors would not be able to pay and would have to default.

Now imagine that a major financial institution, say First Bank of Nowhere (First, for short) has payment difficulties. Other financial institutions may well have lent to First and will want to recover their money before anyone else. A bank run starts. Other financial institutions are aware that *some* institutions have lent to First, cannot recover their loans, and are therefore vulnerable themselves, as are their creditors in turn. There arises a general uncertainty as to who lent to whom and who is in trouble because someone (or many) in the many layers of credit and intermediation cannot meet redemption demands. As a result, *all* credit freezes; nobody wants to lend to anyone because everyone is afraid of being pulled into the default. But if nobody wants to lend, short-term credit lines cannot be rolled over, and many institutions become illiquid. The process deteriorates in a 1930s-style financial collapse as assets are liquidated to recover liquidity.

The Fed enters in such a situation by *isolating* the center of the storm, guaranteeing the liabilities of the individual financial institution (beyond the guarantees of the FDIC). The guarantee assures everybody that third parties will not suffer losses and hence not become a risk.* Thus, the lender-of-last-resort function prevents spillover effects to the credit market of individual payment difficulties. But the function also comes into its own when there is a marketwide problem. Walter Bagehot (1826–1877) in his famous 1873 book, *Lombard Street,* gave the classic prescription: *"During crisis discount freely!"*

Milton Friedman and Anna Schwartz, in their *A Monetary History of the United States,* blamed the Fed for not responding to the systemwide problems induced by the stock market crash of 1929, thus violating Bagehot's prescription. But during the stock market crash of 1987, the lesson had been learned. Then Fed Chairman Alan Greenspan did not hesitate. He announced that the Fed stood behind the banking system. The Fed immediately reduced interest rates, providing much needed liquidity that would help stem the risk of a credit collapse.

*Knowing that the Fed stands ready to bail them out in case of trouble, bank managers have an incentive to take too many risks. To discourage such behavior, the Fed often fires bank managers and eliminates stockholder equity when bailing out a bank.

BOX 16-3 The Fed as Market Maker of Last Resort

In Box 16-2 we discussed the Fed's role as "lender of last resort." During the financial crisis in 2008–2009 the Fed stepped past the role of lender and became a "market maker" for certain critical financial markets. During the crisis, financial institutions became afraid to trade with one another because they were unsure who was solvent. That fear brought many routine financial interactions to a grinding halt. The Fed stepped in and "made markets" by trading in assets that it hadn't in the past. These trades brought the markets back to life and averted a prolonged meltdown.

Traditionally, the Fed has mostly bought a very limited array of financial assets. Specifically, open market operations are usually conducted on short-term, U.S. Treasury bills. One very good reason for this limitation is that the Fed is a *very* big player in financial markets and wants to avoid distorting microeconomic incentives by driving prices up or down for particular private sector assets. In the emergency of 2007–2009, the Fed decided that keeping markets working was the more important issue, and so bought hundreds of billions of dollars of assets related to money market funds, the commercial paper market, and a variety of other assets that it hadn't traditionally held. Even as the Fed established new "facilities" (names of some of the largest included "Term Auction Facility," "Term Securities Lending Facility," and "Primary Dealer Credit Facility"), it also announced plans to unwind these novel transactions and eventually get back to the business of primarily dealing in Treasury bills.

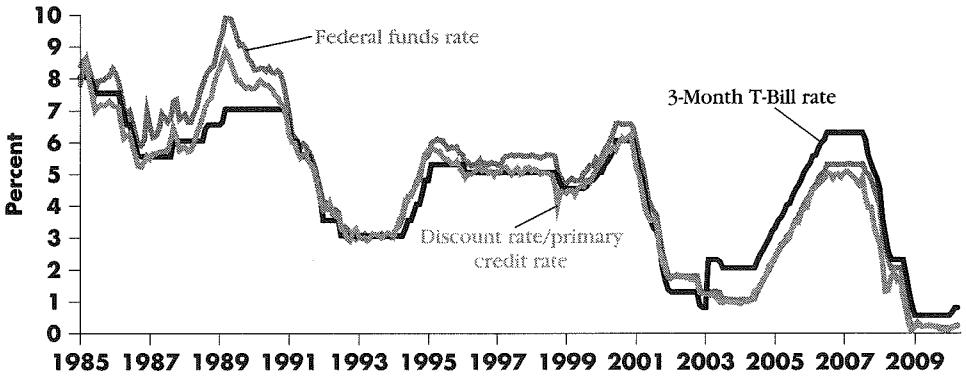

FIGURE 16-3 THE THREE MAJOR U.S. INTEREST RATES, 1985–2010.
(Source: Federal Reserve Economic Data [FRED II].)

BOX 16-4 The Discount Rate Is Not Itself a Component of a Bank's Cost of Funds

It is often thought that banks obtain funds primarily from the Fed and that, as a result, changes in the discount rate directly change the banks' cost of funds. Changes in the discount rate sometimes affect market interest rates through the money supply mechanism, but the amount banks borrow from the Fed is completely trivial as a component of costs (except in rare emergencies, such as the recession that began in 2007). For example, in June 2006, borrowing from the Fed equaled about 0.03 percent of loans and securities at depository institutions.

Discount rate changes used to serve two functions: (1) They signaled the Fed's intentions; (2) they affected the free-market federal funds rate. However, today the Fed links the discount rate to the federal funds rate explicitly to avoid both of these effects.

In some countries other than the United States, the central bank is a more significant source of funds for the banking system.

the discount rate. You can see that in the big picture, all the rates move closely together. To a banker of course, the remaining small differences represent opportunities to make money.

The Fed provides *high-powered money* to banks that need it temporarily by lending to them at the discount rate. Banks' willingness to borrow from the Fed is affected by the discount rate, which accordingly influences the volume of borrowing. Since borrowed reserves are also part of high-powered money, the Fed's discount rate has some effect on the monetary base. However, the real role of the discount rate is as a signaling mechanism of Fed intentions. When the Fed increases the discount rate, banks and financial markets take this as a signal that the Fed intends to reduce the money supply and increase market interest rates.

What happens when the Fed raises interest rates and does *not* increase the discount rate? Banks have an incentive to borrow more from the Fed, since the banks can then relend the funds at the higher interest rate. Historically, the Fed frequently changed the discount rate along with market interest rates to prevent "profiteering" of this sort. But then the Fed needed to convince the market that the change in the discount rate was *not* intended to send a signal. In 2003, the Fed changed the operation of the discount window so that the discount rate would float up and down as the Fed's target for the federal funds rate changed. The discount rate is set higher—initially 1 percentage point higher—than the Fed funds rate.

THE RESERVE RATIO AND INTEREST ON RESERVES

Looking at the money multiplier in equation (3), it is easy to see that the Fed can increase the money supply by reducing the required-reserve ratio. However, this has not been done in recent years.

Until 2008 reserves paid no interest in the United States, although other countries did pay interest on reserves. During the financial crisis the Fed began paying interest at a rate pegged to its target for the federal funds rate. Initially at least, the interest rate on excess reserves was set to be 75 basis points below the federal funds target. Doing this more or less guarantees that the actual federal funds rate will never be more than 75 basis points below the target rate. (However, historically this has not been much of an issue.) In this way, paying interest on excess reserves gives the Fed an extra tool for setting interest rates.

Under the new rules interest is also paid on required reserves at a rate just under the targeted federal funds rate. This reduces the opportunity cost gap between what banks earn on required reserves and what could be earned if they were allowed to loan the funds in the open market. The flip side of this is that the interest paid to banks is no longer turned over to the Treasury.

FINANCING FEDERAL DEFICITS

The U.S. Treasury maintains an account at the Fed and makes payments to the public by writing checks on its Fed account. The relationship between the Fed and the Treasury helps clarify the financing of government budget deficits.

Budget deficits can be financed by the Treasury's borrowing from the public. In that case, the Treasury sells bonds to the public. The public pays for the bonds with checks, which the Treasury deposits in an account it holds in a commercial bank, thereby making sure it does not affect the stock of high-powered money. When the Treasury uses the proceeds of the bond sales to make a payment, it moves the money into its Fed account just before making the payment. As a result, the monetary base is not affected by the Treasury's deficit financing, except for the short time between which the Treasury moves the money into its Fed account and then pays it out.

Alternatively, the Treasury can finance its deficit by borrowing from the Fed. It is simplest to think of the Treasury's selling a bond to the Fed instead of to the public. When the bond is sold, the Fed's holdings of government securities increase and, simultaneously, Treasury deposits (a liability of the Fed) rise. But then when the Treasury uses the borrowed money to make a payment, the stock of high-powered money rises. Accordingly, when a budget deficit is financed by the Treasury's borrowing from the Fed, the stock of high-powered money is increased.

We often talk of central bank financing of government deficits as financing through the printing of money. Typically, the deficit is not literally financed by the central bank through the printing of money, but central bank financing increases the stock of high-powered money, which comes to much the same thing.

In some countries the central bank automatically finances the treasury and may be subordinated to the treasury. In the United States, by contrast, the Federal Reserve answers to Congress and is not legally obliged to finance government deficits by buying

bonds. Thus, it still retains its ability to control the stock of high-powered money even when the Treasury is running a budget deficit.

16-3

THE MONEY MULTIPLIER AND BANK LOANS

We now present an alternative way of describing the workings of the money multiplier by showing how adjustments by banks and the public following an increase in the monetary base produce a multiple expansion of the money stock.

A Fed open market purchase increases the monetary base. To start with, the increase in the base shows up as an increase in bank reserves. The reason is that the Fed pays for the securities by writing a check on itself, which the seller of the securities deposits in his or her bank account. The bank in turn presents the check for collection to the Fed and will be credited with an increase in its reserve position at the Fed.

The bank in which the original check was deposited now has a reserve ratio that is too high. Its reserves and deposits have gone up by the same amount. Therefore, its ratio of reserves to deposits has risen. To reduce the ratio of reserves to deposits, it increases its lending.

When the bank makes a loan, the person receiving the loan gets a bank deposit. At this stage, when the bank makes a loan, **the money supply has risen by more than the amount of the open market operation.** The person who sold the security to the Fed has increased his or her holdings of money by the value of the bonds sold. The person receiving the loan has a new bank deposit and thus the process has already generated a multiple expansion of the money stock.

In the subsequent adjustment, part of the increase in high-powered money finds its way into the public's holdings of currency and part serves as the basis for an expansion of lending by the banking system. When banks lend, they do so by crediting the deposits of their loan customers with the loan. Banks therefore create money whenever they make loans.

The expansion of loans, and hence money, continues until the reserve-deposit ratio has fallen to the desired level and the public again has achieved its desired currency-deposit ratio. The money multiplier summarizes the total expansion of money created by a dollar increase in the monetary base.

16-4

CONTROL OF THE MONEY STOCK AND CONTROL OF THE INTEREST RATE

We make a simple but important point in this section: **The Fed cannot simultaneously set both the interest rate and the stock of money at any given target levels that it may choose.**

Figure 16-4 illustrates this point. Suppose that the Fed, for some reason, wants to set the interest rate at a level i^* and the money stock at a level M^* and that the

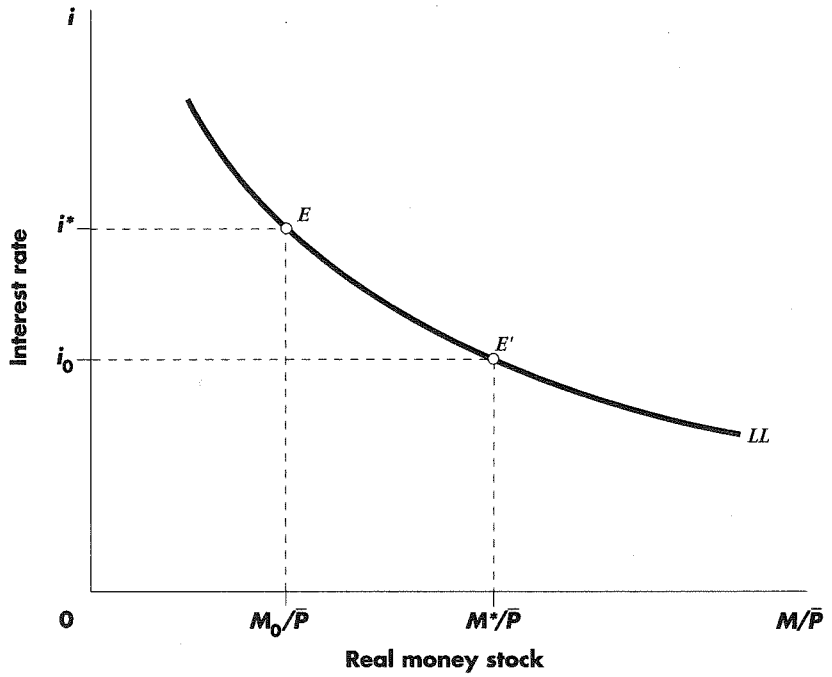

FIGURE 16-4 RELATIONSHIP BETWEEN THE REAL MONEY STOCK AND INTEREST RATES.

demand-for-money function is as shown by *LL*. The Fed can move the money supply function around, but it cannot move the money demand function around. It can set only the combinations of the interest rate and the money supply that lie along *LL*. At interest rate i^*, it can have money supply $M_0 / \overline{P}$. At target money supply $M^* / \overline{P}$, it can have interest rate i_0. But it cannot have both $M^* / \overline{P}$ and i^*.

The point is sometimes put more dramatically, as follows: When the Fed decides to set the interest rate at some given level and keep it fixed—a policy known as *pegging the interest rate*—it loses control over the money supply. If the money demand curve were to shift, the Fed would have to supply whatever amount of money was demanded at the pegged interest rate.

The Fed in its day-to-day operations can more accurately control interest rates than the money stock. The Fed buys and sells government securities through its *open market desk* at the New York Fed every day. If it wants to raise the price of government securities (lower the interest rate), it can buy the securities at that price. If it wants to reduce the price of government securities (raise the interest rate), it can sell a sufficient amount of securities from its large portfolio. Thus, on a day-to-day basis, the Fed can determine the market interest rate quite accurately.[10]

[10]For a description of techniques of monetary control, see Daniel Thornton, "The Borrowed-Reserves Operating Procedure: Theory and Evidence," Federal Reserve Bank of St. Louis *Review,* January–February 1988.

These are *technical* reasons why the Fed cannot hit the target stock of money exactly even if it wants to. But over a slightly longer period, the Fed can determine the money supply fairly accurately. As data on the behavior of the money stock and the money multiplier become available, the Fed can make midcourse corrections to its setting of the base. For example, if the Fed were aiming for monetary growth of 5 percent over a given period, it might start the base growing at 5 percent. If it found halfway into the period that the multiplier had been falling, and the money stock therefore growing by less than 5 percent, the Fed would step up the growth rate of the base to compensate.

The main reasons the Fed does not hit its money growth targets are not technical but, rather, have to do with its having both interest rate *and* money stock targets, and as we have seen in this section, it cannot hit them both at the same time.

16-5

MONEY STOCK AND INTEREST RATE TARGETS

Over the period since the 1950s, the emphasis the Fed has placed on controlling the interest rate versus controlling the money supply has changed. Initially the emphasis was almost entirely on interest rates—indeed, it was not until 1959 that the Fed even began to publish money stock data. Until 1982 the emphasis on monetary targets increased more or less steadily. Since then the emphasis has shifted back increasingly toward interest rates and to a more eclectic approach to monetary policy.[11] Today, short-run targeting is entirely in terms of interest rates.

In this section we discuss the issues involved in the choice between interest rate and money stock targets. The analysis we present here is based on a classic article by William Poole.[12]

We assume that the Fed's aim is to have the economy reach a particular level of output. The analysis, which uses the *IS-LM* model, applies to a short period such as three to nine months. In Figure 16-5, the *LM* curve labeled *LM(M)* is the *LM* curve that exists when the Fed fixes the money stock. The *LM* curve labeled *LM(i)* describes money market equilibrium when the Fed fixes the interest rate. It is horizontal at the chosen level of the interest rate, i^*.

The problem for policy is that the *IS* and *LM* curves shift unpredictably. When they shift, output ends up at a level different from the target level. In Figure 16-5*a* we show two alternative positions for the *IS* curve: IS_1 and IS_2. We assume that the Fed does not know in advance which will be the true *IS* curve: The position depends, for instance, on investment demand, which is difficult to predict. The Fed's aim is to have income come out as close as possible to the target level, Y^*.

[11]See Ann-Marie Meulendyke, "A Review of Federal Reserve Policy Targets and Operating Guides in Recent Decades," Federal Reserve Bank of New York *Quarterly Review,* Autumn 1988.

[12]W. Poole, "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model," *Quarterly Journal of Economics,* May 1970.

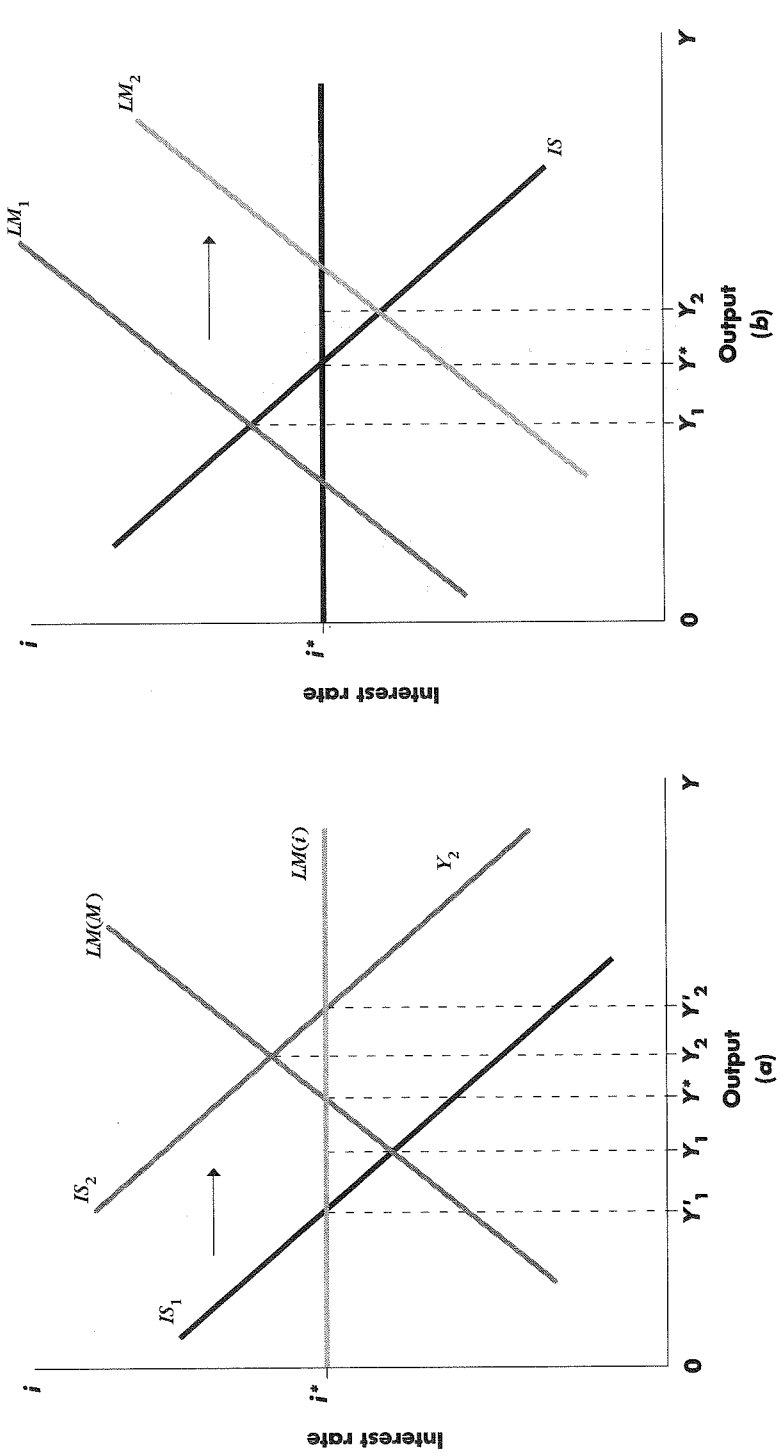

FIGURE 16-5 MONEY STOCK AND INTEREST RATE TARGETS.

In Figure 16-5*a* we see that the level of output stays closer to Y^* if the *LM* curve is *LM(M)*. In that case the level of output will be Y_1 if the *IS* curve is IS_1 and Y_2 if the *IS* curve is IS_2. If policy had kept the interest rate constant, we would in each case have a level of income that is further from Y^* : Y'_1 instead of Y_1, and Y'_2 instead of Y_2.

Thus, we have our first conclusion: **If output deviates from its equilibrium level mainly because the *IS* curve shifts about, output is stabilized by keeping the money stock constant. The Fed should, in this case, have a money stock target.**

We can see from Figure 16-5*a* why it is more stabilizing to keep *M* rather than *i* constant. When the *IS* curve shifts to the right and the *LM(M)* curve applies, the interest rate rises, thereby reducing investment demand and moderating the effect of the shift. But if the *LM(i)* curve applies, there is no resistance from monetary policy to the effects of the *IS* shift. Monetary policy is thus automatically stabilizing in Figure 16-5*a* when the *IS* curve shifts and the money stock is held constant.

In Figure 16-5*b* we assume that the *IS* curve is stable. Now the uncertainty about the effects of monetary policy results from shifts in the *LM* curve. Assuming that the Fed can fix the money stock, the *LM* curve shifts because the money demand function shifts. When it sets the money stock, the Fed does not know what the interest rate will be. The *LM* curve could end up being either LM_1 or LM_2. Alternatively, the Fed could simply fix the interest rate at level i^*. That would ensure that the level of output is Y^*.

If the Fed were to fix the money stock, output could be either Y_1 or Y_2. If it fixes the interest rate, output will be Y^*. Thus, we have our second conclusion: **If output deviates from its equilibrium level mainly because the demand-for-money function shifts about, the Fed should operate monetary policy by fixing the interest rate.** That way it automatically neutralizes the effects of the shifts in money demand. In this case the Fed should have interest rate targets.

The Poole analysis helps explain why the Fed stopped specifying *M*1 targets from 1987 on, while continuing to target *M*2 (and other monetary targets). The increasing instability of the demand for *M*1 limited its usefulness as a monetary target. Similarly, the unpredictability of the growth of all the monetary aggregates in the last few years has led to the increasing weight on interest rates.

In practice, the Federal Reserve sets its short-term targets in terms of interest rates, specifically, the federal funds rate. The Federal Open Market Committee (FOMC) typically meets every six weeks and announces a federal funds rate target, although in turbulent times the FOMC can meet more frequently or even set rates following a teleconference. But while the immediate target is an interest rate, the Fed looks carefully at the money supply, output, unemployment, inflation, and other factors in deciding whether to raise or lower its target.

THE SHORT RUN AND THE LONG RUN

It is important to note that the Poole argument discusses Fed targeting over short periods. The Fed is *not* to be thought of as announcing or desiring that the interest rate will be, say, 8 percent forever. Rather, the Fed should readjust its targets in light of the changing behavior of the economy: The target interest rate might be 5 percent

at the bottom of a recession and 15 percent when the economy is overheating. Similarly, the money growth targets could also be adjusted in response to the state of the economy.

Monetarist proponents of money stock targeting might agree with the technical details of the Poole analysis but still argue that it is a mistake to target interest rates rather than money. They argue that increases in the money stock lead eventually to inflation and that the only way to avoid inflation in the long run is by keeping money growth moderate. The problem with focusing on interest rates, they suggest, is that while the Fed keeps its eye on interest rates, the growth rate of money and the inflation rate often tend to increase.[13] This argument appears to fit the facts of the 1960s and 1970s well.

However, that experience has led the Fed to watch inflationary trends very closely and to tighten policy when inflation threatens. That experience, and the monetarist analysis, has also led the Fed to set monetary targets for itself and, when it misses the targets, to appraise carefully the reasons for the miss. At the same time, it pays attention to interest rates in case its monetary targets lead in the short run to recession or inflation if there are shifts in money demand.

16-6

MONEY, CREDIT, AND INTEREST RATES

The Fed watches not only the money supply and interest rates but also the increase in the total *debt* of the nonfinancial sectors, that is, the debt of the government, households, and firms other than financial firms. Their debt is equal to the *credit* (lending) that has been extended to them. Thus, the Fed can also be described as having *credit targets*.

Why? In the first instance, this is a very old approach of the Fed, which had credit targets in the 1950s. The Fed returned to them in 1982 in part because of econometric evidence, presented by Benjamin Friedman of Harvard, showing that there was a tighter link between the volume of debt and GNP than between money and nominal GNP.[14]

At a fundamental level, proponents of the credit view, such as Federal Reserve chairman Ben Bernanke and Mark Gertler of New York University, argue for the importance of the extent of financial intermediation—the volume of lending and borrowing through financial institutions—in the economy. Financial intermediation occurs when financial institutions channel funds from savers to investors, as banks do when they lend funds deposited with them to borrowers who want to invest. Bernanke's research suggests that a large part of the decline in output in the Great Depression was the result of

[13]Another argument for money targeting arises from the distinction between real and nominal interest rates. The nominal interest rate can rise because inflation is expected. If the Fed fights this increase in the nominal rate by increasing the money stock, it is only feeding the inflation. We will examine this argument in Chap. 17.

[14]B. Friedman, "The Roles of Money and Credit in Macroeconomic Analysis," in James Tobin (ed.), *Macroeconomics, Prices, and Quantities* (Washington, DC: The Brookings Institution, 1983).

the breakdown of the financial system and the collapse in the quantity of credit, rather than the decline in the quantity of money.[15] The slow growth of credit in 1989–1991 has also been blamed for the 1990–1991 recession (see Box 16-5).

Proponents of the central role of credit also argue that *credit rationing* makes interest rates an unreliable indicator of monetary policy. **Credit is rationed when individuals cannot borrow as much as they want at the going interest rate.** Credit is rationed because lenders fear that borrowers who are willing to borrow may not be able to repay. But if credit is rationed at a given interest rate, that interest rate does not fully describe the impact of monetary policy on investment and aggregate demand. Proponents of the credit view argue that the Fed should focus directly on the volume of credit to see what impact monetary policy is having on demand.

Remember that loans not only have interest rates attached, they also have creditworthiness standards. When a crisis hits, banks (and other parts of the financial market) worry about getting loans repaid and refuse to make loans to all but the best customers. Figure 16-6

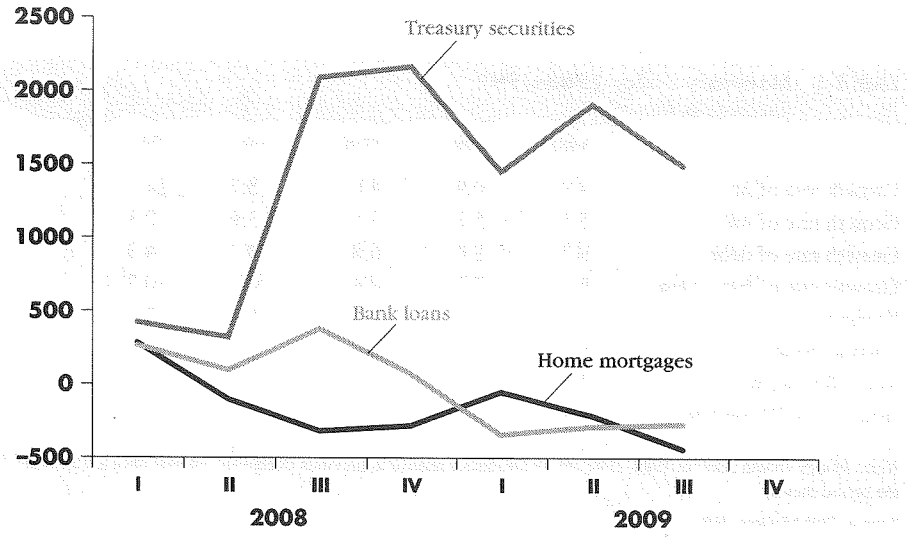

FIGURE 16-6 CREDIT MARKET BORROWING, 2008–2009 QUARTERLY AT ANNUAL RATES.
(Source: Economic Report of the President, 2010, Table B-74.)

[15]Ben Bernanke, "Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression," *American Economic Review,* June 1983. See, too, Ben Friedman, "Monetary Policy without Quantity Variables," *American Economic Review,* May 1988; and Anil Kashyap, Jeremy Stein, and David Wilcox, "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance," *American Economic Review,* March 1993. For more recent work on the operation of the credit channel, see Stephen D. Oliner and Glenn D. Rudebusch, "Is There a Broad Credit Channel for Monetary Policy?" Federal Reserve Bank of San Francisco *Economic Review* 1 (1996).

BOX 16-5 Money Growth, Interest Rates, and Credit in the 1990–1991 Recession

In the 1990–1991 recession, fiscal policy was completely immobilized by the size of the budget deficit. The burden of dealing with the recession therefore fell on monetary policy, which ran into severe difficulties as banks appeared unwilling to lend and the different monetary aggregates grew at very different rates.

The starting point for the 1990–1991 recession was the gradually rising inflation rate at the end of the 1980s. From a low of 1.9 percent in 1986, the CPI inflation rate reached 4.8 percent in 1989. With the unemployment rate in 1989 at 5.2 percent, perhaps even below the natural rate, the Fed's main concern was to fight inflation.

The main indicators of monetary policy showed a tightening in 1989 (see Table 1). The most visible sign was the rise in the Treasury bill rate from an average of 6.7 percent in 1988 to 8.1 percent in 1989; in addition, the growth rate of each of the monetary

TABLE 1 Monetary Policy 1988–1992
(Percent per Annum)

	1988	1989	1990	1991	1992
Growth rate of *M*1	4.9	0.9	4.0	8.7	14.2
Growth rate of *M*2	5.5	5.1	3.5	3.0	2.3
Growth rate of debt	9.3	8.0	6.8	4.2	4.3
Growth rate of bank loans	9.1	7.7	4.4	−0.1	−0.3
Treasury bill rate	6.7	8.1	7.5	5.4	3.8
10-year bond rate	8.9	8.5	8.6	7.9	7.3
Real GDP growth	3.9	2.5	1.0	−0.7	2.1
Inflation (GDP deflator)	3.9	4.4	4.1	3.7	2.5

Note: Money growth rates for 1989–1992 are for December relative to previous December; interest rates are averages for the period shown.

Source: DRI/McGraw-Hill.

shows what happened to credit market borrowing during the Great Recession. Issuance of home mortgages and bank loans crashed. In fact, more loans were being paid off than were being made, so net new credit was actually negative. Where did all the money go? Into the world's safest asset, bonds issued by the United States Treasury.

How do we know that collapse in credit markets reflected tightening credit standards, not just a decline in demand due to weak economic conditions? While the latter surely played a role, the way we know that tighter credit standards were applied is that the

aggregates and of debt declined between 1988 and 1989—though M1 growth virtually collapsed while M2 fell very little. The Fed entered 1990 with inflation on its mind, viewing the 2.5 percent GDP growth in 1989 as being at about the sustainable rate.

The recession dates from July 1990, before the Iraqi invasion of Kuwait. We know now that GDP fell in both the third and fourth quarters of 1990, though the third-quarter decline showed up only in revised data in July 1992. But the Fed, then preoccupied with the question of how to deal with the 40 percent rise in the price of oil that followed the Iraqi invasion, held its interest rates constant through the end of the year. Then, as the recession continued, the Fed kept reducing the interest rate, very slowly through 1991, always concerned not to go too far in case it reignited inflation.

At the end of 1991, with the recession probably already over, the data again began to show signs of weakening production and output. There was much talk of a double-dip recession. This time the Fed moved decisively, cutting the discount rate from 4.5 percent to 3.5 percent. Treasury bill rates moved to their lowest level in 20 years, and then as growth continued to be sluggish, they fell to their lowest level in 30 years. Interestingly though, long-term interest rates were very slow to come down, as can be seen by looking at the 10-year bond rate in Table 1. The explanation is that markets believed that inflation would soon return.

It is striking that in the 1990–1992 period, the Fed conducted monetary policy almost entirely with reference to interest rates. The reason can be seen in Table 1: The growth rates of the different monetary aggregates diverged wildly.

There was one other special feature of the recession: the view that credit was unusually difficult to get. Even before the recession began, business executives and policymakers were complaining about the difficulty of getting loans. The credit crunch—the reluctance of banks and thrifts to lend—seemed to worsen as the recession continued. The volume of bank loans declined in the recession, confirming the existence of the problem.*

Why was there a crunch? Bank regulators, worried about bank failures, were tightening their standards, trying to make sure the banks did not make bad loans. Banks, in response, tended to move to safety, holding government securities rather than making loans to businesses.

*Ben Bernanke and Cara Lown, "The Credit Crunch," *Brookings Papers on Economic Activity* 2 (1991). See also the special issue on the credit slowdown published by the Federal Reserve Bank of New York *Quarterly Review*, Spring 1993.

Fed surveys senior bank loan officers and asks them.[16] For example, at the end of 2008 every loan officer reported raising credit standards for subprime loans. And in early 2009, two-thirds of loan officers reported raising credit standards even further for commercial and industrial loans. Unfortunately, these initiatives were just a few years too late.

[16]"Senior Loan Officer Opinion Survey on Bank Lending Practices," Federal Reserve Board, www.federalreserve.gov/boarddocs/SnloanSurvey/201002. For the story of how the survey works and how credit standards relate to loan growth see Cara S. Lown, Donald P. Morgan, and Sonali Rohatgi, "Listening to Loan Officers: The Impact of Commercial Credit Standards on Lending and Output," *FRBNY Economic Policy Review*, July 2000.

16-7 WHICH TARGETS FOR THE FED?

We are now ready to set monetary policy in a broader perspective by discussing the targets of monetary policy. There are three points to note before we get down to the details:

1. A key distinction is between *ultimate targets* of policy and *intermediate targets*. Ultimate targets are variables such as the inflation rate and the unemployment rate (or real output) whose behavior matters. The interest rate or the rate of growth of money or credit are intermediate targets of policy—targets the Fed aims at so that it can hit the ultimate targets more accurately. The discount rate, open market operations, and reserve requirements are the *instruments* the Fed has with which to hit the targets.[17]
2. It matters how often the intermediate targets are reset. For instance, if the Fed were to commit itself to 5.5 percent money growth over a period of several years, it would have to be sure that the velocity of money was not going to change unpredictably; otherwise, the actual level of GDP would be far different from the targeted level. If the money target were reset more often, as velocity changed, the Fed could come closer to hitting its ultimate targets.
3. The need for targeting arises from a lack of knowledge. If the Fed had the right ultimate goals and knew exactly how the economy worked, it could do whatever was needed to keep the economy as close to its ultimate targets as possible.[18]

Intermediate targets give the Fed something concrete and specific to aim for in the next year. That enables the Fed itself to focus on what it should be doing. It also helps the private sector know what to expect. If the Fed announces and will stick to its targets, firms and consumers have a better idea of what monetary policy will be.

Another benefit of specifying targets for monetary policy is that the Fed can then be held *accountable* for its actions. It has a job to do. By announcing targets, the Fed makes it possible for outsiders to discuss whether it is aiming in the right direction and then later to judge whether it succeeded in its aims.

The ideal intermediate target is a variable that the Fed can control exactly and that, at the same time, has an exact relationship with the ultimate targets of policy. For instance, if the ultimate target could be expressed as some particular level of nominal GDP, and if the money multiplier and velocity were both constant, the Fed could hit its ultimate target by having the money base as its intermediate target.

In practice, life is not so simple. Rather, **in choosing intermediate targets, the Fed has to trade off between those targets it can control exactly and those targets that are most closely related to its ultimate targets.**

[17]See Benjamin Friedman, "Targets and Indicators of Monetary Policy," in B. Friedman and F. Hahn (eds.), *Handbook of Monetary Economics* (Amsterdam: North-Holland, 1991).

[18]See the discussions of lags and of multiplier uncertainty in Chap. 17.

SUMMARY

1. The stock of money is determined by the Fed through its control of the monetary base (high-powered money); by the public, through its preferred currency-deposit ratio; and by the banks, through their preferred reserve-holding behavior.
2. The money stock is larger than the stock of high-powered money because part of the money stock consists of bank deposits, against which the banks hold less than 1 dollar of reserves per dollar of deposits.
3. The money multiplier is the ratio of the money stock to high-powered money. It is larger the smaller the reserve ratio and the smaller the currency-deposit ratio.
4. The Fed creates high-powered money in open market purchases when it buys assets (e.g., Treasury bills, gold, foreign exchange) by creating liabilities on its balance sheet. These purchases increase banks' reserves held at the Fed and lead, through the multiplier process, to an increase in the money stock that is larger than the increase in high-powered money.
5. The money multiplier builds up through an adjustment process in which banks make loans (or buy securities) because deposits have increased their reserves above desired levels.
6. The Fed has three basic policy instruments: open market operations, the discount rate, and required reserves for depository institutions.
7. The Fed cannot control both the interest rate and the money stock exactly. It can only choose combinations of the interest rate and money stock that are consistent with the demand-for-money function.
8. The Fed operates monetary policy by specifying target ranges for both the money stock and the interest rate. In order to hit its target level of output, the Fed should concentrate on its money stock targets if the *IS* curve is unstable or shifts about a great deal. It should concentrate on interest rate targets if the money demand function is the major source of instability in the economy.
9. The Fed targets not only money stock and interest rates but also total nonfinancial debt, or the volume of credit, in the economy.

KEY TERMS

credit
credit rationing
credit targets
currency-deposit ratio
discount rate
disintermediation
excess reserves
Federal Deposit Insurance Corporation (FDIC)
federal funds rate
foreign exchange market intervention
fractional reserve banking
high-powered money
instruments
intermediate targets
monetary base
money multiplier
open market desk
open market operations
open market purchase
pegging the interest rate
required reserves
required-reserve ratio
reserve ratio
run on a bank
ultimate targets

PROBLEMS

Conceptual

1. The Fed wants to increase the money supply. What are the main instruments available to it, and how can each, specifically, increase the money supply? (*Hint:* There are three.)
2. Can the Fed affect the currency-deposit ratio?
3. Under what circumstances should the Fed conduct monetary policy by targeting mainly (*a*) interest rates or (*b*) the money stock?
4. **a.** What is a bank run?
   b. Why might one occur?
   c. If the Fed took no action in the face of a bank run, what would be the effects on the money supply and on the money multiplier?
   d. How does the existence of the FDIC help prevent this problem?
5. **a.** Why does the Fed not stick more closely to its target paths for money?
   b. What are the dangers of targeting nominal interest rates?
6. Categorize each of the following as either an ultimate or intermediate target or an instrument of monetary policy:
   a. Nominal GDP
   b. The discount rate
   c. The monetary base
   d. *M*1
   e. The Treasury bill rate
   f. The unemployment rate
7. What might be the danger in using interest rates as targets for monetary policy when credit rationing is taking place?
8. Why might the Fed choose intermediate targets for its monetary policy, as opposed to directly pursuing its ultimate targets? What are the benefits and the dangers of using these intermediate targets?

Technical

1. Show how an open market sale affects the Fed's balance sheet and also the balance sheet of the commercial bank of the purchaser of the bond sold by the Fed.
2. When the Fed buys or sells gold or foreign exchange, it automatically offsets, or *sterilizes,* the impact of these operations on the monetary base by compensating open market operations. What it does is to buy gold and at the same time sell bonds from its portfolio. Show the effects on the Fed balance sheet of a purchase of gold and a corresponding sterilization through an open market sale.
3. A proposal for "100 percent banking" involves a reserve ratio of unity. Such a scheme has been proposed for the United States in order to enhance the Fed's control over the money supply.
   a. Indicate why such a scheme would help monetary control.
   b. Indicate what bank balance sheets would look like under this scheme.
   c. Under 100 percent banking, how would banking remain profitable?
4. You, as chairman of the Fed (congratulations), are considering whether the monetary base or the interest rate should be used as a target. What information do you need to have to make an informed decision? When would each be a good (or bad!) choice?

Empirical

1. Go to www.federalreserve.gov/FOMC/default.htm, the official website of the Federal Open Market Committee (FOMC) of the Federal Reserve Board. Click on the "Meeting Calendars, Statements, and Minutes" tab and choose the link to one of the most recent statements from FOMC meetings. What are the factors cited in this statement that determined the FOMC's decision of changing (or keeping constant) its target for the federal funds rate?
2. Box 16-5 and Table 1 investigate U.S. monetary policy during the 1990–1991 recession. In this exercise you will take a look at the monetary policy conducted by the Federal Reserve during the 2001 recession. Go to http://research.stlouisfed.org/fred2 and, using the search bar, find data on money stock measures, federal government debt, commercial and industrial loans at all commercial banks, the 3-month Treasury bill rate, the 10-year Treasury bond rate, annual real GDP, and the GDP deflator. (Note: For growth rates, you will need to download level data and transform it to growth rates before downloading.) Compare your table with Table 1 in Box 16-5.

	1999	2000	2001	2002	2003
Growth rate of *M*1					
Growth rate of *M*2					
Growth rate of debt					
Growth rate of bank loans					
Treasury bill rate (3-month)					
10-year bond rate (Treasury)					
Real GDP growth					
Inflation (GDP deflator)					

Note: Money, debt, and bank loans growth rates are for December to December; interest rates are averages for each year.