Interest Rates

The Fed's primary influence is on the money supply and interest rates. Interest rates can be thought of in several ways. Most basically, **interest** is the price paid for the use of money. It is also the price that borrowers need to pay lenders for transferring purchasing power to the future. And it can be thought of as the amount of money that must be paid for the use of $1 for 1 year. Although there are many different interest rates that vary by purpose, size, risk, maturity, and taxability, we will simply speak of "*the* interest rate" unless stated otherwise.

Let's see how the interest rate is determined. Because it is a "price," we again turn to demand and supply analysis for the answer.

The Demand for Money

Why does the public want to hold some of its wealth as *money?* There are two main reasons: to make purchases with it and to hold it as an asset.

Transactions Demand, D_t

People hold money because it is convenient for purchasing goods and services. Households usually are paid once a week, every 2 weeks, or monthly, whereas their expenditures are less predictable and typically more frequent. So households must have enough money on hand to buy groceries and pay mortgage and utility bills. Nor are business revenues and expenditures simultaneous. Businesses need to have money available to pay for labor, materials, power, and other inputs. The demand for money as a medium of exchange is called the **transactions demand** for money.

The level of nominal GDP is the main determinant of the amount of money demanded for transactions. The larger the total money value of all goods and services exchanged in the economy, the larger the amount of money needed to negotiate those transactions. The transactions demand for money varies directly with nominal GDP. We specify *nominal* GDP because households and firms will want more money for transactions if prices rise or if real output increases. In both instances a larger dollar volume will be needed to accomplish the desired transactions.

In **Figure 33.1a (Key Graph)** we graph the quantity of money demanded for transactions against the interest rate. For simplicity, let's assume that the amount demanded depends exclusively on the level of nominal GDP and is independent of the interest rate. (In reality, higher interest rates are associated with slightly lower volumes of money demanded for transactions.) Our simplifying assumption allows us to graph the transactions demand, D_t, as a vertical line. This demand curve is positioned at $100 billion, on the assumption that each dollar held for transactions purposes is spent on an average of three times per year and that nominal GDP is $300 billion. Thus the public needs $100 billion (= $300 billion/3) to purchase that GDP.

Asset Demand, D_a

The second reason for holding money derives from money's function as a store of value. People may hold their financial assets in many forms, including corporate stocks, corporate or government bonds, or money. To the extent they want to hold money as an asset, there is an **asset demand** for money.

People like to hold some of their financial assets as money (apart from using it to buy goods and services) because money is the most liquid of all financial assets; it is immediately usable for purchasing other assets when opportunities arise. Money is also an attractive asset to hold when the prices of other assets such as bonds are expected to decline. For example, when the price of a bond falls, the bondholder who sells the bond prior to the payback date of the full principal will suffer a loss (called a *capital loss*). That loss will partially or fully offset the interest received on the bond. There is no such risk of capital loss in holding money.

The disadvantage of holding money as an asset is that it earns no or very little interest. Checkable deposits pay either no interest or lower interest rates than bonds. Currency itself earns no interest at all.

Knowing these advantages and disadvantages, the public must decide how much of its financial assets to hold as money, rather than other assets such as bonds. The answer depends primarily on the rate of interest. A household or a business incurs an opportunity cost when it holds money; in both cases, interest income is forgone or sacrificed. If a bond pays 6 percent interest, for example, holding $100 as cash or in a noninterest checkable account costs $6 per year of forgone income.

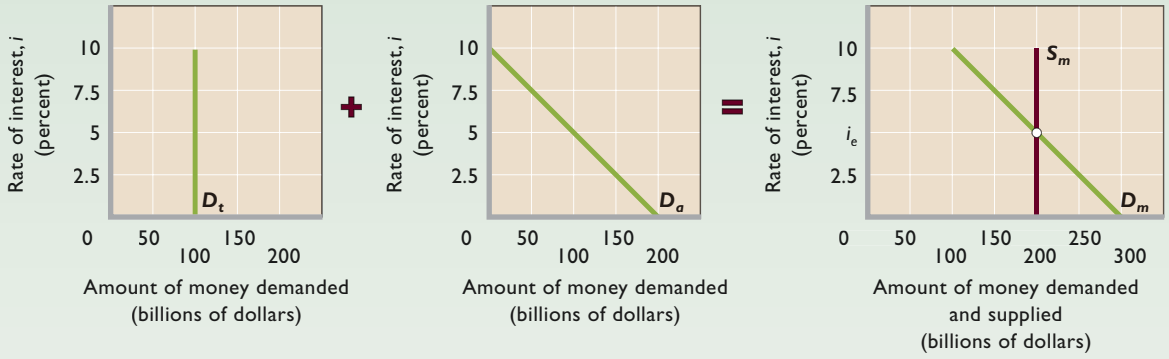
The amount of money demanded as an asset therefore varies inversely with the rate of interest (which is the opportunity cost of holding money as an asset). When the interest rate rises, being liquid and avoiding capital losses becomes more costly. The public reacts by reducing its holdings of money as an asset. When the interest rate falls, the cost of being liquid and avoiding capital losses also declines. The public therefore increases the amount of financial assets that it wants to hold as money. This inverse relationship just described is shown by D_a in Figure 33.1b.

ORIGIN OF THE IDEA
O 33.1
Liquidity preference

Total Money Demand, D_m

As shown in Figure 33.1, we find the **total demand for money,** D_m, by

FIGURE 33.1 The demand for money, the supply of money, and the equilibrium interest rate. The total demand for money D_m is determined by horizontally adding the asset demand for money D_a to the transactions demand D_t. The transactions demand is vertical because it is assumed to depend on nominal GDP rather than on the interest rate. The asset demand varies inversely with the interest rate because of the opportunity cost involved in holding currency and checkable deposits that pay no interest or very low interest. Combining the money supply (stock) S_m with the total money demand D_m portrays the market for money and determines the equilibrium interest rate i_e.



(a) Transactions demand for money, D_t

(b) Asset demand for money, D_a

(c) Total demand for money, $D_m = D_t + D_a$, and supply of money

QUICK QUIZ FOR FIGURE 33.1

1. In this graph, at the interest rate i_e (5 percent):
   a. the amount of money demanded as an asset is $50 billion.
   b. the amount of money demanded for transactions is $200 billion.
   c. bond prices will decline.
   d. $100 billion is demanded for transactions, $100 billion is demanded as an asset, and the money supply is $200 billion.
2. In this graph, at an interest rate of 10 percent:
   a. no money will be demanded as an asset.
   b. total money demanded will be $200 billion.
   c. the Federal Reserve will supply $100 billion of money.
   d. there will be a $100 billion shortage of money.
3. Curve D_a slopes downward because:
   a. lower interest rates increase the opportunity cost of holding money.
   b. lower interest rates reduce the opportunity cost of holding money.
   c. the asset demand for money varies directly (positively) with the interest rate.
   d. the transactions-demand-for-money curve is perfectly vertical.
4. Suppose the supply of money declines to $100 billion. The equilibrium interest rate would:
   a. fall, the amount of money demanded for transactions would rise, and the amount of money demanded as an asset would decline.
   b. rise, and the amounts of money demanded both for transactions and as an asset would fall.
   c. fall, and the amounts of money demanded both for transactions and as an asset would increase.
   d. rise, the amount of money demanded for transactions would be unchanged, and the amount of money demanded as an asset would decline.

Answers: 1. d; 2. a; 3. b; 4. d

horizontally adding the asset demand to the transactions demand.The resulting downward-sloping line in Figure 33.1c represents the total amount of money the public wants to hold, both for transactions and as an asset, at each possible interest rate.

Recall that the transactions demand for money depends on the nominal GDP. A change in the nominal GDP—working through the transactions demand for money—will shift the total money demand curve. Specifically, an increase in nominal GDP means that the public wants to hold a larger amount of money for transactions, and that extra demand will shift the total money demand curve to the right. In contrast, a decline in the nominal GDP will shift the total money demand curve to the left. As an example, suppose nominal GDP increases from $300 billion to $450 billion

WORKED PROBLEMS

W 33.1

Demand for money

and the average dollar held for transactions is still spent three times per year. Then the transactions demand curve will shift from $100 billion (= $300 billion/3) to $150 billion (= $450 billion/3). The total money demand curve will then lie $50 billion farther to the right at each possible interest rate.

The Equilibrium Interest Rate

We can combine the demand for money with the supply of money to determine the equilibrium rate of interest. In Figure 33.1c, the vertical line, S_m, represents the money supply. It is a vertical line because the monetary authorities and financial institutions have provided the economy with some particular stock of money. Here it is $200 billion.

Just as in a product market or a resource market, the intersection of demand and supply determines the equilibrium price in the market for money. Here, the equilibrium "price" is the interest rate (i_e)—the price that is paid for the use of money over some time period.

Changes in the demand for money, the supply of money, or both can change the equilibrium interest rate. For reasons that will soon become apparent, we are most interested in changes in the supply of money. The important generalization is this: An increase in the supply of money will lower the equilibrium interest rate; a decrease in the supply of money will raise the equilibrium interest rate. **(Key Questions 1 and 2)**

INTERACTIVE GRAPHS
G 33.1
Equilibrium interest rate

Interest Rates and Bond Prices

Interest rates and bond prices are inversely related. When the interest rate increases, bond prices fall; when the interest rate falls, bond prices rise. Why so? First understand that bonds are bought and sold in financial markets and that the price of bonds is determined by bond demand and bond supply.

Suppose that a bond with no expiration date pays a fixed $50 annual interest payment and is selling for its face value of $1000. The interest yield on this bond is 5 percent:

$$\frac{\$50}{\$1000} = 5\% \text{ interest yield}$$

Now suppose the interest rate in the economy rises to $7\frac{1}{2}$ percent from 5 percent. Newly issued bonds will pay $75 per $1000 lent. Older bonds paying only $50 will not be salable at their $1000 face value. To compete with the $7\frac{1}{2}$ percent bond, the price of this bond will need to fall to $667 to remain competitive. The $50 fixed annual interest payment will then yield $7\frac{1}{2}$ percent to whoever buys the bond:

$$\frac{\$50}{\$667} = 7\tfrac{1}{2}\%$$

Next suppose that the interest rate falls to $2\frac{1}{2}$ percent from the original 5 percent. Newly issued bonds will pay $25 on $1000 loaned. A bond paying $50 will be highly attractive. Bond buyers will bid up its price to $2000, at which price the yield will equal $2\frac{1}{2}$ percent:

$$\frac{\$50}{\$2000} = 2\tfrac{1}{2}\%$$

The point is that bond prices fall when the interest rate rises and rise when the interest rate falls. There is an inverse relationship between the interest rate and bond prices. **(Key Question 3)**

WORKED PROBLEMS
W 33.2
Bond prices and interest rates

QUICK REVIEW 33.1

- People demand money for transaction and asset purposes.
- The total demand for money is the sum of the transactions and asset demands; it is graphed as an inverse relationship (downward-sloping line) between the interest rate and the quantity of money demanded.
- The equilibrium interest rate is determined by money demand and supply; it occurs when people are willing to hold the exact amount of money being supplied by the monetary authorities.
- Interest rates and bond prices are inversely related.

The Consolidated Balance Sheet of the Federal Reserve Banks

With this basic understanding of interest rates, we can turn to monetary policy, which relies on changes in interest rates to be effective. The 12 Federal Reserve Banks together constitute the U.S. "central bank," nicknamed the "Fed." (Global Perspective 33.1 also lists some of the other central banks in the world, along with their nicknames.)

The Fed's balance sheet helps us consider how the Fed conducts monetary policy. Table 33.1 consolidates the pertinent assets and liabilities of the 12 Federal Reserve Banks as of February 14, 2008. You will see that some of the Fed's assets and liabilities differ from those found on the balance sheet of a commercial bank.

TABLE 33.1 Consolidated Balance Sheet of the 12 Federal Reserve Banks, February 14, 2008 (in Millions)

Assets		Liabilities and Net Worth	
Securities	$713,369	Reserves of commercial banks	$ 11,312
Loans to commercial banks	60,039	Treasury deposits	4,979
All other assets	111,689	Federal Reserve Notes (outstanding)	778,937
		All other liabilities and net worth	89,869
Total	885,097	Total	885,097

Source: Federal Reserve Statistical Release, H.4.1, February 14, 2008, **www.federalreserve.gov.**

GLOBAL PERSPECTIVE 33.1

Central Banks, Selected Nations

The monetary policies of the world's major central banks are often in the international news. Here are some of their official names, along with a few of their popular nicknames.

- Australia: Reserve Bank of Australia (RBA)
- Canada: Bank of Canada
- Euro Zone: European Central Bank (ECB)
- Japan: The Bank of Japan (BOJ)
- Mexico: Banco de Mexico (Mex Bank)
- Russia: Central Bank of Russia
- Sweden: Sveriges Riksbank
- United Kingdom: Bank of England
- United States: Federal Reserve System (the "Fed") (12 regional Federal Reserve Banks)

Assets

The two main assets of the Federal Reserve Banks are securities and loans to commercial banks. (Again, we will simplify by referring only to *commercial banks*, even though the analysis also applies to *thrifts*—savings and loans, mutual savings banks, and credit unions.)

Securities The securities shown in Table 33.1 are government bonds that have been purchased by the Federal Reserve Banks. They consist largely of Treasury bills (short-term securities), Treasury notes (mid-term securities), and Treasury bonds (long-term securities) issued by the U.S. government to finance past budget deficits. These securities are part of the public debt—the money borrowed by the Federal government. The Federal Reserve Banks bought these securities from commercial banks and the public through open-market operations. Although they are an important source of interest income to the Federal Reserve Banks, they are mainly bought and sold to influence the size of commercial bank reserves and, therefore, the ability of those banks to create money by lending.

Loans to Commercial Banks For reasons that will soon become clear, commercial banks occasionally borrow from Federal Reserve Banks. The IOUs that commercial banks give these "bankers' banks" in return for loans are listed on the Federal Reserve balance sheet as "Loans to commercial banks." They are assets to the Fed because they are claims against the commercial banks. To commercial banks, of course, these loans are liabilities in that they must be repaid. Through borrowing in this way, commercial banks can increase their reserves.

Liabilities

On the "liabilities and net worth" side of the Fed's consolidated balance sheet, three entries are noteworthy: reserves, Treasury deposits, and Federal Reserve Notes.

Reserves of Commercial Banks The Fed requires that the commercial banks hold reserves against their checkable deposits. When held in the Federal Reserve Banks, these reserves are listed as a liability on the Fed's balance sheet. They are assets on the books of the commercial banks, which still own them even though they are deposited at the Federal Reserve Banks.

Treasury Deposits The U.S. Treasury keeps deposits in the Federal Reserve Banks and draws checks on them to pay its obligations. To the Treasury these deposits are assets; to the Federal Reserve Banks they are liabilities. The Treasury creates and replenishes these deposits by depositing tax receipts and money borrowed from the public or from the commercial banks through the sale of bonds.

Federal Reserve Notes Outstanding As we have seen, the supply of paper money in the United States consists of Federal Reserve Notes issued by the Federal

Reserve Banks. When this money is circulating outside the Federal Reserve Banks, it constitutes claims against the assets of the Federal Reserve Banks. The Fed thus treats these notes as a liability.

Tools of Monetary Policy

ORIGIN OF THE IDEA
O 33.2
Tools of monetary policy

With this look at the Federal Reserve Banks' consolidated balance sheet, we can now explore how the Fed can influence the money-creating abilities of the commercial banking system. The Fed has four tools of monetary control it can use to alter the reserves of commercial banks:

- Open-market operations
- The reserve ratio
- The discount rate
- The term auction facility

Open-Market Operations

Bond markets are "open" to all buyers and sellers of corporate and government bonds (securities). The Federal Reserve is the largest single holder of U.S. government securities. The U.S. government, not the Fed, issued these Treasury bills, Treasury notes, and Treasury bonds to finance past budget deficits. Over the decades, the Fed has purchased these securities from major financial institutions that buy and sell government and corporate securities for themselves or their customers.

The Fed's **open-market operations** consist of the buying of government bonds from, or the selling of government bonds to, commercial banks and the general public. (The Fed actually buys and sells the government bonds to commercial banks and the public through two dozen or so large financial firms, called "primary dealers.") Open-market operations are the Fed's most important day-to-day instrument for influencing the money supply.

Buying Securities

Suppose that the Fed decides to have the Federal Reserve Banks buy government bonds. They can purchase these bonds either from commercial banks or from the public. In both cases the reserves of the commercial banks will increase.

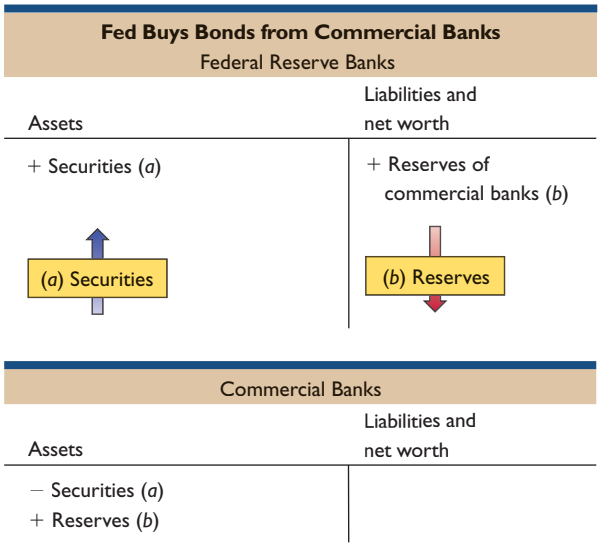
From Commercial Banks

When Federal Reserve Banks buy government bonds *from commercial banks*,

(*a*) The commercial banks give up part of their holdings of securities (the government bonds) to the Federal Reserve Banks.

(*b*) The Federal Reserve Banks, in paying for these securities, place newly created reserves in the accounts of the commercial banks at the Fed. (These reserves are created "out of thin air," so to speak!) The reserves of the commercial banks go up by the amount of the purchase of the securities.

We show these outcomes as (*a*) and (*b*) on the following consolidated balance sheets of the commercial banks and the Federal Reserve Banks:



The upward arrow shows that securities have moved from the commercial banks to the Federal Reserve Banks. So we enter " − Securities" (minus securities) in the asset column of the balance sheet of the commercial banks. For the same reason, we enter " + Securities" in the asset column of the balance sheet of the Federal Reserve Banks.

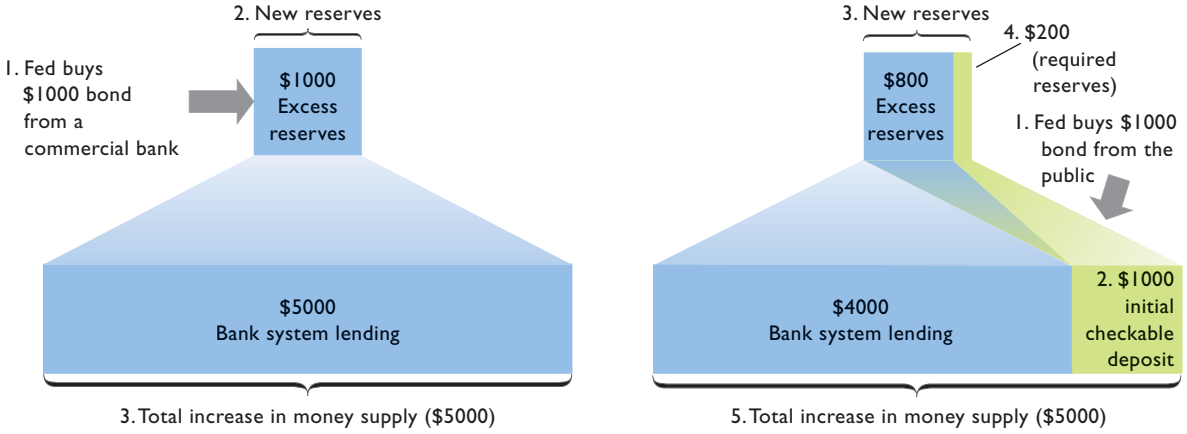
The downward arrow indicates that the Federal Reserve Banks have provided reserves to the commercial banks. So we enter " + Reserves" in the asset column of the balance sheet for the commercial banks. In the liability column of the balance sheet of the Federal Reserve Banks, the plus sign indicates that although commercial bank reserves have increased, they are a liability to the Federal Reserve Banks because the reserves are owned by the commercial banks.

What is most important about this transaction is that when Federal Reserve Banks purchase securities from commercial banks, they increase the reserves in the banking system, which then increases the lending ability of the commercial banks.

From the Public

The effect on commercial bank reserves is much the same when Federal Reserve Banks purchase securities from the general public. Suppose the

FIGURE 33.2 The Federal Reserve's purchase of bonds and the expansion of the money supply. Assuming all banks are loaned up initially, a Federal Reserve purchase of a $1000 bond from either a commercial bank or the public can increase the money supply by $5000 when the reserve ratio is 20 percent. In the left panel of the diagram, the purchase of a $1000 bond from a commercial bank creates $1000 of excess reserves that support a $5000 expansion of checkable deposits through loans. In the right panel, the purchase of a $1000 bond from the public creates a $1000 checkable deposit but only $800 of excess reserves because $200 of reserves is required to "back up" the $1000 new checkable deposit. The commercial banks can therefore expand the money supply by only $4000 by making loans. This $4000 of checkable-deposit money plus the new checkable deposit of $1000 equals $5000 of new money.



Gristly Meat Packing Company has government bonds that it sells in the open market to the Federal Reserve Banks. The transaction has several elements:

(*a*) Gristly gives up securities to the Federal Reserve Banks and gets in payment a check drawn by the Federal Reserve Banks on themselves.

(*b*) Gristly promptly deposits the check in its account with the Wahoo bank.

(*c*) The Wahoo bank sends this check against the Federal Reserve Banks to a Federal Reserve Bank for collection. As a result, the Wahoo bank enjoys an increase in its reserves.

To keep things simple, we will dispense with showing the balance sheet changes resulting from the Fed's sale or purchase of bonds from the public. But two aspects of this transaction are particularly important. First, as with Federal Reserve purchases of securities directly from commercial banks, the purchases of securities from the public increase the lending ability of the commercial banking system. Second, the supply of money is directly increased by the Federal Reserve Banks' purchase of government bonds (aside from any expansion of the money supply that may occur from the increase in commercial bank reserves). This direct increase in the money supply has taken the form of an increased amount of checkable deposits in the economy as a result of Gristly's deposit.

The Federal Reserve Banks' purchases of securities from the commercial banking system differ slightly from their purchases of securities from the public. If we assume that all commercial banks are loaned up initially, Federal Reserve bond purchases *from commercial banks* increase the actual reserves and excess reserves of commercial banks by the entire amount of the bond purchases. As shown in the left panel in Figure 33.2, a $1000 bond purchase from a commercial bank increases both the actual and the excess reserves of the commercial bank by $1000.

In contrast, Federal Reserve Bank purchases of bonds from the public increase actual reserves but also increase checkable deposits when the sellers place the Fed's check into their personal checking accounts. Thus, a $1000 bond purchase from the public would increase checkable deposits by $1000 and hence the actual reserves of the loaned-up banking system by the same amount. But with a 20 percent reserve ratio applied to the $1000 checkable deposit, the excess reserves of the banking system would be only $800 since $200 of the $1000 would have to be held as reserves.

However, in both transactions the end result is the same: When Federal Reserve Banks buy securities in the open market, commercial banks' reserves are increased. When the banks lend out an amount equal to their excess reserves, the nation's money supply will rise. Observe in Figure 33.2 that a $1000 purchase of bonds by the Federal Reserve results in a potential of $5000 of additional money, regardless of whether the purchase was made from commercial banks or from the general public.

WORKED PROBLEMS

W 33.3
Open-market operations

Selling Securities

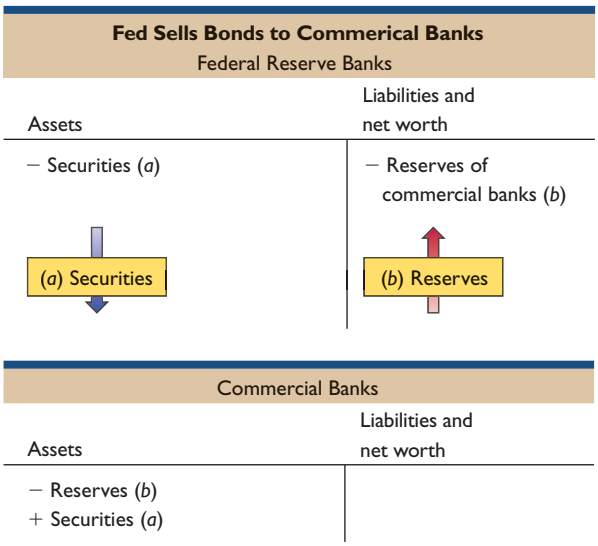
As you may suspect, when the Federal Reserve Banks sell government bonds, commercial banks' reserves are reduced. Let's see why.

To Commercial Banks When the Federal Reserve Banks sell securities in the open market to commercial banks,

(*a*) The Federal Reserve Banks give up securities that the commercial banks acquire.

(*b*) The commercial banks pay for those securities by drawing checks against their deposits—that is, against their reserves—in Federal Reserve Banks. The Fed collects on those checks by reducing the commercial banks' reserves accordingly.

The balance-sheet changes—again identified by (*a*) and (*b*)—appear as shown below. The reduction in commercial bank reserves is indicated by the minus signs before the appropriate entries.



To the Public When the Federal Reserve Banks sell securities to the public, the outcome is much the same. Let's put the Gristly Company on the buying end of government bonds that the Federal Reserve Banks are selling:

(*a*) The Federal Reserve Banks sell government bonds to Gristly, which pays with a check drawn on the Wahoo bank.

(*b*) The Federal Reserve Banks clear this check against the Wahoo bank by reducing Wahoo's reserves.

(*c*) The Wahoo bank returns the canceled check to Gristly, reducing Gristly's checkable deposit accordingly.

Federal Reserve bond sales of $1000 to the commercial banking system reduce the system's actual and excess reserves by $1000. But a $1000 bond sale to the public reduces excess reserves by $800 because the public's checkable-deposit money is also reduced by $1000 by the sale. Since the commercial banking system's outstanding checkable deposits are reduced by $1000, banks need keep $200 less in reserves.

Whether the Fed sells bonds to the public or to commercial banks, the result is the same: When Federal Reserve Banks sell securities in the open market, commercial bank reserves are reduced. If all excess reserves are already lent out, this decline in commercial bank reserves produces a decline in the nation's money supply. In our example, a $1000 sale of government securities results in a $5000 decline in the money supply whether the sale is made to commercial banks or to the general public. You can verify this by reexamining Figure 33.2 and tracing the effects of a *sale* of a $1000 bond by the Fed either to commercial banks or to the public.

What makes commercial banks and the public willing to sell government securities to, or buy them from, Federal Reserve Banks? The answer lies in the price of bonds and their interest yields. We know that bond prices and interest rates are inversely related. When the Fed buys government bonds, the demand for them increases. Government bond prices rise, and their interest yields decline. The higher bond prices and their lower interest yields prompt banks, securities firms, and individual holders of government bonds to sell them to the Federal Reserve Banks.

When the Fed sells government bonds, the additional supply of bonds in the bond market lowers bond prices and raises their interest yields, making government bonds attractive purchases for banks and the public.

The Reserve Ratio

The Fed also can manipulate the **reserve ratio** in order to influence the ability of commercial banks to lend. Suppose a commercial bank's balance sheet shows that reserves are $5000 and checkable deposits are $20,000. If the legal reserve ratio is 20 percent (row 2, Table 33.2), the bank's required reserves are $4000. Since actual reserves are $5000, the excess reserves of this bank are $1000. On the basis of $1000 of excess reserves, this one bank can lend $1000; however, the banking system as a whole can create a maximum of $5000 of new checkable-deposit money by lending (column 7).

Raising the Reserve Ratio

Now, what if the Fed raised the reserve ratio from 20 to 25 percent? (See row 3.) Required reserves would jump from $4000 to $5000, shrinking excess reserves from $1000 to zero. Raising the reserve ratio increases the amount of required reserves banks must keep. As a consequence, either banks lose excess reserves, diminishing their ability to create money by lending, or they find their reserves deficient and are forced to contract checkable deposits and therefore the money supply. In the

TABLE 33.2 The Effects of Changes in the Reserve Ratio on the Lending Ability of Commercial Banks

(1) Reserve Ratio, %	(2) Checkable Deposits	(3) Actual Reserves	(4) Required Reserves	(5) Excess Reserves, (3) − (4)	(6) Money-Creating Potential of Single Bank, = (5)	(7) Money-Creating Potential of Banking System
(1) 10	$20,000	$5000	$2000	$ 3000	$ 3000	$30,000
(2) 20	20,000	5000	4000	1000	1000	5000
(3) 25	20,000	5000	5000	0	0	0
(4) 30	20,000	5000	6000	−1000	−1000	−3333

example in Table 33.2, excess reserves are transformed into required reserves, and the money-creating potential of our single bank is reduced from $1000 to zero (column 6). Moreover, the banking system's money-creating capacity declines from $5000 to zero (column 7).

What if the Fed increases the reserve requirement to 30 percent? (See row 4.) The commercial bank, to protect itself against the prospect of failing to meet this requirement, would be forced to lower its checkable deposits and at the same time increase its reserves. To reduce its checkable deposits, the bank could let outstanding loans mature and be repaid without extending new credit. To increase reserves, the bank might sell some of its bonds, adding the proceeds to its reserves. Both actions would reduce the supply of money.

Lowering the Reserve Ratio What would happen if the Fed lowered the reserve ratio from the original 20 percent to 10 percent? (See row 1.) In this case, required reserves would decline from $4000 to $2000, and excess reserves would jump from $1000 to $3000. The single bank's lending (money-creating) ability would increase from $1000 to $3000 (column 6), and the banking system's money-creating potential would expand from $5000 to $30,000 (column 7). Lowering the reserve ratio transforms required reserves into excess reserves and enhances the ability of banks to create new money by lending.

The examples in Table 33.2 show that a change in the reserve ratio affects the money-creating ability of the *banking system* in two ways:

- It changes the amount of excess reserves.
- It changes the size of the monetary multiplier.

For example, when the legal reserve ratio is raised from 10 to 20 percent, excess reserves are reduced from $3000 to $1000 and the checkable-deposit multiplier is reduced from 10 to 5. The money-creating potential of the banking system declines from $30,000 (= $3000 × 10) to $5000 (= $1000 × 5). Raising the reserve ratio forces banks to reduce the amount of checkable deposits they create through lending.

The Discount Rate

One of the functions of a central bank is to be a "lender of last resort." Occasionally, commercial banks have unexpected and immediate needs for additional funds. In such cases, each Federal Reserve Bank will make short-term loans to commercial banks in its district.

When a commercial bank borrows, it gives the Federal Reserve Bank a promissory note (IOU) drawn against itself and secured by acceptable collateral—typically U.S. government securities. Just as commercial banks charge interest on the loans they make to their clients, so too Federal Reserve Banks charge interest on loans they grant to commercial banks. The interest rate they charge is called the **discount rate.**

As a claim against the commercial bank, the borrowing bank's promissory note is an asset to the lending Federal Reserve Bank and appears on its balance sheet as "Loans to commercial banks." To the commercial bank the IOU is a liability, appearing as "Loans from the Federal Reserve Banks" on the commercial bank's balance sheet. [See the two (*a*) entries on the balance sheets below.]