16 Tools of Monetary Policy

Learning Objectives

- Illustrate the market for reserves, and demonstrate how changes in monetary policy can affect the equilibrium federal funds rate.
- Summarize how conventional monetary policy tools are implemented and the relative advantages and limitations of each tool.
- Explain the key monetary policy tools that are used when conventional policy is no longer effective.
- Identify the distinctions and similarities between the monetary policy tools of the Federal Reserve and those of the European Central Bank.

Preview

In this chapter, we examine the tools of monetary policy used by the Fed to control the money supply and interest rates. Because the Fed's use of these policy tools has such an important impact on interest rates and economic activity, it is vital to understand how the Fed wields them in practice and how relatively useful each tool is.

In recent years, the Federal Reserve has increasingly focused on the **federal funds rate** (the interest rate on overnight loans of reserves from one bank to another) as the primary instrument of monetary policy. Since February 1994, the Fed has announced a federal funds rate target at each Federal Open Market Committee (FOMC) meeting, an announcement that is watched closely by market participants because it affects interest rates throughout the economy. Thus, to fully comprehend how the Fed uses its tools in the conduct of monetary policy, we must understand not only their effect on the money supply but also their direct effect on the federal funds rate and how they can be used to help achieve a federal funds rate that is close to the target. The chapter therefore begins with a supply and demand analysis of the market for reserves to explain how the Fed's settings for the four tools of monetary policy—open market operations, discount policy, reserve requirements, and the interest paid on reserves—determine the federal funds rate. We next go on to look in more detail at each of these tools of monetary policy to see how they are used in practice and to gain a sense of their relative advantages. We then examine the nonconventional tools of monetary policy that the Federal Reserve was forced to use during the extraordinary circumstances of the recent financial crisis. The chapter ends with a discussion of the tools of monetary policy used by other central banks besides the Federal Reserve.

THE MARKET FOR RESERVES AND THE FEDERAL FUNDS RATE

In Chapter 15, we saw how open market operations (changes in nonborrowed reserves) and Federal Reserve lending (changes in borrowed reserves) affect the balance sheet of the Fed and the amount of reserves. The market for reserves is where the federal funds rate is determined, and this is why we turn to a supply and demand analysis of this market to analyze how the tools of monetary policy affect the federal funds rate.

Demand and Supply in the Market for Reserves

The analysis of the market for reserves proceeds in a similar fashion to the analysis of the bond market that we conducted in Chapter 5. First, we derive demand and supply curves for reserves. Then, the market equilibrium in which the quantity of reserves demanded equals the quantity of reserves supplied determines the level of the federal funds rate, the interest rate charged on the loans of these reserves.

Demand Curve To derive the demand curve for reserves, we need to ask what happens to the quantity of reserves demanded by banks, holding everything else constant, as the federal funds rate changes. Recall from Chapter 15 that the amount of reserves can be split up into two components: (1) required reserves, which are equal to the required reserve ratio times the amount of deposits on which reserves are required; and (2) excess reserves, the additional reserves banks choose to hold. Therefore, the quantity of reserves demanded by banks equals required reserves plus the quantity of excess reserves demanded. Excess reserves are insurance against deposit outflows, and the cost of holding these excess reserves is their *opportunity cost*—the interest rate that could have been earned on lending these reserves out minus the interest rate that is earned on these reserves, i_{or}.

Before the fall of 2008, the Federal Reserve did not pay interest on reserves, but since then it has paid interest on reserves at a level that is typically set at a fixed amount below the federal funds rate target and therefore changes when the target changes. When the federal funds rate is above the rate paid on reserves, i_{or}, then as the federal funds rate decreases, the opportunity cost of holding excess reserves falls. Holding everything else constant, including the quantity of required reserves, the quantity of reserves demanded rises. Consequently, the demand curve for reserves, R^d, slopes downward in Figure 1 when the federal funds rate is above i_{or}. If, however, the federal funds rate begins to fall below the interest rate paid on excess reserves i_{or}, banks do not lend in the overnight market at a lower interest rate. Instead, they just keep on adding to their holdings of excess reserves indefinitely. The result is that the demand curve for reserves, R^d, becomes flat (infinitely elastic) at i_{or} in Figure 1.

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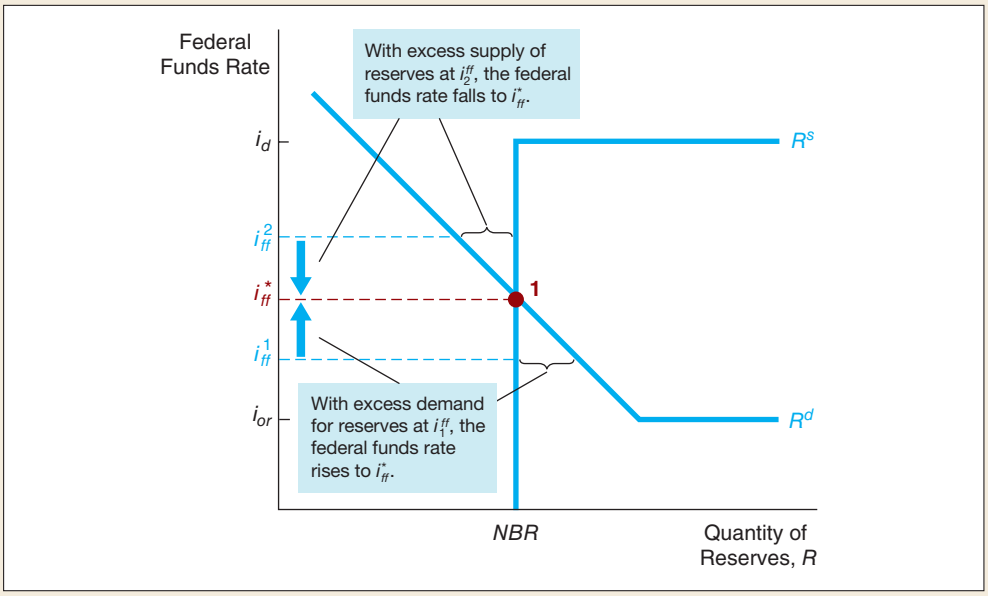
FIGURE 1
Equilibrium in the Market for Reserves

Equilibrium occurs at the intersection of the supply curve R^s and the demand curve R^d, at point 1 and an interest rate of i^*_{ff}.



Supply Curve The supply of reserves, R^s, can be broken up into two components: the amount of reserves that are supplied by the Fed's open market operations, called *nonborrowed reserves* (*NBR*), and the amount of reserves borrowed from the Fed, called *borrowed reserves* (*BR*). The primary cost of borrowing from the Fed is the interest rate charged by the Fed on these loans—the discount rate, i_d, which is set at a fixed amount above the federal funds target rate and thus changes when the target changes. Because borrowing federal funds from other banks is a substitute for borrowing (taking out discount loans) from the Fed, if the federal funds rate i_{ff} is below the discount rate i_d, then banks will not borrow from the Fed. Borrowed reserves will be zero because borrowing in the federal funds market is cheaper. Thus, as long as i_{ff} remains below i_d, the supply of reserves will just equal the amount of nonborrowed reserves supplied by the Fed, *NBR*, and so the supply curve will be vertical, as shown in Figure 1. However, as the federal funds rate begins to rise above the discount rate, banks will want to keep borrowing more and more at i_d and then lending out the proceeds in the federal funds market at the higher rate, i_{ff}. The result is that the supply curve becomes flat (infinitely elastic) at i_d, as shown in Figure 1.

Market Equilibrium Market equilibrium occurs when the quantity of reserves demanded equals the quantity supplied, $R^s = R^d$. Equilibrium therefore occurs at the intersection of the demand curve R^d and the supply curve R^s at point 1, with an equilibrium federal funds rate of i_{ff}^*. When the federal funds rate is above the equilibrium rate at i_{ff}^2, more reserves are supplied than are demanded (excess supply), and so the federal funds rate falls to i_{ff}^*, as shown by the downward arrow. When the federal funds rate is below the equilibrium rate at i_{ff}^1, more reserves are demanded than are supplied (excess demand), and so the federal funds rate rises, as shown by the upward arrow. (Note that Figure 1 is drawn so that i_d is above i_{ff}^* because the Federal Reserve now keeps the discount rate substantially above the target for the federal funds rate.)

How Changes in the Tools of Monetary Policy Affect the Federal Funds Rate

Now that we understand how the federal funds rate is determined, we can examine how changes in the four tools of monetary policy—open market operations, discount lending, reserve requirements, and the interest rate paid on reserves—affect the market for reserves and the equilibrium federal funds rate.

Open Market Operations The effect of an open market operation depends on whether the supply curve initially intersects the demand curve in its downward-sloped section or in its flat section. Panel (a) of Figure 2 shows what happens if the intersection initially occurs on the downward-sloped section of the demand curve. We have already seen that an open market purchase leads to a greater quantity of reserves supplied; this is true at any given federal funds rate because of the higher amount of nonborrowed reserves, which rises from NBR_1 to NBR_2. An open market purchase therefore shifts the supply curve to the right from R_1^s to R_2^s and moves the equilibrium from point 1 to point 2, lowering the federal funds rate from i_{ff}^1 to i_{ff}^2.[1] The same reasoning implies that an open market sale decreases the quantity of nonborrowed reserves supplied, shifts the supply curve to the left, and causes the federal funds rate to rise. Because this is the typical situation—since the Fed usually keeps the federal funds rate target above the interest rate paid on reserves—the conclusion is that ***an open market purchase causes the federal funds rate to fall, whereas an open market sale causes the federal funds rate to rise.***

[1]We come to the same conclusion if we use the money supply framework outlined in Chapter 15, along with the liquidity preference framework outlined in Chapter 5. An open market purchase raises reserves and the money supply, and then the liquidity preference framework shows that interest rates fall as a result.

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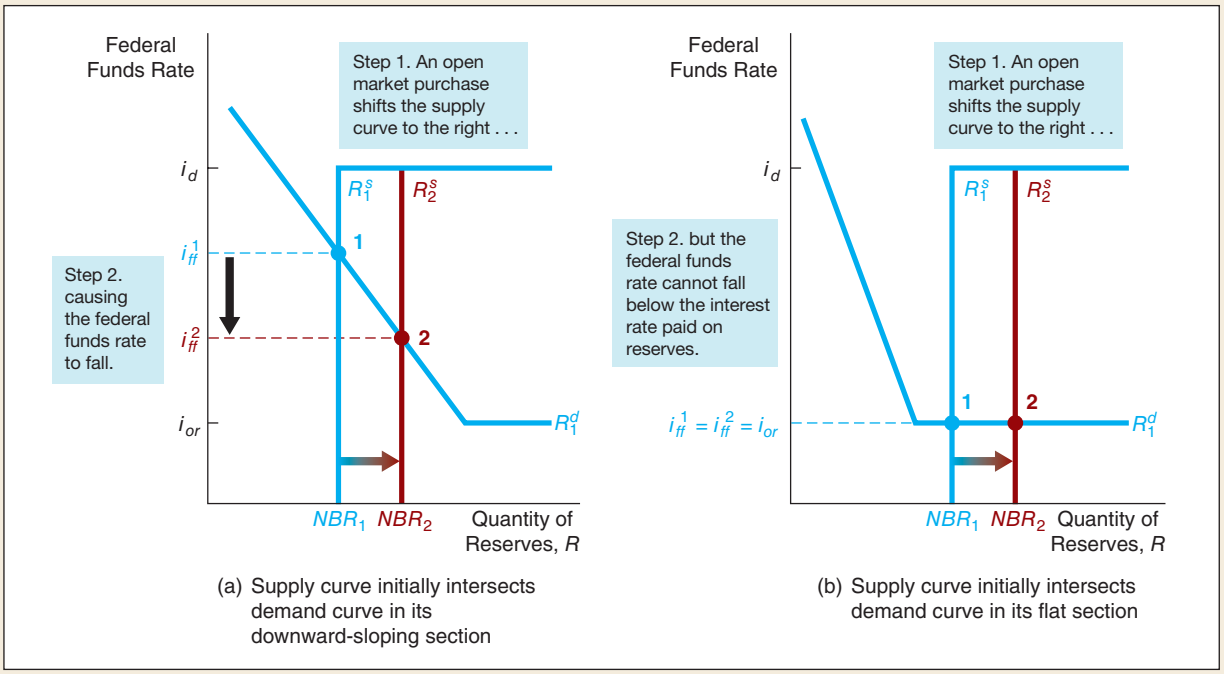

FIGURE 2 Response to an Open Market Operation

An open market purchase increases nonborrowed reserves and hence the reserves supplied, and shifts the supply curve from R_1^s to R_2^s. In panel (a), the equilibrium moves from point 1 to point 2, lowering the federal funds rate from i_{ff}^1 to i_{ff}^2. In panel (b), the equilibrium moves from point 1 to point 2, but the federal funds rate remains unchanged, $i_{ff}^1 = i_{ff}^2 = i_{or}$.

However, if the supply curve initially intersects the demand curve on its flat section, as in panel (b) of Figure 2, open market operations have no effect on the federal funds rate. To see this, let's again look at an open market purchase that raises the quantity of reserves supplied, which shifts the supply curve from R_1^s to R_2^s. However, this time we consider the case in which $i_{ff}^1 = i_{or}$ initially. The shift in the supply curve moves the equilibrium from point 1 to point 2, but the federal funds rate remains unchanged at i_{or} because ***the interest rate paid on reserves, i_{or}, sets a floor for the federal funds rate.***

Discount Lending The effect of a discount rate change depends on whether the demand curve intersects the supply curve in its vertical section or its flat section. Panel (a) of Figure 3 shows what happens if the intersection occurs on the vertical section of the supply curve, so that there is no discount lending and borrowed reserves, BR, are zero. In this case, when the discount rate is lowered by the Fed from i_d^1 to i_d^2, the horizontal section of the supply curve falls, as in R_2^s, but the intersection of the supply and demand curves remains at point 1. Thus, in this case, no change occurs in the equilibrium federal funds rate, which remains at i_{ff}^1. Because this is the typical situation—since the Fed now usually keeps the discount rate above its target for the federal funds rate—the conclusion is that ***most changes in the discount rate have no effect on the federal funds rate.***

However, if the demand curve intersects the supply curve on its flat section, so that there is some discount lending (i.e., $BR > 0$), as in panel (b) of Figure 3, changes in the discount rate do affect the federal funds rate. In this case, initially

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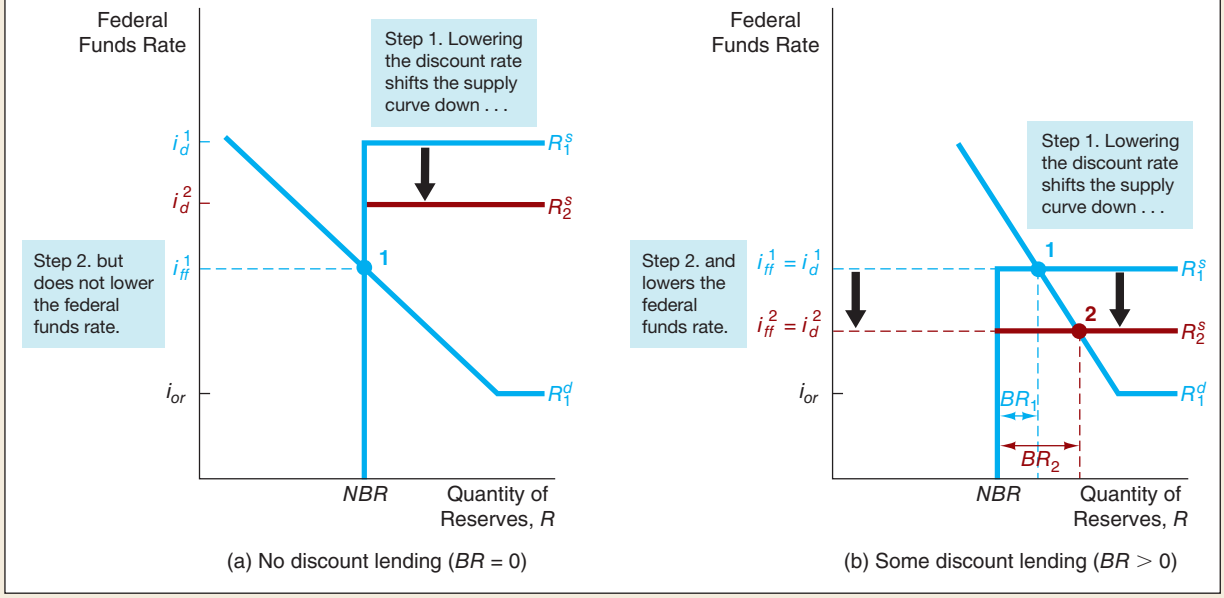

FIGURE 3 **Response to a Change in the Discount Rate**

In panel (a), when the discount rate is lowered by the Fed from i_d^1 to i_d^2, the horizontal section of the supply curve falls, as in R_2^s, and the equilibrium federal funds rate remains unchanged at i_{ff}^1. In panel (b), when the discount rate is lowered by the Fed from i_d^1 to i_d^2, the horizontal section of the supply curve R_2^s falls, and the equilibrium federal funds rate falls from i_{ff}^1 to i_{ff}^2 as borrowed reserves increase.

discount lending is positive and the equilibrium federal funds rate equals the discount rate, $i_{ff}^1 = i_d^1$. When the discount rate is lowered by the Fed from i_d^1 to i_d^2, the horizontal section of the supply curve R_2^s falls, moving the equilibrium from point 1 to point 2, and the equilibrium federal funds rate falls from i_{ff}^1 to i_{ff}^2 $(=i_d^2)$, as shown in panel (b). In this case, BR increases from BR_1 to BR_2.

Reserve Requirements When the required reserve ratio increases, required reserves increase and hence the quantity of reserves demanded increases for any given interest rate. Thus a rise in the required reserve ratio shifts the demand curve to the right from R_1^d to R_2^d in Figure 4, moves the equilibrium from point 1 to point 2, and in turn raises the federal funds rate from i_{ff}^1 to i_{ff}^2. The result is that ***when the Fed raises reserve requirements, the federal funds rate rises.***[2]

Similarly, a decline in the required reserve ratio lowers the quantity of reserves demanded, shifts the demand curve to the left, and causes the federal funds rate to fall. ***When the Fed decreases reserve requirements, the federal funds rate falls.***

Interest on Reserves The effect of a change in the interest rate paid by the Fed on reserves depends on whether the supply curve intersects the demand curve in its

[2]Because an increase in the required reserve ratio means that the same amount of reserves is able to support a smaller amount of deposits, a rise in the required reserve ratio leads to a decline in the money supply. Using the liquidity preference framework from Chapter 5, the fall in the money supply results in a rise in interest rates, yielding the same conclusion given in the text—that raising reserve requirements leads to higher interest rates.

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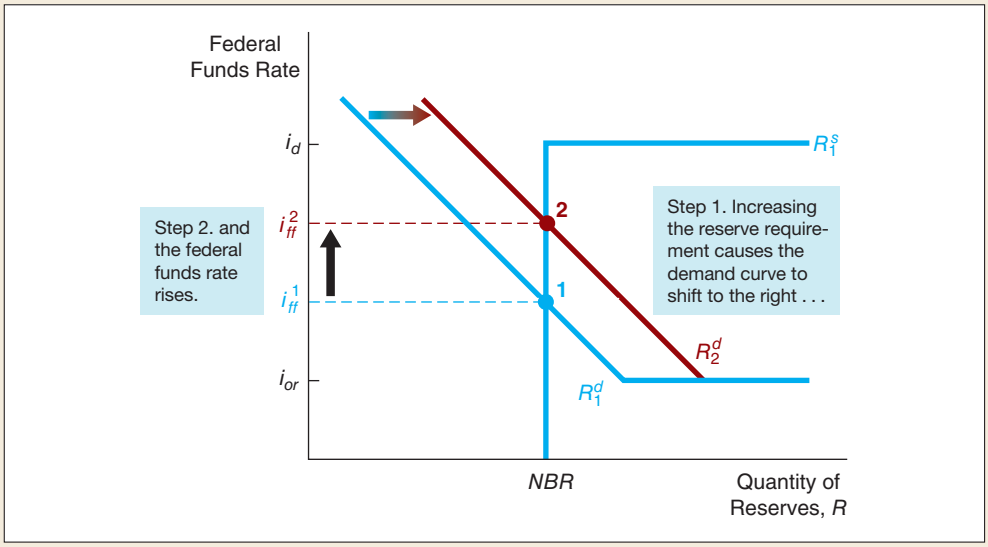
FIGURE 4
Response to a Change in Required Reserves

When the Fed raises reserve requirements, required reserves increase, which raises the demand for reserves. The demand curve shifts from R_1^d to R_2^d, the equilibrium moves from point 1 to point 2, and the federal funds rate rises from i_{ff}^1 to i_{ff}^2.



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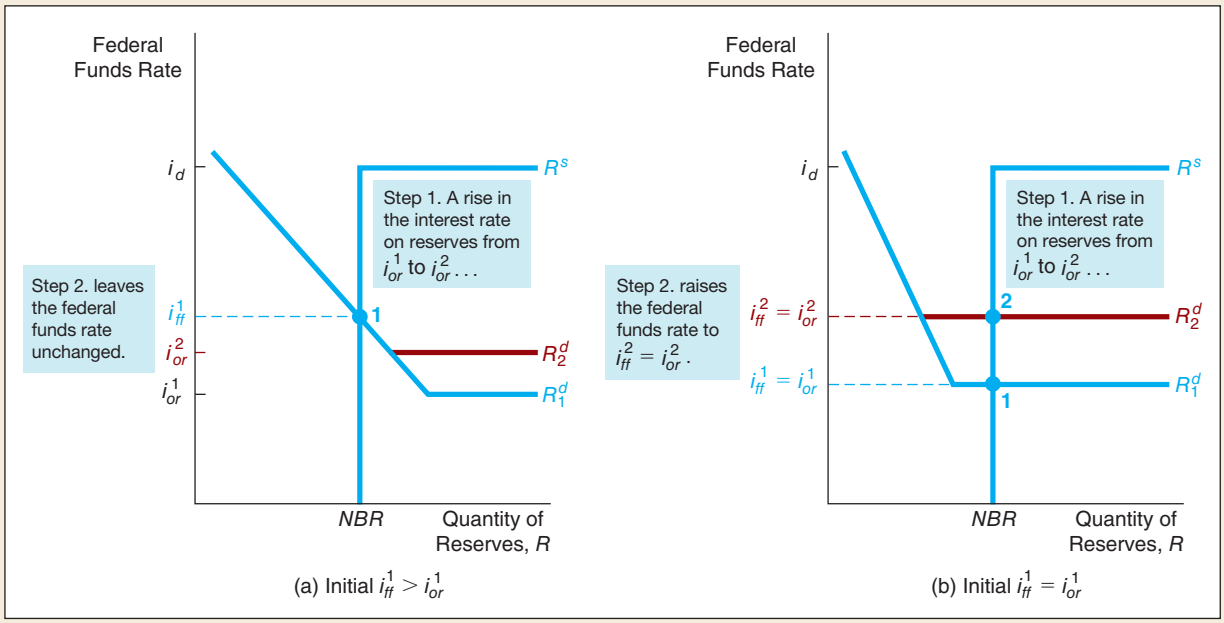

FIGURE 5 **Response to a Change in the Interest Rate on Reserves**

In panel (a), when the equilibrium federal funds rate is above the interest rate paid on reserves, a rise in the interest rate on reserves from i_{or}^1 to i_{or}^2 raises the horizontal section of the demand curve, as in R_1^d, but the equilibrium federal funds rate remains unchanged at i_{ff}^1. In panel (b), when the equilibrium federal funds rate is equal to the interest rate paid on reserves, a rise in the interest rate on reserves from i_{or}^1 to i_{or}^2 raises the equilibrium federal funds rate $i_{ff}^1 = i_{or}^1$ to $i_{ff}^1 = i_{or}^1$.

downward-sloping section or its flat section. Panel (a) of Figure 5 shows what happens if the intersection occurs on the demand curve's downward-sloping section, where the equilibrium federal funds rate is above the interest rate paid on reserves. In this case, when the interest rate on reserves is raised from i_{or}^1 to i_{or}^2, the horizontal section of the demand curves rises, as in R_2^d, but the intersection of the supply and demand curves remains at point 1. However, if the supply curve intersects the demand curve on its flat section, where the equilibrium federal funds rate is equal to the interest rate paid on reserves, as in panel (b) of Figure 5, a rise in the interest rate on reserves from i_{or}^1 to i_{or}^2 moves the equilibrium to point 2, where the equilibrium federal funds rate rises from $i_{ff}^1 = i_{or}^1$ to $i_{ff}^2 = i_{or}^2$. ***When the federal funds rate is at the interest rate paid on reserves, a rise in the interest rate on reserves raises the federal funds rate.***

APPLICATION How the Federal Reserve's Operating Procedures Limit Fluctuations in the Federal Funds Rate

An important advantage of the Fed's current procedures for operating the discount window and paying interest on reserves is that they limit fluctuations in the federal funds rate. We can use our supply and demand analysis of the market for reserves to see why.

Suppose that, initially, the equilibrium federal funds rate is at the federal funds rate target of i_{ff}^T in Figure 6. If the demand for reserves experiences a large unexpected increase, the demand curve shifts to the right to $R^{d''}$, where it now intersects the supply curve for reserves on the flat portion, where the equilibrium federal funds rate i_{ff}'' equals the discount rate i_d. No matter how far the demand curve shifts to the right, the equilibrium federal funds rate i_{ff}'' will stay at i_d because borrowed reserves will just continue to increase, matching the increase in demand. Similarly, if the demand for reserves experiences a large unexpected decrease, the demand curve shifts to the left to $R^{d'}$, and the supply curve intersects the demand curve on its flat portion, where the equilibrium federal funds rate i_{ff}' equals the interest rate paid on reserves i_{or}. No matter how far left the demand curve shifts, the equilibrium federal funds rate i_{ff}' stays at i_{or} because excess reserves will keep on decreasing so that the quantity demanded of reserves equals the quantity of nonborrowed reserves supplied.[3]

Our analysis therefore shows that the ***Federal Reserve's operating procedures limit the fluctuations of the federal funds rate so that it remains between i_{er} and i_d.*** If the range between i_{or} and i_d is kept narrow enough, then fluctuations around the target rate will be small. ◆

[3]There are times when the federal funds rate might fall below the level of the interest rate on reserves. This situation can occur because some participants in the federal funds market, particularly Fannie Mae and Freddie Mac, are not banks and so cannot keep their funds as deposits at the Federal Reserve. When they have excess funds, they may be forced to accept a lower interest rate than that paid on reserves because they don't have access to this higher rate from the Federal Reserve.

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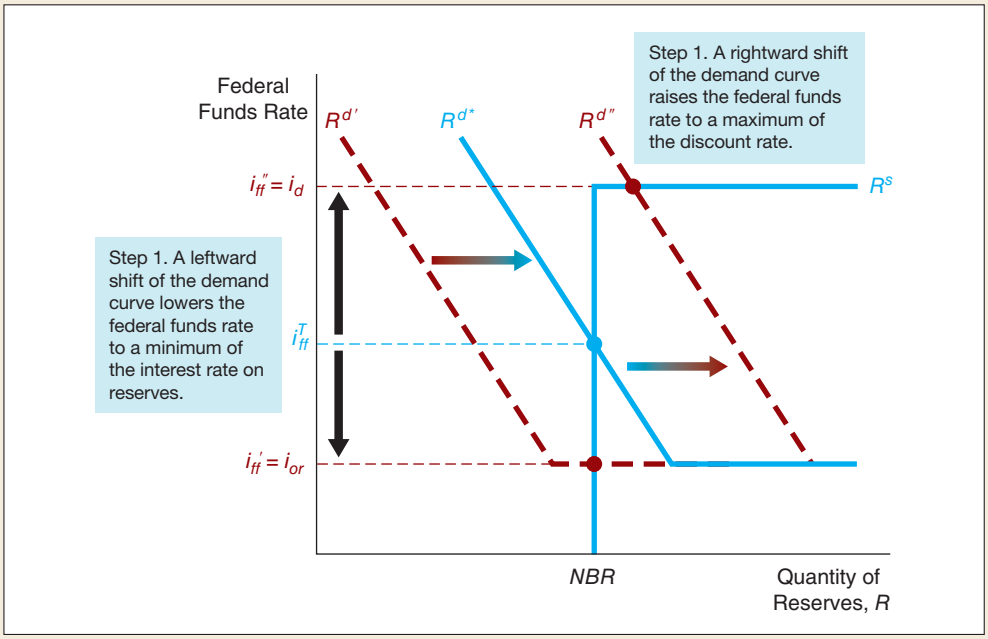
FIGURE 6
How the Federal Reserve's Operating Procedures Limit Fluctuations in the Federal Funds Rate

A rightward shift in the demand curve for reserves to $R^{d''}$ will raise the equilibrium federal funds rate to a maximum of $i''_{ff} = i_d$, whereas a leftward shift of the demand curve to $R^{d'}$ will lower the federal funds rate to a minimum of $i'_{ff} = i_{or}$.



CONVENTIONAL MONETARY POLICY TOOLS

During normal times, the Federal Reserve uses three tools of monetary policy—open market operations, discount lending, and reserve requirements—to control the money supply and interest rates, and these three tools are referred to as **conventional monetary policy tools**. We will look at each of them in turn, and then at the additional tool of paying interest on reserves, to see how the Fed wields them in practice and how relatively useful each tool is.

Open Market Operations

Open market operations are the most important conventional monetary policy tool because they are the primary determinants of changes in interest rates and the monetary base, the main source of fluctuations in the money supply. Open market purchases expand reserves and the monetary base, thereby increasing the money supply and lowering short-term interest rates. Open market sales shrink reserves and the monetary base, decreasing the money supply and raising short-term interest rates. Now that we understand from Chapter 15 the elements of the Fed's balance sheet that influence reserves and the monetary base, we can examine how the Federal Reserve conducts open market operations with the objective of controlling short-term interest rates and the money supply.

Open market operations fall into two categories: **Dynamic open market operations** are intended to change the level of reserves and the monetary base, and **defensive open market operations** are intended to offset movements in other factors that affect reserves and the monetary base, such as changes in Treasury deposits with the Fed or changes in float. The Fed conducts conventional open market operations in U.S.

Treasury and government agency securities, especially U.S. Treasury bills. The Fed conducts most of its open market operations in Treasury securities because the market for these securities is the most liquid and has the largest trading volume. It has the capacity to absorb the Fed's substantial volume of transactions without experiencing excessive price fluctuations that would disrupt the market.

As we saw in Chapter 14, the decision-making authority for open market operations is the Federal Open Market Committee (FOMC), which sets a target for the federal funds rate. The actual execution of these operations, however, is conducted by the trading desk at the Federal Reserve Bank of New York, whose operations are described by the Inside the Fed box, "A Day at the Trading Desk."

Open market operations are conducted electronically through a specific set of dealers in government securities, known as **primary dealers**, by a computer system called TRAPS (Trading Room Automated Processing System). A message is electronically transmitted to all the primary dealers simultaneously over TRAPS, indicating the type and maturity of the operation being arranged. The dealers are given several minutes to respond via TRAPS with their propositions to buy or sell government securities at various prices. The propositions are then assembled and displayed on a computer screen for evaluation. The desk will select all propositions, beginning with the most attractively priced, up to the point at which the desired amount of securities is purchased or sold, and it will then notify each dealer via TRAPS on which of its propositions have been chosen. The entire selection process is typically completed in a matter of minutes.

Defensive open market operations are of two basic types. In a **repurchase agreement** (often called a **repo**), the Fed purchases securities with an agreement that the seller will repurchase them in a short period of time, anywhere from one to fifteen days from the original date of purchase. Because the effects on reserves of a repo are reversed on the day the agreement matures, a repo is actually a temporary open market purchase and is an especially desirable way of conducting a defensive open market purchase that will be reversed shortly. When the Fed wants to conduct a temporary open market sale, it engages in a **matched sale–purchase transaction** (sometimes called a **reverse repo**) in which the Fed sells securities and the buyer agrees to sell them back to the Fed in the near future.

At times, the desk may see the need to address a persistent reserve shortage or surplus and wish to arrange a dynamic open market operation that will have a more permanent impact on the supply of reserves. Outright transactions, which involve a purchase or sale of securities that is not self-reversing, are also conducted over TRAPS.

Discount Policy and the Lender of Last Resort

The facility at which banks can borrow reserves from the Federal Reserve is called the **discount window**. The easiest way to understand how the Fed affects the volume of borrowed reserves is by looking at how the discount window operates.

Operation of the Discount Window

The Fed's discount loans to banks are of three types: primary credit, secondary credit, and seasonal credit.[4] *Primary credit* is the discount lending that plays the most important role in monetary policy. Healthy banks

[4]The procedures for administering the discount window were changed in January 2003. The primary credit facility replaced an adjustment credit facility whose discount rate was typically set below market interest rates, so banks were restricted in their access to this credit. In contrast, healthy banks now can borrow all they want from the primary credit facility. The secondary credit facility replaced the extended credit facility, which focused somewhat more on longer-term credit extensions. The seasonal credit facility remains basically unchanged.

Inside the Fed A Day at the Trading Desk

The manager of domestic open market operations supervises the analysts and traders who execute the purchases and sales of securities in the drive to hit the federal funds rate target. To get a grip on what might happen in the federal funds market that day, the manager's workday starts early in the morning, around 7:30 a.m., when her staff presents a review of developments in the federal funds market the previous day and an update on the actual amount of reserves in the banking system the day before. Then the staff produces updated reports that contain detailed forecasts of what will be happening to some of the short-term factors affecting the supply and demand of reserves (discussed in Chapter 15). For example, if float is predicted to decrease because good weather throughout the country is speeding up check delivery, the manager of domestic open market operations knows that she will have to conduct a defensive open market operation (in this case, a *purchase* of securities) to offset the expected decline in reserves and the monetary base from the decreased float. However, if Treasury deposits with the Fed are predicted to fall, a defensive open market *sale* would be needed to offset the expected increase in reserves. The report also predicts the change in the public's holding of currency. If currency holdings are expected to rise, then, as we saw in Chapter 15, reserves will fall, and an open market purchase is needed to raise reserves back up again.

This information helps the manager of domestic open market operations and her staff decide how large a change in nonborrowed reserves is needed to reach the federal funds rate target. If the amount of reserves in the banking system is too large, many banks will have excess reserves to lend that other banks may have little desire to hold, and the federal funds rate will fall. If the level of reserves is too low, banks seeking to borrow reserves from the few banks that have excess reserves to lend may push the funds rate higher than the desired level. Also during the morning, the staff will monitor the behavior of the federal funds rate and contact some of the major participants in the market for reserves, which may provide independent information about whether a change in reserves is needed to achieve the desired level of the federal funds rate.

Members of the manager's staff also contact several representatives of the primary dealers with whom the open market desk trades. Her staff finds out how the dealers view market conditions to get a feel for what may happen to the prices of the securities they trade in over the course of the day. They also call the Treasury to get updated information on the expected level of Treasury balances at the Fed to refine their estimates of the supply of reserves.

Members of the Monetary Affairs Division at the Board of Governors are then contacted, and the New York Fed's forecasts of reserve supply and demand are compared with the Board's. On the basis of these projections and the observed behavior of the federal funds market, the desk formulates and proposes a course of action to be taken that day, which may involve plans to add reserves to or drain reserves from the banking system through open market operations. If an operation is contemplated, the type, size, and maturity will be discussed.

At about 9 a.m., a daily conference call takes place, linking the desk with the Office of the Director of Monetary Affairs at the Board of Governors and with one of the four voting Reserve Bank presidents outside New York. During the call, a member of the open market operations unit outlines the desk's proposed reserve management strategy for the day. After the plan is approved, it is announced to the markets at 9:30 a.m., and the desk is instructed to execute immediately any temporary open market operations that are planned for that day.

At times, the desk may see the need to address a persistent reserve shortage or surplus and may wish to arrange an operation that will have a more permanent impact on the supply of reserves. These operations, referred to as *outright operations*, involve a straightforward purchase or sale of securities that is not self-reversing, and they are traditionally executed later in the day, when temporary operations are not being conducted. Even when outright operations are not being conducted, the manager of domestic open market operations and her staff do not sit idle for the rest of the day. They are continually monitoring the markets and bank reserves to plan for the next day's operations.

are allowed to borrow all they want at very short maturities (usually overnight) from the primary credit facility, and it is therefore referred to as a **standing lending facility**.[5] The interest rate on these loans is the discount rate, and as we mentioned before, it is set higher than the federal funds rate target, usually by 100 basis points (one percentage point) because the Fed prefers that banks borrow from each other in the federal funds market so that they continually monitor each other for credit risk. As a result, in most circumstances the amount of discount lending under the primary credit facility is very small. If the amount is so small, why does the Fed have this facility?

The answer is that the facility is intended to be a backup source of liquidity for sound banks so that the federal funds rate never rises too far above the federal funds target set by the FOMC. We have already seen how this works in Figure 6. When the demand for reserves experiences a large unexpected increase, no matter how far right the demand curve shifts, the equilibrium federal funds rate i_{ff}^{*} will stay at i_d because borrowed reserves will just continue to increase, and the federal funds rate can rise no further. The primary credit facility has thus put a ceiling on the federal funds rate at i_d.

Secondary credit is given to banks that are in financial trouble and are experiencing severe liquidity problems. The interest rate on secondary credit is set at 50 basis points (0.5 percentage point) above the discount rate. The interest rate on these loans is set at a higher, penalty rate to reflect the less-sound condition of these borrowers. *Seasonal credit* is given to meet the needs of a limited number of small banks in vacation and agricultural areas that have a seasonal pattern of deposits. The interest rate charged on seasonal credit is tied to the average of the federal funds rate and certificate of deposit rates. The Federal Reserve has questioned the need for the seasonal credit facility because of improvements in credit markets and is thus contemplating eliminating it at some point in the future.

Lender of Last Resort In addition to its use as a tool to influence reserves, the monetary base, and the money supply, discounting is important in preventing and coping with financial panics. When the Federal Reserve System was created, its most important role was intended to be as the **lender of last resort**; to prevent bank failures from spinning out of control, the Fed was to provide reserves to banks when no one else would, thereby preventing bank and financial panics. Discounting is a particularly effective way to provide reserves to the banking system during a banking crisis because reserves are immediately channeled to the banks that need them most.

In performing the role of lender of last resort, the Fed must use the discount tool wisely when attempting to thwart financial panics. This is an extremely important aspect of successful monetary policymaking. Financial panics can severely damage the economy because they interfere with the ability of financial intermediaries and markets to move funds to people with productive investment opportunities (see Chapter 12).

Unfortunately, the discount tool has not always been used by the Fed to prevent financial panics, as the massive bank failures during the Great Depression attest. The Fed learned from its mistakes of that period and has performed admirably in its role of lender of last resort in the post–World War II period. The Fed has used its discount lending weapon several times to avoid bank panics by extending loans to troubled banking institutions, thereby preventing further bank failures.

[5]This type of standard lending facility is commonly called a *Lombard facility* in other countries, and the interest rate charged on these loans is often called a *Lombard rate*. (This name comes from Lombardy, a region in northern Italy that was an important center of banking in the Middle Ages.)

At first glance, it might seem that the presence of the FDIC, which insures depositors up to a limit of $250,000 per account from losses due to a bank's failure, would make the lender-of-last-resort function of the Fed superfluous. There are two reasons why this is not the case. First, it is important to recognize that the FDIC's insurance fund amounts to about 1% of the total amount of deposits held by banks. If a large number of bank failures occurred simultaneously, the FDIC would not be able to cover all the depositors' losses. Indeed, the large number of bank failures in the 1980s and early 1990s led to large losses and a shrinkage of the FDIC's insurance fund, which reduced the FDIC's ability to cover depositors' losses. This fact has not weakened the confidence of small depositors in the banking system because the Fed has been ready to stand behind the banks to provide whatever reserves are needed to prevent bank panics. Second, the $1.7 trillion of large-denomination deposits in the banking system are not guaranteed by the FDIC because they exceed the $250,000 limit. A loss of confidence in the banking system could still lead to runs on banks from the large-denomination depositors, and bank panics could still occur despite the existence of the FDIC. The Federal Reserve's role as lender of last resort is, if anything, more important today than ever because of the high number of bank failures experienced in the 1980s and early 1990s, and during the global financial crisis from 2007 to 2009.

Not only can the Fed act as a lender of last resort to banks, but it can also play the same role in the financial system as a whole. The Fed's discount window can help prevent and address financial panics that are not triggered by bank failures, such as the Black Monday stock market crash of 1987 and the terrorist destruction of the World Trade Center in September 2001 (discussed in the Inside the Fed box). Although the Fed's role as the lender of last resort provides the benefit of preventing bank and financial panics, it does come with a cost. If a bank expects that the Fed will provide it with discount loans if it gets into trouble, then it will be willing to take on more risk, knowing that the Fed will come to the rescue if necessary. The Fed's lender-of-last-resort role has thus created a moral hazard problem similar to the one created by deposit insurance (discussed in Chapter 10): Banks take on more risk, thus exposing the deposit insurance agency, and hence taxpayers, to greater losses. The moral hazard problem is most severe for large banks, which may believe that the Fed and the FDIC view them as "too big to fail"; that is, they believe they will always receive Fed loans when they are in trouble because their failure would be likely to precipitate a bank panic.

Similarly, Federal Reserve actions to prevent financial panics may encourage financial institutions other than banks to take on greater risk. They, too, expect that the Fed will bail them out if their failure would cause or worsen a financial panic. When the Fed considers using the discount weapon to prevent a panic, it needs to consider the trade-off between the moral hazard cost of its role as lender of last resort and the benefit of preventing the financial panic. This trade-off explains why the Fed must be careful not to perform its function as lender of last resort too frequently.

Reserve Requirements

As we saw in Chapter 15, changes in reserve requirements affect the money supply by causing the money supply multiplier to change. A rise in reserve requirements reduces the amount of deposits that can be supported by a given level of the monetary base and leads to a contraction of the money supply. A rise in reserve requirements also increases the demand for reserves and raises the federal funds rate. Conversely, a decline in reserve requirements leads to an expansion of the money supply and a fall in the federal funds rate. The Fed has had the authority to vary reserve requirements since the 1930s;

Inside the Fed — Using Discount Policy to Prevent a Financial Panic

The Black Monday Stock Market Crash of 1987 and the Terrorist Destruction of the World Trade Center in September 2001. Although October 19, 1987, dubbed "Black Monday," will go down in the history books as the day of the largest one-day percentage decline in stock prices to date (the Dow Jones Industrial Average decreased by more than 20%), it was on Tuesday, October 20, 1987, that financial markets almost stopped functioning. Felix Rohatyn, one of the most prominent players on Wall Street, stated flatly: "Tuesday was the most dangerous day we had in 50 years."* Much of the credit for preventing a market meltdown after Black Monday must be given to the Federal Reserve System and then-Chair of the Board of Governors, Alan Greenspan.

The stress of keeping markets functioning during the sharp decline in stock prices that occurred on Monday, October 19, meant that many brokerage houses and specialists (dealer-brokers who maintain orderly trading on the stock exchanges) were severely in need of additional funds to finance their activities. However, understandably enough, New York banks, as well as foreign and regional U.S. banks, who were growing very nervous about the financial health of securities firms, began to cut back credit to the securities industry at the very time when it was most needed. Panic was in the air. One chair of a large specialist firm commented that on Monday, "from 2 p.m. on, there was total despair. The entire investment community fled the market. We were left alone on the field." It was time for the Fed, like the cavalry, to come to the rescue.

Upon learning of the plight of the securities industry, Alan Greenspan and E. Gerald Corrigan, then president of the Federal Reserve Bank of New York and the Fed official most closely in touch with Wall Street, became fearful of a spreading collapse of securities firms. To prevent this collapse, Greenspan announced before the market opened on Tuesday, October 20, the Federal Reserve System's "readiness to serve as a source of liquidity to support the economic and financial system." In addition to this extraordinary announcement, the Fed made it clear that it would provide discount loans to any bank that would make loans to the securities industry, although this did not prove to be necessary. As one New York banker said, the Fed's message was, "We're here. Whatever you need, we'll give you."

The outcome of the Fed's timely action was that a financial panic was averted. The markets kept functioning on Tuesday, and a market rally ensued that day, with the Dow Jones Industrial Average climbing over 100 points.

A similar lender-of-last-resort operation was carried out in the aftermath of the destruction of the World Trade Center in New York City on Tuesday, September 11, 2001—the worst terrorist incident in U.S. history. Because of the disruption to the most important financial center in the world, the liquidity needs of the financial system skyrocketed. To satisfy these needs and to keep the financial system from seizing up, within a few hours of the incident, the Fed made an announcement similar to that made after the crash of 1987: "The Federal Reserve System is open and operating. The discount window is available to meet liquidity needs."† The Fed then proceeded to provide $45 billion to banks through the discount window, a 200-fold increase over the amount provided during the previous week. As a result of this action, along with the injection of as much as $80 billion of reserves into the banking system through open market operations, the financial system kept functioning. When the stock market reopened on Monday, September 17, trading was orderly, although the Dow Jones Average did decrease 7%.

The terrorists were able to bring down the twin towers of the World Trade Center, causing nearly 3,000 deaths. However, they were unable to bring down the U.S. financial system because of the timely actions of the Federal Reserve.

*"Terrible Tuesday: How the Stock Market Almost Disintegrated a Day After the Crash," *Wall Street Journal*, November 20, 1987, p. 1. This article provides a fascinating and more detailed view of the events described here and is the source of all the quotations cited.

†"Economic Front: How Policy Makers Regrouped to Defend the Financial System," *Wall Street Journal*, September 18, 2001, p. A1, provides more detail on this episode.

this method was once a powerful way of affecting the money supply and interest rates but is rarely used today.

The Depository Institutions Deregulation and Monetary Control Act of 1980 provided a simpler scheme for setting reserve requirements. All depository institutions, including commercial banks, savings and loan associations, mutual savings banks, and credit unions, are subject to the same reserve requirements: Required reserves on all checkable deposits—including non–interest-bearing checking accounts, NOW accounts, super-NOW accounts, and ATS (automatic transfer savings) accounts—are equal to zero for the first $13.3 million of a bank's checkable deposits, 3% on checkable deposits from $13.3 to $89.0 million, and 10% on checkable deposits over $89.0 million.[6] The percentage set at 10% can be varied between 8% and 14%, at the Fed's discretion. In extraordinary circumstances, the percentage can be raised as high as 18%.

Interest on Reserves

Because the Fed started paying interest on reserves only in 2008, this tool of monetary policy does not have a long history. For the same reason the Fed sets the discount rate above the federal funds target—that is, to encourage borrowing and lending in the federal funds market so that banks monitor each other—the Fed to date generally has set the interest rate on reserves below the federal funds target. This means that the Fed has not yet used interest on reserves as a tool of monetary policy, but instead has just used it to help provide a floor under the federal funds rate. However, in the aftermath of the global financial crisis, banks have accumulated huge quantities of excess reserves and, in this situation, increasing the federal funds rate would require massive amounts of open market operations to remove these reserves from the banking system. The interest-on-reserves tool can come to the rescue because it can be used to raise the federal funds rate, as illustrated in panel (b) of Figure 5. Indeed, it is likely that this tool of monetary policy will be used extensively when the Fed wants to raise the federal funds rate and exit from the policy of maintaining it at zero, a policy that started in December 2008.

Relative Advantages of the Different Tools

Open market operations constitute the most important conventional monetary policy tool because they have four basic advantages over the other tools:

1. Open market operations occur at the initiative of the Fed, which has complete control over their volume. This control is not found, for example, in discount operations, in which the Fed can encourage or discourage banks' borrowing of reserves by altering the discount rate but cannot directly control the volume of borrowed reserves.

2. Open market operations are flexible and precise; they can be used to the exact extent desired. No matter how small a change in reserves or the monetary base is required, open market operations can achieve it with a small purchase or sale of securities. Conversely, if the desired change in reserves or the base is very large, the open market operations tool is strong enough to do the job through a very large purchase or sale of securities.

[6]These figures are for 2014. Each year, the figures are adjusted upward by 80% of the percentage increase in checkable deposits in the United States.

3. Open market operations are easily reversed. If a mistake is made in conducting an open market operation, the Fed can immediately reverse it. If the trading desk decides that the federal funds rate is too low because it has made too many open market purchases, it can immediately make a correction by conducting open market sales.

4. Open market operations can be implemented quickly; they involve no administrative delays. When the trading desk decides that it wants to change the monetary base or reserves, it just places orders with securities dealers, and the trades are executed immediately. Changes to reserve requirements, on the other hand, take time to implement because banks must be given advance warning so that they can adjust their computer systems to calculate required reserves. Also, since it is costly to adjust computer systems, reversing a change in reserve requirements is burdensome to banks. For these reasons, the policy tool of changing reserve requirements does not have much to recommend it, and it is rarely used.

There are two situations in which the other tools have advantages over open market operations. One is when the Fed wants to raise interest rates after banks have accumulated large amounts of excess reserves. In this case, the federal funds rate can be raised by increasing the interest on reserves, which eliminates the need to conduct massive open market operations to raise the federal funds rate by reducing reserves. The second situation is when discount policy can be used by the Fed to perform its role as lender of last resort. The Black Monday crash, the terrorist attacks of September 11, 2001, and the global financial crisis, which we will discuss next, all indicate that the role of discount policy has become more important in the past couple of decades.

NONCONVENTIONAL MONETARY POLICY TOOLS AND QUANTITATIVE EASING

In normal times, conventional monetary policy tools, which expand the money supply and lower interest rates, are enough to stabilize the economy. However, when the economy experiences a full-scale financial crisis like the one we recently experienced, conventional monetary policy tools cannot do the job, for two reasons. First, the financial system seizes up to such an extent that it becomes unable to allocate capital to productive uses, and so investment spending and the economy collapse, as discussed in Chapter 12. Second, the negative shock to the economy can lead to the **zero-lower-bound problem**, in which the central bank is unable to lower short-term interest rates further because they have hit a floor of zero, as occurred at the end of 2008. The zero-lower-bound problem occurs because people can always earn more from holding bonds than from holding cash, and therefore nominal interest rates cannot be negative. For both of these reasons, central banks need non–interest-rate tools, known as **nonconventional monetary policy tools**, to stimulate the economy. These nonconventional monetary policy tools take three forms: (1) liquidity provision, (2) asset purchases, and (3) commitment to future monetary policy actions.

Liquidity Provision

Because conventional monetary policy actions were not sufficient to heal the financial markets during the recent financial crisis, the Federal Reserve implemented unprecedented increases in its lending facilities to provide liquidity to the financial markets.

1. **Discount Window Expansion:** At the outset of the crisis in mid-August 2007, the Fed lowered the discount rate (the interest rate on loans it makes to banks) to 50 basis points (0.50 percentage point) above the federal funds rate target from the normal 100 basis points. It then lowered it further in March 2008, to only 25 basis points above the federal funds rate target. However, because borrowing from the discount window has a "stigma" attached to it (because such borrowing suggests that the borrowing bank is desperate for funds and thus in trouble), use of the discount window was limited during the crisis.
2. **Term Auction Facility:** To encourage additional borrowing, in December 2007 the Fed set up a temporary Term Auction Facility (TAF), in which it made loans at a rate determined through competitive auctions. The TAF was more widely used than the discount window facility because it enabled banks to borrow at a rate lower than the discount rate, and the rate was determined competitively rather than being set at a penalty rate. The TAF auctions started at amounts of $20 billion, but as the crisis worsened, the Fed raised the amounts dramatically, with a total outstanding of over $400 billion. (The European Central Bank conducted similar operations, with one auction in June 2008 of over 400 billion euros.)
3. **New Lending Programs:** The Fed broadened its provision of liquidity to the financial system well beyond its traditional lending to banking institutions. These actions included lending to investment banks as well as lending to promote purchases of commercial paper, mortgage-backed securities, and other asset-backed securities. In addition, the Fed engaged in lending to J.P. Morgan to assist in its purchase of Bear Stearns and to AIG to prevent its failure. The enlargement of the Fed's lending programs during the 2007–2009 financial crisis was indeed remarkable, expanding the Fed's balance sheet by over $1 trillion by the end of 2008, with the balance-sheet expansion continuing even after 2008. The number of new programs introduced over the course of the crisis spawned a whole new set of abbreviations, including the TAF, TSLF, PDCF, AMLF, MMIFF, CPFF, and TALF. These facilities are described in more detail in the Inside the Fed box, "Fed Lending Facilities During the Global Financial Crisis."

Large-Scale Asset Purchases

The Fed's open market operations normally involve only the purchase of government securities, particularly those that are short-term. However, during the crisis, the Fed started two new, large-scale asset purchase programs (often referred to as LSAPs) to lower interest rates for particular types of credit.

1. In November 2008, the Fed set up a Government Sponsored Entities Purchase Program in which the Fed eventually purchased $1.25 trillion of mortgage-backed securities (MBS) guaranteed by Fannie Mae and Freddie Mac. Through these purchases, the Fed hoped to prop up the MBS market and to lower interest rates on residential mortgages to stimulate the housing market.
2. In November 2010, the Fed announced that it would purchase $600 billion of long-term Treasury securities at a rate of about $75 billion per month. This large-scale purchase program, which became known as *QE2* (which stands for Quantitative Easing 2, not the Cunard cruise ship), was intended to lower long-term interest rates. Although *short-term* interest rates on Treasury securities hit a floor of zero during the global financial crisis, *long-term* interest rates did not. Since investment projects have a long life, long-term interest rates are more relevant to investment

Inside the Fed — Fed Lending Facilities During the Global Financial Crisis

During the global financial crisis, the Federal Reserve became very creative in assembling a host of new lending facilities to help restore liquidity to different parts of the financial system. The new facilities, the dates on which they were created, and their functions are listed in the table below.

Lending Facility	Date of Creation	Function
Term Auction Facility (TAF)	December 12, 2007	To increase borrowing from the Fed, the TAF extends loans of fixed amounts to banks at interest rates that are determined by competitive auction rather than set by the Fed as with normal discount lending
Term Securities Lending Facility (TSLF)	March 11, 2008	To provide sufficient Treasury securities to act as collateral in credit markets, the TSLF lends Treasury securities to primary dealers for terms longer than overnight against a broad range of collateral
Swap Lines	March 11, 2008	Lend dollars to foreign central banks in exchange for foreign currencies so that these central banks can in turn make dollar loans to their domestic banks
Loans to J.P. Morgan to buy Bear Stearns	March 14, 2008	Buys $30 billion of Bear Stearns assets through nonrecourse loans to J.P. Morgan to facilitate its purchase of Bear Stearns
Primary Dealer Credit Facility (PDCF)	March 16, 2008	Lends to primary dealers (including investment banks) so that they can borrow on terms similar to those on which banks borrow from the traditional discount window facility
Loans to AIG	September 16, 2008	Loans $85 billion to AIG
Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF)	September 19, 2008	Lends to primary dealers so that they can purchase asset-backed commercial paper from money market mutual funds so that these funds can sell this paper to meet redemptions from their investors
Commercial Paper Funding Facility (CPFF)	October 7, 2008	Finances purchase of commercial paper from issuers
Money Market Investor Funding Facility (MMIFF)	October 21, 2008	Lends to special-purpose vehicles that can buy a wider range of money market mutual fund assets
Term Asset-Backed Securities Loan Facility (TALF)	November 25, 2008	Lends to issuers of asset-backed securities against these securities as collateral to improve functioning of this market

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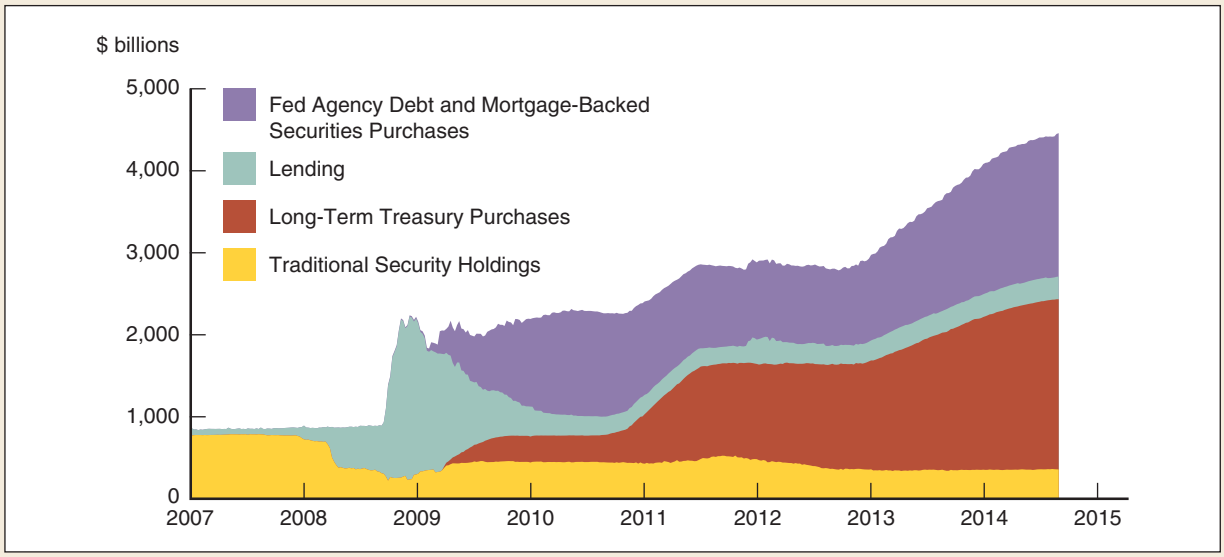

FIGURE 7 The Expansion of the Federal Reserve's Balance Sheet, 2007–2014

The shaded areas show the Federal Reserve's holdings of four different categories of assets: traditional security holdings, long-term Treasuries, lending, and agency debt and mortgage-backed securities. The Federal Reserve's lending and asset-purchase programs led to a quadrupling of the Fed's balance sheet.

Source: Federal Reserve Bank of Cleveland: http://www.clevelandfed.org/research/data/redit_easing/index.cfm

decisions than short-term rates. The Fed's purchase of long-term Treasuries was an effort to stimulate investment spending and the economy by lowering long-term interest rates.

3. In September 2012, the Federal Reserve announced a third large-scale asset-purchase program, which became known as *QE3*, that combined elements of QE1 and QE2. Through QE3, the Fed conducted purchases of $40 billion of mortgage-backed securities and $45 billion of long-term Treasuries. However, QE3 differed in one major way from the previous QE programs in that its goal was not to increase assets by a fixed dollar amount but instead was open-ended, with the purchase plan set to continue "if the outlook for the labor market does not improve substantially."

These liquidity-provision and large-scale asset-purchase programs led to an unprecedented quadrupling of the Federal Reserve's balance sheet (shown in Figure 7).

Quantitative Easing Versus Credit Easing

As we just learned, the programs introduced by the Fed in response to the global financial crisis led to an unprecedented expansion of the Federal Reserve's balance sheet. From before the financial crisis began in September 2007 through 2014, the amount of Federal Reserve assets rose from about $800 billion to over $4 trillion. This expansion of the balance sheet is referred to as **quantitative easing** because, as shown in Chapter 15, it leads to a huge increase in the monetary base. Because

such an increase in the monetary base would usually result in an expansion of the money supply, it seems as though such an expansion could be a powerful force in stimulating the economy in the near term and possibly producing inflation down the road.

There are reasons to be very skeptical of this hypothesis. First, as we saw in the final application in Chapter 15, the huge expansion in the Fed's balance sheet and the monetary base did not result in a large increase in the money supply, because most of the increase in the monetary base just flowed into holdings of excess reserves. Second, because the federal funds rate had already fallen to the zero lower bound, the expansion of the balance sheet and the monetary base could not lower short-term interest rates any further and thereby stimulate the economy. Third, an increase in the monetary base does not mean that banks will increase lending, because they can just add to their holdings of excess reserves instead of making loans. Indeed, this appears to be exactly what happened during the global financial crisis, when the huge increase in the monetary base led primarily to a massive rise in excess reserves, and bank lending did not increase. A similar phenomenon seems to have occurred when the Bank of Japan engaged in quantitative easing after Japan's stock and real estate market bubbles burst in the 1990s; yet not only did the Japanese economy fail to recover, but inflation even turned negative.

Does skepticism about the merits of quantitative easing mean that the Fed's nonconventional monetary policy actions during the financial crisis were ineffective in stimulating the economy? Former Fed Chair Ben Bernanke has argued that the answer is no, because the Fed's policies were directed not at expanding the Fed's balance sheet but rather at **credit easing**—that is, altering the composition of the Fed's balance sheet in order to improve the functioning of particular segments of the credit markets. Indeed, Bernanke was adamant that the Fed's policies should not be characterized as quantitative easing.

Altering the composition of the Fed's balance sheet can stimulate the economy in several ways. First, when the Fed provides liquidity to a particular segment of the credit markets that has seized up, such liquidity can help unfreeze the market and thereby enable it to allocate capital to productive uses, consequently stimulating the economy. Second, when the Fed purchases particular securities, it increases the demand for those securities and, as we saw in Chapter 6, such an action can lower the interest rates on those securities relative to rates on other securities. Thus, even if short-term interest rates have hit a floor of zero, asset purchases can lower interest rates for borrowers in particular credit markets and thereby stimulate spending. For example, purchases of GSE mortgage-backed securities appear to have lowered the interest rates on these securities, which led to a substantial decrease in residential mortgage rates. Purchases of long-term government securities could also lower their interest rates relative to short-term interest rates, and because long-term interest rates are likely to be more relevant to investment decisions, these asset market purchases could boost investment spending. Recent research appears to support this viewpoint, with estimates of the decline in long-term interest rates following the Fed's asset purchase programs on the order of 100 basis points (one percentage point).[7]

[7]See, for example, Joseph Gagnon, Mathew Raskin, Julie Remache, and Brian Sack, "Large Scale Asset Purchases by the Federal Reserve: Did They Work?" *Federal Reserve Bank of New York Economic Policy Review*, Volume 17, Number 1 (May 2011), pp. 41–59.

Forward Guidance and the Commitment to Future Policy Actions

Although short-term interest rates could not be driven below zero in the aftermath of the global financial crisis, the Federal Reserve had the option of taking a different route in its efforts to achieve lower long-term interest rates, which, as we mentioned above, would stimulate the economy. This route involved a commitment by the Fed to keep the federal funds rate at zero for a long period of time. To see how this would work, recall our discussion of the expectations theory of the term structure of interest rates in Chapter 6. There we saw that long-term interest rates will equal an average of the short-term interest rates that markets expect to occur over the life of the long-term bond. By committing to the future policy action of keeping the federal funds rate at zero for an extended period, the Fed could lower the market's expectations of future short-term interest rates, thereby causing the long-term interest rate to fall. Michael Woodford of Columbia University has referred to such a strategy as **management of expectations**, but it is more commonly referred to as **forward guidance**.

The Fed pursued this forward-guidance strategy when it announced, after its FOMC meeting on December 16, 2008, that not only would it lower the federal funds rate target to between zero and ¼%, but also that "the Committee anticipates that weak economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time." The Fed continued to use this type of language in its FOMC statements for several years afterward, even committing to keep the federal funds rate near zero until an actual date of mid-2013 at its FOMC meeting in August of 2011 (modified to mid-2015 at later meetings). Although long-term interest rates on Treasury securities did subsequently fall, it is not clear how much of this decline was due to the Fed's forward guidance versus the general weakness of the economy.

There are two types of commitments to future policy actions: conditional and unconditional. The commitment to keep the federal funds rate at zero for an extended period starting in 2008 was *conditional* because it stated that the decision was predicated on a weak economy going forward. If economic circumstances changed, the FOMC was indicating that it might abandon the commitment. Alternatively, the Fed could have made an *unconditional* commitment by just stating that it would keep the federal funds rate at zero for an extended period, without indicating that this decision might change depending on the state of the economy. An unconditional commitment is stronger than a conditional commitment because it does not suggest that the commitment will be abandoned and so is likely to have a larger effect on long-term interest rates. Unfortunately, it has the disadvantage that, even if circumstances change in such a way that it would be better to abandon the commitment, the Fed may feel that it cannot go back on its word and therefore cannot abandon the commitment.

The disadvantages of an unconditional commitment are illustrated by the Fed's experience in the 2003–2006 period. In 2003, the Fed became worried that inflation was too low and that the probability of a deflation was significant. At the August 12, 2003, FOMC meeting, the FOMC stated, "In these circumstances, the Committee believes that policy accommodation can be maintained for a considerable period." Then, when the Fed started to tighten policy at its June 30, 2004, FOMC meeting, it changed its statement to "policy accommodation can be removed at a pace that is likely to be measured." For the next ten FOMC meetings, through June 2006, the Fed raised the federal funds rate target by exactly ¼ percentage point at every single meeting. The market interpreted the FOMC's statements as indicating an unconditional commitment, and this is why the Fed may have been constrained not to deviate from a ¼ percentage

point move at every FOMC meeting. In retrospect, this commitment led to monetary policy that was too easy for too long, with inflation subsequently rising to well above desirable levels and, as discussed in Chapter 12, may have helped promote the housing bubble whose bursting led to such devastating consequences for the economy.

When the Fed announced a specific date for exiting from exceptionally low rates, many market participants viewed this announcement as an unconditional commitment, despite the Federal Reserve's objections to such an interpretation. To avoid the problems associated with an unconditional commitment, in December of 2012 the Fed changed its statement to be more clearly conditional by indicating that "the exceptionally low range for the federal funds rate will be appropriate at least as long as the unemployment rate remains above 6-1/2 percent, and inflation between one and two years ahead is projected to be no more than a half percentage point above the Committee's 2 percent longer-run goal."

Although it is an improvement over a fixed-date commitment, this type of conditional approach based on thresholds is not without its own problems. First, it may be viewed as a Federal Reserve commitment to achieve a specific unemployment rate, regardless of the monetary stimulus required to reach it. It was exactly this kind of commitment that got the Fed into trouble in the 1970s and produced the escalation in inflation that became known as the "Great Inflation" (discussed in Chapter 24). Second, this approach may be viewed as an increase in the inflation target from 2% to 2.5% and a weakening of the Federal Reserve's credibility with regard to its commitment to keep inflation low and stable. As we will see in Chapter 25, this loss of credibility can result in poorer outcomes in stabilizing not only inflation but also economic activity.

At its March 2014 meeting, with the unemployment rate approaching 6½%, the FOMC dropped forward guidance based on unemployment and inflation thresholds. Instead, it announced that it would assess its commitment to keeping the federal funds rate near zero by taking "into account a wide range of information, including measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial developments."

MONETARY POLICY TOOLS OF THE EUROPEAN CENTRAL BANK

Like the Federal Reserve, the European System of Central Banks (usually referred to as the European Central Bank) signals the stance of its monetary policy by setting a **target financing rate**, which in turn sets a target for the **overnight cash rate**. Like the federal funds rate, the overnight cash rate is the interest rate for very short-term interbank loans. The monetary policy tools used by the European Central Bank are similar to those used by the Federal Reserve and involve open market operations, lending to banks, and reserve requirements.

Open Market Operations

Like the Federal Reserve, the European Central Bank uses open market operations as its primary tool for conducting monetary policy and setting the overnight cash rate at the target financing rate. **Main refinancing operations** are the predominant form of open market operations and are similar to the Fed's repo transactions. They involve weekly **reverse transactions** (purchase or sale of eligible assets under repurchase or

credit operations against eligible assets as collateral) that are reversed within two weeks. Credit institutions submit bids, and the European Central Bank decides which bids to accept. Like the Federal Reserve, the European Central Bank accepts the most attractively priced bids and makes purchases or sales up to the point at which the desired amount of reserves is supplied. In contrast to the Federal Reserve, which conducts open market operations in one location at the Federal Reserve Bank of New York, the European Central Bank decentralizes its open market operations by conducting them through the individual national central banks.

A second category of open market operations is **longer-term refinancing operations**, which are a much smaller source of liquidity for the euro-area banking system and are similar to the Fed's outright purchases or sales of securities. These operations are carried out monthly and typically involve purchases or sales of securities with a maturity of three months. They are not used for signaling the monetary policy stance, but instead are aimed at providing euro-area banks access to longer-term funds.

Lending to Banks

As is the case for the Fed, the next most important tool of monetary policy for the European Central Bank involves lending to banking institutions, which is carried out by the national central banks, just as discount lending is performed by the individual Federal Reserve Banks. This lending takes place through a standing lending facility called the **marginal lending facility**. Through these facilities, banks can borrow (against eligible collateral) overnight loans from the national central banks at the **marginal lending rate**, which is set at 100 basis points above the target financing rate. The marginal lending rate provides a ceiling for the overnight market interest rate in the European Monetary Union, just as the discount rate does in the United States. As in the United States, Canada, Australia, and New Zealand, the Eurosystem has another standing facility, the **deposit facility**, in which banks are paid a fixed interest rate that is 100 basis points below the target financing rate. The prespecified interest rate on the deposit facility provides a floor for the overnight market interest rate, while the marginal lending rate sets a ceiling. This creates a channel/corridor, but with a much wider range of 100 basis points on either side.

Reserve Requirements

Like the Federal Reserve, the European Central Bank imposes reserve requirements such that all deposit-taking institutions are required to hold 2% of the total amount of checking deposits and other short-term deposits in reserve accounts with national central banks. All institutions that are subject to minimum reserve requirements have access to the European Central Bank's standing lending facilities and participate in open market operations.

SUMMARY

1. A supply and demand analysis of the market for reserves yields the following results: When the Fed makes an open market purchase or lowers reserve requirements, the federal funds rate drops. When the Fed makes an open market sale or raises reserve requirements, the federal funds rate rises. Changes in the discount rate and the interest rate paid on reserves may also affect the federal funds rate.

2. Conventional monetary policy tools include open market operations, discount policy, reserve requirements, and interest on reserves. Open market operations are the primary tool used by the Fed to implement monetary policy in normal times because they occur at the initiative of the Fed, are flexible, are easily reversed, and can be implemented quickly. Discount policy has the advantage of enabling the Fed to perform its role of lender of last resort, while raising interest rates on reserves to increase the federal funds rate eliminates the need to conduct massive open market operations to reduce reserves when banks have accumulated large amounts of excess reserves.
3. Conventional monetary policy tools are no longer effective when the zero-lower-bound problem occurs, in which the central bank is unable to lower short-term interest rates because they have hit a floor of zero. In this situation, central banks use nonconventional monetary policy tools, which involve liquidity provision, asset purchases, and commitment to future policy actions. Liquidity provision and asset purchases lead to an expansion of the central bank balance sheet, which is referred to as *quantitative easing*. Expansion of the central bank balance sheet by itself is unlikely to have a large impact on the economy, but changing the composition of the balance sheet, which is accomplished by liquidity provisions and asset purchases and is referred to as *credit easing*, can have a large impact by improving the functioning of credit markets.
4. The monetary policy tools used by the European Central Bank are similar to those used by the Federal Reserve System and involve open market operations, lending to banks, and reserve requirements. Main financing operations—open market operations in repos that are typically reversed within two weeks—are the primary tool used to set the overnight cash rate at the target financing rate. The European Central Bank also operates standing lending facilities, which ensure that the overnight cash rate remains within 100 basis points of the target financing rate.

KEY TERMS

conventional monetary policy tools, p. 418
credit easing, p. 429
defensive open market operations, p. 418
deposit facility, p. 432
discount window, p. 419
dynamic open market operations, p. 418
federal funds rate, p. 411
forward guidance, p. 430
lender of last resort, p. 421
longer-term refinancing operations, p. 432
main refinancing operations, p. 431
management of expectations, p. 430
marginal lending facility, p. 432
marginal lending rate, p. 432
matched sale–purchase transaction (reverse repo), p. 419
nonconventional monetary policy tools, p. 425
overnight cash rate, p. 431
primary dealers, p. 419
quantitative easing, p. 428
repurchase agreement (repo), p. 419
reverse transactions, p. 431
standing lending facility, p. 421
target financing rate, p. 431
zero-lower-bound problem, p. 425

QUESTIONS

Select questions are available in MyEconLab *at* http://www.myeconlab.com.

1. If the manager of the open market desk hears that a snowstorm is about to strike New York City, making it difficult to present checks for payment there and so raising the float, what defensive open market operations will the manager undertake?
2. During the holiday season, when the public's holdings of currency increase, what defensive open market operations typically occur? Why?
3. If the Treasury pays a large bill to defense contractors and as a result its deposits with the Fed fall, what defensive open market operations will the manager of the open market desk undertake?
4. If float decreases to below its normal level, why might the manager of domestic operations consider it more desirable to use repurchase agreements to affect the monetary base, rather than an outright purchase of bonds?

5. "The only way that the Fed can affect the level of borrowed reserves is by adjusting the discount rate." Is this statement true, false, or uncertain? Explain your answer.
6. "The federal funds rate can never be above the discount rate." Is this statement true, false, or uncertain? Explain your answer.
7. "The federal funds rate can never be below the interest rate paid on reserves." Is this statement true, false, or uncertain? Explain your answer.
8. Why is paying interest on reserves an important tool for the Federal Reserve in managing crises?
9. Why are repurchase agreements used to conduct most short-term monetary policy operations, rather than the simple, outright purchase and sale of securities?
10. Open market operations are typically repurchase agreements. What does this tell you about the likely volume of defensive open market operations relative to the volume of dynamic open market operations?
11. Following the global financial crisis in 2008, assets on the Federal Reserve's balance sheet increased dramatically, from approximately $800 billion at the end of 2007 to $3 trillion by 2011. Many of the assets held are longer-term securities acquired through various loan programs instituted as a result of the crisis. In this situation, how could reverse repos (matched sale–purchase transactions) help the Fed reduce its assets held in an orderly fashion, while reducing potential inflationary problems in the future?
12. "Discount loans are no longer needed because the presence of the FDIC eliminates the possibility of bank panics." Is this statement true, false, or uncertain?
13. What are the disadvantages of using loans to financial institutions to prevent bank panics?
14. "Considering that raising reserve requirements to 100% makes complete control of the money supply possible, Congress should authorize the Fed to raise reserve requirements to this level." Discuss.
15. Compare the methods of controlling the money supply—open market operations, loans to financial institutions, and changes in reserve requirements—-on the basis of the following criteria: flexibility, reversibility, effectiveness, and speed of implementation.
16. Why was the Term Auction Facility more widely used by financial institutions than the discount window during the global financial crisis?
17. What are the advantages and disadvantages of *quantitative easing* as an alternative to conventional monetary policy when short-term interest rates are at the zero lower bound?
18. Why is the composition of the Fed's balance sheet a potentially important aspect of monetary policy during an economic crisis?
19. What is the main advantage and the main disadvantage of an unconditional policy commitment?

APPLIED PROBLEMS

Select applied problems are available in MyEconLab *at* http://www.myeconlab.com.

20. If a switch occurs from deposits into currency, what happens to the federal funds rate? Use the supply and demand analysis of the market for reserves to explain your answer.
21. Why is it that a decrease in the discount rate does not normally lead to an increase in borrowed reserves? Use the supply and demand analysis of the market for reserves to explain.
22. Using the supply and demand analysis of the market for reserves, indicate what happens to the federal funds rate, borrowed reserves, and nonborrowed reserves, holding everything else constant, under the following situations.
    a. The economy is surprisingly strong, leading to an increase in the amount of checkable deposits.
    b. Banks expect an unusually large increase in withdrawals from checking deposit accounts in the future.
    c. The Fed raises the target federal funds rate.
    d. The Fed raises the interest rate on reserves above the current equilibrium federal funds rate.
    e. The Fed reduces reserve requirements.
    f. The Fed reduces reserve requirements and then offsets this action by conducting an open market sale of securities.

DATA ANALYSIS PROBLEMS

The Problems update with real-time data in MyEconLab and are available for practice or instructor assignment.

1. Go to the St. Louis Federal Reserve FRED database, and find data on nonborrowed reserves (NONBORRES) and the federal funds rate (FEDFUNDS).

a. Calculate the percent change in nonborrowed reserves and the percentage point change in the federal funds rate for the most recent month of data available and for the same month a year earlier.

b. Is your answer to part (a) consistent with what you expect from the market for reserves? Why or why not?

2. In December 2008, the Fed switched from a point federal funds target to a range target (and it's possible that it will switch back to a point target in the future). Go to the St. Louis Federal Reserve FRED database, and find data on the federal funds targets/ranges (DFEDTAR, DFEDTARU, DFEDTARL) and the effective federal funds rate (DFF). Download into a spreadsheet the data from the beginning of 2006 through the most current data available.

a. What is the current federal funds target/range, and how does it compare to the effective federal funds rate?

b. When was the last time the Fed missed its target or was outside the target range? By how much did it miss?

c. For each daily observation, calculate the "miss" by taking the absolute value of the difference between the effective federal funds rate and the target (use the abs(.) function). For the periods in which the rate was a range, calculate the absolute value of the "miss" as the amount by which the effective federal funds rate was above or below the range. What was the average daily miss between the beginning of 2006 and the end of 2007? What was the average daily miss between the beginning of 2008 and December 15, 2008? What is the average daily miss for the period from December 16, 2008, to the most current date available? Since 2006, what was the largest single daily miss? Comment on the Fed's ability to control the federal funds rate during these three periods.

WEB EXERCISES

1. Go to http://www.federalreserve.gov/fomc/. This site reports activity by the FOMC. Scroll down to Calendar and click on the statement released after the most recent FOMC meeting. Summarize this statement in one paragraph. Be sure to note what the committee decided to do to the federal funds rate target. Now review the statements from the past two meetings. Has the stance of the committee changed?

2. Go to http://www.federalreserve.gov/releases/h15/update/. What is the current federal funds rate? What is the current Federal Reserve discount rate? (Define this rate as well.) Have short-term rates increased or decreased since the end of 2008?

WEB REFERENCES

http://www.federalreserve.gov/fomc/fundsrate.htm

Historical federal funds rates and discussions about Federal Reserve targets.

http://www.frbdiscountwindow.org/

Information on the operation of the discount window, and data on current and historical interest rates.

http://www.federalreserve.gov/monetarypolicy/reservereq.htm

Historical data and discussions about reserve requirements.

http://www.federalreserve.gov/fomc

A discussion about the Federal Open Market Committee, a list of current members, meeting dates, and other current information.