Monetary Policy and Inflation

Little did Ben S. Bernanke know when he took over the reins as chairman of the Federal Reserve on February 1, 2006, that he would face a novel and complex crisis brought on by the fall in housing prices and its reverberations throughout the entire financial system in 2007 and 2008. Unlike his immediate predecessors, Alan Greenspan and Paul Volcker, who had gained their experience and expertise working on Wall Street and in banking, Bernanke had primarily an academic career. As a former chairman of the Economics Department at Princeton University, he was known for his scholarly work focused on the Great Depression and the role of monetary policy in controlling inflation. Although he had little direct experience in financial markets, he did have some experience in economic policy and monetary policy in Washington.

Bernanke used his academic and policy experience to his advantage...
in meeting the challenges of the financial crisis. He convened brainstorming sessions with the president of the New York Federal Reserve Bank and leading financiers on Wall Street to further develop his own understanding of rapidly changing financial structures and the risks the mortgage crisis posed to them. As a scholar of the Great Depression, he also understood that the Federal Reserve had to take bold action to avert major crises. This background helped him to devise new and daring strategies for the Fed to deal with an unforeseen financial crisis. After a career in academia, his job as chairman provided Bernanke with a new education—by fire.

**APPLYING THE CONCEPTS**

1. Why did the Federal Reserve introduce new mechanisms for institutions to borrow money from it?
   *New Ways to Borrow from the Fed*

2. What happens to interest rates when the economy recovers from a recession?
   *Rising Interest Rates during an Economic Recovery*

3. Is it better for decisions about monetary policy to be made by a single individual or by a committee?
   *The Effectiveness of Committees*
In this chapter, we will learn why everyone is so interested in what the Federal Reserve is about to do. In the short run, when prices don’t have enough time to change and we consider them temporarily fixed, the Federal Reserve can influence interest rate levels in the economy. When the Federal Reserve lowers interest rates, investment spending and GDP increase because the cost of funds is cheaper. Conversely, when the Fed increases interest rates, investment spending and GDP decrease because the cost of funds is higher. In the long run, however, the Federal Reserve does not have this power to control real GDP. In the long run, changes in the money supply will only affect inflation.

17.1 THE MONEY MARKET

The money market is the market for money where the amount supplied and the amount demanded meet to determine the nominal interest rate. Recall that the nominal interest rate is the stated or quoted interest rate before adjusting for inflation. We begin by learning the factors that determine the public’s demand for money. Once we understand what affects the demand for money, we can see how the actions of the Federal Reserve determine the supply of money. Then we’ll see how the demand and supply of money together determine interest rates.

The Demand for Money

Let’s think of money as simply one part of wealth. Suppose your total wealth is valued at $1,000. In what form will you hold your wealth? Should you put all your wealth into the stock market? Or perhaps into the bond market? Or should you hold some of your wealth in money, that is, currency and deposits in checking accounts?

**INTEREST RATES AFFECT MONEY DEMAND** If you invest in assets such as stocks or bonds, you will generally earn income on them. Stocks are shares in the ownership of a corporation. There are two sources of income from stocks: dividends paid to their owners out of the profits of the corporation, and the typical increase in their value over time. Bonds are loans that are repaid with interest. Thus, both stocks and bonds provide returns to investors. If you hold your wealth in currency or in a checking account, however, you will receive either no interest or very low interest. And if inflation rises sharply, you might even lose money. Holding your wealth as money in currency or a checking account means you sacrifice some potential income.

Money does, however, provide a valuable service. It facilitates transactions. If you go to a grocery store to purchase cereal, the store will accept currency as a check, but you won’t be able to pay for cereal with your stocks and bonds. People hold money primarily for this basic reason: Money makes it easier to conduct everyday transactions. Economists call this reason for holding money the transaction demand for money.

To understand the demand for money, we rely on the principle of opportunity cost.

**PRINCIPLE OF OPPORTUNITY COST**

The opportunity cost of something is what you sacrifice to get it.

The opportunity cost of holding money is the return you could have earned by holding your wealth in other assets. We measure the opportunity cost of holding money by the interest rate. Suppose the interest rate available to you on a long-term bond is 6 percent per year. If you hold $100 of your wealth in the form of this bond, you’ll earn $6 a year. If you hold currency instead, you’ll earn no interest. So the opportunity cost of holding $100 in currency is $6 per year, or 6 percent per year.
As interest rates increase in the economy, the opportunity cost of holding money also increases. Economists have found that as the opportunity cost of holding money increases, the public demands less money. The quantity demanded of money will decrease with an increase in interest rates.

In Figure 17.1, we draw a demand for money curve, \( M^d \), as a function of the interest rate. At higher interest rates, individuals will want to hold less money than they will at lower interest rates because the opportunity cost of holding money is higher. As interest rates rise from \( r_0 \) to \( r_1 \), the quantity of money demanded falls from \( M_0 \) to \( M_1 \).

\[ \text{FIGURE 17.1} \]
Demand for Money
As interest rates increase from \( r_0 \) to \( r_1 \), the quantity of money demanded falls from \( M_0 \) to \( M_1 \).

**THE PRICE LEVEL AND GDP AFFECT MONEY DEMAND** The demand for money also depends on two other factors. One is the overall price level in the economy. The demand for money will increase as the level of prices increases. If prices for your groceries are twice as high, you will need twice as much money to purchase them. The amount of money people typically hold during any time period will be closely related to the dollar value of the transactions they make. This is an example of the real-nominal principle in action.

**REAL-NOMINAL PRINCIPLE**
What matters to people is the real value of money or income—its purchasing power—not the face value of money or income.

The other factor that influences the demand for money is the level of real GDP or real income. It seems obvious that as income increases, individuals and businesses will make more purchases. Similarly, as real GDP increases, individuals and businesses will make more transactions. To facilitate these transactions, they will want to hold more money.
Figure 17.2 shows how changes in prices and GDP affect the demand for money. Panel A shows how the demand for money shifts to the right as the price level increases. At any interest rate, people will want to hold more money as prices increase. Panel B shows how the demand for money shifts to the right as real GDP increases. At any interest rate, people will want to hold more money as real GDP increases. These graphs both show the same result. An increase in prices or an increase in real GDP will increase money demand.

![Graph showing demand for money shifting with price increases and real GDP increases.](image)

**FIGURE 17.2**
Shifting the Demand for Money
Changes in prices and real GDP shift the demand for money.

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**OTHER COMPONENTS OF MONEY DEMAND** Traditionally, economists have identified other motives besides transactions for individuals or firms to hold money. If you hold your wealth in the form of property, such as a house or a boat, it is costly to sell it on short notice if you need to obtain funds. These forms of wealth are illiquid, meaning that they are not easily transferable into money. If you hold your wealth in currency or checking accounts, you do not have this problem. Economists recognize that people have a liquidity demand for money; they want to hold money so they can make transactions on short notice.

During periods of economic volatility, investors might not want to hold stocks and bonds because their prices might fall. Instead, they might convert them into holdings that fall into the M2 category, such as savings accounts and money market funds. These investments earn lower interest rates on average, but are less risky than stocks and bonds, whose prices can fluctuate. This demand for safer assets is called the speculative demand for money. For example, after the stock market began to fall in 2000, individuals became very uncertain about the future and shifted their funds from the stock market to money market mutual funds. This shift of assets from stocks to money temporarily increased M2. When the market started to recover, some investors shifted funds back into the stock market.

In summary, individuals hold money for three motives: to facilitate transactions, to provide liquidity, and to reduce risk. The amount of money they want to hold will depend on interest rates, the level of real GDP, and the price level.

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**17.2 HOW THE FEDERAL RESERVE CAN CHANGE THE MONEY SUPPLY**
As we discussed in the last chapter, the banking system as a whole can expand the money supply only if new reserves come into the system. As we saw, when private citizens and firms write checks to one another, there will be no net change in the supply.
of money. Because the total amount of reserves in the system is unchanged, the money supply cannot expand. There is one organization, however, that has the power to change the total amount of reserves in the banking system: the Federal Reserve.

**Open Market Operations**

The Fed can increase or decrease the total amount of reserves in the banking system through **open market operations**, which are the purchase or sale of U.S. government securities by the Fed. There are two types of open market operations:

- **In open market purchases**, the Fed buys government bonds from the private sector.
- **In open market sales**, the Fed sells government bonds to the private sector.

To understand how the Fed can increase the supply of money, let's trace what happens after an open market purchase. Suppose the Federal Reserve purchases $1 million worth of government bonds currently owned by the private sector. The Fed writes a check for $1 million and presents it to the party who sold the bonds. The Federal Reserve now owns those bonds. The party who sold the bonds then deposits the $1 million in its bank.

Here is the key to how the supply of money increases when the Fed purchases government bonds: As we explained in the last chapter, each bank must keep an account with the Fed containing both its required and excess reserves. The check written against the Federal Reserve increases the bank's total reserves, essentially giving it more money to loan out. In this case, the bank's account balance increases by $1 million. If the reserve requirement is 10 percent, the bank must keep $100,000 in reserves, but it can now loan out $900,000 from its excess reserves. Basically, when the Fed buys bonds, the proceeds go out into the economy. Open market purchases of bonds therefore increase the money supply.

The Federal Reserve has powers that ordinary citizens and even banks do not have. The Fed can write checks against itself to purchase government bonds without having any explicit "funds" in its account for the purchase. Banks accept these checks because they count as part of their total reserves.

As you might expect, open market sales will, conversely, decrease the supply of money. Suppose the Federal Reserve sells $1 million worth of government bonds to a Wall Street firm. The firm will pay for the bonds with a check for $1 million drawn on its bank and give this check to the Federal Reserve. The bank must either hand over $1 million in cash or, more likely, reduce its total reserves with the Federal Reserve by $1 million. When the Fed sells bonds, it is basically taking the money exchanged for them out of the hands of the public. Open market sales therefore decrease the money freely available in the economy.

In summary, if the Federal Reserve wishes to increase the money supply to stimulate the economy (perhaps it is operating too sluggishly), it buys government bonds from the private sector in open market purchases. If the Fed wishes to decrease the money supply to slow the economy down (perhaps it is growing too quickly and inflation is occurring), it sells government bonds to the private sector in open market sales.

**Other Tools of the Fed**

Open market operations are by far the most important way in which the Federal Reserve changes the supply of money. There are two other ways in which the Fed can change the supply of money, which we'll discuss next.

**CHANGING RESERVE REQUIREMENTS** Another way the Fed can change the money supply is by changing the reserve requirements for banks. If the Fed wishes to increase the supply of money, it can reduce banks' reserve requirements so they have more money to loan out. This would expand the money supply. To decrease the supply of money, the Federal Reserve can raise reserve requirements.
APPLICATION 1

NEW WAYS TO BORROW FROM THE FED

APPLYING THE CONCEPTS #1: Why did the Federal Reserve introduce new mechanisms for institutions to borrow money from it?

Suppose you needed to borrow some money. Would you rather borrow from a good friend or from your parents? You might want to borrow from your friend if your parents will ask too many questions.

Banks faced a similar situation with the Federal Reserve. They might need funds but be reluctant to borrow from the Fed, because the Fed is also their regulator and could become concerned about the banks’ solvency. These concerns limit the amount banks wanted to borrow from the Fed.

However, faced with the mortgage and financial crisis in 2008, the Fed desperately wanted to provide more liquidity directly to the banking system and developed a new approach. It came up with a number of new ideas. The first was the Term Auction Facility, in which the Fed auctioned off loans in the market to banks and other eligible depository institutions. As backing for their loans, the banks could pledge a wide variety of assets. The Fed believed this new market-based approach and the large amount of credit made available would reduce the potential stigma of borrowing from the Fed. It was a bit more like borrowing from a friend than from your parents. A second new idea was a Term Securities Lending Facility that provided loans to 20 different banks and financial institutions that were major dealers in government securities. Both these mechanisms allowed the Fed to inject new funds into the financial system at a time of need.

As a response to the deepening of the financial crisis in October 2008, the Fed also developed two additional means of providing funding to the economy. The Commercial Paper Funding Facility allows the Fed to indirectly purchase short-term corporate debt—commercial paper—from firms. In addition, the Fed developed the Money Market Investor Funding Facility to provide a mechanism to support money market funds that came under stress during the financial crisis in 2008. All these new facilities were designed to make the Fed a more effective lender to the private economy.

Related to Exercise 2.7.

Changing reserve requirements is a powerful tool, but the Federal Reserve doesn’t use it very often because it disrupts the banking system. Suppose a bank is required to hold exactly 10 percent of its deposits as reserves and has loaned the other 90 percent out. If the Federal Reserve suddenly increases its reserve requirement to 20 percent, the bank would be forced to call in or cancel many of its loans. Its customers would not like this. Today, the Fed doesn’t make sharp changes in reserve requirements. It did in the past, including during the Great Depression, because it mistakenly believed that the banks were holding too much in excess reserves. Banks, however, were holding additional reserves because they wanted to protect themselves from bank runs. As a result, after the increase in required reserves, banks increased their reserves even more, further reducing the supply of money to the economy.

CHANGING THE DISCOUNT RATE Another way the Fed can change the money supply is by changing the discount rate. The discount rate is the interest rate at which banks can borrow directly from the Fed. Suppose a major customer asks for a large loan from a bank that has no excess reserves. Unless the bank can find an additional source of funds, it will not be able to make the loan. Banks are reluctant to turn away major customers. They first try to borrow reserves from other banks through the federal funds market, a market in which banks borrow and lend reserves to and from one another. If the rate—called the federal funds rate—seems too high to the bank, it
could borrow directly from the Federal Reserve at the discount rate. By changing the
discount rate, the Federal Reserve can influence the amount of borrowing by banks. If
the Fed raises the discount rate, banks will be discouraged from borrowing reserves
because it has become more costly. Lowering the discount rate will induce banks to
borrow additional reserves. Recently, the Fed has developed new methods to allow
banks and other institutions to borrow from it.

17.3 **HOW INTEREST RATES ARE DETERMINED:**
**COMBINING THE DEMAND AND SUPPLY OF MONEY**

Combining the demand for money, determined by the public, with the supply of
money, determined by the Fed, we can see how interest rates are determined in the
short run in a demand-and-supply model of the money market.

Figure 17.3 depicts a model of the money market. The supply of money is deter-
mained by the Federal Reserve, and we assume for simplicity that it is independent
of interest rates. We represent this independence by a vertical supply curve for
money, \( M^s \). In the same graph, we draw the demand for money \( M^d \). Market equilib-
rium occurs where the demand for money equals the supply of money, at an interest
rate of \( r^* \).

![Figure 17.3](image)

**Figure 17.3**
Equilibrium in the Money Market

Equilibrium in the money market occurs at an interest rate of \( r^* \), at which the quantity of money
demanded equals the quantity of money supplied.

At this equilibrium interest rate \( r^* \), the quantity of money demanded by the pri-
ivate sector equals the quantity of money supplied by the Federal Reserve. What hap-
pens if the interest rate is higher than \( r^* \)? At a higher interest rate, the quantity of
money demanded will be less than the fixed quantity supplied, so there will be an
excess supply of money. In other markets, excess supplies cause the price to fall. The
same result happens here. The "price of money" in the market for money is the inter-
est rate. If the interest rate were below \( r^* \), the demand for money would exceed the
fixed supply: There would be an excess demand for money. As in other markets when
there are excess demands, the price rises. Here, the price of money or the interest rate
would rise until it reached \( r^* \). As you can see, money-market equilibrium follows the
same logic as any other economic equilibrium.
APPLICATION 2

RISING INTEREST RATES DURING AN ECONOMIC RECOVERY

APPLYING THE CONCEPTS #2: What happens to interest rates when the economy recovers from a recession?

Economists have often noticed that as an economy recovers from a recession, interest rates start to rise. And, in general, interest rates tend to rise as the economy grows quickly. An example occurred during 2005, when interest rates on three-month Treasury bills rose from 2.3 percent at the beginning of the year to 3.9 percent at the end of the year, as real GDP grew very rapidly.

Some observers think this is puzzling because they associate higher interest rates with lower output. Why should a recovery be associated with higher interest rates?

The simple model of the money market helps explain why interest rates can rise during an economic recovery. One key to understanding this phenomenon is that the extra income being generated by firms and individuals during the recovery will increase the demand for money. Because the demand for money increases while the supply of money remains fixed, interest rates rise.

Another factor is that the Federal Reserve itself may want to raise interest rates as the economy grows rapidly to avoid overheating the economy. In this case, the Fed acts to reduce the supply of money to raise interest rates. In both cases, however, the public should expect rising interest rates during a period of economic recovery and rapid GDP growth. Related to Exercise 3.4.

We can use this simple model of the money market to understand the power of the Federal Reserve. Suppose the Federal Reserve increases the money supply through an open market purchase of bonds. In Panel A of Figure 17.4, an increase in the supply of money shifts the money supply curve to the right, leading to lower interest rates. A decrease in the money supply through the Fed's open market sale of bonds, as depicted in Panel B of Figure 17.4, decreases the supply of money, shifting the money supply curve to the left and increasing interest rates.

![Diagram](https://via.placeholder.com/150)

(A) An open market purchase shifts the supply of money to the right and leads to lower interest rates.

(B) An open market sale shifts the supply of money to the left and leads to higher interest rates.

\[\text{FIGURE 17.4}
\text{ Federal Reserve and Interest Rates}
\text{Changes in the supply of money will change interest rates.}\]

We can also think of the process from the perspective of banks. Recall our discussion of money creation through the banking system. After the Fed's open market purchase of bonds, some of the money the Fed paid for the bonds gets deposited into...
banks. Banks will want to make loans to consumers and businesses with that money, because holding it in their reserves with the Fed earns them no interest. To entice people to borrow, banks will lower the interest rates they charge on their loans. After an open-market purchase of bonds by the Fed, interest rates will fall throughout the entire economy.

Now we understand why potential new homeowners—as well as businesspeople and politicians—want to know what the Federal Reserve is likely to do in the near future. The Fed exerts direct control over interest rates in the short run. If the Fed decides interest rates should be lower, it buys bonds in the open market to increase the supply of money. If the Fed wants higher interest rates, it sells bonds in the open market to decrease the money supply.

## 17.4 INTEREST RATES AND HOW THEY CHANGE INVESTMENT AND OUTPUT (GDP)

Higher or lower interest rates are just a means to an end, though, for the Fed. The Fed's ultimate goal is to change output—either to slow or speed the economy by influencing aggregate demand.

To show how the Fed affects the interest rate, which in turn affects investment (a component of GDP), and finally, GDP itself, we combine our demand and supply for money with a curve that shows how investment spending is related to interest rates. This is shown in Figure 17.5. Panel A in Figure 17.5 shows how interest rates are determined by the demand and supply for money. It is identical to Figure 17.3 on page 411, which we studied earlier. The graph shows us the equilibrium interest rate for money.

![Figure 17.5](image)

**Figure 17.5**

The Money Market and Investment Spending

The equilibrium interest rate $r^*$ is determined in the money market. At that interest rate, investment spending is given by $I^*$.

Panel B shows a downward sloping relationship between interest rates and investment spending. In other words, the graph shows that as interest rates fall, investment spending in the economy will increase. Why is there this negative relationship between interest rates and investment? Firms have a number of investment projects that they could undertake, which all have payoffs in the future. These projects all require firms to either use their own funds or borrow funds in order to undertake the investments. The opportunity cost to the firms of these funds is the interest rate that
they could earn by simply investing the funds in the financial markets. As interest rates in the economy fall, so does the opportunity cost of the funds needed for investment. With a lower opportunity cost, investments become more attractive to firms and total investment in the economy will increase. Conversely, as interest rates rise, the opportunity cost of funds increases and investment spending will decrease. Now let's combine Panel A and Panel B. We can see that at the equilibrium interest rate $r^*$ the level of investment in the economy will be given by $I^*$.

We should note that consumption as well as investment can depend on interest rates. That is, spending on consumer durables, such as automobiles and refrigerators, will also depend negatively on the rate of interest. Consumer durables are really investment goods for the household: If you buy an automobile, you incur the cost today and receive benefits, such as the ability to use the car, in the future. As interest rates rise, the opportunity costs of investing in an automobile will rise. Consumers will respond to the increase in opportunity cost by purchasing fewer cars. In this chapter, we discuss how changes in interest rates affect investment, but keep in mind that the purchases of consumer durables are affected too.

In Figure 17.6, we show the effects of an increase in the money supply using our money market and investment graphs. As the supply of money increases, interest rates fall from $r_0$ to $r_1$. With lower interest rates, investment spending will increase from $I_0$ to $I_1$. This increase in investment spending will then increase aggregate demand—the total demand for goods and services in the economy—and shift the aggregate demand curve to the right.

**Figure 17.6**
Monetary Policy and Interest Rates
As the money supply increases, interest rates fall from $r_0$ to $r_1$. Investment spending increases from $I_0$ to $I_1$.

We show the shift of the aggregate demand curve in Figure 17.7. With the increase in aggregate demand, both output ($y$) and the price level ($P$) in the economy as a whole will increase in the short run. Thus, by reducing interest rates, the Fed affects output and prices in the economy.

In summary, when the Fed increases the money supply, it leads to lower interest rates and increased investment spending. In turn, a higher level of investment spending will ultimately lead to a higher level of GDP.
Money Supply and Aggregate Demand

When the money supply is increased, investment spending increases, shifting the AD curve to the right. Output increases and prices increase in the short run.

The Fed can also use its influence to increase interest rates, which will have the exact opposite effect. Investment spending will fall, along with aggregate demand. The aggregate demand curve will shift to the left, and the price level and output in the economy will fall, too. We can again represent this entire sequence of events:

- open market purchase of bonds
- decrease in money supply
- decrease in interest rates
- decrease in investment spending
- decrease in GDP

Monetary Policy and International Trade

We have been discussing monetary policy without taking into account international trade or international movements of financial funds across countries. Once we bring in these considerations, we will see that monetary policy operates through an additional route.

Suppose the Federal Reserve lowers U.S. interest rates through an open market purchase of bonds. As a result, investors in the United States will be earning lower interest rates and will seek to invest some of their funds abroad. To invest abroad, they will need to sell their U.S. dollars and buy the foreign currency of the country where they intend to invest. This will affect the exchange rate—the rate at which one currency trades for another currency in the market. As more investors sell their dollars to buy foreign currency, the exchange rate will fall. A fall in the exchange rate is called depreciation of a currency. Lower U.S. interest rates brought on by the Fed will cause the dollar to depreciate. This will ultimately change the demand and supply of goods and services around the globe because it will make U.S. goods cheaper than foreign goods. Let's see why.

In this case, the lower value of the dollar will mean that U.S. goods become relatively cheaper on world markets. Suppose the exchange rate is two Swiss francs to the dollar, meaning you will receive two Swiss francs for every dollar you exchange. If a U.S. machine sells for $100,000, it will cost 200,000 Swiss francs. Now suppose the value of the dollar depreciates so that one dollar now buys only one Swiss franc. The same U.S. machine will now cost Swiss residents half of what they used to pay for it—just 100,000 francs instead of 200,000. In other words, the lower value of the dollar makes U.S. goods cheaper for foreigners. As a result, foreign residents will want to buy more U.S. goods, and U.S. companies will want to export more goods to meet the higher foreign demand.

That's the good news about the lower value of the U.S. dollar. The bad news is that the lower value of the dollar will make it more expensive for U.S. residents to buy foreign...
goods. If the exchange rate were still two Swiss francs to the dollar as it originally was at the outset of our example, Swiss chemicals with a price tag of 60,000 francs would cost a U.S. resident $30,000. If the exchange rate of the dollar depreciates to one franc per dollar, however, the same chemicals will cost twice as much—$60,000. As the dollar depreciates, imports become more expensive, and U.S. residents tend to import fewer of them.

Let's reap this: As the exchange rate for the U.S. dollar falls, U.S. goods become cheaper and foreign goods become more expensive. The United States then exports more goods and imports fewer goods. Net exports increase, in other words. This increase in net exports increases the demand for U.S. goods and increases GDP. Remember that this all began with an open market purchase of bonds by the Fed that increased the money supply. Here is the sequence of events:

- **open market purchase** of bonds by the Fed
- **supply** of money increases
- **interest rates** fall
- **exchange rate** falls
- **value** of currency

The three new links in the sequence are from interest rates to exchange rates, from exchange rates to net exports, and from net exports to GDP.

This sequence also works in reverse. If the Fed conducts an open market sale of bonds, U.S. interest rates rise. As a result, foreign investors earning lower interest rates elsewhere will want to move their money to the United States where they can earn a higher return. As they buy more U.S. dollars, the exchange rate for the dollar will increase, and the dollar will increase in value. An increase in the value of a currency is called appreciation of a currency. The appreciation of the dollar will make U.S. goods more expensive for foreigners and imports cheaper for U.S. residents. Suppose the U.S. dollar appreciates, and each dollar can now be exchanged for three Swiss francs instead of two. The same machine the Swiss had to pay 200,000 francs for when the exchange rate was one dollar to two francs now costs 100,000 francs. The Swiss chemicals U.S. residents bought for $30,000 will now cost them less—just $20,000.

When U.S. interest rates rise as a result of an open market sale by the Fed, we expect exports to decrease and imports to increase, decreasing net exports. The decrease in net exports will reduce the demand for U.S. goods and lead to a fall in output. Here is the sequence of events:

- **open market sale** of bonds by the Fed
- **supply** of money decreases
- **interest rates** increase
- **exchange rate** rises
- **appreciation of a currency**

To summarize, an increase in interest rates will reduce both investment spending (including consumer durables) and net exports. A decrease in interest rates will increase investment spending and net exports. As you can see, monetary policy in an open economy is even more powerful than monetary policy used in a closed economy.

The Fed and other central banks are well aware of the power they have to influence exchange rates and international trade. Countries that depend extensively on international trade—such as Canada and Switzerland—find the effects of monetary policy on exchange rates are critical to their economic well-being.

### 17.5 Monetary Policy Challenges for the Fed

Now that we have seen how changes in the money supply affect aggregate demand, we can see that the government has two different types of tools to change the level of GDP in the short run: The government can use either fiscal policy—changes in the level of taxes or government spending—or monetary policy—changes in the supply of money and interest rates—to alter the level of GDP.

If the current level of GDP is below full employment or potential output, the government can use expansionary policies such as tax cuts, increased spending, or