5

Goods and Financial Markets; The *IS-LM* Model

In Chapter 3, we looked at the goods market. In Chapter 4, we looked at financial markets. We now look at goods and financial markets together. By the end of this chapter you will have a framework to think about how output and the interest rate are determined in the short run.

In developing this framework, we follow a path first traced by two economists, John Hicks and Alvin Hansen in the late 1930s and the early 1940s. When the economist John Maynard Keynes published his *General Theory* in 1936, there was much agreement that his book was both fundamental and nearly impenetrable. (Try to read it, and you will agree.) There were (and still are) many debates about what Keynes "really meant." In 1937, John Hicks summarized what he saw as one of Keynes's main contributions: the joint description of goods and financial markets. His analysis was later extended by Alvin Hansen. Hicks and Hansen called their formalization the *IS-LM* model.

Macroeconomics has made substantial progress since the early 1940s. This is why the *IS-LM* model is treated in this and the next chapter rather than in Chapter 24 of this book. (If you had taken this course 40 years ago, you would be nearly done!) But to most economists, the *IS-LM* model still represents an essential building block—one that, despite its simplicity, captures much of what happens in the economy in *the short run.* This is why the *IS-LM* model is still taught and used today.

The version of the *IS-LM* presented in this book is a bit different (and, you will be happy to know, simpler) than the model developed by Hicks and Hansen. This reflects a change in the way central banks now conduct monetary policy, with a shift in focus from controlling the money stock in the past to controlling the interest rate today. More in Section 5-2.

This chapter develops the basic version of the *IS-LM* model. It has five sections:

Section 5-1 looks at equilibrium in the goods market and derives the *IS* relation.

Section 5-2 looks at equilibrium in financial markets and derives the *LM* relation.

Sections 5-3 and 5-4 put the *IS* and the *LM* relations together and use the resulting *IS-LM* model to study the effects of fiscal and monetary policy—first separately, then together.

Section 5-5 introduces dynamics and explores how the *IS-LM* model captures what happens in the economy in the short run.

5-1 The Goods Market and the *IS* Relation

Let's first summarize what we learned in Chapter 3:

- We characterized equilibrium in the goods market as the condition that production, Y, be equal to the demand for goods, Z. We called this condition the *IS* relation.
- We defined demand as the sum of consumption, investment, and government spending. We assumed that consumption was a function of disposable income (income minus taxes), and took investment spending, government spending, and taxes as given:

$$Z = C(Y - T) + \bar{I} + G$$

  (In Chapter 3, we assumed, to simplify the algebra, that the relation between consumption, C, and disposable income, $Y - T$, was linear. Here, we shall not make this assumption but use the more general form $C = C(Y - T)$ instead.)
- The equilibrium condition was thus given by

$$Y = C(Y - T) + \bar{I} + G$$

- Using this equilibrium condition, we then looked at the factors that moved equilibrium output. We looked in particular at the effects of changes in government spending and of shifts in consumption demand.

The main simplification of this first model was that the interest rate did not affect the demand for goods. Our first task in this chapter is to abandon this simplification and introduce the interest rate in our model of equilibrium in the goods market. For the time being, we focus only on the effect of the interest rate on investment and leave a discussion of its effects on the other components of demand until later.

Much more on the effects of interest rates on both consumption and investment in Chapter 15. ▶

Investment, Sales, and the Interest Rate

In Chapter 3, investment was assumed to be constant. This was for simplicity. Investment is in fact far from constant and depends primarily on two factors:

- The level of sales. Consider a firm facing an increase in sales and needing to increase production. To do so, it may need to buy additional machines or build an additional plant. In other words, it needs to invest. A firm facing low sales will feel no such need and will spend little, if anything, on investment.
- The interest rate. Consider a firm deciding whether or not to buy a new machine. Suppose that to buy the new machine, the firm must borrow. The higher the interest rate, the less attractive it is to borrow and buy the machine. (For the moment, and to keep things simple, we make two simplifications. First, we assume that all firms can borrow at the same interest rate—namely, the interest rate on bonds as determined in Chapter 4. In fact, many firms borrow from banks, possibly at a different rate. We also leave aside the distinction between the nominal interest rate—the interest rate in terms of dollars—and the real interest rate—the interest rate in terms of goods. We return to both issues in Chapter 6.) At a high enough interest rate, the additional profits from using the new machine will not cover interest payments, and the new machine will not be worth buying.

The argument still holds if the firm uses its own funds: The higher the interest rate, the more attractive it is to lend the funds rather than to use them to buy the new machine. ▶

To capture these two effects, we write the investment relation as follows:

$$I = I(Y, i) \qquad (5.1)$$
$$(+,-)$$

Equation (5.1) states that investment I depends on production Y and the interest rate i. (We continue to assume that inventory investment is equal to zero, so sales and production are always equal. As a result, Y denotes both sales and production.) The positive sign under Y indicates that an increase in production (equivalently, an increase in sales) leads to an increase in investment. The negative sign under the interest rate i indicates that an increase in the interest rate leads to a decrease in investment.

An increase in output leads to an increase in investment. An increase in the interest rate leads to a decrease in investment.

Determining Output

Taking into account the investment relation (5.1), the condition for equilibrium in the goods market becomes

$$Y = C(Y - T) + I(Y, i) + G \tag{5.2}$$

Production (the left side of the equation) must be equal to the demand for goods (the right side). Equation (5.2) is our expanded *IS relation*. We can now look at what happens to output when the interest rate changes.

Start with Figure 5-1. Measure the demand for goods on the vertical axis. Measure output on the horizontal axis. For a given value of the interest rate i, demand is an increasing function of output, for two reasons:

- An increase in output leads to an increase in income and thus to an increase in disposable income. The increase in disposable income leads to an increase in consumption. We studied this relation in Chapter 3.
- An increase in output also leads to an increase in investment. This is the relation between investment and production that we have introduced in this chapter.

In short, an increase in output leads, through its effects on both consumption and investment, to an increase in the demand for goods. This relation between demand and output, for a given interest rate, is represented by the upward-sloping curve ZZ.
Note two characteristics of ZZ in Figure 5-1:

- Because we have not assumed that the consumption and investment relations in equation (5.2) are linear, ZZ is in general a curve rather than a line. Thus, we have drawn it as a curve in Figure 5-1. All the arguments that follow would apply if we

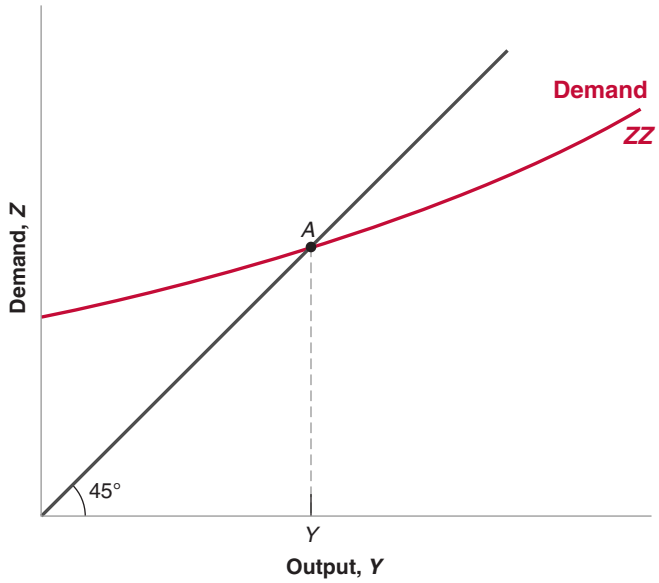

Figure 5-1

Equilibrium in the Goods Market

The demand for goods is an increasing function of output. Equilibrium requires that the demand for goods be equal to output.

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Figure 5-2

The IS Curve

(a) An increase in the interest rate decreases the demand for goods at any level of output, leading to a decrease in the equilibrium level of output. (b) Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. The *IS* curve is therefore downward sloping.

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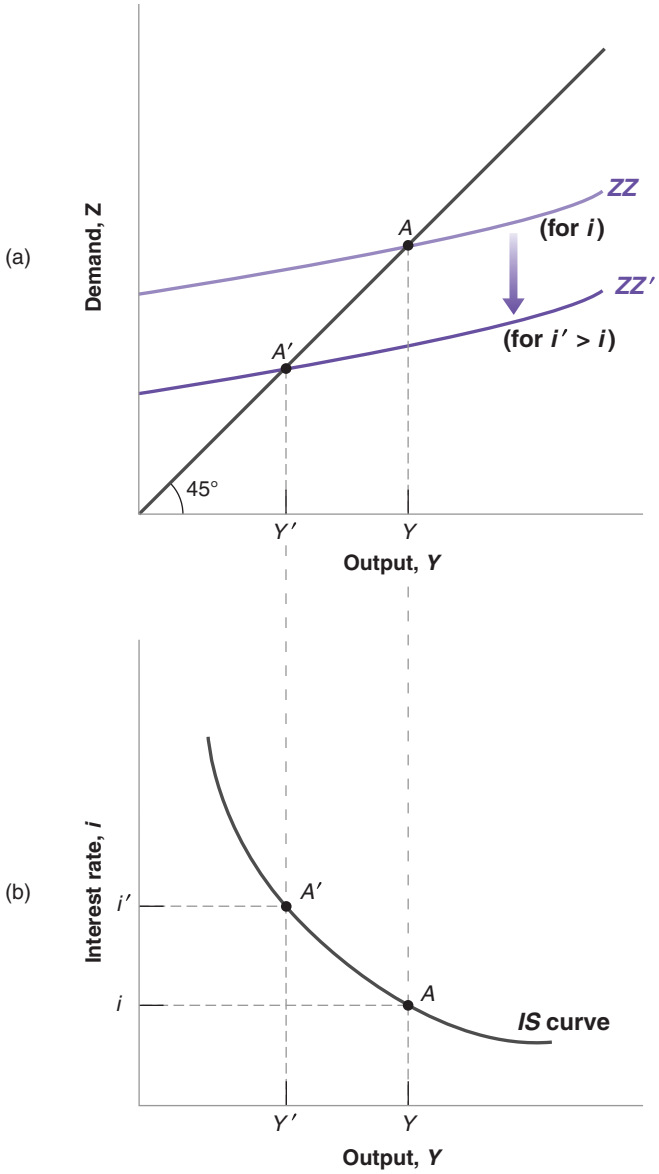

assumed that the consumption and investment relations were linear and that ZZ were a straight line.

■ We have drawn ZZ so that it is flatter than the 45-degree line. Put another way, we have assumed that an increase in output leads to a less than one-for-one increase in demand. In Chapter 3, where investment was constant, this restriction naturally followed from the assumption that consumers spend only part of their additional income on consumption. But now that we allow investment to respond to production, this restriction may no longer hold. When output increases, the sum of the increase in consumption and the increase in investment could exceed the initial increase in output. Although this is a theoretical possibility, the empirical evidence suggests that it is not the case in reality. That's why we shall assume the response of demand to output is less than one-for-one and draw ZZ flatter than the 45-degree line.

Make sure you understand ▶ why the two statements mean the same thing.

Equilibrium in the goods market is reached at the point where the demand for goods equals output; that is, at point A, the intersection of ZZ and the 45-degree line. The equilibrium level of output is given by Y.

So far, what we have done is extend, in straightforward fashion, the analysis of Chapter 3. But we are now ready to derive the *IS* curve.

Deriving the *IS* Curve

We have drawn the demand relation, ZZ, in Figure 5-1 for a given value of the interest rate. Let's now derive in Figure 5-2 what happens if the interest rate changes.

Suppose that, in Figure 5-2(a), the demand curve is given by ZZ, and the initial equilibrium is at point A. Suppose now that the interest rate increases from its initial value i to a new higher value i'. At any level of output, the higher interest rate leads to lower investment and lower demand. The demand curve ZZ shifts down to ZZ': At a given level of output, demand is lower. The new equilibrium is at the intersection of the lower demand curve ZZ' and the 45-degree line, at point A'. The equilibrium level of output is now equal to Y'.

In words: The increase in the interest rate decreases investment. The decrease in investment leads to a decrease in output, which further decreases consumption and investment, through the multiplier effect.

Can you show graphically what the size of the multiplier is? (*Hint*: Look at the ratio of the decrease in equilibrium output to the initial decrease in investment.)

Using Figure 5-2(a), we can find the equilibrium value of output associated with *any* value of the interest rate. The resulting relation between equilibrium output and the interest rate is drawn in Figure 5-2(b).

Figure 5-2(b) plots equilibrium output Y on the horizontal axis against the interest rate on the vertical axis. Point A in Figure 5-2(b) corresponds to point A in Figure 5-2(a), and point A' in Figure 5-3(b) corresponds to A' in Figure 5-2(a). The higher interest rate is associated with a lower level of output.

This relation between the interest rate and output is represented by the downward–sloping curve in Figure 5-2(b). This curve is called the ***IS* curve**.

Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. This relation is represented by the downward-sloping *IS* curve.

Shifts of the *IS* Curve

We have drawn the *IS* curve in Figure 5-2 taking as given the values of taxes, T, and government spending, G. Changes in either T or G will shift the *IS* curve.

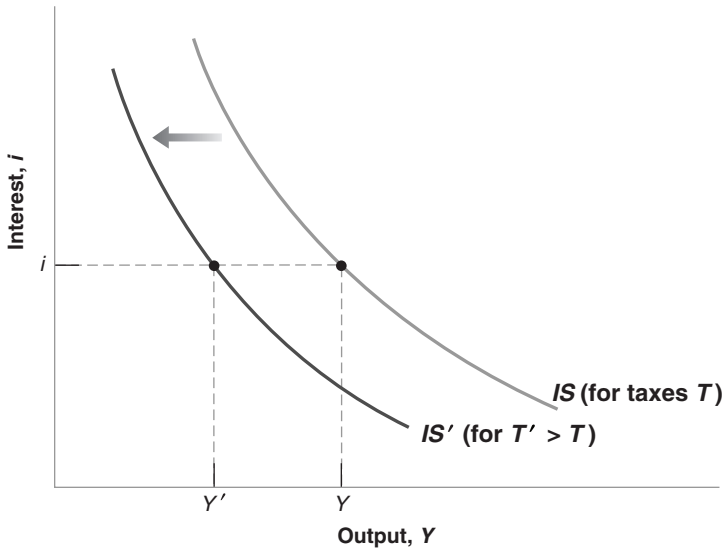

Figure 5-3

Shifts of the IS Curve

An increase in taxes shifts the *IS* curve to the left.

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To see how, consider Figure 5-3. The *IS* curve gives the equilibrium level of output as a function of the interest rate. It is drawn for given values of taxes and spending. Now consider an increase in taxes, from T to T'. At a given interest rate, say i, disposable income decreases, leading to a decrease in consumption, leading in turn to a decrease in the demand for goods and a decrease in equilibrium output. The equilibrium level of output decreases from Y to Y'. Put another way, the *IS* curve shifts to the left: At a given interest rate, the equilibrium level of output is lower than it was before the increase in taxes.

For a given interest rate, an increase in taxes leads to a decrease in output. In graphic terms: An increase in taxes shifts the *IS* curve to the left.

More generally, any factor that, for a given interest rate, decreases the equilibrium level of output causes the *IS* curve to shift to the left. We have looked at an increase in taxes. But the same would hold for a decrease in government spending, or a decrease in consumer confidence (which decreases consumption given disposable income). Symmetrically, any factor that, for a given interest rate, increases the equilibrium level of output—a decrease in taxes, an increase in government spending, an increase in consumer confidence—causes the *IS* curve to shift to the right.

Suppose that the government announces that the Social Security system is in trouble, and it may have to cut retirement benefits in the future. How are consumers likely to react? What is then likely to happen to demand and output today?

Let's summarize:

- Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. This relation is represented by the downward-sloping *IS* curve.
- Changes in factors that decrease the demand for goods given the interest rate shift the *IS* curve to the left. Changes in factors that increase the demand for goods given the interest rate shift the *IS* curve to the right.

5-2 Financial Markets and the *LM* Relation

Let's now turn to financial markets. We saw in Chapter 4 that the interest rate is determined by the equality of the supply of and the demand for money:

$$M = \$Y\ L(i)$$

The variable M on the left side is the nominal money stock. We shall ignore here the details of the money-supply process that we saw in Section 4-3, and simply think of the central bank as controlling M directly.

The right side gives the demand for money, which is a function of nominal income, $\$Y$, and of the nominal interest rate, i. As we saw in Section 4-1, an increase in nominal income increases the demand for money; an increase in the interest rate decreases the demand for money. Equilibrium requires that money supply (the left side of the equation) be equal to money demand (the right side of the equation).

Real Money, Real Income, and the Interest Rate

From Chapter 2:
Nominal GDP = Real GDP multiplied by the GDP deflator
$\$Y = YP$.
Equivalently:
Real GDP = Nominal GDP divided by the GDP deflator
$\$Y/P = Y$.

The equation $M = \$Y\ L(i)$ gives a relation between money, nominal income, and the interest rate. It will be more convenient here to rewrite it as a relation among real money (that is, money in terms of goods), real income (that is, income in terms of goods), and the interest rate.

Recall that nominal income divided by the price level equals real income, Y. Dividing both sides of the equation by the price level P gives

$$\frac{M}{P} = Y\ L(i) \tag{5.3}$$

Hence, we can restate our equilibrium condition as the condition that the *real money supply*—that is, the money stock in terms of goods, not dollars—be equal to the *real money demand*, which depends on real income, Y, and the interest rate, i.

The notion of a "real" demand for money may feel a bit abstract, so an example will help. Think not of your demand for money in general but just of your demand for coins. Suppose you like to have coins in your pocket to buy two cups of coffee during the day. If a cup costs \$1.20, you will want to keep about \$2.40 in coins: This is your nominal demand for coins. Equivalently, you want to keep enough coins in your pocket to buy two cups of coffee. This is your demand for coins in terms of goods—here in terms of cups of coffee.

From now on, we shall refer to equation (5.3) as the *LM relation*. The advantage of writing things this way is that *real income*, Y, appears on the right side of the equation instead of *nominal income*, $\$Y$. And real income (equivalently real output) is the variable we focus on when looking at equilibrium in the goods market. To make the reading lighter, we will refer to the left and right sides of equation (5.3) simply as "money supply" and "money demand" rather than the more accurate but heavier "real money supply" and "real money demand." Similarly, we will refer to income rather than "real income."

Deriving the *LM* Curve

In deriving the *IS* curve, we took the two policy variables as government spending, G, and taxes, T. In deriving the *LM* curve, we have to decide how we characterize monetary policy, as the choice of M, the money stock, or as the choice of i, the interest rate.

If we think of monetary policy as choosing the nominal money supply, M,and, by implication, given the price level which we shall take as fixed in the short run, choosing M/P, the real money stock, equation (5.3) tells us that real money demand, the right hand side of the equation, must be equal to the *given* real money supply, the left-hand side of the equation. Thus, if for example, real income increases, increasing money demand, the interest rate must increase so as money demand remains equal to the given money supply. In other words, for a given money supply, an increase in income automatically leads to an increase in the interest rate.

◀ Go back to Figure 4-3 in the previous chapter.

This is the traditional way of deriving the LM relation and the resulting LM curve. The assumption that the central bank chooses the money stock and then just lets the interest rate adjust is at odds however with reality today. Although, in the past, central banks thought of the money supply as the monetary policy variable, they now focus directly on the interest rate. They choose an interest rate, call it, $\bar{i}$, and adjust the money supply so as to achieve it. Thus, in the rest of the book, we shall think of the central bank as choosing the interest rate (and doing what it needs to do with the money supply to achieve this interest rate). This will make for an extremely simple ***LM* curve**, namely, a horizontal line in Figure 5-4, at the value of the interest rate, $\bar{i}$, chosen by the central bank.

LM curve is a bit of a misnomer, as, under our assumption, the LM relation is a simple horizontal line. But the use of the term *curve* is traditional, and I shall follow tradition.

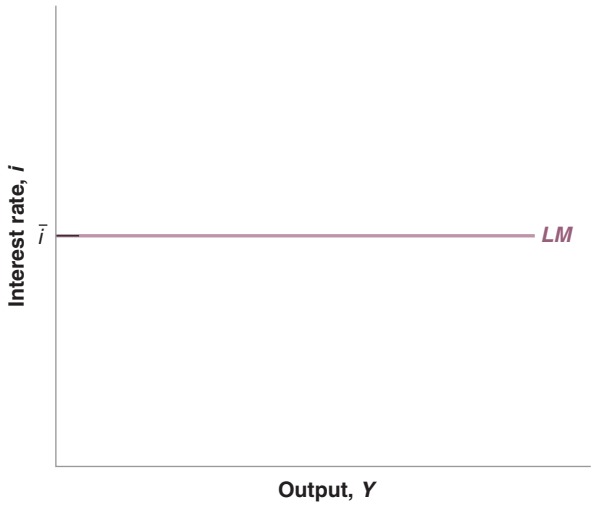

Figure 5-4

The *LM* Curve

The central bank chooses the interest rate (and adjusts the money supply so as to achieve it).

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5-3 Putting the *IS* and the *LM* Relations Together

The *IS* relation follows from goods market equilibrium. The *LM* relation follows from financial market equilibrium. They must both hold.

$$\textit{IS relation:} \quad Y = C(Y - T) + I(Y, i) + G$$
$$\textit{LM relation:} \quad i = \bar{i}$$

Together they determine output. Figure 5-5 plots both the *IS* curve and the *LM* curve on one graph. Output—equivalently, production or income—is measured on the horizontal axis. The interest rate is measured on the vertical axis.

Any point on the downward-sloping *IS* curve corresponds to equilibrium in the goods market. *Any point* on the horizontal *LM* curve corresponds to equilibrium in financial markets. *Only at point A* are both equilibrium conditions satisfied. That means point *A*, with the associated level of output Y and interest rate $\bar{i}$ is the overall equilibrium—the point at which there is equilibrium in both the goods market and the financial markets.

The *IS* and *LM* relations that underlie Figure 5-5 contain a lot of information about consumption, investment, and equilibrium conditions. But you may ask: So what if the equilibrium is at point *A*? How does this fact translate into anything directly useful about the world? Don't despair: Figure 5-5 holds the answer to many questions in macroeconomics. Used properly, it allows us to study what happens to output when the central bank decides to decrease the interest rate, or when the government decides to increase taxes, or when consumers become more pessimistic about the future, and so on.

In future chapters, you will see how we can extend it to think about the financial crisis, or about the role of expectations, or about the role of policy in an open economy.

Let's now see what the *IS-LM* model tells us, by looking separately at the effects of fiscal and monetary policy.

Fiscal Policy

Suppose the government decides to reduce the budget deficit and does so by increasing taxes while keeping government spending unchanged. Such a reduction in the budget deficit is often called a **fiscal contraction** or a **fiscal consolidation**. (An *increase* in the deficit, either due to an increase in government spending or to a decrease in taxes, is called a **fiscal expansion**.) What are the effects of this fiscal contraction on output, on its composition, and on the interest rate?

Decrease in G-T ⇔ fiscal contraction ⇔ fiscal consolidation

Increase in G-T ⇔ fiscal expansion

Figure 5-5

The IS-LM Model

Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. This is represented by the *IS* curve. Equilibrium in financial markets is represented by the horizontal *LM* curve. Only at point *A*, which is on both curves, are both goods and financial markets in equilibrium.

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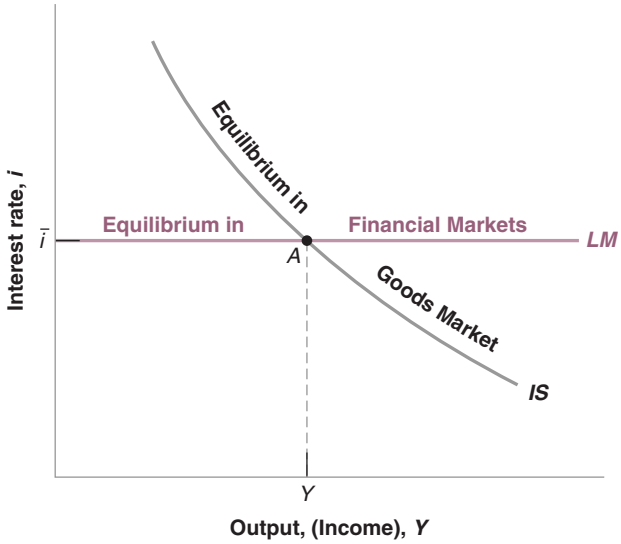

When you answer this or any question about the effects of changes in policy (or, more generally, changes in exogenous variables), always go through the following three steps:

1. Ask how the change affects equilibrium in the goods market and how it affects equilibrium in the financial markets. Put another way: Does it shift the *IS* curve and/or the *LM* curve, and, if so, how?
2. Characterize the effects of these shifts on the intersection of the *IS* and the *LM* curves. What does this do to equilibrium output and the equilibrium interest rate?
3. Describe the effects in words.

With time and experience, you will often be able to go directly to step 3. By then you will be ready to give an instant commentary on the economic events of the day. But until you get to that level of expertise, go step by step.

And when you feel really confident, put on a bow tie and go explain events on TV. (Why so many TV economists actually wear bow ties is a mystery.)

In this case, the three steps are easy. But going through them is good practice anyway:

- Start with step 1. The first question is how the increase in taxes affects equilibrium in the goods market—that is, how it affects the relation between output and the interest rate captured in the *IS* curve. We derived the answer in Figure 5-3 previously: At a given interest rate, the increase in taxes decreases output. The *IS* curve shifts to the left, from *IS* to *IS′*, in Figure 5-6.

  Next, let's see if anything happens to the *LM* curve. By assumption, as we are looking at a change only in fiscal policy, the central bank does not change the interest rate. Thus, the *LM* curve, i.e. the horizontal line at $i = \bar{i}$ remains unchanged. The *LM* curve does not shift.
- Now consider step 2, the determination of the equilibrium.

  Before the increase in taxes, the equilibrium is given by point *A*, at the intersection of the *IS* and *LM* curves. After the increase in taxes and the shift to the left of the *IS* curve from *IS* to *IS′*, the new equilibrium is given by point *A′*. Output decreases from *Y* to *Y′*. By assumption, the interest rate does not change. Thus, as the *IS* curve *shifts*, the economy *moves along* the *LM* curve, from *A* to *A′*. The reason these words are italicized is that it is important always to distinguish between the *shift of* a curve (here the shift of the *IS* curve) and the *movement along* a curve (here the movement along the *LM* curve). Many mistakes come from not distinguishing between the two.

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The increase in taxes shifts the *IS* curve. The *LM* curve does not shift. The economy moves along the *LM* curve.

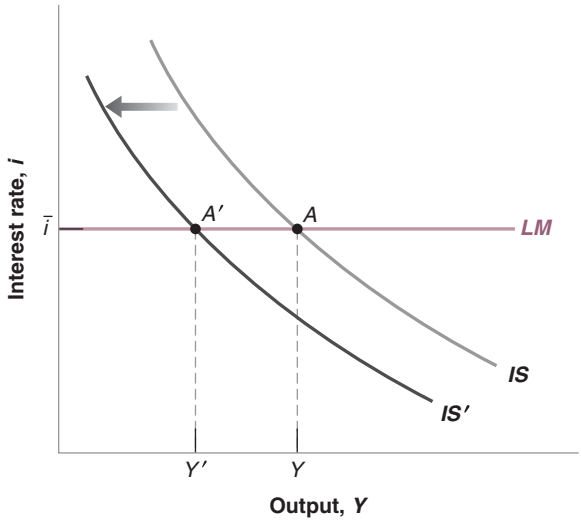

Figure 5-6

The Effects of an Increase in Taxes

An increase in taxes shifts the *IS* curve to the left. This leads to a decrease in the equilibrium level of output.

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- Step 3 is to tell the story in words:

  The increase in taxes leads to lower disposable income, which causes people to decrease their consumption. This decrease in demand leads, in turn through a multiplier, to a decrease in output and income. At a given interest rate, the increase in taxes leads therefore to a decrease in output. Looking at the components of output: The decrease in income and the increase in taxes both contribute to the decrease in disposable income and, in turn, a decrease in consumption. The decrease in output leads to a decrease in investment. Thus, both consumption and investment decrease.

Note that we have just given a formal treatment of the informal discussion of the effects of an increase in public saving given in the Focus box on "The Paradox of Saving" in Chapter 3. ▶

Monetary Policy

Now turn to monetary policy. Suppose the central bank decreases the interest rate. Recall that, to do so, it increases the money supply, so such a change in monetary policy is called a **monetary expansion**. (Conversely, an increase in the interest rate, which is achieved through a decrease in the money supply, is called a **monetary contraction** or **monetary tightening**.)

Decrease in $i \Leftrightarrow$ increase in $M \Leftrightarrow$ monetary expansion. ▶

Increase in $i \Leftrightarrow$ decrease in $M \Leftrightarrow$ monetary contraction $\Leftrightarrow$ monetary tightening.

- Again, step 1 is to see whether and how the *IS* and the *LM* curves shift.

  Let's look at the *IS* curve first. The change in the interest rate does not change the relation between output and the interest rate. It does not shift the *IS* curve.

  The change in the interest rate however leads (trivially) to a shift in the *LM* curve. The *LM* curve shifts down, from the horizontal line at $i = \bar{i}$ to the horizontal line $i = \bar{i}'$.
- Step 2 is to see how these shifts affect the equilibrium. The equilibrium is represented in Figure 5-7. The *IS* curve does not shift. The *LM* curve shifts down. The economy moves down along the *IS* curve, and the equilibrium moves from point *A* to point *A'*. Output increases from *Y* to *Y'*, and the interest rate decreases from *i* to *i'*.
- Step 3 is to say it in words: The lower interest rate leads to an increase in investment and, in turn, to an increase in demand and output. Looking at the components of output: The increase in output and the decrease in the interest rate both lead to an increase in investment. The increase in income leads to an increase in disposable income and, in turn, in consumption. So both consumption and investment increase.

Figure 5-7

The Effects of a Decrease in the Interest Rate

A monetary expansion shifts the *LM* curve down, and leads to higher output.

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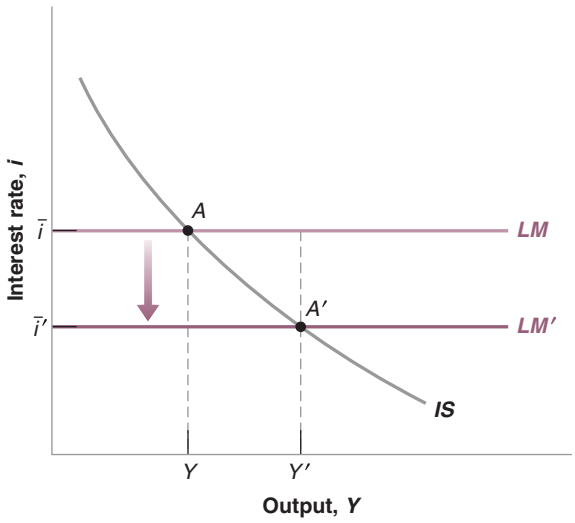

5-4 Using a Policy Mix

We have looked so far at fiscal policy and monetary policy in isolation. Our purpose was to show how each worked. In practice, the two are often used together. The combination of monetary and fiscal policies is known as the **monetary-fiscal policy mix**, or simply the *policy mix*.

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Sometimes, the right mix is to use fiscal and monetary policy in the same direction. Suppose for example that the economy is in a recession and output is too low. Then, both fiscal and monetary policies can be used to increase output. This combination is represented in Figure 5-8. The initial equilibrium is given by the intersection of *IS* and *LM* at point *A*, with corresponding output *Y*. Expansionary fiscal policy, say through a decrease in taxes, shifts the *IS* curve to the right, from *IS* to *IS′*. Expansionary monetary policy shifts the *LM* curve from *LM* to *LM′*. The new equilibrium is at *A′*, with corresponding output *Y′*. Thus, both fiscal and monetary policies contribute to the increase in output. Higher income and lower taxes imply that consumption is also higher. Higher output and a lower interest rate imply that investment is also higher.

Such a combination of fiscal and monetary policy is typically used to fight recessions, and it was for example used during the 2001 recession. The story of how the German and French governments and central banks adopted unconventional policy mixes during the recessions are described in the Focus box "The German and French Recessions of 2001–2002." You might ask: Why use a policy mix when one on its own could achieve the desired increase in output? As we saw in the previous section, the increase in output could in principle be achieved just by using fiscal policy—say through a sufficiently large increase in government spending, or a sufficiently large decrease in taxes—or just by using monetary policy, through a sufficiently large decrease in the interest rate? The answer is that there are a number of reasons why policy makers may want to use a policy mix:

- A fiscal expansion means either an increase in government spending, or an increase in taxes, or both. This means an increase in the budget deficit (or, if the budget was initially in surplus, a smaller surplus). As we shall see later, but you surely can guess why already, running a large deficit and increasing government debt may be dangerous. In this case, it is better to rely, at least in part, on monetary policy.

◀ More on this in Chapter 22.

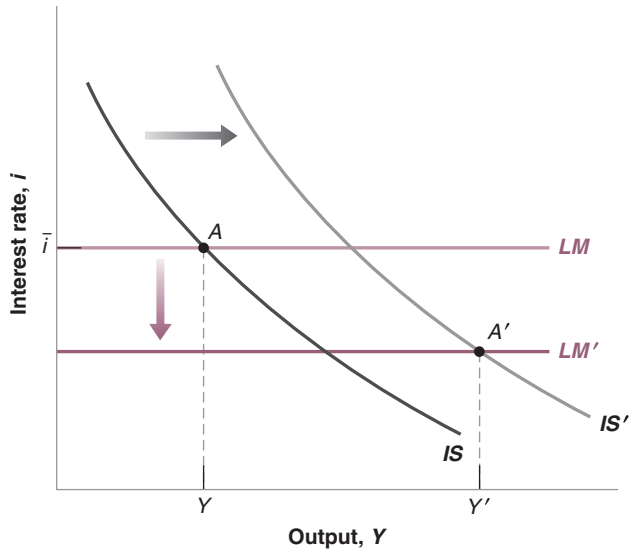

Figure 5-8

The Effects of a Combined Fiscal and Monetary Expansion

The fiscal expansion shifts the *IS* curve to the right. A monetary expansion shifts the *LM* curve down. Both lead to higher output.

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The German and French Recessions of 2001–2002

At the turn of the millennium, several industrial nations suffered from a decline in economic activity. Germany and France are two of the developed economies of the European Union (EU) that were hit by the recession of 2001. A number of factors are blamed for this recession. First, after the prolonged economic boom and low inflation of the 1990s it was inevitable that a slump in economic activity and employment would follow suit. Second, the Asian financial crisis and the banking crises that hit many emerging market economies took their toll on international trade, hence reducing exports of industrial nations. Third, the collapse of the dot-com or information technology bubble in 2001 further impacted the economies of developed nations negatively. As a result of these combined factors, both manufacturing investments and consumption expenditures of private households declined, hence, weakening GDP growth throughout 2001 and 2002. The only sector that showed signs of stabilization in Europe was the construction sector.

The Organization of Economic Cooperation and Development (OECD), an international economic organization and a forum comprising 34 countries committed to democracy and to stimulate economic progress and world trade, concluded that the economies of Germany and France had suffered from a recession in 2001 starting in the second quarter of 2001 and ending after nine months. However, signs of slow recovery persisted till 2005.

As you observe from Figure 1, during the fourth quarter of 2001 France witnessed negative GDP growth of −0.2%. This macroeconomic contraction coincided with the lowest level of growth in consumption expenditure of 0.1% and −0.8% change in capital investment, according to OECD statistics. The ultimate result was that exports declined by 2.4%. Similarly, what triggered the recession in Q1 2002 in Germany was a −0.7% slash of consumer spending accompanied by a sharp decline in investment demand equivalent to −1.9%. This was reflected by a massive decline in German exports for the first time in decades by −0.1%.

However, the 2001 recession in Germany and France was not that significant in comparison to previous worldwide recessions. In fact, many economists stipulate that this may not be a recession in its own right since neither Germany nor France witnessed two consecutive quarters of negative GDP growth. As it launched the euro in January 1999, the EU was in a state of cautious anticipation during the early 2000s after the recessions in both of these nations had led to a decline in the value of the euro. It was not till 2002 that the value of the euro began to increase, reaching parity with the US Dollar in mid-2002. The stronger euro hurt European exports.

While both France and Germany entered recession in late 2001, by mid-2002 both nations claimed that their recessions had ended. In reality, however, the economic slump persisted until the mid-2005. The slowdown was partly blamed on the weak macroeconomic policy responses. Let us try to evaluate these policies in both nations.

As shown in Figure 2, the response of the cut in fiscal spending was more marked in Germany in comparison to France. This could be explained by the fact that as a welfare state, France is committed to high social welfare spending. On the other hand, Germany's Social-Democrats/Greens ruling coalition at the time introduced the socially unpopular fiscal austerity and labor reform package, known as the Hartz concept. The German Chancellor Schröder implemented fiscal measures aiming to reduce the burdens and pressures on the fiscal budget exerted by the generous welfare system. The reforms that were to be phased out from 2003 throughout 2010 included gradual tax increases, phased rises in pension

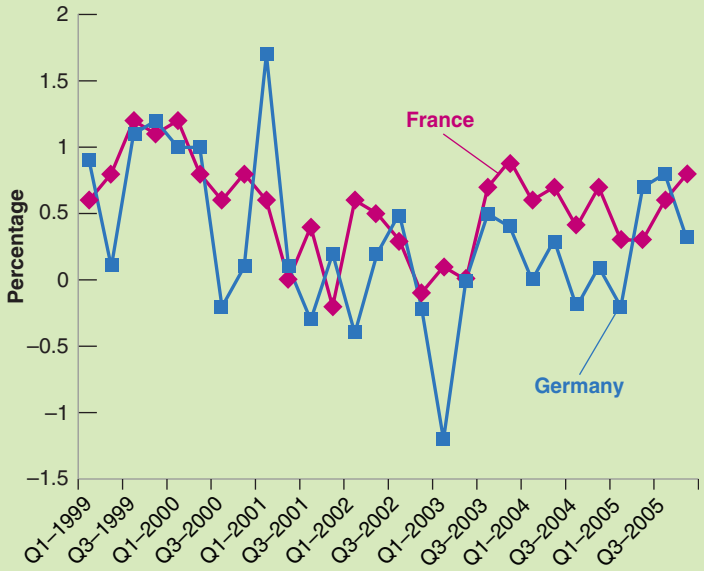

Figure 1 *France and Germany Quarterly GDP Growth Rates (1999–2005)*

Source: OECD.Stat. https://stats.oecd.org/index.aspx?queryid=350#.

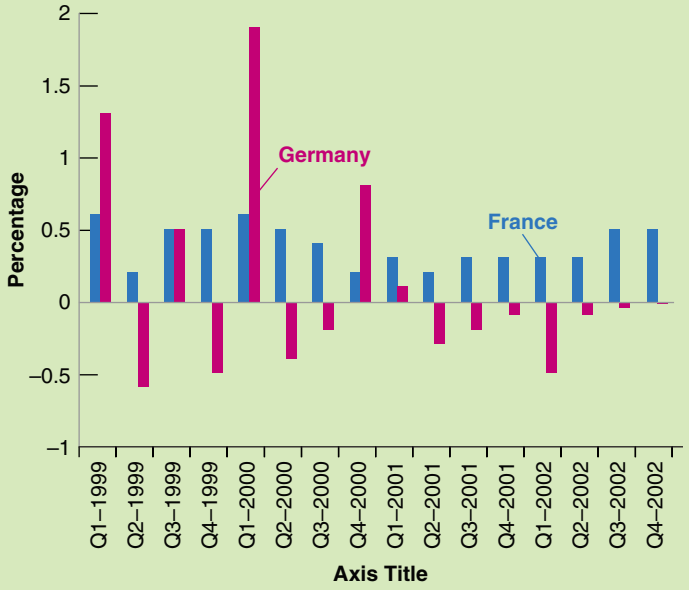

Figure 2 *Government Expenditure in France and Germany (1999–2002)*

Source: OECD.Stat, https://stats.oecd.org/index.aspx?queryid=350#.

contributions, cuts in pension benefits, reductions in the amounts allocated to medical treatment, and cutbacks in unemployment benefits.

The economic conditions of France and Germany are important because both these nations constitute more than 50% of the GDP of the EU. Sensing the potential impact of the recession on the rest of the Euro zone, the European Central Bank (ECB) adopted an expansionary monetary policy, increasing money supply and decreasing the interbank rate aggressively. Figure 3 shows the gradual decline of the interbank rate from 2% in 1999 to 1% in 2004. The lower lending rate of the euro was most certainly very successful as it has effectively boosted consumption and investment expenditure.

From all of the above, it is obvious that the monetary and fiscal policy mix was used to reduce the impact of the recession in both France and Germany. Had economists been able to predict the imminent onset of the macroeconomic slump these policies would have been more effective in diluting

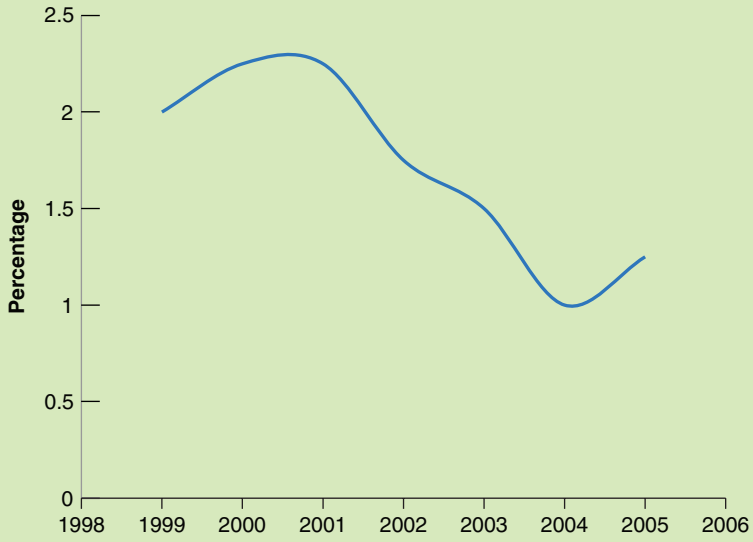

Figure 3 *European Central Bank Euro Interbank Rates (1999–2005)*

Source: European Central Bank; Key ECB Interest Rates, https://www.ecb.europa.eu/stats/monetary/rates/html/index.en.html.

the depth of the recession and reducing its duration. The European Central Bank is commended for cutting interest rates as soon as the Euro zone economies slowed down. France was more capable of weathering the crisis since the drop in its fiscal spending was quite limited and short-lived. However, the recovery in Germany was slower due to the contractive effects of the Hartz concept. Opponents of the Hartz concept argue that these reforms should have been designed to give room to boosting the economy, but instead they were geared to solving the persistent fiscal budget problem. They argue that the phased out austerity measures should have been discarded right after the German economy emerged out of the recession. Proponents of the Hartz concept argue that the reforms aim to tackle the persistent budget deficits, albeit that the timing was wrong as austerity measures should not be followed amidst a recession. This explains why the economic recovery in France was more marked in comparison to that of Germany.

However, one question remains. If the fiscal and monetary policy mixes have shown some success during the recession of 2001–2002, why have they been incapable of avoiding the global financial crisis of 2008? Quite simply, the 2008 crisis was not foreseeable since it started in the financial sector and its effects spilled over to various economic sectors with rapid global contagion impacts. As hundreds of banks and financial institutions failed, the impact of the shocks was much larger on the real economy. Conventional fiscal and monetary policy responses were ineffectual; hence, governments and central banks resorted to unconventional policy mixes. We shall return to these aspects in Chapter 6.

- A monetary expansion means a decrease in the interest rate. If the interest rate is very low, then the room for using monetary policy may be limited. In this case, fiscal policy has to do more of the job. If the interest rate is already equal to zero, the case of *the zero lower bound* we saw in the previous chapter, then fiscal policy has to do all the job.
- Fiscal and monetary policies have different effects on the composition of output. A decrease in income taxes for example will tend to increase consumption relative to investment. A decrease in the interest rate will affect investment more than consumption. Thus, depending on the initial composition of output, policy makers may want to rely more on fiscal or more on monetary policy.

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- Finally, neither fiscal policy nor monetary policy work perfectly. A decrease in taxes may fail to increase consumption. A decrease in the interest rate may fail to increase investment. Thus, in case one policy does not work as well as hoped for, it is better to use both.

Sometimes, the right policy mix is instead to use the two policies in opposite directions, for example, combining a fiscal consolidation with a monetary expansion.

Figure 5-9

The Effects of a Combined Fiscal Consolidation and a Monetary Expansion

The fiscal consolidation shifts the *IS* curve to the left. A monetary expansion shifts the *LM* curve down. Both lead to higher output.

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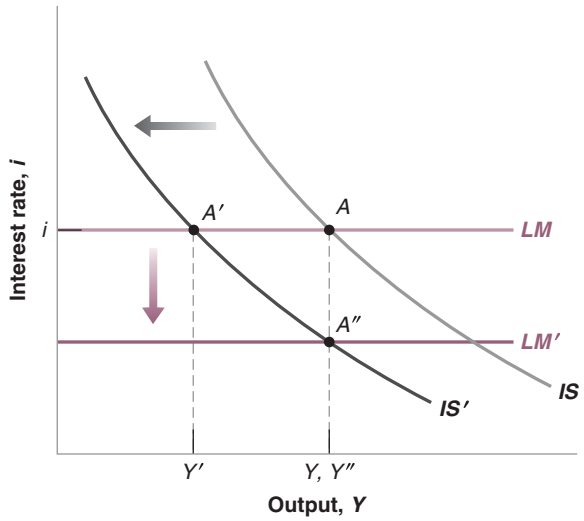

Deficit Reduction: Good or Bad for Investment?

FOCUS

You may have heard this argument in some form before: "Private saving goes either toward financing the budget deficit or financing investment. It does not take a genius to conclude that reducing the budget deficit leaves more saving available for investment, so investment increases."

This argument sounds convincing. But, as we have seen in the text, it must be wrong. If, for example, deficit reduction is not accompanied by a decrease in the interest rate, then we know that output decreases (see Figure 5-7), and by implication, so does investment—as it depends on output. So what is going on in this case?

To make progress, go back to Chapter 3, equation (3.10). There we learned that we can also think of the goods-market equilibrium condition as

$$\text{Investment} = \text{Private saving} + \text{Public saving}$$
$$I = S + (T - G)$$

In equilibrium, investment is indeed equal to private saving plus public saving. If public saving is positive, the government is said to be running a budget surplus; if public saving is negative, the government is said to be running a budget deficit. So it is true that *given private saving*, if the government reduces its deficit—either by increasing taxes or reducing government spending so that *T-G* goes up—investment must go up: Given *S*, *T-G* going up implies that *I* goes up.

The crucial part of this statement, however, is "given private saving." The point is that a fiscal contraction affects private saving as well: The contraction leads to lower output and therefore to lower income. As consumption goes down by less than income, private saving also goes down. It actually goes down by more than the reduction in the budget deficit, leading to a decrease in investment. In terms of the equation: *S* decreases by more than *T-G* increases, and so *I* decreases. (You may want to do the algebra and convince yourself that saving actually goes down by *more* than the increase in *T-G*. See problem 3 in the Questions and Problems section.)

Does this mean that deficit reduction always decreases investment? The answer is clearly *no*. We saw this in Figure 5-9. If when the deficit is reduced, the central bank also decreases the interest rate so as to keep output constant, then investment necessarily goes up. Although output is unchanged, the lower interest rate leads to higher investment.

The morale of this box is clear: Whether deficit reduction leads to an increase in investment is far from automatic. It may or it may not, depending on the response of monetary policy.

Suppose for example that the government is running a large budget deficit and would like to reduce it, but does not want to trigger a recession. In terms of Figure 5-9, the initial equilibrium is given by the intersection of the *IS* and *LM* curves at point *A*, with associated output *Y*. Output is thought to be at the right level, but the budget deficit, *T-G*, is too large.

If the government reduces the deficit, say by increasing T or by decreasing G (or both), the *IS* curve will shift to the left, from *IS* to *IS'*. The equilibrium will be at point A', with level of output Y'. At a given interest rate, higher taxes or lower spending will decrease demand, and through the multiplier, decrease output. Thus, the reduction in the deficit will lead to a recession.

The recession can be avoided however if monetary policy is also used. If the central bank reduces the interest rate to $\bar{i}'$, the equilibrium is given by point A', with corresponding output $Y'' = Y$. The combination of both policies thus allows for the reduction in the deficit, but without a recession.

What happens to consumption and investment in this case? What happens to consumption depends on how the deficit is reduced. If the reduction takes the form of a decrease in government spending rather than an increase in taxes, income is unchanged, disposable income is unchanged, and so consumption is unchanged. If the reduction takes the form of an increase in income taxes, then disposable income is lower, and so is consumption. What happens to investment is unambiguous: Unchanged output and a lower interest rate implies higher investment. The relation between deficit reduction and investment is discussed further in the Focus box "Deficit Reduction: Good or Bad for Investment?"

We have just seen a second example of a policy mix. Such a policy mix was used in the early 1990s in the United States. When Bill Clinton was elected President in 1992, one of his priorities was to reduce the budget deficit using a combination of cuts in spending and increases in taxes. Clinton was worried, however, that, by itself, such a fiscal contraction would lead to a decrease in demand and trigger another recession. The right strategy was to combine a fiscal contraction (so as to get rid of the deficit) with a monetary expansion (to make sure that demand and output remained high). This was the strategy adopted and carried out by Bill Clinton (who was in charge of fiscal policy) and Alan Greenspan (who was in charge of monetary policy). The result of this strategy—and a bit of economic luck—was a steady reduction of the budget deficit (which turned into a budget surplus at the end of the 1990s) and a steady increase in output throughout the rest of the decade.

5-5 How Does the *IS-LM* Model Fit the Facts?

We have so far ignored dynamics. For example, when looking at the effects of an increase in taxes in Figure 5-6—or the effects of a monetary expansion in Figure 5-7—we made it look as if the economy moved instantaneously from A to A', as if output went instantaneously from Y to Y'. This is clearly not realistic: The adjustment of output clearly takes time. To capture this time dimension, we need to reintroduce dynamics.

Introducing dynamics formally would be difficult. But, as we did in Chapter 3, we can describe the basic mechanisms in words. Some of the mechanisms will be familiar from Chapter 3, some are new:

- Consumers are likely to take some time to adjust their consumption following a change in disposable income.
- Firms are likely to take some time to adjust investment spending following a change in their sales.
- Firms are likely to take some time to adjust investment spending following a change in the interest rate.
- Firms are likely to take some time to adjust production following a change in their sales.

So, in response to an increase in taxes, it takes some time for consumption spending to respond to the decrease in disposable income, some more time for production to decrease in response to the decrease in consumption spending, yet more time for investment to decrease in response to lower sales, for consumption to decrease in response to the decrease in income, and so on.

In response to a decrease in the interest rate, it takes some time for investment spending to respond to the decrease in the interest rate, some more time for production to increase in response to the increase in demand, yet more time for consumption and investment to increase in response to the induced change in output, and so on.

Describing precisely the adjustment process implied by all these sources of dynamics is obviously complicated. But the basic implication is straightforward: Time is needed for output to adjust to changes in fiscal and monetary policy. How much time? This question can only be answered by looking at the data and using econometrics. Figure 5-10 shows the results of such an econometric study, which uses data from the United States from 1960 to 1990.

We discussed the federal funds market and the federal funds rate in Chapter 4, Section 4-3. ▶

The study looks at the effects of a decision by the Fed to increase the federal funds rate by 1%. It traces the typical effects of such an increase on a number of macroeconomic variables.

Each panel in Figure 5-10 represents the effects of the change in the interest rate on a given variable. Each panel plots three lines. The solid line in the center of a band

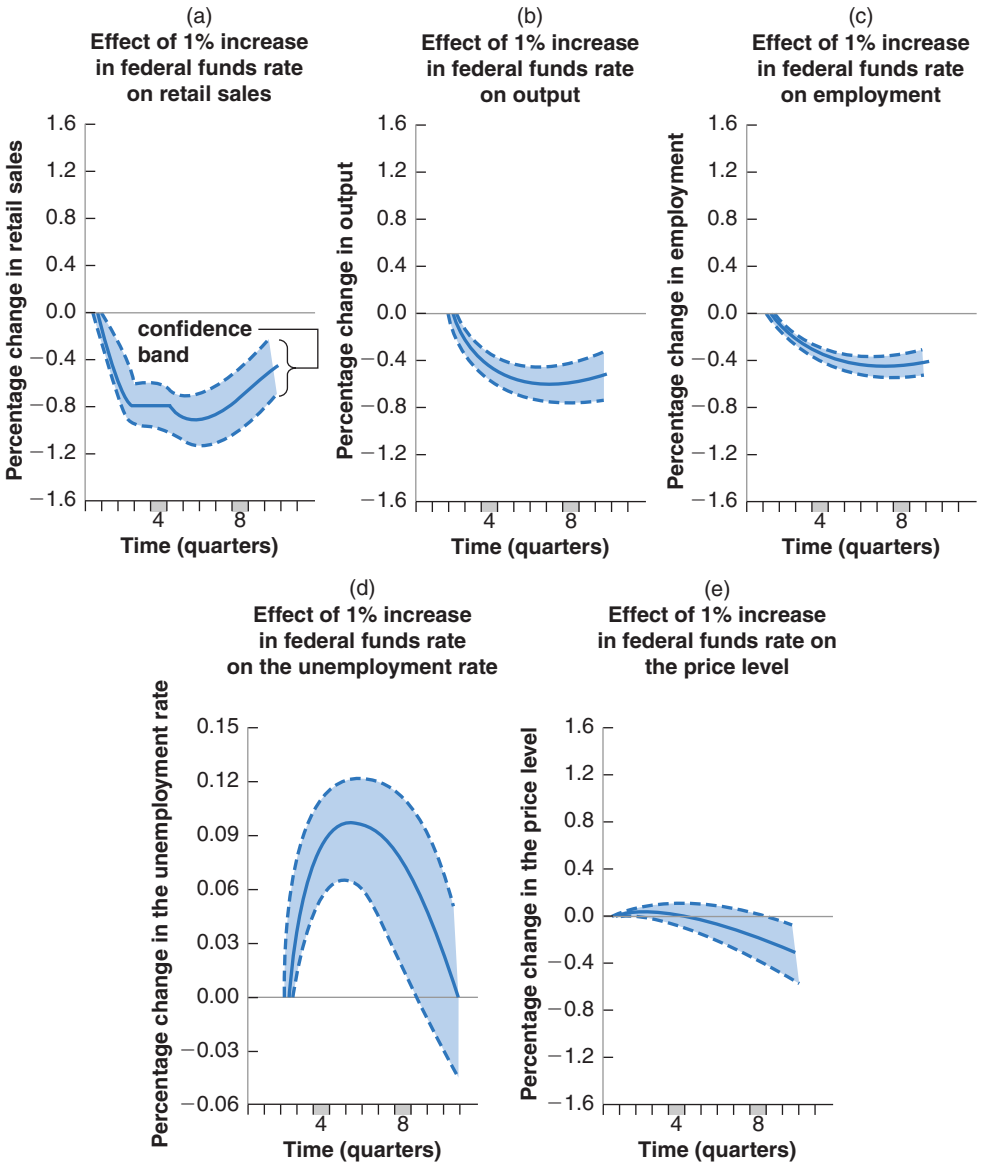

Figure 5-10

The Empirical Effects of an Increase in the Federal Funds Rate

In the short run, an increase in the federal funds rate leads to a decrease in output and to an increase in unemployment, but it has little effect on the price level.

Source: Lawrence Christiano, Martin Eichenbaum, and Charles Evans, "The Effects of Monetary Policy Shocks: Evidence From the Flow of Funds," *Review of Economics and Statistics*. 1996, 78 (February): pp. 16–34.

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gives the best estimate of the effect of the change in the interest rate on the variable we look at in the panel. The two dashed lines and the tinted space between the dashed lines represents a **confidence band**, a band within which the true value of the effect lies with 60% probability.

There is no such thing in econometrics as learning the exact value of a coefficient or the exact effect of one variable on another. Rather, what econometrics does is to provide us a best estimate—here, the thick line—and a measure of confidence we can have in the estimate—here, the confidence band.

- Panel 5-10(a) shows the effects of an increase in the federal funds rate of 1% on retail sales over time. The percentage change in retail sales is plotted on the vertical axis; time, measured in quarters, is on the horizontal axis.
  Focusing on the best estimate—the solid line—we see that the increase in the federal funds rate of 1% leads to a decline in retail sales. The largest decrease in retail sales, −0.9%, is achieved after five quarters.
- Figure 5-10(b) shows how lower sales lead to lower output. In response to the decrease in sales, firms cut production, but by less than the decrease in sales. Put another way, firms accumulate inventories for some time. The adjustment of production is smoother and slower than the adjustment of sales. The largest decrease,

−0.7%, is reached after eight quarters. In other words, monetary policy works, but it works with long lags. It takes nearly two years for monetary policy to have its full effect on output.

This explains why monetary policy could not prevent the 2001 recession. When at the start of 2001, the Fed starting decreasing the federal funds rate, it was already too late for these cuts to have much effect in 2001.

- Panel 5-10(c) shows how lower output leads to lower employment: As firms cut production, they also cut employment. As with output, the decline in employment is slow and steady, reaching −0.5% after eight quarters. The decline in employment is reflected in an increase in the unemployment rate, shown in Panel 5-10(d).
- Panel 5-10(e) looks at the behavior of the price level. Remember, one of the *assumptions* of the *IS-LM* model is that the price level is given, and so it does not change in response to changes in demand. Panel 5-10(b) shows that this assumption is not a bad approximation of reality in the short run. The price level is nearly unchanged for the first six quarters or so. Only after the first six quarters does the price level appear to decline. This gives us a strong hint as to why the *IS-LM* model becomes less reliable as we look at the medium run: In the medium run, we can no longer assume that the price level is given, and movements in the price level become important.

Figure 5-10 provides two important lessons. First, it gives us a sense of the dynamic adjustment of output and other variables to monetary policy.

Second, and more fundamentally, it shows that what we observe in the economy is consistent with the implications of the *IS-LM* model. This does not *prove* that the *IS-LM* model is the right model. It may be that what we observe in the economy is the result of a completely different mechanism, and the fact that the *IS-LM* model fits well is a coincidence. But this seems unlikely. The *IS-LM* model looks like a solid basis on which to build when looking at movements in activity in the short run. Later on, we shall extend the model to look at the role of expectations (Chapters 14 to 16) and the implications of openness in goods and financial markets (Chapters 17 to 20). But we must first understand what determines output in the medium run. This is the topic of the next four chapters.

Summary

- The *IS-LM model* characterizes the implications of equilibrium in both the goods and the financial markets.
- The *IS* relation and the *IS* curve show the combinations of the interest rate and the level of output that are consistent with equilibrium in the goods market. An increase in the interest rate leads to a decline in output. Consequently, the *IS* curve is downward sloping.
- The *LM* relation and the *LM* curve show the combinations of the interest rate and the level of output consistent with equilibrium in financial markets. Under the assumption that the central bank chooses the interest rate, the *LM* curve is a horizontal line at the interest rate chosen by the central bank.
- A fiscal expansion shifts the *IS* curve to the right, leading to an increase in output. A fiscal contraction shifts the *IS* curve to the left, leading to a decrease in output.
- A monetary expansion shifts the *LM* curve down, leading to a decrease in the interest rate and an increase in output. A monetary contraction shifts the *LM* curve up, leading to an increase in the interest rate and a decrease in output.
- The combination of monetary and fiscal policies is known as the monetary-fiscal policy mix, or simply the policy mix. Sometimes monetary and fiscal policy are used in the same direction. Sometimes, they are used in opposite directions. Together, fiscal contraction and monetary expansion can, for example, achieve a decrease in the budget deficit while avoiding a decrease in output.
- The *IS-LM* model appears to describe well the behavior of the economy in the short run. In particular, the effects of monetary policy appear to be similar to those implied by the *IS-LM* model once dynamics are introduced in the model. An increase in the interest rate due to a monetary contraction leads to a steady decrease in output, with the maximum effect taking place after about eight quarters.

Key Terms

IS curve, 113
LM curve, 115
fiscal contraction, 116
fiscal consolidation, 116
fiscal expansion, 116
monetary expansion, 118
monetary contraction, 118
monetary tightening, 118
monetary-fiscal policy mix, 119
confidence band, 125

Questions and Problems

QUICK CHECK

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1. Using the information in this chapter, label each of the following statements true, false, or uncertain. Explain briefly.

a. The main determinants of investment are the level of sales and the interest rate.
b. If all the exogenous variables in the *IS* relation are constant, then a higher level of output can be achieved only by lowering the interest rate.
c. The *IS* curve is downward sloping because goods market equilibrium implies that an increase in taxes leads to a lower level of output.
d. If government spending and taxes increase by the same amount, the *IS* curve does not shift.
e. The LM curve is horizontal at the central bank's policy choice of the interest rate.
f. The real money supply is constant along the *LM* curve.
g. If the nominal money supply is \$400 billion and the price level rises from an index value of 100 to an index value of 103; the real money supply rises.
h. If the nominal money supply rises from \$400 billion to \$420 billion and the price level rises from an index value of 100 to 102, the real money supply rises.
i. An increase in government spending leads to a decrease in investment in the *IS-LM* model.

2. Consider first the goods market model with constant investment that we saw in Chapter 3. Consumption is given by

$$C = c_0 + c_1(Y - T)$$

and I, G, *and* T *are given.*

a. Solve for equilibrium output. What is the value of the multiplier for a change in autonomous spending?

Now let investment depend on both sales and the interest rate:

$$I = b_0 + b_1 Y - b_2 i$$

b. Solve for equilibrium output using the methods learned in Chapter 3. At a given interest rate, why is the effect of a change in autonomous spending bigger than what it was in part (a)? Why? (Assume $c_1 + b_1 < 1$.)
c. Suppose the central bank chooses an interest rate of $\bar{i}$. Solve for equilibrium output at that interest rate.
d. Draw the equilibrium of this economy using an *IS-LM* diagram.

3. The response of the economy to fiscal policy

a. Use an *IS-LM* diagram, show the effects on output of a decrease in government spending. Can you tell what happens to investment? Why?

Now consider the following IS-LM *model*:

$$C = c_0 + c_1(Y - T)$$
$$I = b_0 + b_1 Y - b_2 i$$
$$Z = C + I + G$$
$$i = \bar{i}$$

b. Solve for equilibrium output when the interest rate is $\bar{i}$. Assume $c_1 + b_1 < 1$. (*Hint*: You may want to rework through Problem 2 if you are having trouble with this step.)
c. Solve for equilibrium level of investment.
d. Let's go behind the scene in the money market. Use the equilibrium in the money market $M/P = d_1 Y - d_2 i$ to solve for the equilibrium level of the real money supply when $i = \bar{i}$. How does the real money supply vary with government spending?

4. Consider the money market to better understand the horizontal LM curve in this chapter.

The money market relation (equation 5.3) is $\dfrac{M}{P} = Y\, L(i)$

a. What is on the left-hand side of equation (5.3)?
b. What is on the right-hand side of equation (5.3)?
c. Go back to Figure 4-3 in the previous chapter. How is the function *L(i)* represented in that figure?
d. You need to modify Figure 4-3 to represent equation (5.3) in two ways. How does the horizontal axis have to be relabeled? What is the variable that now shifts the money demand function? Draw a modified Figure 4-3 with the appropriate labels.
e. Use your modified Figure 4-3 to show that (1) as output rises, to keep the interest rate constant, the central bank must increase the real money supply; (2) as output falls, to keep the interest rate constant, the central bank must decrease the real money supply.

5. Consider the following numerical example of the IS-LM model:

$$C = 100 + 0.3Y_D$$
$$I = 150 + 0.2Y - 1000i$$
$$T = 100$$
$$G = 200$$
$$\bar{i} = .01$$

$$(M/P)^s = 1200$$
$$(M/P)^d = 2Y - 4000i$$

a. Find the equation for aggregate demand (Y).
b. Derive the IS relation.
c. Derive the LM relation if the central bank sets an interest rate of 1%.
d. Solve for the equilibrium values of output, interest rate, C and I.
e. Expansionary monetary policy. Suppose that the central bank increases money supply to 1500. What is the impact of this expansionary monetary policy on the IS and LM curves? Find the new equilibrium values of output, interest rate, C and I.
f. Expansionary fiscal policy. Suppose that the government increases its spending G to 300. What is the impact of this expansionary fiscal policy on the IS and LM curves? Find the new equilibrium values of output, interest rate, C and I.

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6. Investment and the interest rate

The chapter argues that investment depends negatively on the interest rate because an increase in the cost of borrowing discourages investment. However, firms often finance their investment projects using their own funds.

If a firm is considering using its own funds (rather than borrowing) to finance investment projects, will higher interest rates discourage the firm from undertaking these projects? Explain. (*Hint*: Think of yourself as the owner of a firm that has earned profits and imagine that you are going to use the profits either to finance new investment projects or to buy bonds. Will your decision to invest in new projects in your firm be affected by the interest rate?)

7. The Fiscal-Monetary policy mix in the aftermath of the global financial crisis

The global financial crisis of 2008 left many nations with slow GDP growth rates and high levels of public debt. While most nations followed a unanimous monetary policy, some nations simply lowered income taxes while others massively expanded fiscal spending.

a. Compare and contrast the expected impact of each of these two policy mixes on output.
b. Why do you think nations followed different policy mixes in 2008?
c. Were these policy mixes successful in combatting the global meltdown?

8. What policy mix of monetary and fiscal policy is needed to meet the objectives given here?

a. Increase Y while keeping $\bar{i}$ constant. Would investment (I) change?
b. Decrease a fiscal deficit while keeping Y constant. Why must $\bar{i}$ also change?

9. The (less paradoxical) paradox of saving

A chapter problem at the end of Chapter 3 considered the effect of a drop in consumer confidence on private saving and investment, when investment depended on output but not on the interest rate. Here, we consider the same experiment in the context of the IS-LM *framework, in which investment depends on the interest rate and output but the central bank moves interest rates to keep output constant.*

a. Suppose households attempt to save more, so that consumer confidence falls. In an *IS-LM* diagram where the central bank moves interest rates to keep output constant, show the effect of the fall in consumer confidence on the equilibrium in the economy.
b. How will the fall in consumer confidence affect consumption, investment, and private saving? Will the attempt to save more necessarily lead to more saving? Will this attempt necessarily lead to less saving?

EXPLORE FURTHER

10. The Clinton-Greenspan policy mix

As described in this chapter, during the Clinton administration the policy mix changed toward more contractionary fiscal policy and more expansionary monetary policy. This question explores the implications of this change in the policy mix, both in theory and fact.

a. What must the Federal Reserve do to ensure that if G falls and T rises so that combination of policies has no effect on output. Show the effects of these policies in an *IS-LM* diagram. What happens to the interest rate? What happens to investment?
b. Go to the Web site of the *Economic Report of the President* (www.whitehouse.gov/administration/eop/cea/economic-report-of-the-President) Look at Table B-79 in the statistical appendix. What happened to federal receipts (tax revenues), federal outlays, and the budget deficit as a percentage of GDP over the period 1992 to 2000? (Note that federal outlays include transfer payments, which would be excluded from the variable G, as we define it in our *IS-LM* model. Ignore the difference.)
c. The Federal Reserve Board of Governors posts the recent history of the federal funds rate at http://www.federalreserve.gov/releases/h15/data.htm. You will have to choose to look at the rate on a daily, weekly, monthly, or annual interval. Look at the years between 1992 and 2000. When did monetary policy become more expansionary?
d. Go to Table B-2 of the *Economic Report of the President* and collect data on real GDP and real gross domestic investment for the period 1992 to 2000. Calculate investment as a percentage of GDP for each year. What happened to investment over the period?
e. Finally, go to Table B-31 and retrieve data on real GDP per capita (in chained 2005 dollars) for the period. Calculate the growth rate for each year. What was the average annual growth rate over the period 1992 to 2000? In Chapter 10 you will learn that the average annual growth rate of U.S. real GDP per capita was 2.6% between 1950 and 2004. How did growth between 1992 and 2000 compare to the Post World War II average?

11. Consumption, investment, and GDP in China

Along with other emerging market economies, China has been considered as the main driver of global growth especially during the global financial crisis. Since 1990, the Chinese economy has been able to sustain the highest levels of GDP growth, rendering it one of the largest economies in the world, second to USA. But why has the Chinese economy started to show slower GDP growth after the global financial crisis? To answer this question, you need to examine (1) the changes in the components of GDP over this period and (2) the movements of investment and consumption in China during the last two or three decades and its relative slowdown since the global financial crisis. Go to the Web site of the Bureau of Economic Analysis (www.stats.gov.cn). Find the annual National Accounts Tables and examine the Composition of Gross Domestic Product, which shows the percentage contribution of the components of GDP to the overall growth.

a. Track the change in GDP components since 1990. Which component changed most? How can these changes explain the pattern of changes in the Chinese economy? How has this pattern led to higher GDP growth from 1990 till 2010?
b. Why has this trend been reversed since the global financial crisis? To answer this question, you need to examine the levels of Chinese exports. Also, examine the exchange rate of the Yuan in order to study the policies adopted by the Chinese government to boost its exports. Explain whether these policies have been successful or unsuccessful.
c. Plot the changes in investment (gross capital formation) and final consumption expenditure since 1990. Which variable had the bigger percentage change since 1990?
d. Which region in China contributes most to investment expenditure, final consumption expenditure, and GDP growth? How can you explain these changes? Research the factors that have enabled each of these regions to achieve these levels of consumption and investment.

Further Reading

- A description of the U.S. economy, from the period of "irrational exuberance" to the 2001 recession and the role of fiscal and monetary policy, is given by Paul Krugman, in *The Great Unraveling*, W.W. Norton, 2003. New York. (Warning: Krugman did not like the Bush administration or its policies!)

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