In providing the loan, the Federal Reserve Bank increases the reserves of the borrowing commercial bank. Since no required reserves need be kept against loans from Federal Reserve Banks, all new reserves acquired by borrowing from Federal Reserve Banks are excess reserves. [These changes are reflected in the two (*b*) entries on the balance sheets.]

In short, borrowing from the Federal Reserve Banks by commercial banks increases the reserves of the commercial banks and enhances their ability to extend credit.

The Fed has the power to set the discount rate at which commercial banks borrow from Federal Reserve Banks. From the commercial banks' point of view, the discount rate is a cost of acquiring reserves. A lowering of the discount rate encourages commercial banks to obtain additional reserves by borrowing from Federal Reserve Banks. When the commercial banks lend new reserves, the money supply increases.

An increase in the discount rate discourages commercial banks from obtaining additional reserves through borrowing from the Federal Reserve Banks. So the Fed may raise the discount rate when it wants to restrict the money supply. **(Key Question 5)**

Term Auction Facility

The fourth Fed tool for altering bank reserves is its **term auction facility.** This tool was introduced in December 2007 in response to the mortgage debt crisis, in which tens of thousands of homeowners defaulted on mortgage loans when they experienced higher mortgage interest rates and falling home prices. (We discuss this financial mess in detail in this chapter's Last Word.) Under the term auction facility, the Fed holds two auctions each month at which banks bid for the right to borrow reserves for 28-day periods. For instance, the Fed might auction off $20 billion in reserves. Banks that want to participate in the auction submit bids that include two pieces of information: how much they wish to borrow and the interest rate that they would be willing to pay. As an example, Wahoo bank might want to borrow $1 billion and offer to pay an annual interest rate of 4.35 percent.

These bids are submitted secretly. Once they are received, Fed officials arrange them from highest to lowest by interest rate. The limited pool of $20 billion goes to those banks that offer to pay the highest interest rates for the money that they desire to borrow. But the rate that all the auction winners actually pay is the same—it is the rate offered by the lowest bidder whose bid is accepted. For instance, suppose that 56 banks submit bids that total $36 billion. The Fed sorts these from highest to lowest based upon interest rates and then goes down the list to see how many banks can get their desired loan amounts before exhausting the $20 billion. Suppose that the top 23 banks together wish to borrow $18 billion and that the 24th bank wishes to borrow the remaining $2 billion. Since its request would exhaust the $20 billion that is being auctioned off, its interest rate is the one that all 24 of the auction-winning banks will have to pay.

Lending through the term auction facility guarantees that the amount of reserves that the Fed wishes to lend will be borrowed. This is true because the auction procedure for determining the interest rate on the loans serves to produce an equilibrium price (interest rate) at which the quantity demanded of loans exactly equals the quantity supplied of loans (the amount of reserves that the Fed is auctioning off). The Fed finds this to be very helpful when it wants to increase reserves by a specific amount because it can be sure that those reserves will, in fact, be borrowed, thereby increasing the overall level of reserves in the banking system. In contrast, lowering the discount rate may or may not produce the exact level of borrowing the Fed desires.

It was this very positive aspect of the term auction facility that caused the Fed to start using it in late 2007 when it wished to increase bank reserves during the mortgage debt crisis. Reserves fell dramatically during that crisis and the Fed wanted to be sure to increase reserves so that banks would have excess reserves and therefore the ability to keep making loans.

In terms of balance sheets, however, loans of reserves borrowed by auction-winning banks under the term auction facility work exactly the same as loans of reserves taken out by banks when they are borrowing at the discount rate. Commercial banks send IOUs to the Fed and the Fed sends reserves to the commercial banks. As a result, the Fed can modulate the money supply by increasing or decreasing the amount of reserves that it auctions off every two weeks under the term auction facility.

Relative Importance

All four of the Fed's instruments of monetary control are useful in particular economic circumstances, but open-market operations are clearly the most important of the four tools over the course of the business cycle. The buying and selling of securities in the open market has the advantage of flexibility—government securities can be purchased or sold daily in large or small amounts—and the impact on bank reserves is prompt. And, compared with reserve-requirement changes, open-market operations work subtly and less directly. Furthermore, the ability of the Federal Reserve Banks to affect commercial bank reserves through the purchase and sale of bonds is virtually unquestionable.

The Federal Reserve Banks have very large holdings of government securities ($730 billion in early 2008 for example). The sale of those securities could theoretically reduce commercial bank reserves to zero.

Changing the reserve requirement is a potentially powerful instrument of monetary control, but the Fed has used this technique only sparingly. Normally, it can accomplish its monetary goals more easily through open-market operations. The limited use of changes in the reserve ratio undoubtedly relates to the fact that reserves earn no interest. Indeed, when the Fed raises or lowers the reserve ratio, it has a substantial effect on bank profits because it implicitly changes the amount of money on which banks are forced to earn a zero percent rate of return. The last change in the reserve requirement was in 1992, when the Fed reduced the requirement from 12 percent to 10 percent. The main purpose was to shore up the profitability of banks and thrifts in the aftermath of the 1990–1991 recession rather than to reduce interest rates by increasing reserves and expanding the money supply.

Until recently, the discount rate was mainly a passive tool of monetary control, with the Fed raising and lowering the rate simply to keep it in line with other interest rates. However, during the mortgage debt crisis, the Fed aggressively lowered the discount rate independently of other interest rates in order to provide a cheap and plentiful source of reserves to banks whose reserves were being sharply reduced by unexpectedly high default rates on home mortgage loans. Banks borrowed billions at the lower discount rate. This allowed them to meet reserve ratio requirements and thereby preserved their ability to keep extending loans.

As the mortgage debt crisis grew more severe, however, the Fed found that banks became increasingly reluctant to borrow at the discount rate for fear that such borrowing would be interpreted by their own lenders and stockholders as a sign of being in deep financial trouble. This prompted the Fed to create the term auction facility and, perhaps more importantly, to make it anonymous. When the Fed holds an auction of reserves using the term auction facility, banks submit their bids anonymously and auction winners are given their loans anonymously. This anonymity ensures that banks will participate in the auctions since they do not have to worry about being suspected of being in a financially weak condition.

The success of the term auction facility has led the Fed to adopt the auction of reserves as a fourth permanent tool of monetary policy. That being said, most economists believe that it will probably only be used during times of crisis when the Fed believes that the banking system can be helped by a large, quick injection of reserves.

QUICK REVIEW 33.2

- The Fed has four main tools of monetary control, each of which works by changing the amount of reserves in the banking system: (a) conducting open-market operations (the Fed's buying and selling of government bonds to the banks and the public); (b) changing the reserve ratio (the percentage of commercial bank deposit liabilities required as reserves); (c) changing the discount rate (the interest rate the Federal Reserve Banks charge on loans to banks and thrifts); and (d) auctioning off reserves to banks using the term auction facility.
- Open-market operations are the Fed's monetary control mechanism of choice for routine increases or decreases in bank reserves over the business cycle; in contrast, changes in reserve requirements, aggressive changes in discount rates, and auctions of reserves are used only in special situations.

Targeting the Federal Funds Rate

The Federal Reserve focuses monetary policy on the interest rate that it can best control: the **Federal funds rate.** From the previous chapter, you know that this is the rate of interest that banks charge one another on overnight loans made from temporary excess reserves. Recall that the Federal Reserve requires banks (and thrifts) to deposit in their regional Federal Reserve Bank a certain percentage of their checkable deposits as reserves. At the end of any business day, some banks temporarily have excess reserves (more actual reserves than required) and other banks have reserve deficiencies (fewer reserves than required). Because reserves held at the Federal Reserve Banks do not earn interest, banks with excess reserves desire to lend out their temporary excess reserves overnight to other banks that temporarily need them to meet their reserve requirements. The funds being lent and borrowed overnight are called "Federal funds" because they are reserves (funds) that are required by the Federal Reserve to meet reserve requirements. An equilibrium interest rate—the Federal funds rate—arises in this market for bank reserves.

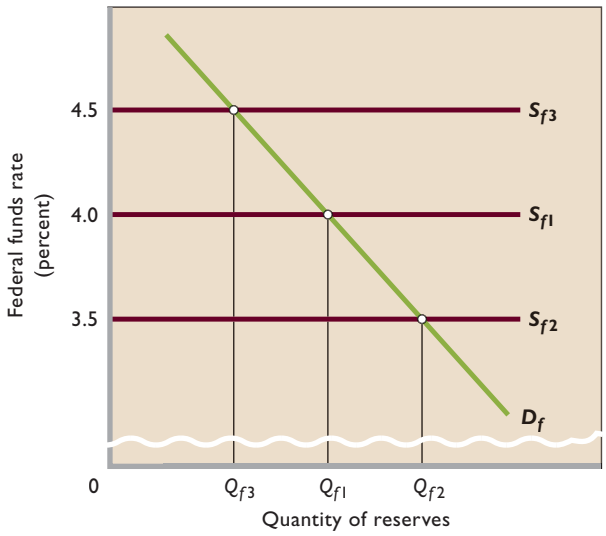
The Federal Reserve targets the Federal funds rate by manipulating the supply of reserves that are offered in the Federal funds market. As previously explained, by buying and selling government bonds, the Fed can increase or decrease the reserves in the banking system. These changes in total reserves in turn affect the amount of *excess reserves* that are available for supply to the Federal funds market by whichever banks end up with them on a given day. For instance, suppose that the level of loans and checkable

deposits at Wahoo bank are constant on a certain day. If the Fed then engages in open-market operations such that Wahoo's total reserves increase, Wahoo will find that it has excess reserves. It will want to loan out these excess reserves to bank customers as soon as possible. But in the meanwhile it will supply these funds overnight in the Federal funds market.

The Federal Open Market Committee (FOMC) meets regularly to choose a desired Federal funds rate. It then directs the Federal Reserve Bank of New York to undertake whatever open-market operations may be necessary to achieve and maintain the targeted rate. We demonstrate how this works in Figure 33.3, where we initially assume the Fed desires a 4 percent interest rate. The demand curve for Federal funds, D_f, is downsloping because lower interest rates give the banks with reserve deficiencies a greater incentive to borrow Federal funds rather than reduce loans as a way to meet their reserve requirements. The supply curve for Federal funds, S_{f1}, is somewhat unusual. Specifically, it is horizontal at the targeted Federal funds rate, here 4 percent. (Disregard supply curves S_{f2} and S_{f3} for now.) It is horizontal because the Fed uses open-market operations to manipulate the supply of Federal funds so that the quantity supplied of Federal funds will exactly equal the quantity demanded of Federal funds at the targeted interest rate.

In this case, the Fed seeks to achieve an equilibrium Federal funds rate of 4 percent. In Figure 33.3 it is successful. Note that at the 4 percent Federal funds rate, the quantity of Federal funds supplied (Q_{f1}) equals the quantity of funds demanded (also Q_{f1}). This 4 percent Federal funds rate will remain, as long as the supply curve of Federal funds is horizontal at 4 percent. If the demand for Federal funds increases (D_f shifts to the right along S_{f1}), the Fed will use its open-market operations to increase the availability of reserves such that the 4 percent Federal funds rate is retained. If the demand for Federal funds declines (D_f shifts to the left along S_{f1}), the Fed will withdraw reserves to keep the Federal funds rate at 4 percent.

FIGURE 33.3 Targeting the Federal funds rate In implementing monetary policy, the Federal Reserve determines a desired Federal funds rate and then uses open-market operations (buying and selling of U.S. securities) to add or subtract bank reserves to achieve and maintain that targeted rate. In an expansionary monetary policy, the Fed increases the supply of reserves, for example, from S_{f1} to S_{f2} in this case, to move the Federal funds rate from 4 percent to 3.5 percent. In a restrictive monetary policy, it decreases the supply of reserves, say, from S_{f1} to S_{f3}. Here, the Federal funds rate rises from 4 percent to 4.5 percent.



Expansionary Monetary Policy

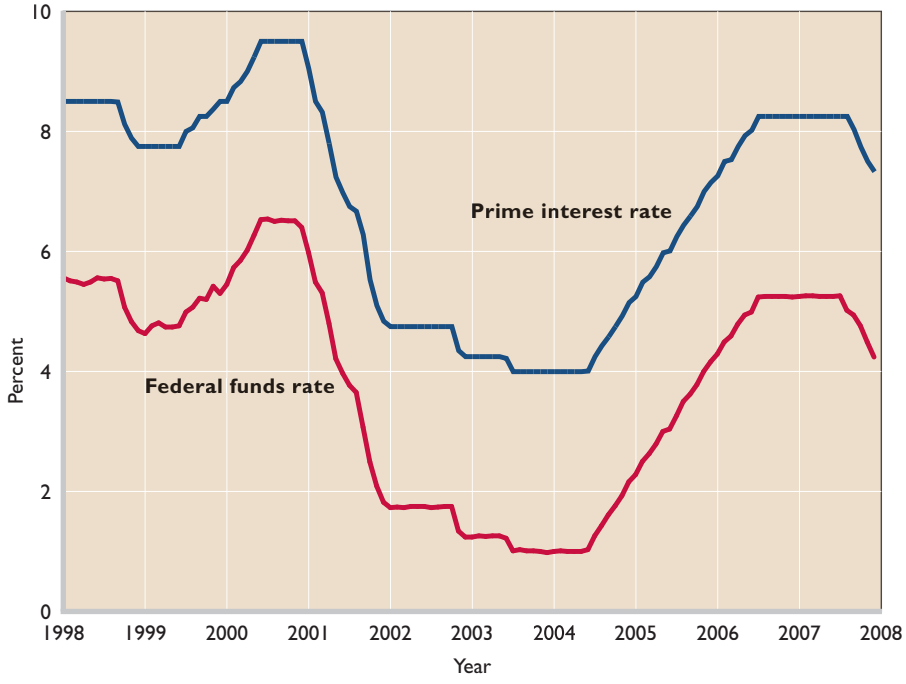
Suppose that the economy faces recession and unemployment. How will the Fed respond? It will initiate an **expansionary monetary policy** (or "easy money policy"). This policy will lower the interest rate to bolster borrowing and spending, which will increase aggregate demand and expand real output. The Fed's immediate step will be to announce a lower target for the Federal funds rate, say 3.5 percent instead of 4 percent. To achieve that lower rate, the Fed will use open-market operations to buy bonds from banks and the public. We know from previous discussion that the purchase of bonds increases the reserves in the banking system. Alternatively, the Fed could expand reserves by lowering the reserve requirement, lowering the discount rate, or auctioning off more reseves, but these alternative tools are less frequently used than open-market operations.

The greater reserves in the banking system produce two critical results:

- The supply of Federal funds increases, lowering the Federal funds rate to the new targeted rate. We show this in Figure 33.3 as a downward shift to the horizontal supply curve from S_{f1} to S_{f2}. The equilibrium Federal funds rate falls to 3.5 percent, just as the FOMC wanted. The equilibrium quantity of reserves in the overnight market for reserves rises from Q_{f1} to Q_{f2}.
- A multiple expansion of the nation's money supply occurs (as we demonstrated in Chapter 32). Given the demand for money, the larger money supply places a downward pressure on other interest rates.

One such rate is the **prime interest rate**—the benchmark interest rate used by banks as a reference point for a wide range of interest rates charged on loans to businesses and individuals. The prime interest rate is higher than the

FIGURE 33.4 The prime interest rate and the Federal funds rate in the United States, 1998–2008. The prime interest rate rises and falls with changes in the Federal funds rate.



Federal funds rate because the prime rate involves longer, more risky loans than overnight loans between banks. But the Federal funds rate and the prime interest rate closely track one another, as evident in Figure 33.4.

Restrictive Monetary Policy

The opposite monetary policy is in order for periods of rising inflation. The Fed will then undertake a **restrictive monetary policy** (or "tight money policy"). This policy will increase the interest rate in order to reduce borrowing and spending, which will curtail the expansion of aggregate demand and hold down price-level increases. The Fed's immediate step will be to announce a higher target for the Federal funds rate, say 4.5 percent instead of 4 percent. Through open-market operations, the Fed will sell bonds to the banks and the public and the sale of those bonds will absorb reserves in the banking system. Alternatively, the Fed could absorb reserves by raising the reserve requirement, raising the discount rate, or reducing the amount of reserves that it auctions off. But, open-market operations are usually sufficient to accomplish the goal.

The smaller reserves in the banking system produce two results opposite those discussed for an expansionary monetary policy:

- The supply of Federal funds decreases, raising the Federal funds rate to the new targeted rate. We show this in Figure 33.3 as an upward shift of the horizonal supply curve from S_{f1} to S_{f3}. The equilibrium Federal funds rate rises to 4.5 percent, just as the FOMC wanted, and the equilibrium quantity of funds in this market falls to Q_{f3}.
- A multiple contraction of the nation's money supply occurs (as demonstrated in Chapter 32). Given the demand for money, the smaller money supply places an upward pressure on other interest rates. For example, the prime interest rate rises.

The Taylor Rule

The proper Federal funds rate for a certain period is a matter of policy discretion by the members of the FOMC. At each of their meetings, committee members assess whether the current target for the Federal funds rate remains appropriate for achieving the twin goals of low inflation and full employment. If the majority of the FOMC members conclude that a change in the rate is needed, the FOMC sets a new targeted rate. This new target is established without adhering to any particular "inflationary target" or "monetary policy rule." Instead, the committee targets the

CONSIDER THIS . . .

The Fed as a Sponge

A good way to remember the role of the Fed in setting the Federal funds rate might be to imagine a bowl of water, with the amount of water in the bowl representing the stock of reserves in the banking system. Then think of the FOMC as having a large sponge, labeled open-market operations. When it wants to decrease the Federal funds rate, it uses the sponge—soaked with water (reserves) created by the Fed—to squeeze new reserves into the banking system bowl. It continues this process until the higher supply of reserves reduces the Federal funds rate to the Fed's desired level. If the Fed wants to increase the Federal funds rate, it uses the sponge to absorb reserves from the bowl (banking system). As the supply of reserves falls, the Federal funds rate rises to the Fed's desired level.

Federal funds rate at the level most appropriate for the current underlying economic conditions.

A rule of thumb suggested by economist John Taylor of Stanford roughly tracks the actual policy of the Fed. This rule of thumb builds on the belief held by many economists that central banks are willing to tolerate a small positive rate of inflation if doing so will help the economy to produce at potential output. The **Taylor rule** assumes that the Fed has a 2 percent "target rate of inflation" that it is willing to tolerate and that the FOMC follows three rules when setting its target for the Federal funds rate:

- When real GDP equals potential GDP and inflation is at its target rate of 2 percent, the Federal funds target rate should be 4 percent, implying a real Federal funds rate of 2 percent (= 4 percent nominal Federal funds rate – 2 percent inflation rate).
- For each 1 percent increase of real GDP above potential GDP, the Fed should raise the *real* Federal funds rate by ½ percentage point.
- For each 1 percent increase in the inflation rate above its 2 percent target rate, the Fed should raise the *real* Federal funds rate by ½ percentage point. (Note, though, that in this case each ½ percentage point increase in the real rate will require a 1.5 percentage point increase in the nominal rate in order to account for the underlying 1 percent increase in the inflation rate.)

The last two rules are applied independently of each other so that if real GDP is above potential output and at the same time inflation is above the 2 percent target rate, the Fed will apply both rules and raise real interest rates in response to both factors. For instance, if real GDP is 1 percent above potential output and inflation is simultaneously 1 percent above the 2 percent target rate, then the Fed will raise the *real* Federal funds rate by 1 percentage point (= ½ percentage point for the excessive GDP + ½ percentage point for the excessive inflation).

Also notice that the last two rules are reversed for situations in which real GDP falls below potential GDP or inflation falls below 2 percent. Each 1 percent decline in real GDP below potential GDP or fall in inflation below 2 percent calls for a decline of the *real* Federal funds rate by ½ percentage point.

We reemphasize that the Fed has no official allegiance to the Taylor rule. It changes the Federal funds rate to any level that it deems appropriate.

ORIGIN OF THE IDEA
O 33.4
Taylor rule

QUICK REVIEW 33.3

- The Fed conducts its monetary policy by establishing a targeted Federal funds interest rate—the rate that commercial banks charge one another for overnight loans of reserves.
- An expansionary monetary policy (loose money policy) lowers the Federal funds rate, increases the money supply, and lowers other interest rates.
- A restrictive monetary policy (tight money policy) increases the Federal funds rate, reduces the money supply, and increases other interest rates.
- The Fed uses it discretion in setting the Federal funds target rate, but its decisions regarding monetary policy and the target rate appear to be broadly consistent with the Taylor rule.

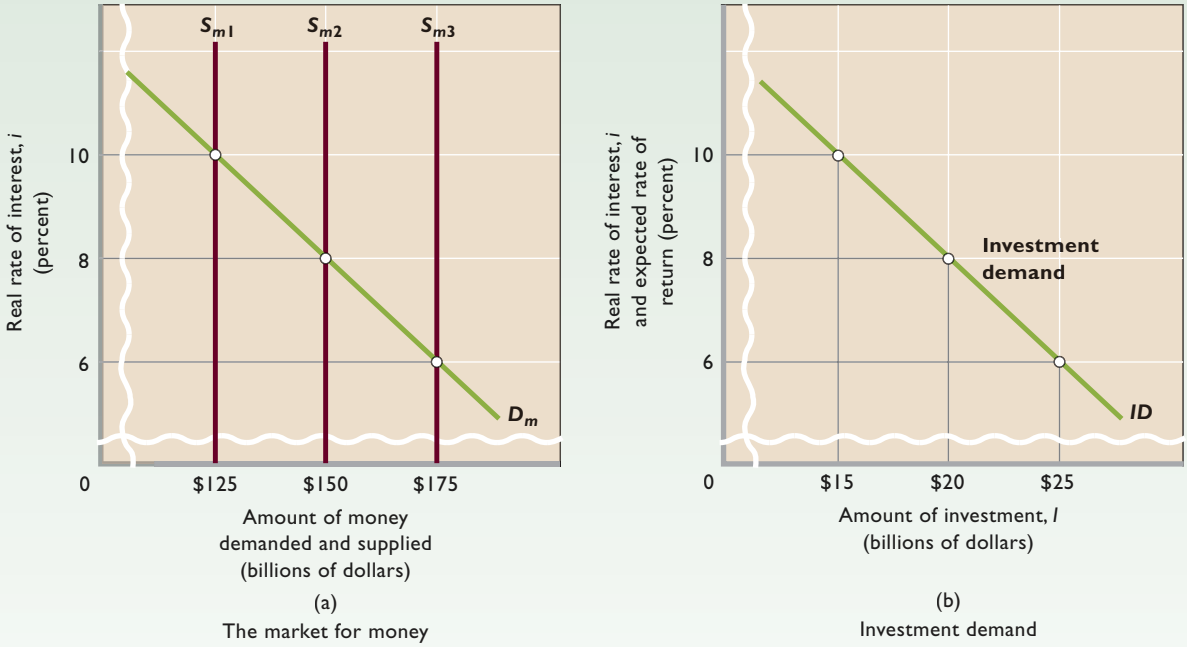
Monetary Policy, Real GDP, and the Price Level

We have identified and explained the tools of expansionary and contractionary monetary policy. We now want to emphasize how monetary policy affects the economy's levels of investment, aggregate demand, real GDP, and prices.

INTERACTIVE GRAPHS
G 33.2
Monetary policy

keygraph

FIGURE 33.5 Monetary policy and equilibrium GDP. An expansionary monetary policy that shifts the money supply curve rightward from S_{m1} to S_{m2} in (a) lowers the interest rate from 10 to 8 percent in (b). As a result, investment spending increases from $15 billion to $20 billion, shifting the aggregate demand curve rightward from AD_1 to AD_2 in (c) so that real output rises from the recessionary level of $880 billion to the fullemployment level Q_f = $900 billion along the horizontal dashed segment of aggregate supply. In (d), the economy at point *a* has an inflationary output gap of $10 billion because it is producing at $910 billion, $10 billion above potential output. A restrictive monetary policy that shifts the money supply curve leftward from Sm_3 = $175 billion to just $162.5 billion in (a) will increase the interest rate from 6 to 7 percent. Investment spending thus falls by $2.5 billion from $25 billion to $22.5 billion in (b). This initial decline is multiplied by 4 by the multiplier process so that the aggregate demand curve shifts leftward in (d) by $10 billion from AD_3 to AD_4, moving the economy along the horizontal dashed segment of aggregate supply to equilibrium *b*. This returns the economy to full employment and eliminates the inflationary output gap.



QUICK QUIZ FOR FIGURE 33.5

1. The ultimate objective of an expansionary monetary policy is depicted by:
   - **a.** a decrease in the money supply from S_{m3} to S_{m2}.
   - **b.** a reduction of the interest rate from 8 to 6 percent.
   - **c.** an increase in investment from $20 billion to $25 billion.
   - **d.** an increase in real GDP from Q_1 to Q_f.

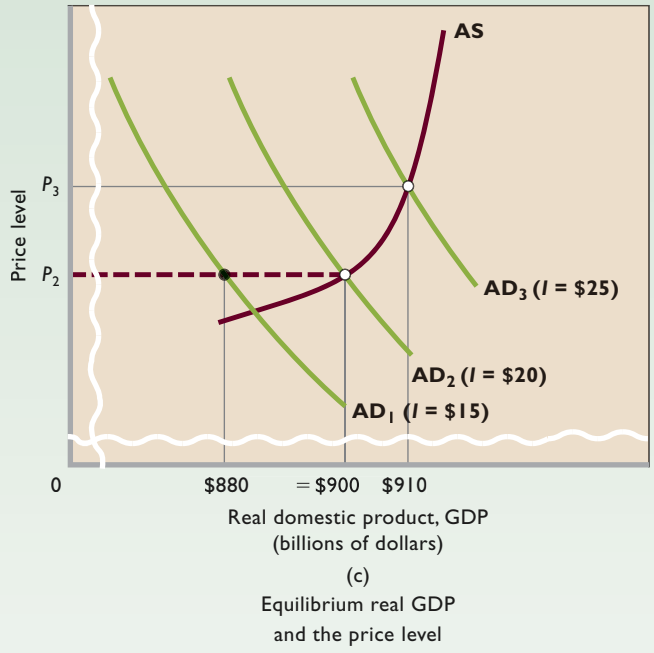
Cause-Effect Chain

The four diagrams in **Figure 33.5 (Key Graph)** will help you understand how monetary policy works toward achieving its goals.

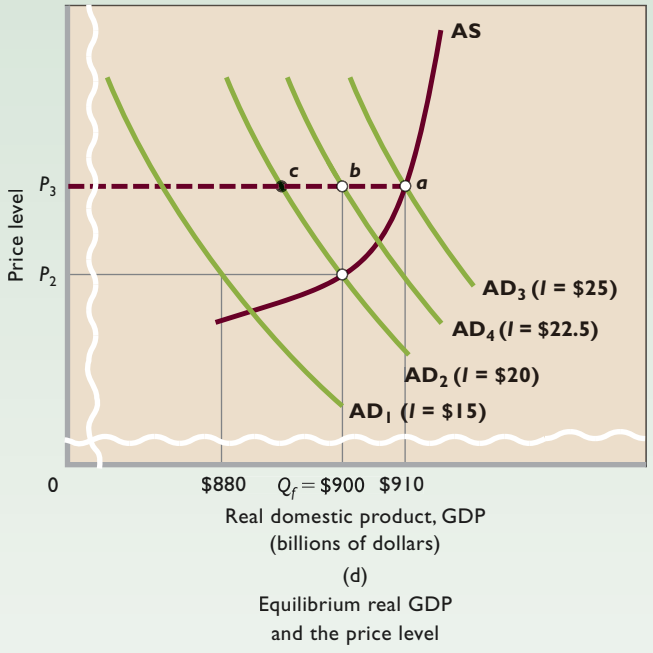
Market for Money Figure 33.5a represents the market for money, in which the demand curve for money and the supply curve of money are brought together. Recall that the total demand for money is made up of the transactions and asset demands.

This figure also shows three potential money supply curves, S_{m1}, S_{m2}, and S_{m3}. In each case, the money supply is shown as a vertical line representing some fixed amount of money determined by the Fed.

The equilibrium interest rate is the rate at which the amount of money demanded and the amount supplied are equal. With money demand D_m in Figure 33.5a, if the supply of money is $125 billion ($S_{m1}$), the equilibrium interest rate is 10 percent. With a money supply of $150 billion ($S_{m2}$), the equilibrium interest rate is 8 percent; with a money supply of $175 billion ($S_{m3}$), it is 6 percent.



(c)
Equilibrium real GDP
and the price level



(d)
Equilibrium real GDP
and the price level

2. A successful restrictive monetary policy is evidenced by a shift in the money supply curve from:
   a. S_{m3} to a point half way between S_{m2} and S_{m3}, a decrease in investment from $25 billion to $22.5 billion, and a decline in aggregate demand from AD_3 to AD_4.
   b. S_{m1} to S_{m2}, an increase in investment from $20 billion to $25 billion, and an increase in real GDP from Q_1 to Q_f.
   c. S_{m3} to S_{m2}, a decrease in investment from $25 billion to $20 billion, and a decline in the price level from P_3 to P_2.
   d. S_{m3} to S_{m2}, a decrease in investment from $25 billion to $20 billion, and an increase in aggregate demand from AD_2 to AD_3.

3. The Federal Reserve could increase the money supply from S_{m1} to S_{m2} by:
   a. increasing the discount rate.
   b. reducing taxes.
   c. buying government securities in the open market.
   d. increasing the reserve requirement.

4. If the spending-income multiplier is 4 in the economy depicted, an increase in the money supply from $125 billion to $150 billion will:
   a. shift the aggregate demand curve rightward by $20 billion.
   b. increase real GDP by $25 billion.
   c. increase real GDP by $100 billion.
   d. shift the aggregate demand curve leftward by $5 billion.

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

You know from Chapter 27 that the real, not the nominal, rate of interest is critical for investment decisions. So here we assume that Figure 33.5a portrays real interest rates.

Investment These 10, 8, and 6 percent real interest rates are carried rightward to the investment demand curve in Figure 33.5b. This curve shows the inverse relationship between the interest rate—the cost of borrowing to invest—and the amount of investment spending. At the 10 percent interest rate, it will be profitable for the nation's businesses to invest $15 billion; at 8 percent, $20 billion; at 6 percent, $25 billion.

Changes in the interest rate mainly affect the investment component of total spending, although they also affect spending on durable consumer goods (such as autos) that are purchased on credit. The impact of changing interest rates on investment spending is great because of the large cost and long-term nature of capital purchases. Capital equipment, factory buildings, and warehouses are tremendously expensive. In absolute terms, interest charges on funds borrowed for these purchases are considerable.

Similarly, the interest cost on a house purchased on a long-term contract is very large: A $\frac{1}{2}$-percentage-point change in the interest rate could amount to thousands of dollars in the total cost of buying a home.

In brief, the impact of changing interest rates is mainly on investment (and, through that, on aggregate demand, output, employment, and the price level). Moreover, as Figure 33.5b shows, investment spending varies inversely with the real interest rate.

Equilibrium GDP Figure 33.5c shows the impact of our three real interest rates and corresponding levels of investment spending on aggregate demand. (Ignore Figure 33.5d for the time being. We will return to it shortly.) As noted, aggregate demand curve AD_1 is associated with the $15 billion level of investment, AD_2 with investment of $20 billion, and AD_3 with investment of $25 billion. That is, investment spending is one of the determinants of aggregate demand. Other things equal, the greater the investment spending, the farther to the right lies the aggregate demand curve.

Suppose the money supply in Figure 33.5a is $150 billion ($S_{m2}$), producing an equilibrium interest rate of 8 percent. In Figure 33.5b we see that this 8 percent interest rate will bring forth $20 billion of investment spending. This $20 billion of investment spending joins with consumption spending, net exports, and government spending to yield aggregate demand curve AD_2 in Figure 33.5c. The equilibrium levels of real output and prices are Q_f = $900 billion and P_2, as determined by the intersection of AD_2 and the aggregate supply curve AS.

To test your understanding of these relationships, explain why each of the other two levels of money supply in Figure 33.5a results in a different interest rate, level of investment, aggregate demand curve, and equilibrium real output.

Effects of an Expansionary Monetary Policy

Recall that the inflationary ratchet effect discussed in Chapter 29 describes the fact that real-world price levels tend to be downwardly inflexible. Thus, with our economy starting from the initial equilibrium where AD_2 intersects AS, the price level will be downwardly inflexible at P_2 so that aggregate supply will be horizontal to the left of Q_f. This means that if aggregate demand decreases, the economy's equilibrium will move leftward along the dashed horizontal line shown in Figure 33.5c.

Just such a decline would happen if the money supply fell to $125 billion ($S_{m1}$), shifting the aggregate demand curve leftward to AD_1 in Figure 33.5c. This results in a real output of $880 billion, $20 billion less than the economy's full-employment output level of $900 billion. The economy will be experiencing recession, a negative GDP gap, and substantial unemployment. The Fed therefore should institute an expansionary monetary policy.

To increase the money supply, the Fed will take some combination of the following actions: (1) buy government securities from banks and the public in the open market, (2) lower the legal reserve ratio, (3) lower the discount rate, and (4) increase reserve auctions. The intended outcome will be an increase in excess reserves in the commercial banking system and a decline in the Federal funds rate. Because excess reserves are the basis on which commercial banks and thrifts can earn profit by lending and thus creating checkable-deposit money, the nation's money supply will rise. An increase in the money supply will lower the interest rate, increasing investment, aggregate demand, and equilibrium GDP.

For example, an increase in the money supply from $125 billion to $150 billion ($S_{m1}$ to S_{m2}) will reduce the interest rate from 10 to 8 percent, as indicated in Figure 33.5a, and will boost investment from $15 billion to $20 billion, as shown in Figure 33.5b. This $5 billion increase in investment will shift the aggregate demand curve rightward by more than the increase in investment because of the multiplier effect. If the economy's MPC is .75, the multiplier will be 4, meaning that the $5 billion increase in investment will shift the AD curve rightward by $20 billion (= 4 × $5 billion) at each price level. Specifically, aggregate demand will shift from AD_1 to AD_2, as shown in Figure 33.5c. This rightward shift in the aggregate demand curve along the dashed horizontal part of aggregate supply will eliminate the negative GDP gap by increasing GDP from $880 billion to the full-employment GDP of Q_f = $900 billion.[1]

Column 1 in Table 33.3 summarizes the chain of events associated with an expansionary monetary policy.

Effects of a Restrictive Monetary Policy

To prevent Figure 33.5c from getting too crowded as we consider restrictive monetary policy, we will combine the money market in Figure 33.5a and the investment demand

[1]To keep things simple, we assume that the increase in real GDP does not increase the demand for money. In reality, the transactions demand for money would rise, slightly dampening the decline in the interest rate shown in Figure 33.5a.