Introduction to Economic Fluctuations

The modern world regards business cycles much as the ancient Egyptians regarded the overflowing of the Nile. The phenomenon recurs at intervals, it is of great importance to everyone, and natural causes of it are not in sight.

— John Bates Clark, 1898

Economic fluctuations present a recurring problem for economists and policymakers. On average, the real GDP of the United States grows about 3 percent per year. But this long-run average hides the fact that the economy's output of goods and services does not grow smoothly. Growth is higher in some years than in others; sometimes the economy loses ground, and growth turns negative. These fluctuations in the economy's output are closely associated with fluctuations in employment. When the economy experiences a period of falling output and rising unemployment, the economy is said to be in *recession*.

A recent recession began in late 2007. From the third quarter of 2007 to the third quarter of 2008, the economy's production of goods and services was approximately flat, in contrast to its normal growth. Real GDP then plunged sharply in the fourth quarter of 2008 and first quarter of 2009. The unemployment rate rose from 4.7 percent in November 2007 to 10.1 percent in October 2009. The recession officially ended in June 2009 when positive growth resumed, but the recovery was weak, and unemployment remained high even a few years later. Not surprisingly, the recession dominated the economic news, and addressing the problem was high on the agenda of President Barack Obama.

Economists call these short-run fluctuations in output and employment the *business cycle*. Although this term suggests that economic fluctuations are regular and predictable, they are not. Recessions are actually as irregular as they are common. Sometimes they occur close together, while at other times they are much farther apart. For example, the United States fell into recession in 1982, only two years after the previous downturn. By the end of that year, the unemployment rate had reached 10.8 percent—the highest level since the Great Depression of the 1930s. But after the 1982 recession, it was eight years before the economy experienced another one.

These historical events raise a variety of related questions: What causes short-run fluctuations? What model should we use to explain them? Can policymakers avoid recessions? If so, what policy levers should they use?

In Parts Two and Three of this book, we developed theories to explain how the economy behaves in the long run. Here, in Part Four, we see how economists explain short-run fluctuations. We begin in this chapter with three tasks. First, we examine the data that describe short-run economic fluctuations. Second, we discuss the key differences between how the economy behaves in the long run and how it behaves in the short run. Third, we introduce the model of aggregate supply and aggregate demand, which most economists use to explain short-run fluctuations. Developing this model in more detail will be our primary job in the chapters that follow.

Just as Egypt now controls the flooding of the Nile Valley with the Aswan Dam, modern society tries to control the business cycle with appropriate economic policies. The model we develop over the next several chapters shows how monetary and fiscal policies influence the business cycle. We will see how these policies can potentially stabilize the economy or, if poorly conducted, make the problem of economic instability even worse.

10-1 The Facts About the Business Cycle

Before thinking about the theory of business cycles, let's look at some of the facts that describe short-run fluctuations in economic activity.

GDP and Its Components

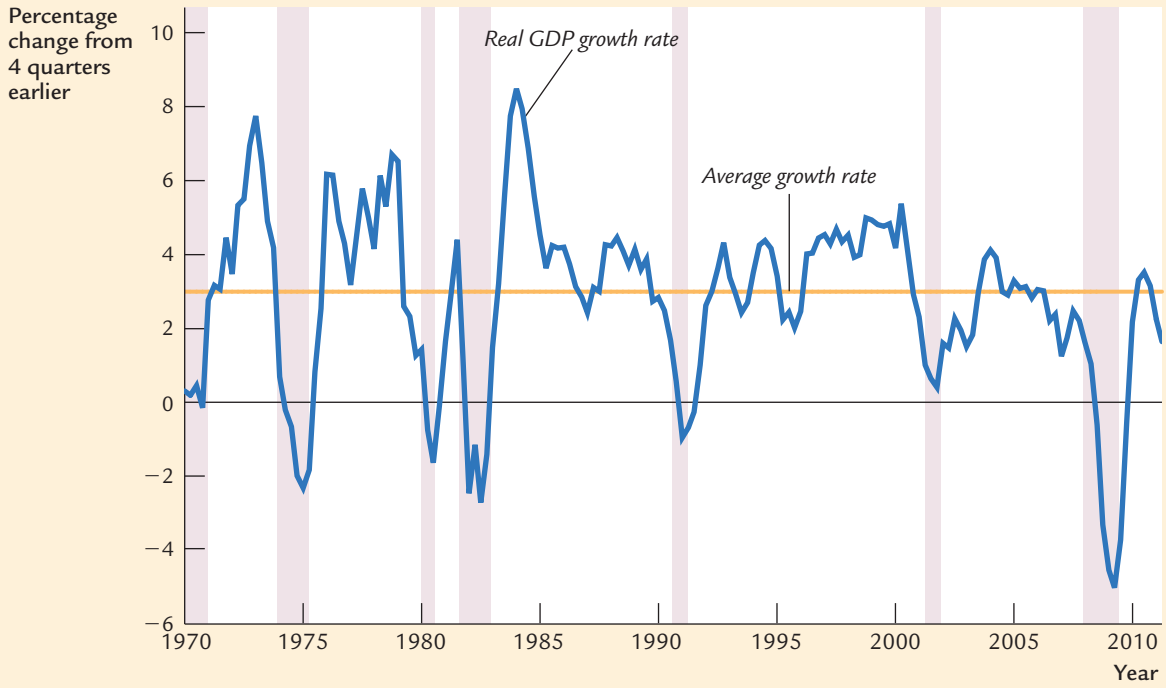
The economy's gross domestic product measures total income and total expenditure in the economy. Because GDP is the broadest gauge of overall economic conditions, it is the natural place to start in analyzing the business cycle. Figure 10-1 shows the growth of real GDP from 1970 to 2011. The horizontal line shows the average growth rate of 3 percent per year over this period. You can see that economic growth is not at all steady and that, occasionally, it turns negative.

Drawing M. Stevens; © 1980 The New Yorker Magazine, Inc.

"Well, so long Eddie, the recession's over."

The shaded areas in the figure indicate periods of recession. The official arbiter of when recessions begin and end is the National Bureau of Economic Research (NBER), a nonprofit economic research group. The NBER's Business Cycle Dating Committee (of which the author of this book was once a member) chooses the stating date of each recession, called the business cycle *peak*, and the ending date, called the business cycle *trough*.

FIGURE 10-1



Real GDP Growth in the United States Growth in real GDP averages about 3 percent per year, but there are substantial fluctuations around this average. The shaded areas represent periods of recession.

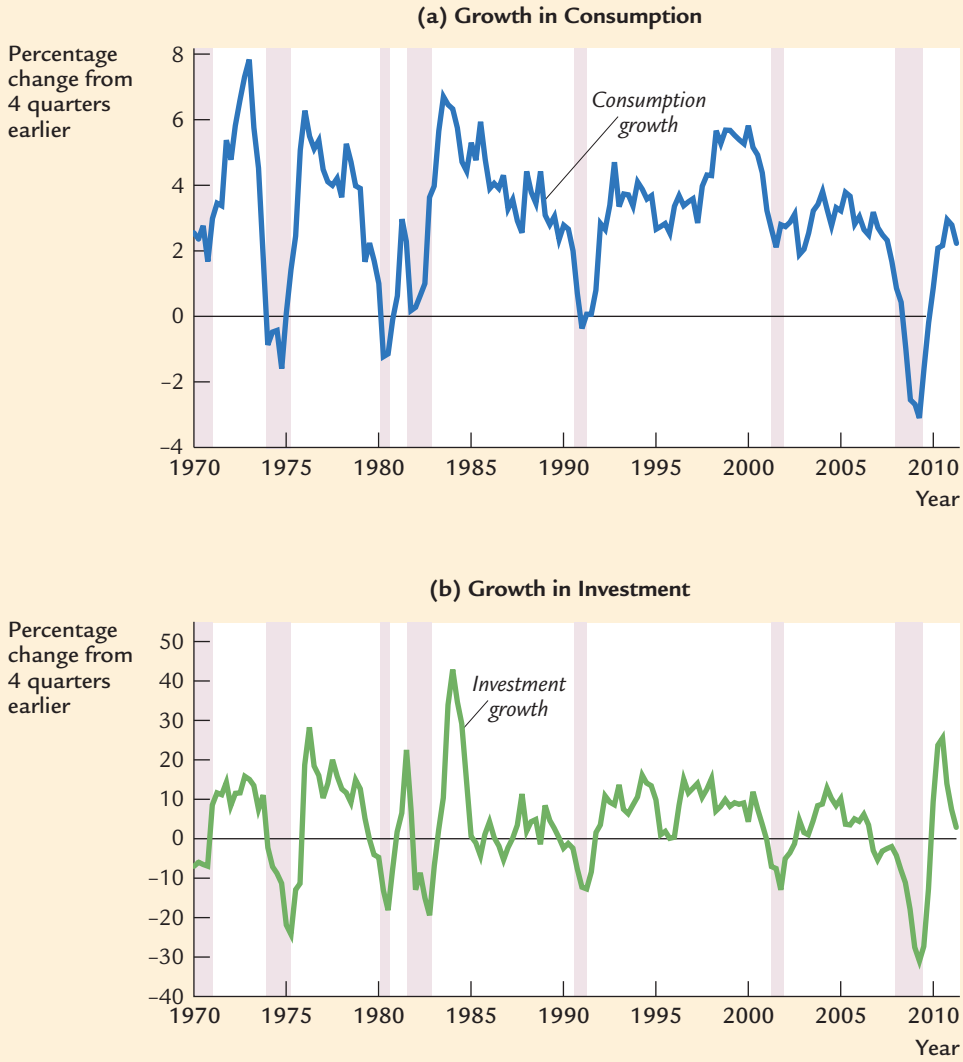
Source: U.S. Department of Commerce.

What determines whether a downturn in the economy is sufficiently severe to be deemed a recession? There is no simple answer. According to an old rule of thumb, a recession is a period of at least two consecutive quarters of declining real GDP. This rule, however, does not always hold. In the most recently revised data, for example, the recession of 2001 had two quarters of negative growth, but those quarters were not consecutive. In fact, the NBER's Business Cycle Dating Committee does not follow any fixed rule but, instead, looks at a variety of economic time series and uses its judgment when picking the starting and ending dates of recessions. As this book was going to press, the economy was recovering from the recession of 2008–2009, but the recovery was weak by historical standards.[1]

Figure 10-2 shows the growth in two major components of GDP—consumption in panel (a) and investment in panel (b). Growth in both of these

[1]Note that Figure 10-1 plots growth in real GDP from four quarters earlier, rather than from the immediately preceding quarter. During the 2001 recession, this measure declined but never turned negative.

FIGURE 10-2

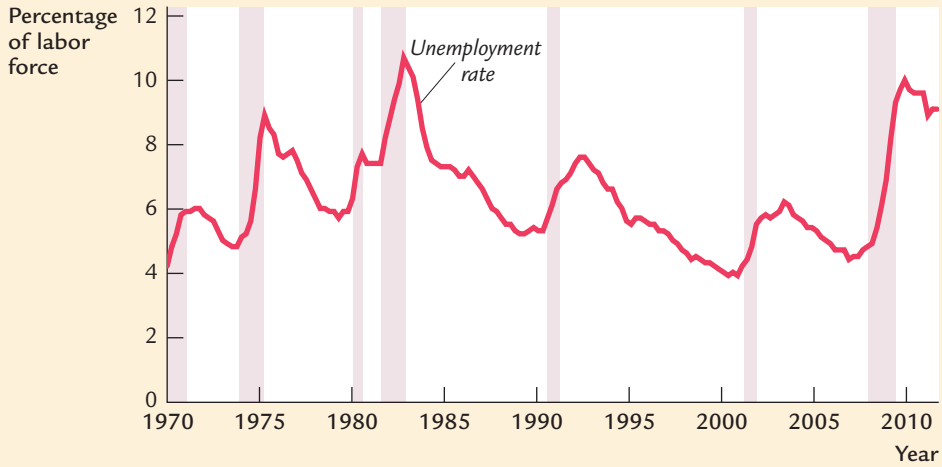


Growth in Consumption and Investment When the economy heads into a recession, growth in real consumption and investment spending both decline. Investment spending, shown in panel (b), is considerably more volatile than consumption spending, shown in panel (a). The shaded areas represent periods of recession.

Source: U.S. Department of Commerce.

variables declines during recessions. Take note, however, of the scales for the vertical axes. Investment is far more volatile than consumption over the business cycle. When the economy heads into a recession, households respond to the fall in their incomes by consuming less, but the decline in spending on business equipment, structures, new housing, and inventories is even more substantial.

FIGURE 10-3



Unemployment The unemployment rate rises significantly during periods of recession, shown here by the shaded areas.

Source: U.S. Department of Labor.

Unemployment and Okun's Law

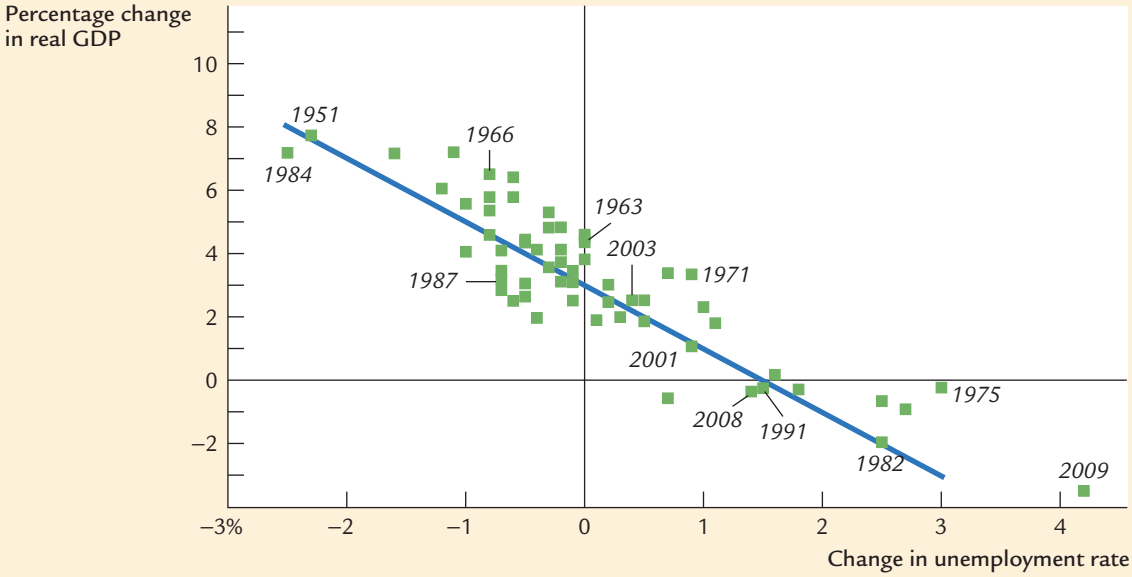
The business cycle is apparent not only in data from the national income accounts but also in data that describe conditions in the labor market. Figure 10-3 shows the unemployment rate from 1970 to 2011 again with the shaded areas representing periods of recession. You can see that unemployment rises in each recession. Other labor-market measures tell a similar story. For example, job vacancies, as measured by the number of help-wanted ads that companies have posted, decline during recessions. Put simply, during an economic downturn, jobs are harder to find.

What relationship should we expect to find between unemployment and real GDP? Because employed workers help to produce goods and services and unemployed workers do not, increases in the unemployment rate should be associated with decreases in real GDP. This negative relationship between unemployment and GDP is called **Okun's law**, after Arthur Okun, the economist who first studied it.[2]

Figure 10-4 uses annual data for the United States to illustrate Okun's law. In this scatterplot, each point represents the data for one year. The horizontal axis represents the change in the unemployment rate from the previous year, and the vertical axis represents the percentage change in GDP. This figure shows clearly

[2]Arthur M. Okun, "Potential GNP: Its Measurement and Significance," in *Proceedings of the Business and Economics Statistics Section, American Statistical Association* (Washington, D.C.: American Statistical Association, 1962): 98–103; reprinted in Arthur M. Okun, *Economics for Policymaking* (Cambridge, Mass.: MIT Press, 1983), 145–158.

FIGURE 10-4



Okun's Law This figure is a scatterplot of the change in the unemployment rate on the horizontal axis and the percentage change in real GDP on the vertical axis, using data on the U.S economy. Each point represents one year. The figure shows that increases in unemployment tend to be associated with lower-than-normal growth in real GDP. The correlation between these two variables is –0.89.

Sources: U.S. Department of Commerce, U.S. Department of Labor.

that year-to-year changes in the unemployment rate are closely associated with year-to-year changes in real GDP.

We can be more precise about the magnitude of the Okun's law relationship. The line drawn through the scatter of points tells us that

$$\text{Percentage Change in Real GDP} = 3\% - 2 \times \text{Change in Unemployment Rate}.$$

If the unemployment rate remains the same, real GDP grows by about 3 percent; this normal growth in the production of goods and services is due to growth in the labor force, capital accumulation, and technological progress. In addition, for every percentage point the unemployment rate rises, real GDP growth typically falls by 2 percent. Hence, if the unemployment rate rises from 5 to 7 percent, then real GDP growth would be

$$\text{Percentage Change in Real GDP} = 3\% - 2 \times (7\% - 5\%)$$
$$= -1\%.$$

In this case, Okun's law says that GDP would fall by 1 percent, indicating that the economy is in a recession.

Okun's law is a reminder that the forces that govern the short-run business cycle are very different from those that shape long-run economic growth. As we saw in Chapters 8 and 9, long-run growth in GDP is determined primarily by technological progress. The long-run trend leading to higher standards of living from generation to generation is not associated with any long-run trend in the rate of unemployment. By contrast, short-run movements in GDP are highly correlated with the utilization of the economy's labor force. The declines in the production of goods and services that occur during recessions are always associated with increases in joblessness.

Leading Economic Indicators

Many economists, particularly those working in business and government, are engaged in the task of forecasting short-run fluctuations in the economy. Business economists are interested in forecasting to help their companies plan for changes in the economic environment. Government economists are interested in forecasting for two reasons. First, the economic environment affects the government; for example, the state of the economy influences how much tax revenue the government collects. Second, the government can affect the economy through its use of monetary and fiscal policy. Economic forecasts are, therefore, an input into policy planning.

One way that economists arrive at their forecasts is by looking at **leading indicators**, which are variables that tend to fluctuate in advance of the overall economy. Forecasts can differ in part because economists hold varying opinions about which leading indicators are most reliable.

Each month the Conference Board, a private economics research group, announces the *index of leading economic indicators*. This index includes ten data series that are often used to forecast changes in economic activity about six to nine months into the future. Here is a list of the series:

- *Average workweek of production workers in manufacturing.* Because businesses often adjust the work hours of existing employees before making new hires or laying off workers, average weekly hours is a leading indicator of employment changes. A longer workweek indicates that firms are asking their employees to work long hours because they are experiencing strong demand for their products; thus, it indicates that firms are likely to increase hiring and production in the future. A shorter workweek indicates weak demand, suggesting that firms are more likely to lay off workers and cut back production.
- *Average initial weekly claims for unemployment insurance.* The number of people making new claims on the unemployment-insurance system is one of the most quickly available indicators of conditions in the labor market. This series is inverted in computing the index of leading indicators, so that an increase in the series lowers the index. An increase in the number of people making new claims for unemployment insurance indicates that firms are laying off workers and cutting back production;

these layoffs and cutbacks will soon show up in data on employment and production.

- *New orders for consumer goods and materials, adjusted for inflation.* This indicator is a direct measure of the demand that firms are experiencing. Because an increase in orders depletes a firm's inventories, this statistic typically predicts subsequent increases in production and employment.
- *New orders for nondefense capital goods.* This series is the counterpart to the previous one, but for investment goods rather than consumer goods.
- *Index of supplier deliveries.* This variable, sometimes called vendor performance, is a measure of the number of companies receiving slower deliveries from suppliers. Vendor performance is a leading indicator because deliveries slow down when companies are experiencing increased demand for their products. Slower deliveries therefore indicate a future increase in economic activity.
- *New building permits issued.* Construction of new buildings is part of investment—a particularly volatile component of GDP. An increase in building permits means that planned construction is increasing, which indicates a rise in overall economic activity.
- *Index of stock prices.* The stock market reflects expectations about future economic conditions because stock market investors bid up prices when they expect companies to be profitable. An increase in stock prices indicates that investors expect the economy to grow rapidly; a decrease in stock prices indicates that investors expect an economic slowdown.
- *Money supply (M2), adjusted for inflation.* Because the money supply is related to total spending, more money predicts increased spending, which in turn means higher production and employment.
- *Interest rate spread: the yield spread between 10-year Treasury notes and 3-month Treasury bills.* This spread, sometimes called the slope of the yield curve, reflects the market's expectation about future interest rates, which in turn reflect the condition of the economy. A large spread means that interest rates are expected to rise, which typically occurs when economic activity increases.
- *Index of consumer expectations.* This is a direct measure of expectations, based on a survey conducted by the University of Michigan's Survey Research Center. Increased optimism about future economic conditions among consumers suggests increased consumer demand for goods and services, which in turn will encourage businesses to expand production and employment to meet the demand.

The index of leading indicators is far from a precise forecast of the future, as short-run economic fluctuations are largely unpredictable. Nonetheless, the index is a useful input into planning by both businesses and the government.

10-2 Time Horizons in Macroeconomics

Now that we have some sense about the facts that describe short-run economic fluctuations, we can turn to our basic task in this part of the book: building a theory to explain these fluctuations. That job, it turns out, is not a simple one. It will take us not only the rest of this chapter but also the next four chapters to develop the model of short-run fluctuations in its entirety.

Before we start building the model, however, let's step back and ask a fundamental question: why do economists need different models for different time horizons? Why can't we stop the course here and be content with the classical models developed in Chapters 3 through 9? The answer, as this book has consistently reminded its reader, is that classical macroeconomic theory applies to the long run but not to the short run. But why is this so?

How the Short Run and Long Run Differ

Most macroeconomists believe that the key difference between the short run and the long run is the behavior of prices. *In the long run, prices are flexible and can respond to changes in supply or demand. In the short run, many prices are "sticky" at some predetermined level.* Because prices behave differently in the short run than in the long run, various economic events and policies have different effects over different time horizons.

To see how the short run and the long run differ, consider the effects of a change in monetary policy. Suppose that the Federal Reserve suddenly reduces the money supply by 5 percent. According to the classical model, the money supply affects nominal variables—variables measured in terms of money—but not real variables. As you may recall from Chapter 5, the theoretical separation of real and nominal variables is called the *classical dichotomy*, and the irrelevance of the money supply for the determination of real variables is called *monetary neutrality*. Most economists believe that these classical ideas describe how the economy works in the long run: a 5 percent reduction in the money supply lowers all prices (including nominal wages) by 5 percent, while output, employment, and other real variables remain the same. Thus, in the long run, changes in the money supply do not cause fluctuations in output and employment.

In the short run, however, many prices do not respond to changes in monetary policy. A reduction in the money supply does not immediately cause all firms to cut the wages they pay, all stores to change the price tags on their goods, all mail-order firms to issue new catalogs, and all restaurants to print new menus. Instead, there is little immediate change in many prices; that is, many prices are sticky. This short-run price stickiness implies that the short-run impact of a change in the money supply is not the same as the long-run impact.

A model of economic fluctuations must take into account this short-run price stickiness. We will see that the failure of prices to adjust quickly and completely

to changes in the money supply (as well as to other exogenous changes in economic conditions) means that, in the short run, real variables such as output and employment must do some of the adjusting instead. In other words, during the time horizon over which prices are sticky, the classical dichotomy no longer holds: nominal variables can influence real variables, and the economy can deviate from the equilibrium predicted by the classical model.

CASE STUDY

If You Want to Know Why Firms Have Sticky Prices, Ask Them

How sticky are prices, and why are they sticky? In an intriguing study, economist Alan Blinder attacked these questions directly by surveying firms about their price-adjustment decisions.

Blinder began by asking firm managers how often they changed prices. The answers, summarized in Table 10-1, yielded two conclusions. First, sticky prices are common. The typical firm in the economy adjusts its prices once or twice a year. Second, there are large differences among firms in the frequency of price adjustment. About 10 percent of firms changed prices more often than once a week, and about the same number changed prices less often than once a year.

Blinder then asked the firm managers why they didn't change prices more often. In particular, he explained to the managers several economic theories of sticky prices and asked them to judge how well each of these theories described their

TABLE 10-1

The Frequency of Price Adjustment

This table is based on answers to the question: How often do the prices of your most important products change in a typical year?

Frequency	Percentage of Firms
Less than once	10.2
Once	39.3
1.01 to 2	15.6
2.01 to 4	12.9
4.01 to 12	7.5
12.01 to 52	4.3
52.01 to 365	8.6
More than 365	1.6

Source: Table 4.1, Alan S. Blinder, "On Sticky Prices: Academic Theories Meet the Real World," in N. G. Mankiw, ed., *Monetary Policy* (Chicago: University of Chicago Press, 1994), 117–154.

TABLE 10-2

Theories of Price Stickiness

Theory and Brief Description	Percentage of Managers Who Accepted Theory
Coordination failure: Firms hold back on price changes, waiting for others to go first	60.6
Cost-based pricing with lags: Price increases are delayed until costs rise	55.5
Delivery lags, service, etc.: Firms prefer to vary other product attributes, such as delivery lags, service, or product quality	54.8
Implicit contracts: Firms tacitly agree to stabilize prices, perhaps out of "fairness" to customers	50.4
Nominal contracts: Prices are fixed by explicit contracts	35.7
Costs of price adjustment: Firms incur costs of changing prices	30.0
Procyclical elasticity: Demand curves become less elastic as they shift in	29.7
Pricing points: Certain prices (like $9.99) have special psychological significance	24.0
Inventories: Firms vary inventory stocks instead of prices	20.9
Constant marginal cost: Marginal cost is flat and markups are constant	19.7
Hierarchical delays: Bureaucratic delays slow down decisions	13.6
Judging quality by price: Firms fear customers will mistake price cuts for reductions in quality	10.0

Source: Tables 4.3 and 4.4, Alan S. Blinder, "On Sticky Prices: Academic Theories Meet the Real World," in N. G. Mankiw, ed., *Monetary Policy* (Chicago: University of Chicago Press, 1994), 117–154.

firms. Table 10-2 summarizes the theories and ranks them by the percentage of managers who accepted the theory as an accurate description of their firms' pricing decisions. Notice that each of the theories was endorsed by some of the managers, but each was rejected by a large number as well. One interpretation is that different theories apply to different firms, depending on industry characteristics, and that price stickiness is a macroeconomic phenomenon without a single microeconomic explanation.

Among the dozen theories, coordination failure tops the list. According to Blinder, this is an important finding because it suggests that the inability of firms to coordinate price changes plays a key role in explaining price

stickiness and, thus, short-run economic fluctuations. He writes, "The most obvious policy implication of the model is that more coordinated wage and price setting—somehow achieved—could improve welfare. But if this proves difficult or impossible, the door is opened to activist monetary policy to cure recessions."[3] ■

The Model of Aggregate Supply and Aggregate Demand

How does the introduction of sticky prices change our view of how the economy works? We can answer this question by considering economists' two favorite words—supply and demand.

In classical macroeconomic theory, the amount of output depends on the economy's ability to *supply* goods and services, which in turn depends on the supplies of capital and labor and on the available production technology. This is the essence of the basic classical model in Chapter 3, as well as of the Solow growth model in Chapters 8 and 9. Flexible prices are a crucial assumption of classical theory. The theory posits, sometimes implicitly, that prices adjust to ensure that the quantity of output demanded equals the quantity supplied.

The economy works quite differently when prices are sticky. In this case, as we will see, output also depends on the economy's *demand* for goods and services. Demand, in turn, depends on a variety of factors: consumers' confidence about their economic prospects, firms' perceptions about the profitability of new investments, and monetary and fiscal policy. Because monetary and fiscal policy can influence demand, and demand in turn can influence the economy's output over the time horizon when prices are sticky, price stickiness provides a rationale for why these policies may be useful in stabilizing the economy in the short run.

In the rest of this chapter, we begin developing a model that makes these ideas more precise. The place to start is the model of supply and demand, which we used in Chapter 1 to discuss the market for pizza. This basic model offers some of the most fundamental insights in economics. It shows how the supply and demand for any good jointly determine the good's price and the quantity sold, as well as how shifts in supply and demand affect the price and quantity. We now introduce the "economy-size" version of this model—*the model of aggregate*

[3]To read more about this study, see Alan S. Blinder, "On Sticky Prices: Academic Theories Meet the Real World," in N. G. Mankiw, ed., *Monetary Policy* (Chicago: University of Chicago Press, 1994), 117–154. For more recent evidence about the frequency of price adjustment, see Emi Nakamura and Jón Steinsson, "Five Facts About Prices: A Reevaluation of Menu Cost Models," *Quarterly Journal of Economics*, 123, no. 4 (November 2008):1415–1464. Nakamura and Steinsson examine the microeconomic data that underlie the consumer and producer price indexes. They report that, including temporary sales, 19 to 20 percent of prices change every month. If sales are excluded, however, the frequency of price adjustment falls to about 9 to 12 percent per month. This latter finding is broadly consistent with Blinder's conclusion that the typical firm adjusts its prices about once a year.

supply and aggregate demand. This macroeconomic model allows us to study how the aggregate price level and the quantity of aggregate output are determined in the short run. It also provides a way to contrast how the economy behaves in the long run and how it behaves in the short run.

Although the model of aggregate supply and aggregate demand resembles the model of supply and demand for a single good, the analogy is not exact. The model of supply and demand for a single good considers only one good within a large economy. By contrast, as we will see in the coming chapters, the model of aggregate supply and aggregate demand is a sophisticated model that incorporates the interactions among many markets. In the remainder of this chapter we get a first glimpse at those interactions by examining the model in its most simplified form. Our goal here is not to explain the model fully but, instead, to introduce its key elements and illustrate how it can help explain short-run economic fluctuations.

10-3 Aggregate Demand

Aggregate demand (*AD*) is the relationship between the quantity of output demanded and the aggregate price level. In other words, the aggregate demand curve tells us the quantity of goods and services people want to buy at any given level of prices. We examine the theory of aggregate demand in detail in Chapters 11 through 13. Here we use the quantity theory of money to provide a simple, although incomplete, derivation of the aggregate demand curve.

The Quantity Equation as Aggregate Demand

Recall from Chapter 5 that the quantity theory says that

$$MV = PY,$$

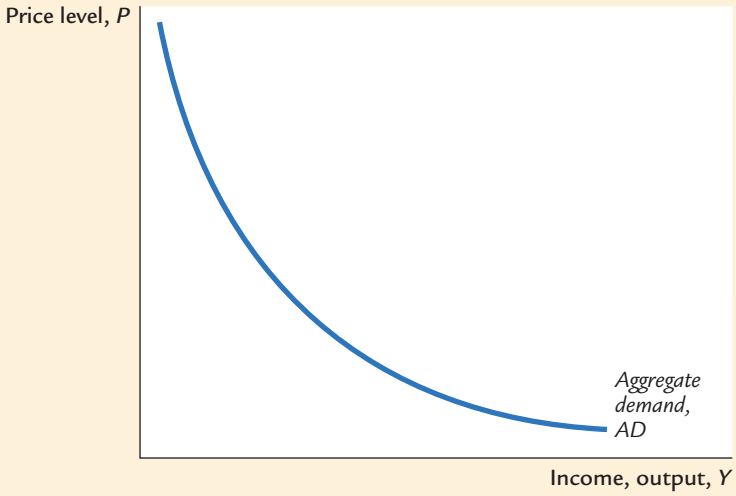
where M is the money supply, V is the velocity of money, P is the price level, and Y is the amount of output. If the velocity of money is constant, then this equation states that the money supply determines the nominal value of output, which in turn is the product of the price level and the amount of output.

When interpreting this equation, it is useful to recall that the quantity equation can be rewritten in terms of the supply and demand for real money balances:

$$M/P = (M/P)^d = kY,$$

where $k = 1/V$ is a parameter representing how much money people want to hold for every dollar of income. In this form, the quantity equation states that the supply of real money balances M/P equals the demand for real money balances $(M/P)^d$ and that the demand is proportional to output Y. The velocity of money V is the flip side of the money demand parameter k. The assumption of constant velocity

FIGURE 10-5



The Aggregate Demand Curve The aggregate demand curve *AD* shows the relationship between the price level *P* and the quantity of goods and services demanded *Y*. It is drawn for a given value of the money supply *M*. The aggregate demand curve slopes downward: the higher the price level *P*, the lower the level of real balances *M*/*P*, and therefore the lower the quantity of goods and services demanded *Y*.

is equivalent to the assumption of a constant demand for real money balances per unit of output.

If we assume that velocity V is constant and the money supply M is fixed by the central bank, then the quantity equation yields a negative relationship between the price level P and output Y. Figure 10-5 graphs the combinations of P and Y that satisfy the quantity equation holding M and V constant. This downward-sloping curve is called the aggregate demand curve.

Why the Aggregate Demand Curve Slopes Downward

As a strictly mathematical matter, the quantity equation explains the downward slope of the aggregate demand curve very simply. The money supply M and the velocity of money V determine the nominal value of output PY. Once PY is fixed, if P goes up, Y must go down.

What is the economic intuition that lies behind this mathematical relationship? For a complete explanation of the downward slope of the aggregate demand curve, we have to wait for a couple of chapters. For now, however, consider the following logic: Because we have assumed the velocity of money is fixed, the money supply determines the dollar value of all transactions in the economy. (This conclusion should be familiar from Chapter 5) If the price level rises, each transaction requires more dollars, so the number of transactions and thus the quantity of goods and services purchased must fall.

We can also explain the downward slope of the aggregate demand curve by thinking about the supply and demand for real money balances. If output is higher, people engage in more transactions and need higher real balances M/P.

For a fixed money supply M, higher real balances imply a lower price level. Conversely, if the price level is lower, real money balances are higher; the higher level of real balances allows a greater volume of transactions, which means a greater quantity of output is demanded.

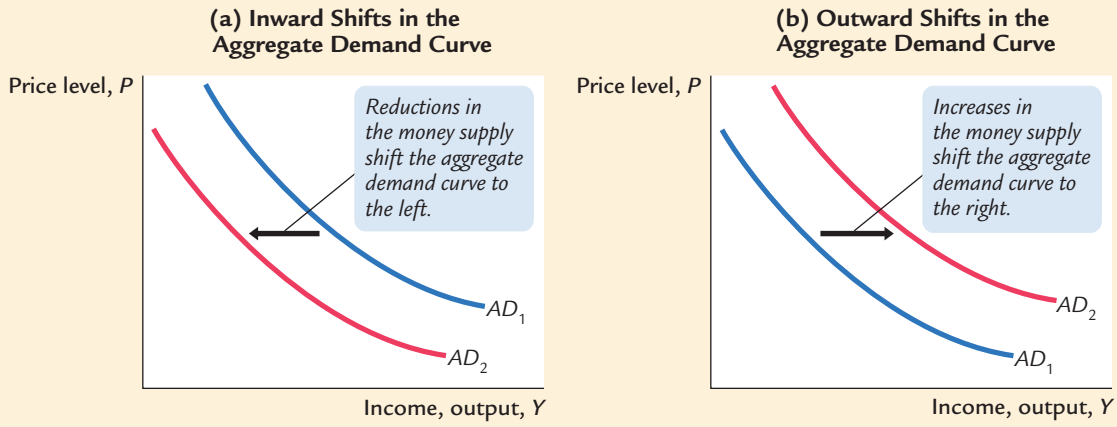
Shifts in the Aggregate Demand Curve

The aggregate demand curve is drawn for a fixed value of the money supply. In other words, it tells us the possible combinations of P and Y for a given value of M. If the Fed changes the money supply, then the possible combinations of P and Y change, which means the aggregate demand curve shifts.

For example, consider what happens if the Fed reduces the money supply. The quantity equation, $MV = PY$, tells us that the reduction in the money supply leads to a proportionate reduction in the nominal value of output PY. For any given price level, the amount of output is lower, and for any given amount of output, the price level is lower. As in Figure 10-6(a), the aggregate demand curve relating P and Y shifts inward.

The opposite occurs if the Fed increases the money supply. The quantity equation tells us that an increase in M leads to an increase in PY. For any given price level, the amount of output is higher, and for any given amount of output, the price level is higher. As shown in Figure 10-6(b), the aggregate demand curve shifts outward.

FIGURE 10-6



Shifts in the Aggregate Demand Curve Changes in the money supply shift the aggregate demand curve. In panel (a), a decrease in the money supply M reduces the nominal value of output PY. For any given price level P, output Y is lower. Thus, a decrease in the money supply shifts the aggregate demand curve inward from AD_1 to AD_2. In panel (b), an increase in the money supply M raises the nominal value of output PY. For any given price level P, output Y is higher. Thus, an increase in the money supply shifts the aggregate demand curve outward from AD_1 to AD_2.

Although the quantity theory of money provides a very simple basis for understanding the aggregate demand curve, be forewarned that reality is more complicated. Fluctuations in the money supply are not the only source of fluctuations in aggregate demand. Even if the money supply is held constant, the aggregate demand curve shifts if some event causes a change in the velocity of money. Over the next two chapters, we develop a more general model of aggregate demand, called the *IS–LM model*, which will allow us to consider many possible reasons for shifts in the aggregate demand curve.

10-4 Aggregate Supply

By itself, the aggregate demand curve does not tell us the price level or the amount of output that will prevail in the economy; it merely gives a relationship between these two variables. To accompany the aggregate demand curve, we need another relationship between P and Y that crosses the aggregate demand curve—an aggregate supply curve. The aggregate demand and aggregate supply curves together pin down the economy's price level and quantity of output.

Aggregate supply (*AS*) is the relationship between the quantity of goods and services supplied and the price level. Because the firms that supply goods and services have flexible prices in the long run but sticky prices in the short run, the aggregate supply relationship depends on the time horizon. We need to discuss two different aggregate supply curves: the long-run aggregate supply curve *LRAS* and the short-run aggregate supply curve *SRAS*. We also need to discuss how the economy makes the transition from the short run to the long run.

The Long Run: The Vertical Aggregate Supply Curve

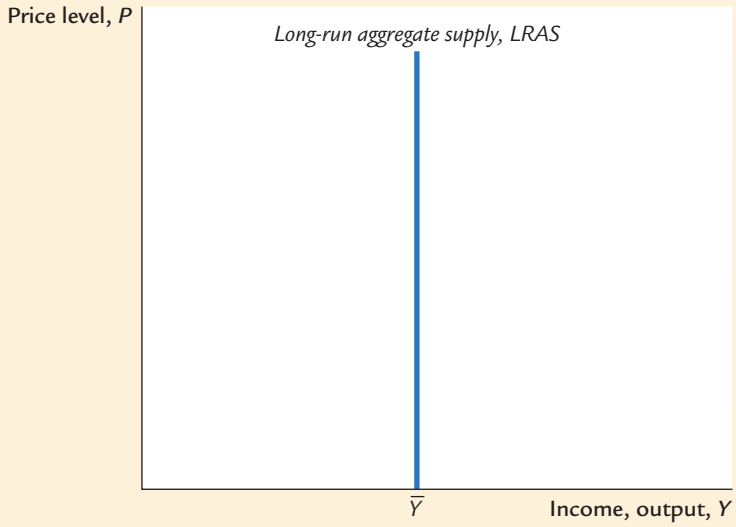
Because the classical model describes how the economy behaves in the long run, we derive the long-run aggregate supply curve from the classical model. Recall from Chapter 3 that the amount of output produced depends on the fixed amounts of capital and labor and on the available technology. To show this, we write

$$Y = F(\bar{K}, \bar{L})$$
$$= \bar{Y}.$$

According to the classical model, output does not depend on the price level. To show that output is fixed at this level, regardless of the price level, we draw a vertical aggregate supply curve, as in Figure 10-7. In the long run, the intersection of the aggregate demand curve with this vertical aggregate supply curve determines the price level.

If the aggregate supply curve is vertical, then changes in aggregate demand affect prices but not output. For example, if the money supply falls, the aggregate demand curve shifts downward, as in Figure 10-8. The economy moves from the old

FIGURE 10-7

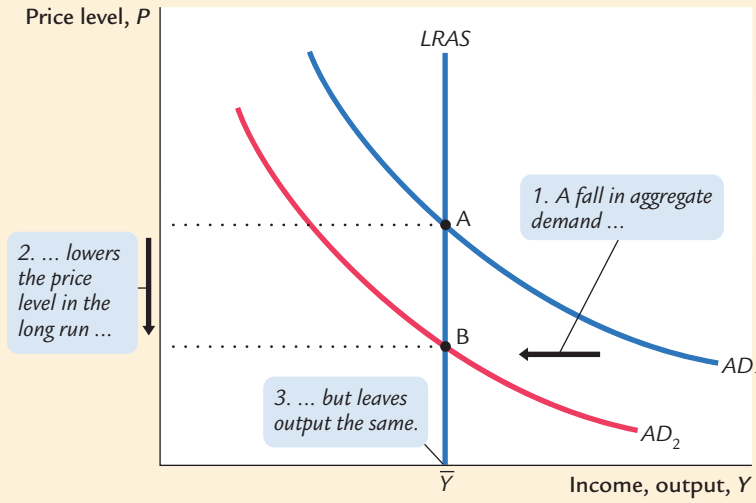


The Long-Run Aggregate Supply Curve In the long run, the level of output is determined by the amounts of capital and labor and by the available technology; it does not depend on the price level. The long-run aggregate supply curve, *LRAS*, is vertical.

intersection of aggregate supply and aggregate demand, point A, to the new intersection, point B. The shift in aggregate demand affects only prices.

The vertical aggregate supply curve satisfies the classical dichotomy because it implies that the level of output is independent of the money supply. This long-run level of output, $\overline{Y}$, is called the *full-employment*, or *natural*, level of output. It is the level of output at which the economy's resources are fully employed or, more realistically, at which unemployment is at its natural rate.

FIGURE 10-8



Shifts in Aggregate Demand in the Long Run A reduction in the money supply shifts the aggregate demand curve downward from AD_1 to AD_2. The equilibrium for the economy moves from point A to point B. Because the aggregate supply curve is vertical in the long run, the reduction in aggregate demand affects the price level but not the level of output.

The Short Run: The Horizontal Aggregate Supply Curve

The classical model and the vertical aggregate supply curve apply only in the long run. In the short run, some prices are sticky and therefore do not adjust to changes in demand. Because of this price stickiness, the short-run aggregate supply curve is not vertical.

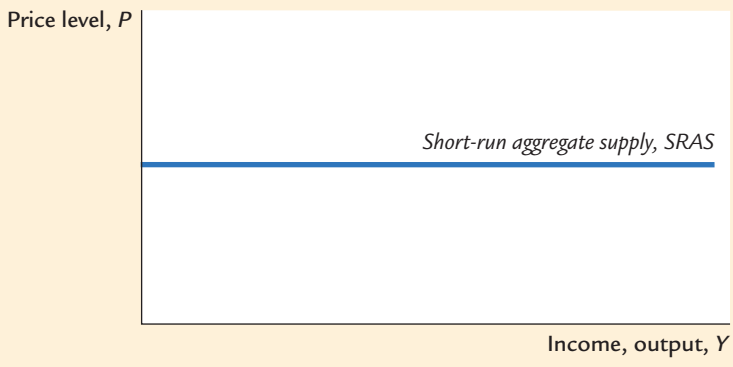
In this chapter, we will simplify things by assuming an extreme example. Suppose that all firms have issued price catalogs and that it is too costly for them to issue new ones. Thus, all prices are stuck at predetermined levels. At these prices, firms are willing to sell as much as their customers are willing to buy, and they hire just enough labor to produce the amount demanded. Because the price level is fixed, we represent this situation in Figure 10-9 with a horizontal aggregate supply curve.

The short-run equilibrium of the economy is the intersection of the aggregate demand curve and this horizontal short-run aggregate supply curve. In this case, changes in aggregate demand do affect the level of output. For example, if the Fed suddenly reduces the money supply, the aggregate demand curve shifts inward, as in Figure 10-10. The economy moves from the old intersection of aggregate demand and aggregate supply, point A, to the new intersection, point B. The movement from point A to point B represents a decline in output at a fixed price level.

Thus, a fall in aggregate demand reduces output in the short run because prices do not adjust instantly. After the sudden fall in aggregate demand, firms are stuck with prices that are too high. With demand low and prices high, firms sell less of their product, so they reduce production and lay off workers. The economy experiences a recession.

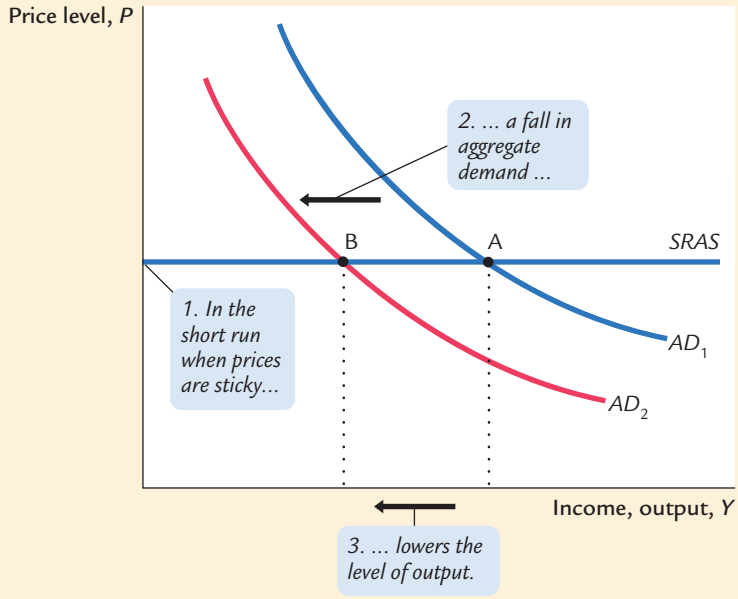
Once again, be forewarned that reality is a bit more complicated than illustrated here. Although many prices are sticky in the short run, some prices are able to respond quickly to changing circumstances. As we will see in Chapter 14, in an economy with some sticky prices and some flexible prices, the short-run aggregate supply curve is upward sloping rather than horizontal.

FIGURE 10-9



The Short-Run Aggregate Supply Curve In this extreme example, all prices are fixed in the short run. Therefore, the short-run aggregate supply curve, *SRAS*, is horizontal.

FIGURE 10-10



Shifts in Aggregate Demand in the Short Run A reduction in the money supply shifts the aggregate demand curve downward from AD_1 to AD_2. The equilibrium for the economy moves from point A to point B. Because the aggregate supply curve is horizontal in the short run, the reduction in aggregate demand reduces the level of output.

Figure 10-10 illustrates the extreme case in which all prices are stuck. Because this case is simpler, it is a useful starting point for thinking about short-run aggregate supply.

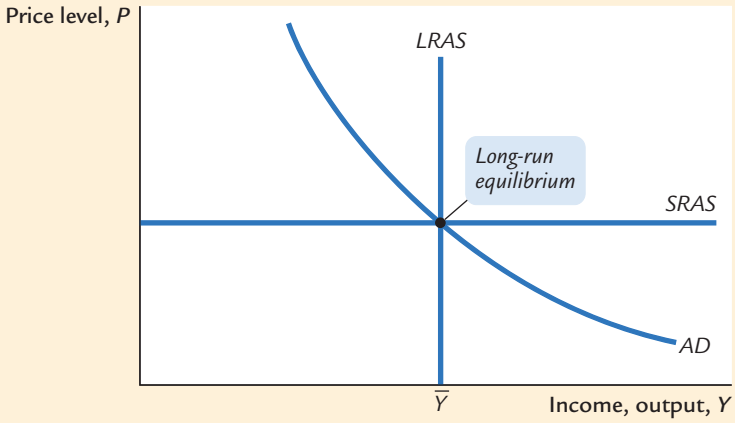
From the Short Run to the Long Run

We can summarize our analysis so far as follows: *Over long periods of time, prices are flexible, the aggregate supply curve is vertical, and changes in aggregate demand affect the price level but not output. Over short periods of time, prices are sticky, the aggregate supply curve is flat, and changes in aggregate demand do affect the economy's output of goods and services.*

How does the economy make the transition from the short run to the long run? Let's trace the effects over time of a fall in aggregate demand. Suppose that the economy is initially in long-run equilibrium, as shown in Figure 10-11. In this figure, there are three curves: the aggregate demand curve, the long-run aggregate supply curve, and the short-run aggregate supply curve. The long-run equilibrium is the point at which aggregate demand crosses the long-run aggregate supply curve. Prices have adjusted to reach this equilibrium. Therefore, when the economy is in its long-run equilibrium, the short-run aggregate supply curve must cross this point as well.

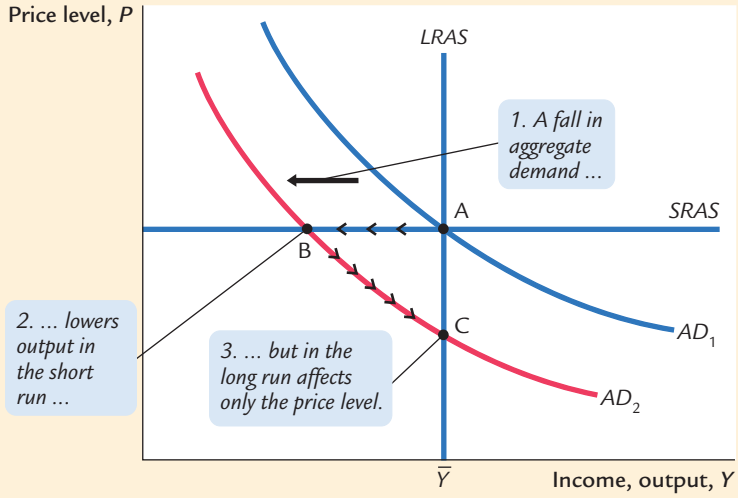
Now suppose that the Fed reduces the money supply and the aggregate demand curve shifts downward, as in Figure 10-12. In the short run, prices are sticky, so the economy moves from point A to point B. Output and

FIGURE 10-11



Long-Run Equilibrium In the long run, the economy finds itself at the intersection of the long-run aggregate supply curve and the aggregate demand curve. Because prices have adjusted to this level, the short-run aggregate supply curve crosses this point as well.

FIGURE 10-12



A Reduction in Aggregate Demand The economy begins in long-run equilibrium at point A. A reduction in aggregate demand, perhaps caused by a decrease in the money supply, moves the economy from point A to point B, where output is below its natural level. As prices fall, the economy gradually recovers from the recession, moving from point B to point C.

employment fall below their natural levels, which means the economy is in a recession. Over time, in response to the low demand, wages and prices fall. The gradual reduction in the price level moves the economy downward along the aggregate demand curve to point C, which is the new long-run equilibrium. In the new long-run equilibrium (point C), output and employment are back to their natural levels, but prices are lower than in the old long-run equilibrium (point A). Thus, a shift in aggregate demand affects output in the short run, but this effect dissipates over time as firms adjust their prices.

CASE STUDY

A Monetary Lesson From French History

Finding modern examples to illustrate the lessons from Figure 10-12 is hard. Modern central banks are too smart to engineer a substantial reduction in the money supply for no good reason. They know that a recession would ensue, and they usually do their best to prevent that from happening. Fortunately, history often fills in the gap when recent experience fails to produce the right experiment.

A vivid example of the effects of monetary contraction occurred in eighteenth-century France. In 2009, François Velde, an economist at the Federal Reserve Bank of Chicago, studied this episode in French economic history.

The story begins with the unusual nature of French money at the time. The money stock in this economy included a variety of gold and silver coins that, in contrast to modern money, did not indicate a specific monetary value. Instead, the monetary value of each coin was set by government decree, and the government could easily change the monetary value and thus the money supply. Sometimes this would occur literally overnight. It is almost as if, while you were sleeping, every $1 bill in your wallet was replaced by a bill worth only 80 cents.

Indeed, that is what happened on September 22, 1724. Every person in France woke up with 20 percent less money than he or she had the night before. Over the course of seven months, the nominal value of the money stock was reduced by about 45 percent. The goal of these changes was to reduce prices in the economy to what the government considered an appropriate level.

What happened as a result of this policy? Velde reports the following consequences:

> Although prices and wages did fall, they did not do so by the full 45 percent; moreover, it took them months, if not years, to fall that far. Real wages in fact rose, at least initially. Interest rates rose. The only market that adjusted instantaneously and fully was the foreign exchange market. Even markets that were as close to fully competitive as one can imagine, such as grain markets, failed to react initially. . . .
>
> At the same time, the industrial sector of the economy (or at any rate the textile industry) went into a severe contraction, by about 30 percent. The onset of the recession may have occurred before the deflationary policy began, but it was widely believed at the time that the severity of the contraction was due to monetary policy, in particular to a resulting "credit crunch" as holders of money stopped providing credit to trade in anticipation of further price declines (the "scarcity of money" frequently blamed by observers). Likewise, it was widely believed (on the basis of past experience) that a policy of inflation would halt the recession, and coincidentally or not, the economy rebounded once the nominal money supply was increased by 20 percent in May 1726.

This description of events from French history fits well with the lessons from modern macroeconomic theory.[4] ■

[4]François R. Velde, "Chronicles of a Deflation Unforetold," *Journal of Political Economy* 117 (August 2009): 591–634.

FYI

David Hume on the Real Effects of Money

As noted in Chapter 5, many of the central ideas of monetary theory have a long history. The classical theory of money we discussed in that chapter dates back as far as the eighteenth-century philosopher and economist David Hume. While Hume understood that changes in the money supply ultimately led to inflation, he also knew that money had real effects in the short run. Here is how Hume described a monetary injection in his 1752 essay *Of Money*:

> To account, then, for this phenomenon, we must consider, that though the high price of commodities be a necessary consequence of the increase of gold and silver, yet it follows not immediately upon that increase; but some time is required before the money circulates through the whole state, and makes its effect be felt on all ranks of people. At first, no alteration is perceived; by degrees the price rises, first of one commodity, then of another; till the whole at last reaches a just proportion with the new quantity of specie which is in the kingdom. In my opinion, it is only in this interval or intermediate situation, between the acquisition of money and rise of prices, that the increasing quantity of gold and silver is favorable to industry. When any quantity of money is imported into a nation, it is not at first dispersed into many hands; but is confined to the coffers of a few persons, who immediately seek to employ it to advantage. Here are a set of manufacturers or merchants, we shall suppose, who have received returns of gold and silver for goods which they sent to Cadiz. They are thereby enabled to employ more workmen than formerly, who never dream of demanding higher wages, but are glad of employment from such good paymasters. If workmen become scarce, the manufacturer gives higher wages, but at first requires an increase of labor; and this is willingly submitted to by the artisan, who can now eat and drink better, to compensate his additional toil and fatigue. He carries his money to market, where he finds everything at the same price as formerly, but returns with greater quantity and of better kinds, for the use of his family. The farmer and gardener, finding that all their commodities are taken off, apply themselves with alacrity to the raising more; and at the same time can afford to take better and more cloths from their tradesmen, whose price is the same as formerly, and their industry only whetted by so much new gain. It is easy to trace the money in its progress through the whole commonwealth; where we shall find, that it must first quicken the diligence of every individual, before it increases the price of labor.

It is likely that when writing these words, Hume was well aware of the French experience described in the preceding Case Study.

10-5 Stabilization Policy

Fluctuations in the economy as a whole come from changes in aggregate supply or aggregate demand. Economists call exogenous events that shift these curves **shocks** to the economy. A shock that shifts the aggregate demand curve is called a **demand shock**, and a shock that shifts the aggregate supply curve is called a **supply shock**. These shocks disrupt the economy by pushing output and employment away from their natural levels. One goal of the model of aggregate supply and aggregate demand is to show how shocks cause economic fluctuations.

Another goal of the model is to evaluate how macroeconomic policy can respond to these shocks. Economists use the term **stabilization policy** to refer to policy actions aimed at reducing the severity of short-run economic fluctuations. Because output and employment fluctuate around their long-run natural levels, stabilization policy dampens the business cycle by keeping output and employment as close to their natural levels as possible.

In the coming chapters, we examine in detail how stabilization policy works and what practical problems arise in its use. Here we begin our analysis of stabilization policy using our simplified version of the model of aggregate demand and aggregate supply. In particular, we examine how monetary policy might respond to shocks. Monetary policy is an important component of stabilization policy because, as we have seen, the money supply has a powerful impact on aggregate demand.

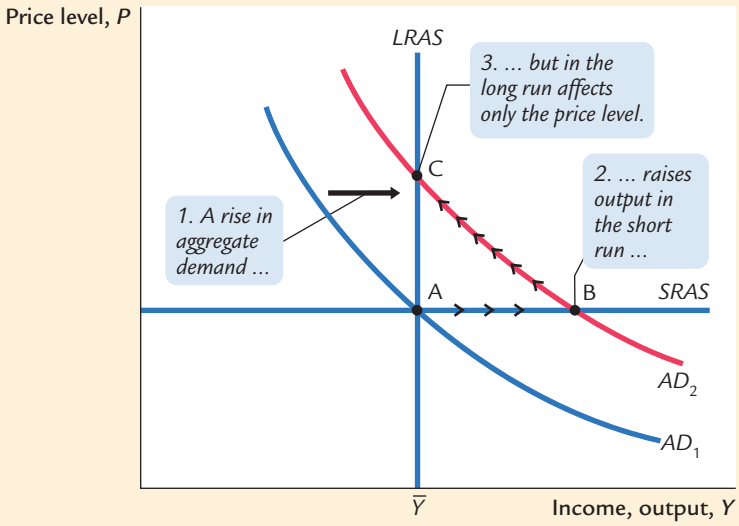
Shocks to Aggregate Demand

Consider an example of a demand shock: the introduction and expanded availability of credit cards. Because credit cards are often a more convenient way to make purchases than using cash, they reduce the quantity of money that people choose to hold. This reduction in money demand is equivalent to an increase in the velocity of money. When each person holds less money, the money demand parameter k falls. This means that each dollar of money moves from hand to hand more quickly, so velocity V $(= 1/k)$ rises.

If the money supply is held constant, the increase in velocity causes nominal spending to rise and the aggregate demand curve to shift outward, as in Figure 10-13. In the short run, the increase in demand raises the output of the economy—it causes an economic boom. At the old prices, firms now sell more output. Therefore, they hire more workers, ask their existing workers to work longer hours, and make greater use of their factories and equipment.

Over time, the high level of aggregate demand pulls up wages and prices. As the price level rises, the quantity of output demanded declines, and the economy gradually approaches the natural level of production. But during the transition to the higher price level, the economy's output is higher than its natural level.

FIGURE 10-13



An Increase in Aggregate Demand The economy begins in long-run equilibrium at point A. An increase in aggregate demand, perhaps due to an increase in the velocity of money, moves the economy from point A to point B, where output is above its natural level. As prices rise, output gradually returns to its natural level, and the economy moves from point B to point C.

What can the Fed do to dampen this boom and keep output closer to the natural level? The Fed might reduce the money supply to offset the increase in velocity. Offsetting the change in velocity would stabilize aggregate demand. Thus, the Fed can reduce or even eliminate the impact of demand shocks on output and employment if it can skillfully control the money supply. Whether the Fed in fact has the necessary skill is a more difficult question, which we take up in Chapter 18.

Shocks to Aggregate Supply

Shocks to aggregate supply can also cause economic fluctuations. A supply shock is a shock to the economy that alters the cost of producing goods and services and, as a result, the prices that firms charge. Because supply shocks have a direct impact on the price level, they are sometimes called *price shocks*. Here are some examples:

- A drought that destroys crops. The reduction in food supply pushes up food prices.
- A new environmental protection law that requires firms to reduce their emissions of pollutants. Firms pass on the added costs to customers in the form of higher prices.
- An increase in union aggressiveness. This pushes up wages and the prices of the goods produced by union workers.
- The organization of an international oil cartel. By curtailing competition, the major oil producers can raise the world price of oil.

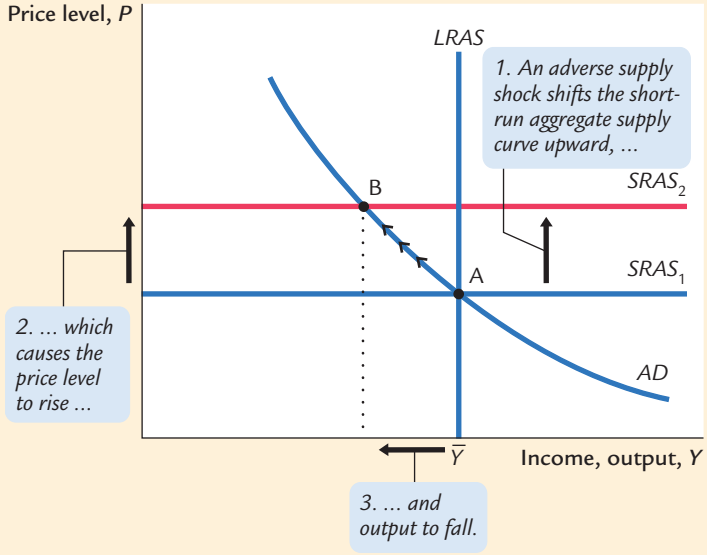
All these events are *adverse* supply shocks, which means they push costs and prices upward. A *favorable* supply shock, such as the breakup of an international oil cartel, reduces costs and prices.

Figure 10-14 shows how an adverse supply shock affects the economy. The short-run aggregate supply curve shifts upward. (The supply shock may also lower the natural level of output and thus shift the long-run aggregate supply curve to the left, but we ignore that effect here.) If aggregate demand is held constant, the economy moves from point A to point B: the price level rises and the amount of output falls below its natural level. An experience like this is called *stagflation* because it combines economic stagnation (falling output and, from Okun's law, rising unemployment) with inflation (rising prices).

Faced with an adverse supply shock, a policymaker with the ability to influence aggregate demand, such as the Fed, has a difficult choice between two options. The first option, implicit in Figure 10-14, is to hold aggregate demand constant. In this case, output and employment are lower than the natural level. Eventually, prices will fall to restore full employment at the old price level (point A), but the cost of this adjustment process is a painful recession.

The second option, illustrated in Figure 10-15, is to expand aggregate demand to bring the economy toward the natural level of output more quickly. If the

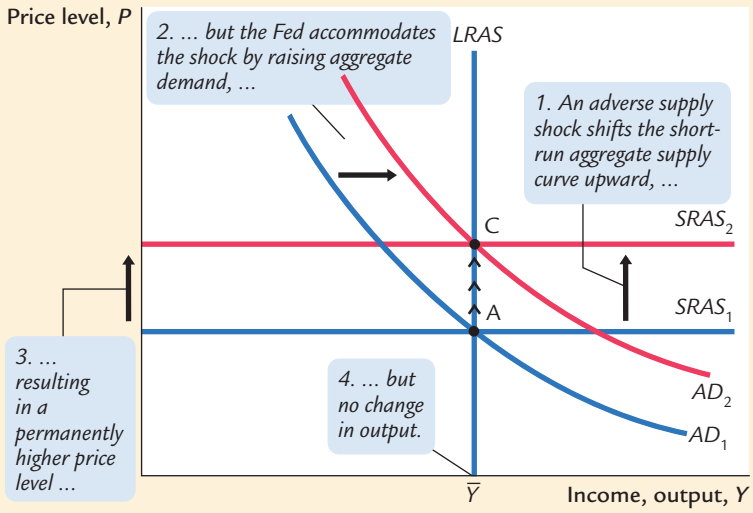
FIGURE 10-14



An Adverse Supply Shock An adverse supply shock pushes up costs and thus prices. If aggregate demand is held constant, the economy moves from point A to point B, leading to stagflation—a combination of increasing prices and falling output. Eventually, as prices fall, the economy returns to the natural level of output, point A.

increase in aggregate demand coincides with the shock to aggregate supply, the economy goes immediately from point A to point C. In this case, the Fed is said to *accommodate* the supply shock. The drawback of this option, of course, is that the price level is permanently higher. There is no way to adjust aggregate demand to maintain full employment and keep the price level stable.

FIGURE 10-15



Accommodating an Adverse Supply Shock In response to an adverse supply shock, the Fed can increase aggregate demand to prevent a reduction in output. The economy moves from point A to point C. The cost of this policy is a permanently higher level of prices.

CASE STUDY

How OPEC Helped Cause Stagflation in the 1970s and Euphoria in the 1980s

The most disruptive supply shocks in recent history were caused by OPEC, the Organization of Petroleum Exporting Countries. OPEC is a cartel, which is an organization of suppliers that coordinate production levels and prices. In the early 1970s, OPEC's reduction in the supply of oil nearly doubled the world price. This increase in oil prices caused stagflation in most industrial countries. These statistics show what happened in the United States:

Year	Change in Oil Prices	Inflation Rate (CPI)	Unemployment Rate
1973	11.0%	6.2%	4.9%
1974	68.0	11.0	5.6
1975	16.0	9.1	8.5
1976	3.3	5.8	7.7
1977	8.1	6.5	7.1

The 68 percent increase in the price of oil in 1974 was an adverse supply shock of major proportions. As one would have expected, this shock led to both higher inflation and higher unemployment.

A few years later, when the world economy had nearly recovered from the first OPEC recession, almost the same thing happened again. OPEC raised oil prices, causing further stagflation. Here are the statistics for the United States:

Year	Change in Oil Prices	Inflation Rate (CPI)	Unemployment Rate
1978	9.4%	7.7%	6.1%
1979	25.4	11.3	5.8
1980	47.8	13.5	7.0
1981	44.4	10.3	7.5
1982	-8.7	6.1	9.5

The increases in oil prices in 1979, 1980, and 1981 again led to double-digit inflation and higher unemployment.

In the mid-1980s, political turmoil among the Arab countries weakened OPEC's ability to restrain supplies of oil. Oil prices fell, reversing the stagflation of the 1970s and the early 1980s. Here's what happened:

Year	Changes in Oil Prices	Inflation Rate (CPI)	Unemployment Rate
1983	–7.1%	3.2%	9.5%
1984	–1.7	4.3	7.4
1985	–7.5	3.6	7.1
1986	–44.5	1.9	6.9
1987	18.3	3.6	6.1

In 1986 oil prices fell by nearly half. This favorable supply shock led to one of the lowest inflation rates experienced during that era and to falling unemployment.

More recently, OPEC has not been a major cause of economic fluctuations. Conservation efforts and technological changes have made the U.S. economy less susceptible to oil shocks. The economy today is more service-based and less manufacturing-based, and services typically require less energy to produce than do manufactured goods. Because the amount of oil consumed per unit of real GDP has fallen by more than half over the previous three decades, it takes a much larger oil-price change to have the impact on the economy that we observed in the 1970s and 1980s. Thus, when oil prices fluctuate substantially, as they have in recent years, these price changes have a smaller macroeconomic impact than they would have had in the past.[5] ■

10-6 Conclusion

This chapter introduced a framework to study economic fluctuations: the model of aggregate supply and aggregate demand. The model is built on the assumption that prices are sticky in the short run and flexible in the long run. It shows how shocks to the economy cause output to deviate temporarily from the level implied by the classical model.

The model also highlights the role of monetary policy. On the one hand, poor monetary policy can be a source of destabilizing shocks to the economy. On the other hand, a well-run monetary policy can respond to shocks and stabilize the economy.

[5]Some economists have suggested that changes in oil prices played a major role in economic fluctuations even before the 1970s. See James D. Hamilton, "Oil and the Macroeconomy Since World War II," *Journal of Political Economy* 91 (April 1983): 228–248.

In the chapters that follow, we refine our understanding of this model and our analysis of stabilization policy. Chapters 11 through 13 go beyond the quantity equation to refine our theory of aggregate demand. Chapter 14 examines aggregate supply in more detail. The remainder of the book then uses this model as the platform from which to dive into more advanced topics in macroeconomic theory and policy.

Summary

1. Economies experience short-run fluctuations in economic activity, measured most broadly by real GDP. These fluctuations are associated with movement in many macroeconomic variables. In particular, when GDP growth declines, consumption growth falls (typically by a smaller amount), investment growth falls (typically by a larger amount), and unemployment rises. Although economists look at various leading indicators to forecast movements in the economy, these short-run fluctuations are largely unpredictable.
2. The crucial difference between how the economy works in the long run and how it works in the short run is that prices are flexible in the long run but sticky in the short run. The model of aggregate supply and aggregate demand provides a framework to analyze economic fluctuations and see how the impact of policies and events varies over different time horizons.
3. The aggregate demand curve slopes downward. It tells us that the lower the price level, the greater the aggregate quantity of goods and services demanded.
4. In the long run, the aggregate supply curve is vertical because output is determined by the amounts of capital and labor and by the available technology but not by the level of prices. Therefore, shifts in aggregate demand affect the price level but not output or employment.
5. In the short run, the aggregate supply curve is horizontal, because wages and prices are sticky at predetermined levels. Therefore, shifts in aggregate demand affect output and employment.
6. Shocks to aggregate demand and aggregate supply cause economic fluctuations. Because the Fed can shift the aggregate demand curve, it can attempt to offset these shocks to maintain output and employment at their natural levels.

KEY CONCEPTS

Okun's law
Leading indicators
Aggregate demand
Aggregate supply
Shocks
Demand shocks
Supply shocks
Stabilization policy

QUESTIONS FOR REVIEW

1. When real GDP declines during a recession, what typically happens to consumption, investment, and the unemployment rate?
2. Give an example of a price that is sticky in the short run but flexible in the long run.
3. Why does the aggregate demand curve slope downward?
4. Explain the impact of an increase in the money supply in the short run and in the long run.
5. Why is it easier for the Fed to deal with demand shocks than with supply shocks?

PROBLEMS AND APPLICATIONS

1. An economy begins in long-run equilibrium, and then a change in government regulations allows banks to start paying interest on checking accounts. Recall that the money stock is the sum of currency and demand deposits, including checking accounts, so this regulatory change makes holding money more attractive.
   a. How does this change affect the demand for money?
   b. What happens to the velocity of money?
   c. If the Fed keeps the money supply constant, what will happen to output and prices in the short run and in the long run?
   d. If the goal of the Fed is to stabilize the price level, should the Fed keep the money supply constant in response to this regulatory change? If not, what should it do? Why?
   e. If the goal of the Fed is to stabilize output, how would your answer to part (d) change?
2. Suppose the Fed reduces the money supply by 5 percent. Assume the velocity of money is constant.
   a. What happens to the aggregate demand curve?
   b. What happens to the level of output and the price level in the short run and in the long run?
   c. In light of your answer to part (b), what happens to unemployment in the short run and in the long run according to Okun's law?
   d. What happens to the real interest rate in the short run and in the long run? (*Hint*: Use the model of the real interest rate in Chapter 3 to see what happens when output changes.)
3. Let's examine how the goals of the Fed influence its response to shocks. Suppose that in scenario A the Fed cares only about keeping the price level stable and in scenario B the Fed cares only about keeping output and employment at their natural levels. Explain how in each scenario the Fed would respond to the following.
   a. An exogenous decrease in the velocity of money.
   b. An exogenous increase in the price of oil.
4. The official arbiter of when recessions begin and end is the National Bureau of Economic Research, a nonprofit economics research group. Go to the NBER's Web site (www.nber.org) and find the latest turning point in the business cycle. When did it occur? Was this a switch from expansion to contraction or the other way around? List all the recessions (contractions) that have occurred during your lifetime and the dates when they began and ended.

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Aggregate Demand I: Building the *IS–LM* Model

I shall argue that the postulates of the classical theory are applicable to a special case only and not to the general case. . . . Moreover, the characteristics of the special case assumed by the classical theory happen not to be those of the economic society in which we actually live, with the result that its teaching is misleading and disastrous if we attempt to apply it to the facts of experience.

—*John Maynard Keynes,* The General Theory

Of all the economic fluctuations in world history, the one that stands out as particularly large, painful, and intellectually significant is the Great Depression of the 1930s. During this time, the United States and many other countries experienced massive unemployment and greatly reduced incomes. In the worst year, 1933, one-fourth of the U.S. labor force was unemployed, and real GDP was 30 percent below its 1929 level.

This devastating episode caused many economists to question the validity of classical economic theory—the theory we examined in Chapters 3 through 7. Classical theory seemed incapable of explaining the Depression. According to that theory, national income depends on factor supplies and the available technology, neither of which changed substantially from 1929 to 1933. After the onset of the Depression, many economists believed that a new model was needed to explain such a large and sudden economic downturn and to suggest government policies that might reduce the economic hardship so many people faced.

In 1936 the British economist John Maynard Keynes revolutionized economics with his book *The General Theory of Employment, Interest, and Money*. Keynes proposed a new way to analyze the economy, which he presented as an alternative to classical theory. His vision of how the economy works quickly became a center of controversy. Yet, as economists debated *The General Theory*, a new understanding of economic fluctuations gradually developed.

Keynes proposed that low aggregate demand is responsible for the low income and high unemployment that characterize economic downturns. He criticized classical theory for assuming that aggregate supply alone—capital, labor, and technology—determines national income. Economists today reconcile these two views with the model of aggregate demand and aggregate supply introduced in

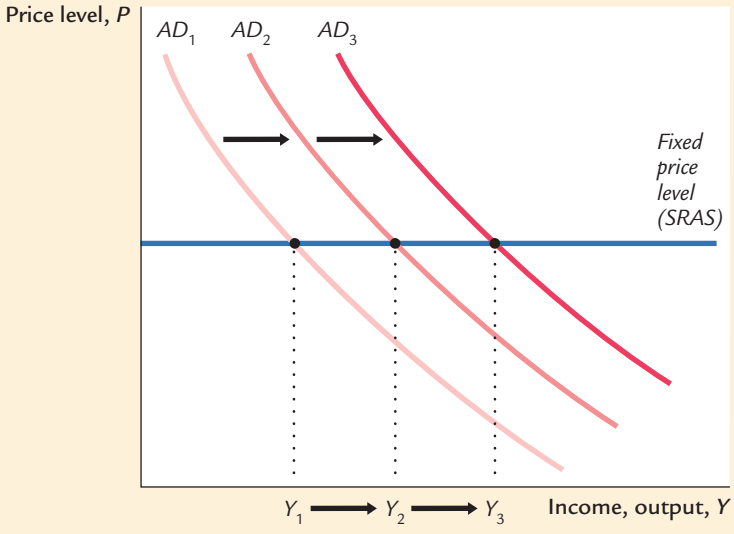
Chapter 10. In the long run, prices are flexible, and aggregate supply determines income. But in the short run, prices are sticky, so changes in aggregate demand influence income.

Keynes's ideas about short-run fluctuations have been prominent since he proposed them in the 1930s, but they have commanded renewed attention in recent years. In the aftermath of the financial crisis of 2008–2009, the United States and Europe descended into a deep recession, followed by a weak recovery. As unemployment lingered at high levels, policymakers around the world debated how best to increase aggregate demand. Many of the issues that gripped economists during the Great Depression were once again at the center of the economic policy debate.

In this chapter and the next, we continue our study of economic fluctuations by looking more closely at aggregate demand. Our goal is to identify the variables that shift the aggregate demand curve, causing fluctuations in national income. We also examine more fully the tools policymakers can use to influence aggregate demand. In Chapter 10 we derived the aggregate demand curve from the quantity theory of money, and we showed that monetary policy can shift the aggregate demand curve. In this chapter we see that the government can influence aggregate demand with both monetary and fiscal policy.

The model of aggregate demand developed in this chapter, called the ***IS–LM* model**, is the leading interpretation of Keynes's theory. The goal of the model is to show what determines national income for a given price level. There are two ways to interpret this exercise. We can view the *IS–LM* model as showing what causes income to change in the short run when the price level is fixed because all prices are sticky. Or we can view the model as showing what causes the aggregate demand curve to shift. These two interpretations of the model are equivalent: as Figure 11-1 shows, in the short run when the price level is fixed,

FIGURE 11-1



Shifts in Aggregate Demand
For a given price level, national income fluctuates because of shifts in the aggregate demand curve. The *IS–LM* model takes the price level as given and shows what causes income to change. The model therefore shows what causes aggregate demand to shift.

shifts in the aggregate demand curve lead to changes in the equilibrium level of national income.

The two parts of the *IS–LM* model are, not surprisingly, the ***IS* curve** and the ***LM* curve**. *IS* stands for "investment" and "saving," and the *IS* curve represents what's going on in the market for goods and services (which we first discussed in Chapter 3). *LM* stands for "liquidity" and "money," and the *LM* curve represents what's happening to the supply and demand for money (which we first discussed in Chapter 5). Because the interest rate influences both investment and money demand, it is the variable that links the two halves of the *IS–LM* model. The model shows how interactions between the goods and money markets determine the position and slope of the aggregate demand curve and, therefore, the level of national income in the short run.[1]

11-1 The Goods Market and the *IS* Curve

The *IS* curve plots the relationship between the interest rate and the level of income that arises in the market for goods and services. To develop this relationship, we start with a basic model called the **Keynesian cross**. This model is the simplest interpretation of Keynes's theory of how national income is determined and is a building block for the more complex and realistic *IS–LM* model.

The Keynesian Cross

In *The General Theory* Keynes proposed that an economy's total income is, in the short run, determined largely by the spending plans of households, businesses, and government. The more people want to spend, the more goods and services firms can sell. The more firms can sell, the more output they will choose to produce and the more workers they will choose to hire. Keynes believed that the problem during recessions and depressions is inadequate spending. The Keynesian cross is an attempt to model this insight.

Planned Expenditure We begin our derivation of the Keynesian cross by drawing a distinction between actual and planned expenditure. *Actual expenditure* is the amount households, firms, and the government spend on goods and services, and as we first saw in Chapter 2, it equals the economy's gross domestic product (GDP). *Planned expenditure* is the amount households, firms, and the government would like to spend on goods and services.

Why would actual expenditure ever differ from planned expenditure? The answer is that firms might engage in unplanned inventory investment because their sales do not meet their expectations. When firms sell less of their product than they planned, their stock of inventories automatically rises; conversely,

[1]The *IS–LM* model was introduced in a classic article by the Nobel Prize–winning economist John R. Hicks, "Mr. Keynes and the Classics: A Suggested Interpretation," *Econometrica* 5 (1937): 147–159.

when firms sell more than planned, their stock of inventories falls. Because these unplanned changes in inventory are counted as investment spending by firms, actual expenditure can be either above or below planned expenditure.

Now consider the determinants of planned expenditure. Assuming that the economy is closed, so that net exports are zero, we write planned expenditure PE as the sum of consumption C, planned investment I, and government purchases G:

$$PE = C + I + G.$$

To this equation, we add the consumption function:

$$C = C(Y - T).$$

This equation states that consumption depends on disposable income $(Y - T)$, which is total income Y minus taxes T. To keep things simple, for now we take planned investment as exogenously fixed:

$$I = \bar{I}.$$

Finally, as in Chapter 3, we assume that fiscal policy—the levels of government purchases and taxes—is fixed:

$$G = \bar{G}.$$
$$T = \bar{T}.$$

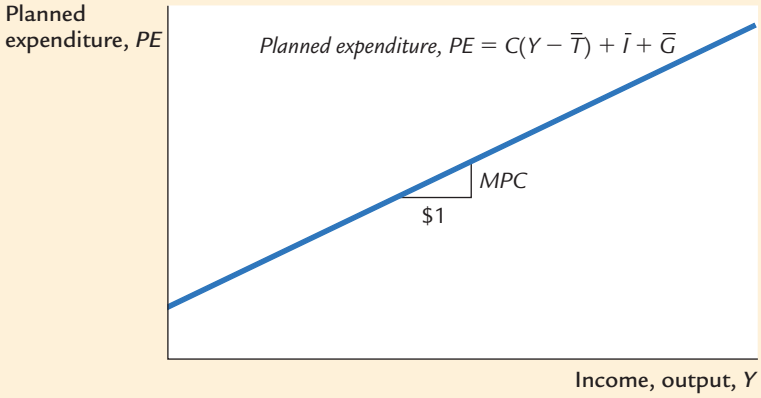
Combining these five equations, we obtain

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

This equation shows that planned expenditure is a function of income Y, the level of planned investment $\bar{I}$, and the fiscal policy variables $\bar{G}$ and $\bar{T}$.

Figure 11-2 graphs planned expenditure as a function of the level of income. This line slopes upward because higher income leads to higher consumption and

FIGURE 11-2



Planned Expenditure as a Function of Income Planned expenditure PE depends on income because higher income leads to higher consumption, which is part of planned expenditure. The slope of the planned-expenditure function is the marginal propensity to consume, MPC.

thus higher planned expenditure. The slope of this line is the marginal propensity to consume, *MPC:* it shows how much planned expenditure increases when income rises by $1. This planned-expenditure function is the first piece of the Keynesian cross.

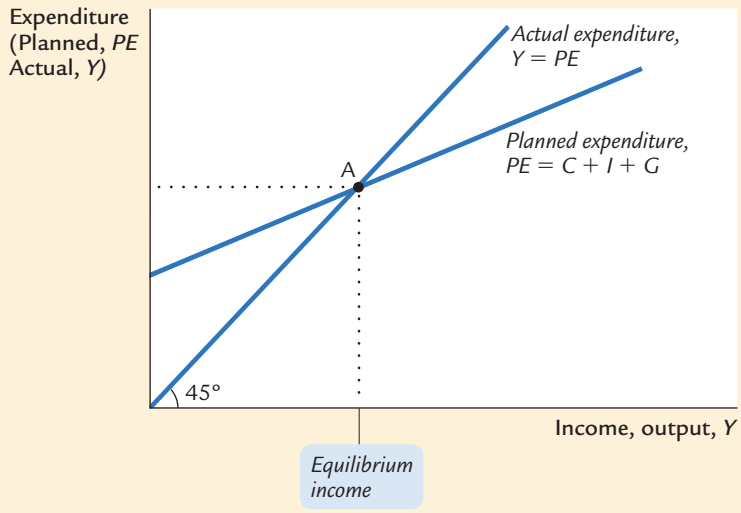
The Economy in Equilibrium The next piece of the Keynesian cross is the assumption that the economy is in equilibrium when actual expenditure equals planned expenditure. This assumption is based on the idea that when people's plans have been realized, they have no reason to change what they are doing. Recalling that Y as GDP equals not only total income but also total actual expenditure on goods and services, we can write this equilibrium condition as

$$\text{Actual Expenditure} = \text{Planned Expenditure}$$
$$Y = PE.$$

The 45-degree line in Figure 11-3 plots the points where this condition holds. With the addition of the planned-expenditure function, this diagram becomes the Keynesian cross. The equilibrium of this economy is at point A, where the planned-expenditure function crosses the 45-degree line.

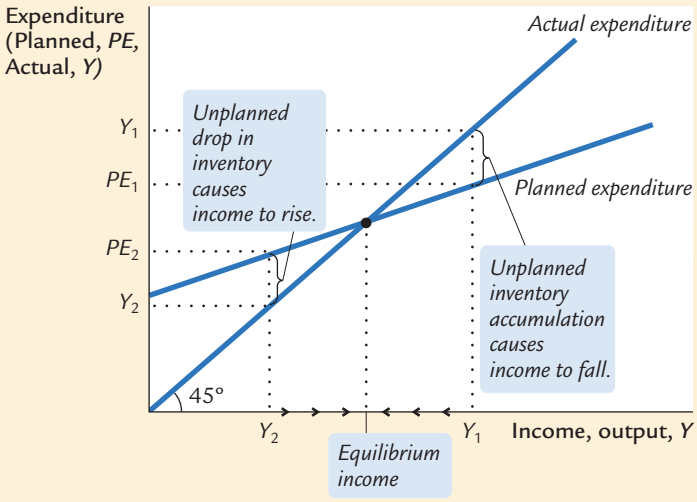
How does the economy get to equilibrium? In this model, inventories play an important role in the adjustment process. Whenever an economy is not in equilibrium, firms experience unplanned changes in inventories, and this induces them to change production levels. Changes in production in turn influence total income and expenditure, moving the economy toward equilibrium.

FIGURE 11-3



The Keynesian Cross The equilibrium in the Keynesian cross is the point at which income (actual expenditure) equals planned expenditure (point A).

FIGURE 11-4



The Adjustment to Equilibrium in the Keynesian Cross If firms are producing at level Y_1, then planned expenditure PE_1 falls short of production, and firms accumulate inventories. This inventory accumulation induces firms to decrease production. Similarly, if firms are producing at level Y_2, then planned expenditure PE_2 exceeds production, and firms run down their inventories. This fall in inventories induces firms to increase production. In both cases, the firms' decisions drive the economy toward equilibrium.

For example, suppose the economy finds itself with GDP at a level greater than the equilibrium level, such as the level Y_1 in Figure 11-4. In this case, planned expenditure PE_1 is less than production Y_1, so firms are selling less than they are producing. Firms add the unsold goods to their stock of inventories. This unplanned rise in inventories induces firms to lay off workers and reduce production; these actions in turn reduce GDP. This process of unintended inventory accumulation and falling income continues until income Y falls to the equilibrium level.

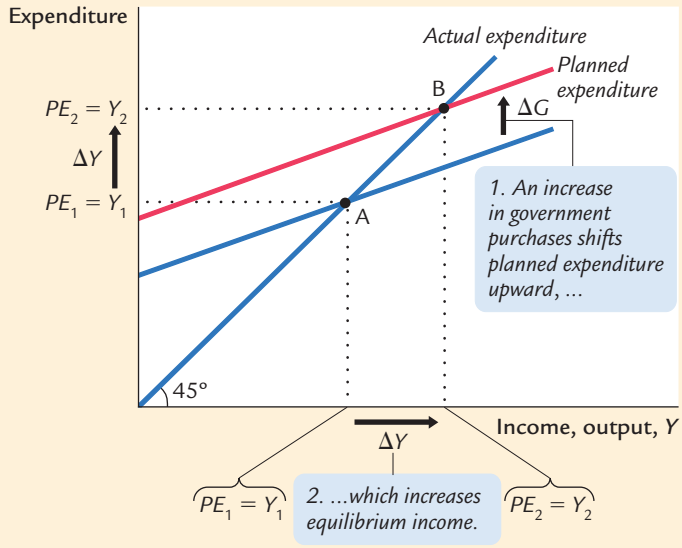
Similarly, suppose GDP is at a level lower than the equilibrium level, such as the level Y_2 in Figure 11-4. In this case, planned expenditure PE_2 is greater than production Y_2. Firms meet the high level of sales by drawing down their inventories. But when firms see their stock of inventories dwindle, they hire more workers and increase production. GDP rises, and the economy approaches equilibrium.

In summary, the Keynesian cross shows how income Y is determined for given levels of planned investment I and fiscal policy G and T. We can use this model to show how income changes when one of these exogenous variables changes.

Fiscal Policy and the Multiplier: Government Purchases Consider how changes in government purchases affect the economy. Because government purchases are one component of expenditure, higher government purchases result in higher planned expenditure for any given level of income. If government purchases rise by ΔG, then the planned-expenditure schedule shifts upward by ΔG, as in Figure 11-5. The equilibrium of the economy moves from point A to point B.

This graph shows that an increase in government purchases leads to an even greater increase in income. That is, ΔY is larger than ΔG. The ratio $\Delta Y/\Delta G$ is called the **government-purchases multiplier**; it tells us how much income

FIGURE 11-5



An Increase in Government Purchases in the Keynesian Cross An increase in government purchases of ΔG raises planned expenditure by that amount for any given level of income. The equilibrium moves from point A to point B, and income rises from Y_1 to Y_2. Note that the increase in income ΔY exceeds the increase in government purchases ΔG. Thus, fiscal policy has a multiplied effect on income.

rises in response to a \$1 increase in government purchases. An implication of the Keynesian cross is that the government-purchases multiplier is larger than 1.

Why does fiscal policy have a multiplied effect on income? The reason is that, according to the consumption function $C = C(Y - T)$, higher income causes higher consumption. When an increase in government purchases raises income, it also raises consumption, which further raises income, which further raises consumption, and so on. Therefore, in this model, an increase in government purchases causes a greater increase in income.

How big is the multiplier? To answer this question, we trace through each step of the change in income. The process begins when expenditure rises by ΔG, which implies that income rises by ΔG as well. This increase in income in turn raises consumption by $MPC \times \Delta G$, where MPC is the marginal propensity to consume. This increase in consumption raises expenditure and income once again. This second increase in income of $MPC \times \Delta G$ again raises consumption, this time by $MPC \times (MPC \times \Delta G)$, which again raises expenditure and income, and so on. This feedback from consumption to income to consumption continues indefinitely. The total effect on income is

$$\begin{aligned}
\text{Initial Change in Government Purchases} &= \Delta G \\
\text{First Change in Consumption} &= MPC \times \Delta G \\
\text{Second Change in Consumption} &= MPC^2 \times \Delta G \\
\text{Third Change in Consumption} &= MPC^3 \times \Delta G \\
&\vdots \qquad\qquad \vdots \\
\Delta Y &= (1 + MPC + MPC^2 + MPC^3 + \cdots)\Delta G.
\end{aligned}$$

The government-purchases multiplier is

$$\Delta Y/\Delta G = 1 + MPC + MPC^2 + MPC^3 + \cdots$$

This expression for the multiplier is an example of an *infinite geometric series*. A result from algebra allows us to write the multiplier as[2]

$$\Delta Y/\Delta G = 1/(1 - MPC).$$

For example, if the marginal propensity to consume is 0.6, the multiplier is

$$\begin{aligned}\Delta Y/\Delta G &= 1 + 0.6 + 0.6^2 + 0.6^3 + \cdots \\ &= 1/(1 - 0.6) \\ &= 2.5.\end{aligned}$$

In this case, a \$1.00 increase in government purchases raises equilibrium income by \$2.50.[3]

Fiscal Policy and the Multiplier: Taxes Now consider how changes in taxes affect equilibrium income. A decrease in taxes of ΔT immediately raises disposable income $Y - T$ by ΔT and, therefore, increases consumption by $MPC \times \Delta T$. For any given level of income Y, planned expenditure is now higher. As Figure 11-6 shows, the planned-expenditure schedule shifts upward by $MPC \times \Delta T$. The equilibrium of the economy moves from point A to point B.

---

[2]*Mathematical note:* We prove this algebraic result as follows. For $|x| < 1$, let

$$z = 1 + x + x^2 + \cdots.$$

Multiply both sides of this equation by x:

$$xz = x + x^2 + x^3 + \cdots.$$

Subtract the second equation from the first:

$$z - xz = 1.$$

Rearrange this last equation to obtain

$$z(1 - x) = 1,$$

which implies

$$z = 1/(1 - x).$$

This completes the proof.

[3]*Mathematical note:* The government-purchases multiplier is most easily derived using a little calculus. Begin with the equation

$$Y = C(Y - T) + I + G.$$

Holding T and I fixed, differentiate to obtain

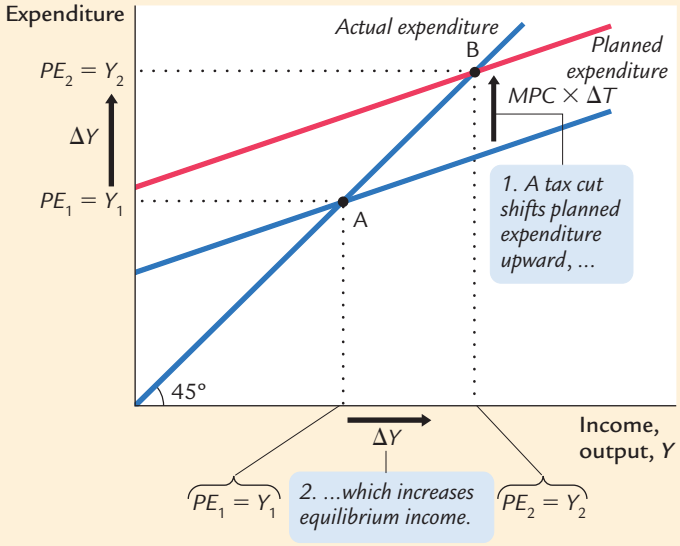
$$dY = C'dY + dG,$$

and then rearrange to find

$$dY/dG = 1/(1 - C').$$

This is the same as the equation in the text.

FIGURE 11-6



A Decrease in Taxes in the Keynesian Cross A decrease in taxes of ΔT raises planned expenditure by $MPC \times \Delta T$ for any given level of income. The equilibrium moves from point A to point B, and income rises from Y_1 to Y_2. Again, fiscal policy has a multiplied effect on income.

Just as an increase in government purchases has a multiplied effect on income, so does a decrease in taxes. As before, the initial change in expenditure, now $MPC \times \Delta T$, is multiplied by $1/(1 - MPC)$. The overall effect on income of the change in taxes is

$$\Delta Y/\Delta T = -MPC/(1 - MPC).$$

This expression is the **tax multiplier**, the amount income changes in response to a \$1 change in taxes. (The negative sign indicates that income moves in the opposite direction from taxes.) For example, if the marginal propensity to consume is 0.6, then the tax multiplier is

$$\Delta Y/\Delta T = -0.6/(1 - 0.6) = -1.5.$$

In this example, a \$1.00 cut in taxes raises equilibrium income by \$1.50.[4]

[4] *Mathematical note:* As before, the multiplier is most easily derived using a little calculus. Begin with the equation

$$Y = C(Y - T) + I + G.$$

Holding I and G fixed, differentiate to obtain

$$dY = C'(dY - dT),$$

and then rearrange to find

$$dY/dT = -C'/(1 - C').$$

This is the same as the equation in the text.

CASE STUDY

Cutting Taxes to Stimulate the Economy: The Kennedy and Bush Tax Cuts

When John F. Kennedy became president of the United States in 1961, he brought to Washington some of the brightest young economists of the day to work on his Council of Economic Advisers. These economists, who had been schooled in the economics of Keynes, brought Keynesian ideas to discussions of economic policy at the highest level.

One of the council's first proposals was to expand national income by reducing taxes. This eventually led to a substantial cut in personal and corporate income taxes in 1964. The tax cut was intended to stimulate expenditure on consumption and investment and thus lead to higher levels of income and employment. When a reporter asked Kennedy why he advocated a tax cut, Kennedy replied, "To stimulate the economy. Don't you remember your Economics 101?"

As Kennedy's economic advisers predicted, the passage of the tax cut was followed by an economic boom. Growth in real GDP was 5.3 percent in 1964 and 6.0 percent in 1965. The unemployment rate fell from 5.7 percent in 1963 to 5.2 percent in 1964 and then to 4.5 percent in 1965.

Economists continue to debate the source of this rapid growth in the early 1960s. A group called *supply-siders* argue that the economic boom resulted from the incentive effects of the cut in income tax rates. According to supply-siders, when workers are allowed to keep a higher fraction of their earnings, they supply substantially more labor and expand the aggregate supply of goods and services. Keynesians, however, emphasize the impact of tax cuts on aggregate demand. Most likely, there is some truth to both views: *Tax cuts stimulate aggregate supply by improving workers' incentives and expand aggregate demand by raising households' disposable income.*

When George W. Bush was elected president in 2000, a major element of his platform was a cut in income taxes. Bush and his advisers used both supply-side and Keynesian rhetoric to make the case for their policy. (Full disclosure: The author of this textbook was one of Bush's economic advisers from 2003 to 2005.) During the campaign, when the economy was doing fine, they argued that lower marginal tax rates would improve work incentives. But when the economy started to slow, and unemployment started to rise, the argument shifted to emphasize that the tax cut would stimulate spending and help the economy recover from the recession.

Congress passed major tax cuts in 2001 and 2003. After the second tax cut, the weak recovery from the 2001 recession turned into a robust one. Growth in real GDP was 4.4 percent in 2004. The unemployment rate fell from its peak of 6.3 percent in June 2003 to 5.4 percent in December 2004.

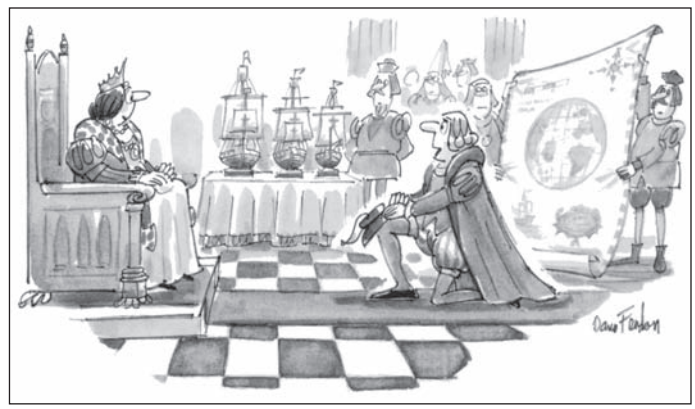
When President Bush signed the 2003 tax bill, he explained the measure using the logic of aggregate demand: "When people have more money, they can spend it on goods and services. And in our society, when they demand an additional good or a service, somebody will produce the good or a service. And when somebody produces that good or a service, it means somebody is more likely to be able to find a job." The explanation could have come from an exam in Economics 101. ■

CASE STUDY

Increasing Government Purchases to Stimulate the Economy: The Obama Spending Plan

When President Barack Obama took office in January 2009, the economy was suffering from a significant recession. (The causes of this recession are discussed in a Case Study in the next chapter and in more detail in Chapter 20.) Even before he was inaugurated, the president and his advisers proposed a sizable stimulus package to increase aggregate demand. As proposed, the package would cost the federal government about $800 billion, or about 5 percent of annual GDP. The package included some tax cuts and higher transfer payments, but much of it was made up of increases in government purchases of goods and services.

Professional economists debated the merits of the plan. Advocates of the Obama plan argued that increased spending was better than reduced taxes because, according to standard Keynesian theory, the government-purchases multiplier exceeds the tax multiplier. The reason for this difference is simple: when the government spends a dollar, that dollar gets spent, whereas when the government gives households a tax cut of a dollar, some of that dollar might be saved. According to an analysis by Obama administration economists, the government purchases multiplier is 1.57, whereas the tax multiplier is only 0.99. Thus, they argued that increased government spending on roads, schools, and other infrastructure was the better route to increase aggregate demand and create jobs. The logic here is quintessentially Keynesian: as the economy sinks into recession, the government is acting as the demander of last resort.



"Your Majesty, my voyage will not only forge a new route to the spices of the East but also create over three thousand new jobs."

The Obama stimulus proposal was controversial among economists for various reasons. One criticism was that the stimulus was not large enough given the apparent depth of the economic downturn. In March 2008, economist Paul Krugman wrote in the *New York Times*:

> The plan was too small and too cautious. . . . Employment has already fallen more in this recession than in the 1981–82 slump, considered the worst since the Great Depression. As a result, Mr. Obama's promise that his plan will create or save 3.5 million jobs by the end of 2010 looks underwhelming, to say the least. It's a credible promise—his economists used solidly mainstream estimates of the impacts of tax and spending policies. But 3.5 million jobs almost two years from now isn't enough in the face of an economy that has already lost 4.4 million jobs, and is losing 600,000 more each month.

Still other economists argued that despite the predictions of conventional Keynesian models, spending-based fiscal stimulus is not as effective as tax-based

initiatives. A recent study of fiscal policy since 1970 in countries that are members of the Organization for Economic Cooperation and Development (OECD) examined which kinds of fiscal stimulus have historically been most successful at promoting growth in economic activity. It found that successful fiscal stimulus relies almost entirely on cuts in business and income taxes, whereas failed fiscal stimulus relies primarily on increases in government spending.[5]

In addition, some economists thought that using infrastructure spending to promote employment might conflict with the goal of obtaining the infrastructure that was most needed. Here is how economist Gary Becker explained the concern on his blog:

> Putting new infrastructure spending in depressed areas like Detroit might have a big stimulating effect since infrastructure building projects in these areas can utilize some of the considerable unemployed resources there. However, many of these areas are also declining because they have been producing goods and services that are not in great demand, and will not be in demand in the future. Therefore, the overall value added by improving their roads and other infrastructure is likely to be a lot less than if the new infrastructure were located in growing areas that might have relatively little unemployment, but do have great demand for more roads, schools, and other types of long-term infrastructure.

In the end, Congress went ahead with President Obama's proposed stimulus plans with relatively minor modifications. The president signed the $787 billion bill on February 17, 2009. Did it work? The economy did recover from the recession, but much more slowly than the Obama administration economists initially forecast. Whether the slow recovery reflects the failure of stimulus policy or a sicker economy than the economists first appreciated is a question of continuing debate. ■

The Interest Rate, Investment, and the *IS* Curve

The Keynesian cross is only a stepping-stone on our path to the *IS–LM* model, which explains the economy's aggregate demand curve. The Keynesian cross is useful because it shows how the spending plans of households, firms, and the government determine the economy's income. Yet it makes the simplifying assumption that the level of planned investment I is fixed. As we discussed in Chapter 3, an important macroeconomic relationship is that planned investment depends on the interest rate r.

To add this relationship between the interest rate and investment to our model, we write the level of planned investment as

$$I = I(r).$$

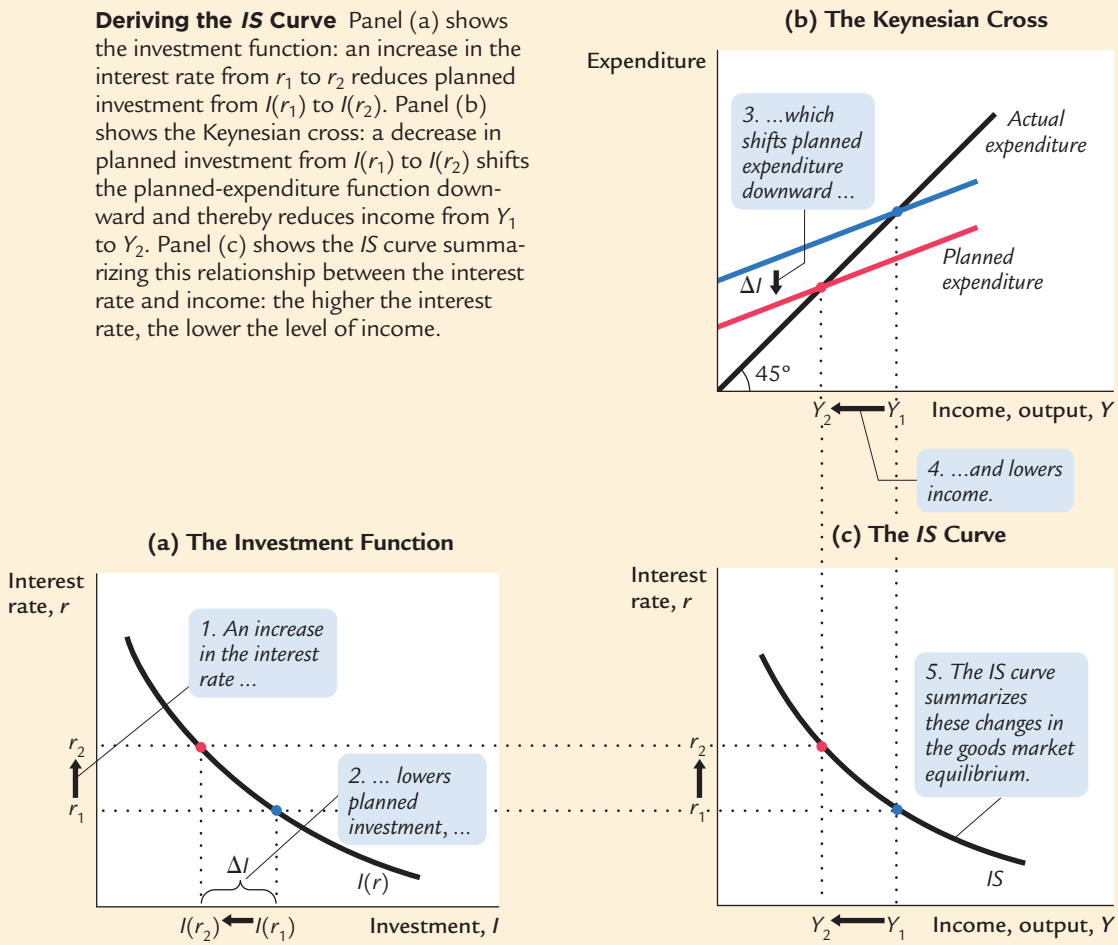
This investment function is graphed in panel (a) of Figure 11-7. Because the interest rate is the cost of borrowing to finance investment projects, an increase in the interest rate reduces planned investment. As a result, the investment function slopes downward.

To determine how income changes when the interest rate changes, we can combine the investment function with the Keynesian-cross diagram. Because

[5]Alberto Alesina and Silvia Ardagna, "Large Changes in Fiscal Policy: Taxes Versus Spending," *Tax Policy and the Economy* 24 (2010): 35-68.

FIGURE 11-7

Deriving the *IS* Curve Panel (a) shows the investment function: an increase in the interest rate from r_1 to r_2 reduces planned investment from $I(r_1)$ to $I(r_2)$. Panel (b) shows the Keynesian cross: a decrease in planned investment from $I(r_1)$ to $I(r_2)$ shifts the planned-expenditure function downward and thereby reduces income from Y_1 to Y_2. Panel (c) shows the *IS* curve summarizing this relationship between the interest rate and income: the higher the interest rate, the lower the level of income.



investment is inversely related to the interest rate, an increase in the interest rate from r_1 to r_2 reduces the quantity of investment from $I(r_1)$ to $I(r_2)$. The reduction in planned investment, in turn, shifts the planned-expenditure function downward, as in panel (b) of Figure 11-7. The shift in the planned-expenditure function causes the level of income to fall from Y_1 to Y_2. Hence, an increase in the interest rate lowers income.

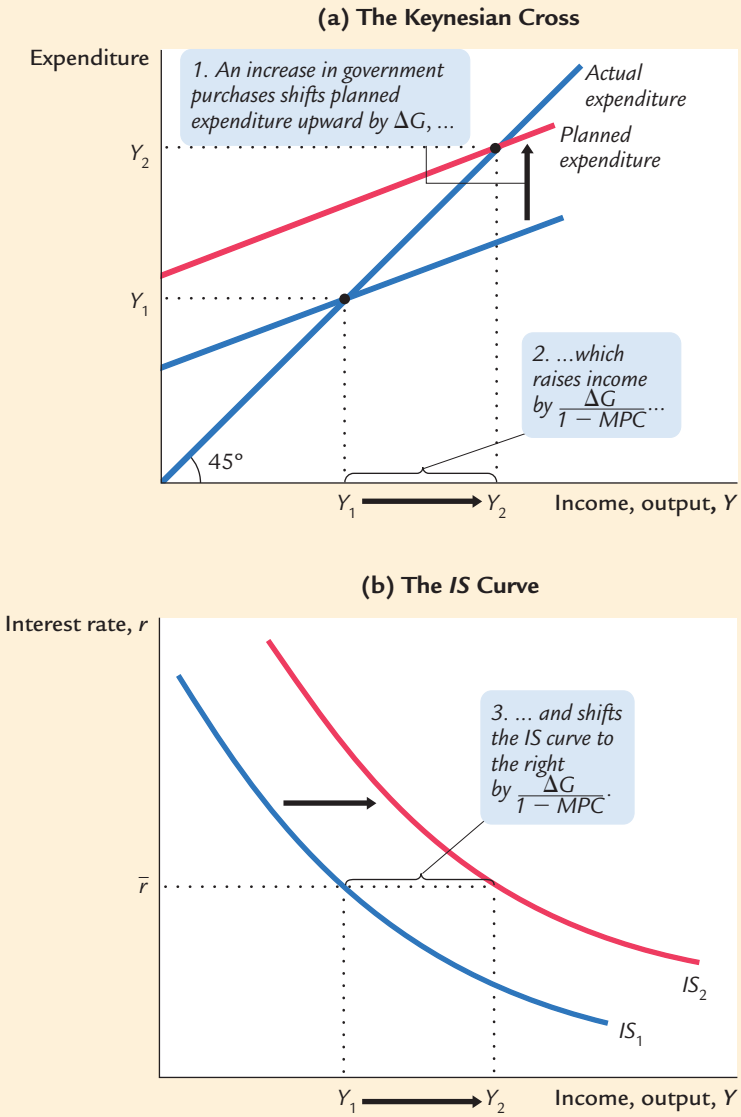
The *IS* curve, shown in panel (c) of Figure 11-7, summarizes this relationship between the interest rate and the level of income. In essence, the *IS* curve combines the interaction between r and I expressed by the investment function and the interaction between I and Y demonstrated by the Keynesian cross. Each point on the *IS* curve represents equilibrium in the goods market, and the curve illustrates how the equilibrium level of income depends on the interest rate. Because an increase in the interest rate causes planned investment to fall, which in turn causes equilibrium income to fall, the *IS* curve slopes downward.

How Fiscal Policy Shifts the *IS* Curve

The *IS* curve shows us, for any given interest rate, the level of income that brings the goods market into equilibrium. As we learned from the Keynesian cross, the equilibrium level of income also depends on government spending G and taxes T. The *IS* curve is drawn for a given fiscal policy; that is, when we construct the *IS* curve, we hold G and T fixed. When fiscal policy changes, the *IS* curve shifts.

Figure 11-8 uses the Keynesian cross to show how an increase in government purchases ΔG shifts the *IS* curve. This figure is drawn for a given interest rate $\bar{r}$ and thus for a given level of planned investment. The Keynesian cross in

FIGURE 11-8



An Increase in Government Purchases Shifts the *IS* Curve Outward Panel (a) shows that an increase in government purchases raises planned expenditure. For any given interest rate, the upward shift in planned expenditure of ΔG leads to an increase in income Y of $\Delta G/(1 - MPC)$. Therefore, in panel (b), the *IS* curve shifts to the right by this amount.

panel (a) shows that this change in fiscal policy raises planned expenditure and thereby increases equilibrium income from Y_1 to Y_2. Therefore, in panel (b), the increase in government purchases shifts the *IS* curve outward.

We can use the Keynesian cross to see how other changes in fiscal policy shift the *IS* curve. Because a decrease in taxes also expands expenditure and income, it, too, shifts the *IS* curve outward. A decrease in government purchases or an increase in taxes reduces income; therefore, such a change in fiscal policy shifts the *IS* curve inward.

In summary, the IS *curve shows the combinations of the interest rate and the level of income that are consistent with equilibrium in the market for goods and services. The* IS *curve is drawn for a given fiscal policy. Changes in fiscal policy that raise the demand for goods and services shift the* IS *curve to the right. Changes in fiscal policy that reduce the demand for goods and services shift the* IS *curve to the left.*

11-2 The Money Market and the *LM* Curve

The *LM* curve plots the relationship between the interest rate and the level of income that arises in the market for money balances. To understand this relationship, we begin by looking at a theory of the interest rate called the **theory of liquidity preference**.

The Theory of Liquidity Preference

In his classic work *The General Theory*, Keynes offered his view of how the interest rate is determined in the short run. His explanation is called the theory of liquidity preference because it posits that the interest rate adjusts to balance the supply and demand for the economy's most liquid asset—money. Just as the Keynesian cross is a building block for the *IS* curve, the theory of liquidity preference is a building block for the *LM* curve.

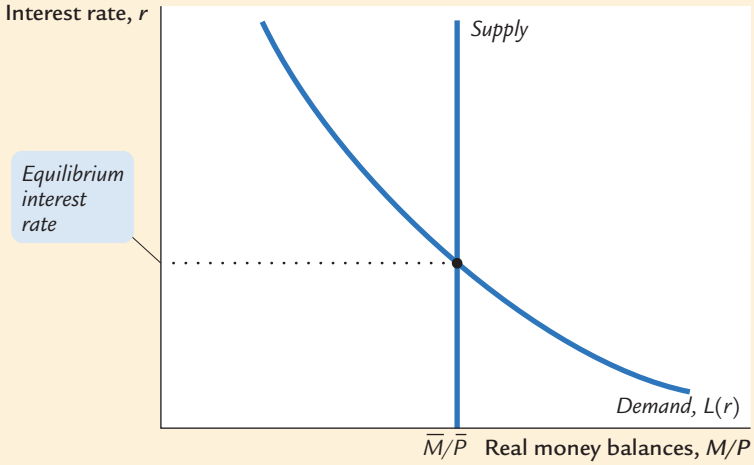
To develop this theory, we begin with the supply of real money balances. If M stands for the supply of money and P stands for the price level, then M/P is the supply of real money balances. The theory of liquidity preference assumes there is a fixed supply of real money balances. That is,

$$(M/P)^s = \overline{M}/\overline{P}.$$

The money supply M is an exogenous policy variable chosen by a central bank, such as the Federal Reserve. The price level P is also an exogenous variable in this model. (We take the price level as given because the *IS–LM* model—our ultimate goal in this chapter—explains the short run when the price level is fixed.) These assumptions imply that the supply of real money balances is fixed and, in particular, does not depend on the interest rate. Thus, when we plot the supply of real money balances against the interest rate in Figure 11-9, we obtain a vertical supply curve.

Next, consider the demand for real money balances. The theory of liquidity preference posits that the interest rate is one determinant of how much money people choose to hold. The underlying reason is that the interest rate is the

FIGURE 11-9



The Theory of Liquidity Preference The supply and demand for real money balances determine the interest rate. The supply curve for real money balances is vertical because the supply does not depend on the interest rate. The demand curve is downward sloping because a higher interest rate raises the cost of holding money and thus lowers the quantity demanded. At the equilibrium interest rate, the quantity of real money balances demanded equals the quantity supplied.

opportunity cost of holding money: it is what you forgo by holding some of your assets as money, which does not bear interest, instead of as interest-bearing bank deposits or bonds. When the interest rate rises, people want to hold less of their wealth in the form of money. We can write the demand for real money balances as

$$(M/P)^d = L(r),$$

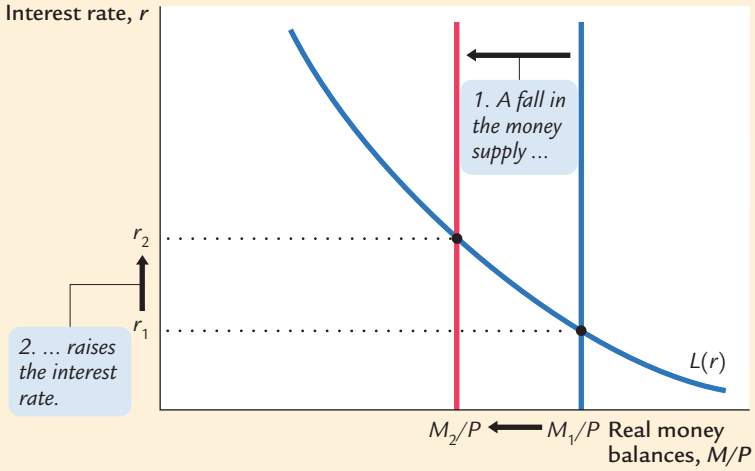
where the function $L(\ )$ shows that the quantity of money demanded depends on the interest rate. The demand curve in Figure 11-9 slopes downward because higher interest rates reduce the quantity of real money balances demanded.[6]

According to the theory of liquidity preference, the supply and demand for real money balances determine what interest rate prevails in the economy. That is, the interest rate adjusts to equilibrate the money market. As the figure shows, at the equilibrium interest rate, the quantity of real money balances demanded equals the quantity supplied.

How does the interest rate get to this equilibrium of money supply and money demand? The adjustment occurs because whenever the money market is not in equilibrium, people try to adjust their portfolios of assets and, in the process, alter the interest rate. For instance, if the interest rate is above the equilibrium level, the quantity of real money balances supplied exceeds the quantity demanded. Individuals holding the excess supply of money try to convert some of their

[6]Note that r is being used to denote the interest rate here, as it was in our discussion of the *IS* curve. More accurately, it is the nominal interest rate that determines money demand and the real interest rate that determines investment. To keep things simple, we are ignoring expected inflation, which creates the difference between the real and nominal interest rates. For short-run analysis, it is often realistic to assume that expected inflation is constant, in which case real and nominal interest rates move together. The role of expected inflation in the *IS–LM* model is explored in Chapter 12.

FIGURE 11-10



A Reduction in the Money Supply in the Theory of Liquidity Preference If the price level is fixed, a reduction in the money supply from M_1 to M_2 reduces the supply of real money balances. The equilibrium interest rate therefore rises from r_1 to r_2.

non-interest-bearing money into interest-bearing bank deposits or bonds. Banks and bond issuers, which prefer to pay lower interest rates, respond to this excess supply of money by lowering the interest rates they offer. Conversely, if the interest rate is below the equilibrium level, so that the quantity of money demanded exceeds the quantity supplied, individuals try to obtain money by selling bonds or making bank withdrawals. To attract now-scarcer funds, banks and bond issuers respond by increasing the interest rates they offer. Eventually, the interest rate reaches the equilibrium level, at which people are content with their portfolios of monetary and nonmonetary assets.

Now that we have seen how the interest rate is determined, we can use the theory of liquidity preference to show how the interest rate responds to changes in the supply of money. Suppose, for instance, that the Fed suddenly decreases the money supply. A fall in M reduces M/P because P is fixed in the model. The supply of real money balances shifts to the left, as in Figure 11-10. The equilibrium interest rate rises from r_1 to r_2, and the higher interest rate makes people satisfied to hold the smaller quantity of real money balances. The opposite would occur if the Fed had suddenly increased the money supply. Thus, according to the theory of liquidity preference, a decrease in the money supply raises the interest rate, and an increase in the money supply lowers the interest rate.

CASE STUDY

Does a Monetary Tightening Raise or Lower Interest Rates?

How does a tightening of monetary policy influence nominal interest rates? According to the theories we have been developing, the answer depends on the time horizon. Our analysis of the Fisher effect in Chapter 5 suggests that,

in the long run when prices are flexible, a reduction in money growth would lower inflation, and this in turn would lead to lower nominal interest rates. Yet the theory of liquidity preference predicts that, in the short run when prices are sticky, anti-inflationary monetary policy would lead to falling real money balances and higher interest rates.

Both conclusions are consistent with experience. A good illustration occurred during the early 1980s, when the U.S. economy saw the largest and quickest reduction in inflation in recent history.

Here's the background: By the late 1970s, inflation in the U.S. economy had reached the double-digit range and was a major national problem. In 1979 consumer prices were rising at a rate of 11.3 percent per year. In October of that year, only two months after becoming the chairman of the Federal Reserve, Paul Volcker decided that it was time to change course. He announced that monetary policy would aim to reduce the rate of inflation. This announcement began a period of tight money that, by 1983, brought the inflation rate down to about 3 percent.

Let's look at what happened to nominal interest rates. If we look at the period immediately after the October 1979 announcement of tighter monetary policy, we see a fall in real money balances and a rise in the interest rate—just as the theory of liquidity preference predicts. Nominal interest rates on three-month Treasury bills rose from 10 percent just before the October 1979 announcement to 12 percent in 1980 and 14 percent in 1981. Yet these high interest rates were only temporary. As Volcker's change in monetary policy lowered inflation and expectations of inflation, nominal interest rates gradually fell, reaching 6 percent in 1986.

This episode illustrates a general lesson: to understand the link between monetary policy and nominal interest rates, we need to keep in mind both the theory of liquidity preference and the Fisher effect. A monetary tightening leads to higher nominal interest rates in the short run and lower nominal interest rates in the long run. ■

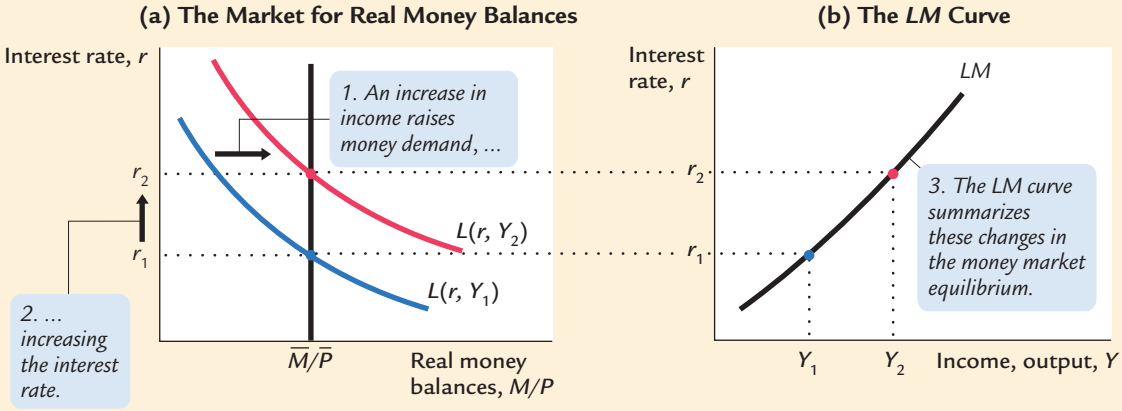
Income, Money Demand, and the *LM* Curve

Having developed the theory of liquidity preference as an explanation for how the interest rate is determined, we can now use the theory to derive the *LM* curve. We begin by considering the following question: how does a change in the economy's level of income Y affect the market for real money balances? The answer (which should be familiar from Chapter 5) is that the level of income affects the demand for money. When income is high, expenditure is high, so people engage in more transactions that require the use of money. Thus, greater income implies greater money demand. We can express these ideas by writing the money demand function as

$$(M/P)^d = L(r, Y).$$

The quantity of real money balances demanded is negatively related to the interest rate and positively related to income.

FIGURE 11-11



Deriving the *LM* Curve Panel (a) shows the market for real money balances: an increase in income from Y_1 to Y_2 raises the demand for money and thus raises the interest rate from r_1 to r_2. Panel (b) shows the *LM* curve summarizing this relationship between the interest rate and income: the higher the level of income, the higher the interest rate.

Using the theory of liquidity preference, we can figure out what happens to the equilibrium interest rate when the level of income changes. For example, consider what happens in Figure 11-11 when income increases from Y_1 to Y_2. As panel (a) illustrates, this increase in income shifts the money demand curve to the right. With the supply of real money balances unchanged, the interest rate must rise from r_1 to r_2 to equilibrate the money market. Therefore, according to the theory of liquidity preference, higher income leads to a higher interest rate.

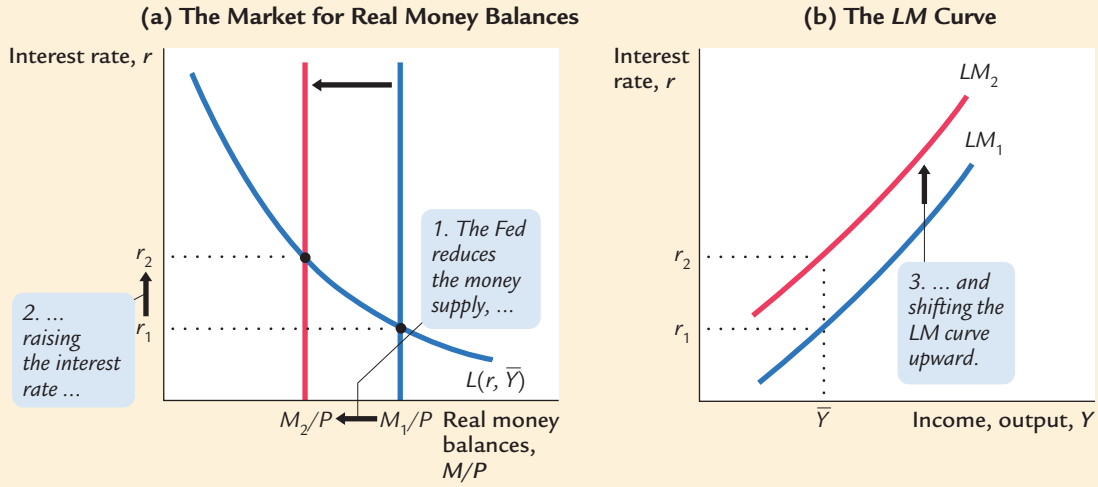
The *LM* curve shown in panel (b) of Figure 11-11 summarizes this relationship between the level of income and the interest rate. Each point on the *LM* curve represents equilibrium in the money market, and the curve illustrates how the equilibrium interest rate depends on the level of income. The higher the level of income, the higher the demand for real money balances, and the higher the equilibrium interest rate. For this reason, the *LM* curve slopes upward.

How Monetary Policy Shifts the *LM* Curve

The *LM* curve tells us the interest rate that equilibrates the money market at any level of income. Yet, as we saw earlier, the equilibrium interest rate also depends on the supply of real money balances M/P. This means that the *LM* curve is drawn for a *given* supply of real money balances. If real money balances change—for example, if the Fed alters the money supply—the *LM* curve shifts.

We can use the theory of liquidity preference to understand how monetary policy shifts the *LM* curve. Suppose that the Fed decreases the money supply

FIGURE 11-12



A Reduction in the Money Supply Shifts the *LM* Curve Upward Panel (a) shows that for any given level of income $\bar{Y}$, a reduction in the money supply raises the interest rate that equilibrates the money market. Therefore, the *LM* curve in panel (b) shifts upward.

from M_1 to M_2, which causes the supply of real money balances to fall from M_1/P to M_2/P. Figure 11-12 shows what happens. Holding constant the amount of income and thus the demand curve for real money balances, we see that a reduction in the supply of real money balances raises the interest rate that equilibrates the money market. Hence, a decrease in the money supply shifts the *LM* curve upward.

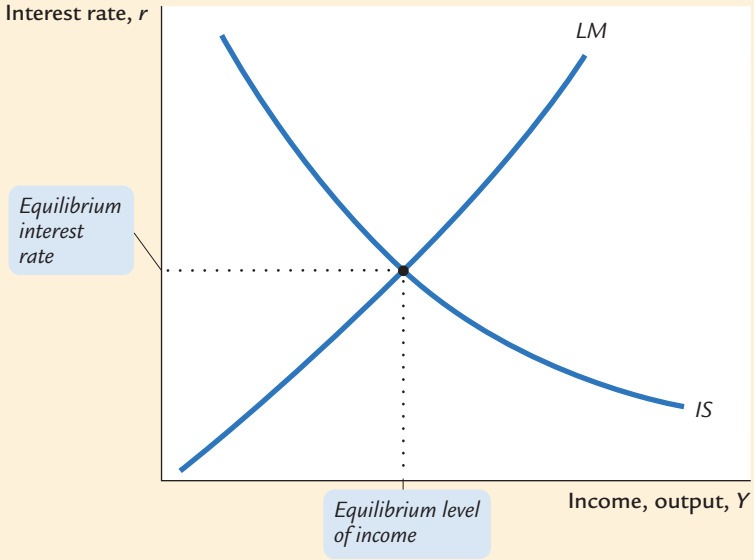
In summary, the LM *curve shows the combinations of the interest rate and the level of income that are consistent with equilibrium in the market for real money balances. The* LM *curve is drawn for a given supply of real money balances. Decreases in the supply of real money balances shift the* LM *curve upward. Increases in the supply of real money balances shift the* LM *curve downward.*

11-3 Conclusion: The Short-Run Equilibrium

We now have all the pieces of the *IS–LM* model. The two equations of this model are

$$Y = C(Y - T) + I(r) + G \qquad IS,$$
$$M/P = L(r, Y) \qquad LM.$$

FIGURE 11-13



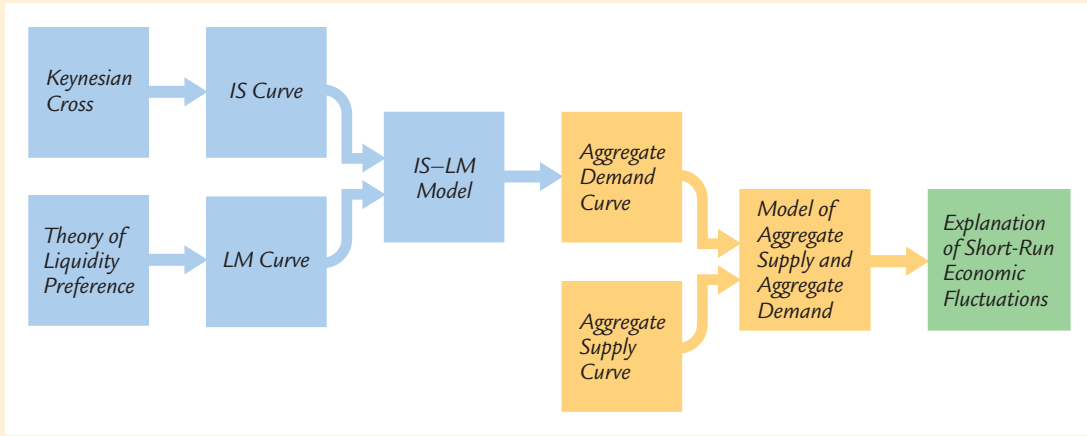
Equilibrium in the *IS–LM* Model The intersection of the *IS* and *LM* curves represents simultaneous equilibrium in the market for goods and services and in the market for real money balances for given values of government spending, taxes, the money supply, and the price level.

The model takes fiscal policy G and T, monetary policy M, and the price level P as exogenous. Given these exogenous variables, the *IS* curve provides the combinations of r and Y that satisfy the equation representing the goods market, and the *LM* curve provides the combinations of r and Y that satisfy the equation representing the money market. These two curves are shown together in Figure 11-13.

The equilibrium of the economy is the point at which the *IS* curve and the *LM* curve cross. This point gives the interest rate r and the level of income Y that satisfy conditions for equilibrium in both the goods market and the money market. In other words, at this intersection, actual expenditure equals planned expenditure, and the demand for real money balances equals the supply.

As we conclude this chapter, let's recall that our ultimate goal in developing the *IS–LM* model is to analyze short-run fluctuations in economic activity. Figure 11-14 illustrates how the different pieces of our theory fit together. In this chapter we developed the Keynesian cross and the theory of liquidity preference as building blocks for the *IS–LM* model. As we see more fully in the next chapter, the *IS–LM* model helps explain the position and slope of the aggregate demand curve. The aggregate demand curve, in turn, is a piece of the model of aggregate supply and aggregate demand, which economists use to explain the short-run effects of policy changes and other events on national income.

FIGURE 11-14



The Theory of Short-Run Fluctuations This schematic diagram shows how the different pieces of the theory of short-run fluctuations fit together. The Keynesian cross explains the *IS* curve, and the theory of liquidity preference explains the *LM* curve. The *IS* and *LM* curves together yield the *IS–LM* model, which explains the aggregate demand curve. The aggregate demand curve is part of the model of aggregate supply and aggregate demand, which economists use to explain short-run fluctuations in economic activity.

Summary

1. The Keynesian cross is a basic model of income determination. It takes fiscal policy and planned investment as exogenous and then shows that there is one level of national income at which actual expenditure equals planned expenditure. It shows that changes in fiscal policy have a multiplied impact on income.
2. Once we allow planned investment to depend on the interest rate, the Keynesian cross yields a relationship between the interest rate and national income. A higher interest rate lowers planned investment, and this in turn lowers national income. The downward-sloping *IS* curve summarizes this negative relationship between the interest rate and income.
3. The theory of liquidity preference is a basic model of the determination of the interest rate. It takes the money supply and the price level as exogenous and assumes that the interest rate adjusts to equilibrate the supply and demand for real money balances. The theory implies that increases in the money supply lower the interest rate.
4. Once we allow the demand for real money balances to depend on national income, the theory of liquidity preference yields a relationship between

income and the interest rate. A higher level of income raises the demand for real money balances, and this in turn raises the interest rate. The upward-sloping *LM* curve summarizes this positive relationship between income and the interest rate.

5. The *IS–LM* model combines the elements of the Keynesian cross and the elements of the theory of liquidity preference. The *IS* curve shows the points that satisfy equilibrium in the goods market, and the *LM* curve shows the points that satisfy equilibrium in the money market. The intersection of the *IS* and *LM* curves shows the interest rate and income that satisfy equilibrium in both markets for a given price level.

KEY CONCEPTS

IS–LM model
IS curve
LM curve
Keynesian cross
Government-purchases multiplier
Tax multiplier
Theory of liquidity preference

QUESTIONS FOR REVIEW

1. Use the Keynesian cross to explain why fiscal policy has a multiplied effect on national income.
2. Use the theory of liquidity preference to explain why an increase in the money supply lowers the interest rate. What does this explanation assume about the price level?
3. Why does the *IS* curve slope downward?
4. Why does the *LM* curve slope upward?

PROBLEMS AND APPLICATIONS

1. Use the Keynesian cross to predict the impact on equilibrium GDP of the following. In each case, state the direction of the change and give a formula for the size of the impact.
   a. An increase in government purchases
   b. An increase in taxes
   c. Equal-sized increases in both government purchases and taxes
2. In the Keynesian cross, assume that the consumption function is given by

$$C = 200 + 0.75\ (Y - T).$$

   Planned investment is 100; government purchases and taxes are both 100.
   a. Graph planned expenditure as a function of income.
   b. What is the equilibrium level of income?
   c. If government purchases increase to 125, what is the new equilibrium income?
   d. What level of government purchases is needed to achieve an income of 1,600?
3. Although our development of the Keynesian cross in this chapter assumes that taxes are a

fixed amount, most countries levy some taxes that rise automatically with national income. (Examples in the United States include the income tax and the payroll tax.) Let's represent the tax system by writing tax revenue as

$$T = \overline{T} + tY,$$

where $\overline{T}$ and t are parameters of the tax code. The parameter t is the marginal tax rate: if income rises by \$1, taxes rise by $t \times \$1$.

a. How does this tax system change the way consumption responds to changes in GDP?

b. In the Keynesian cross, how does this tax system alter the government-purchases multiplier?

c. In the *IS–LM* model, how does this tax system alter the slope of the *IS* curve?

4. Consider the impact of an increase in thriftiness in the Keynesian cross. Suppose the consumption function is

$$C = \overline{C} + c(Y - T),$$

where $\overline{C}$ is a parameter called *autonomous consumption* and c is the marginal propensity to consume.

a. What happens to equilibrium income when the society becomes more thrifty, as represented by a decline in $\overline{C}$?

b. What happens to equilibrium saving?

c. Why do you suppose this result is called the *paradox of thrift*?

d. Does this paradox arise in the classical model of Chapter 3? Why or why not?

5. Suppose that the money demand function is

$$(M/P)^d = 1{,}000 - 100r,$$

where r is the interest rate in percent. The money supply M is 1,000 and the price level P is 2.

a. Graph the supply and demand for real money balances.

b. What is the equilibrium interest rate?

c. Assume that the price level is fixed. What happens to the equilibrium interest rate if the supply of money is raised from 1,000 to 1,200?

d. If the Fed wishes to raise the interest rate to 7 percent, what money supply should it set?

6. The following equations describe an economy.

$$\begin{aligned} Y &= C + I + G. \\ C &= 120 + 0.5(Y - T). \\ I &= 100 - 10r. \\ G &= 50. \\ T &= 40. \\ (M/P)^d &= Y - 20r. \\ M &= 600. \\ P &= 2. \end{aligned}$$

a. Identify each of the variables and briefly explain their meaning.

b. From the above list, use the relevant set of equations to derive the *IS* curve. Graph the *IS* curve on an appropriately labeled graph.

c. From the above list, use the relevant set of equations to derive the *LM* curve. Graph the *LM* curve on the same graph you used in part (b).

d. What are the equilibrium level of income and equilibrium interest rate?

Aggregate Demand II: Applying the *IS–LM* Model

> *Science is a parasite: the greater the patient population the better the advance in physiology and pathology; and out of pathology arises therapy. The year 1932 was the trough of the great depression, and from its rotten soil was belatedly begot a new subject that today we call macroeconomics.*
>
> —*Paul Samuelson*

In Chapter 11 we assembled the pieces of the *IS–LM* model as a step toward understanding short-run economic fluctuations. We saw that the *IS* curve represents the equilibrium in the market for goods and services, that the *LM* curve represents the equilibrium in the market for real money balances, and that the *IS* and *LM* curves together determine the interest rate and national income in the short run when the price level is fixed. Now we turn our attention to applying the *IS–LM* model to analyze three issues.

First, we examine the potential causes of fluctuations in national income. We use the *IS–LM* model to see how changes in the exogenous variables (government purchases, taxes, and the money supply) influence the endogenous variables (the interest rate and national income) for a given price level. We also examine how various shocks to the goods market (the *IS* curve) and the money market (the *LM* curve) affect the interest rate and national income in the short run.

Second, we discuss how the *IS–LM* model fits into the model of aggregate supply and aggregate demand we introduced in Chapter 10. In particular, we examine how the *IS–LM* model provides a theory to explain the slope and position of the aggregate demand curve. Here we relax the assumption that the price level is fixed and show that the *IS–LM* model implies a negative relationship between the price level and national income. The model can also tell us what events shift the aggregate demand curve and in what direction.

Third, we examine the Great Depression of the 1930s. As this chapter's opening quotation indicates, this episode gave birth to short-run macroeconomic theory, for it led Keynes and his many followers to argue that aggregate demand was the key to understanding fluctuations in national income. With the benefit of hindsight, we can use the *IS–LM* model to discuss the various explanations of this traumatic economic downturn.

The *IS–LM* model has played a central role in the history of economic thought, and it offers a powerful lens through which to view economic history,

but it has much modern significance as well. Throughout this chapter we will see that the model can also be used to shed light on more recent fluctuations in the economy; two case studies in the chapter use it to examine the recessions that began in 2001 and 2008. Moreover, as we will see in Chapter 15, the logic of the *IS–LM* model provides a good foundation for understanding newer and more sophisticated theories of the business cycle.

12-1 Explaining Fluctuations With the *IS–LM* Model

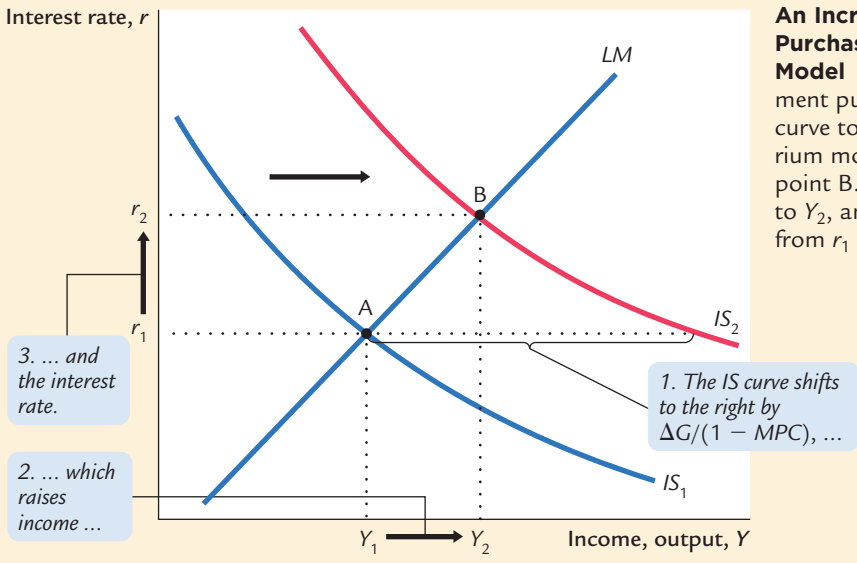
The intersection of the *IS* curve and the *LM* curve determines the level of national income. When one of these curves shifts, the short-run equilibrium of the economy changes, and national income fluctuates. In this section we examine how changes in policy and shocks to the economy can cause these curves to shift.

How Fiscal Policy Shifts the *IS* Curve and Changes the Short-Run Equilibrium

We begin by examining how changes in fiscal policy (government purchases and taxes) alter the economy's short-run equilibrium. Recall that changes in fiscal policy influence planned expenditure and thereby shift the *IS* curve. The *IS–LM* model shows how these shifts in the *IS* curve affect income and the interest rate.

Changes in Government Purchases Consider an increase in government purchases of ΔG. The government-purchases multiplier in the Keynesian cross tells us that this change in fiscal policy raises the level of income at any given interest rate by $\Delta G/(1 - MPC)$. Therefore, as Figure 12-1 shows, the *IS* curve

FIGURE 12-1



An Increase in Government Purchases in the *IS–LM* Model An increase in government purchases shifts the *IS* curve to the right. The equilibrium moves from point A to point B. Income rises from Y_1 to Y_2, and the interest rate rises from r_1 to r_2.

shifts to the right by this amount. The equilibrium of the economy moves from point A to point B. The increase in government purchases raises both income and the interest rate.

To understand fully what's happening in Figure 12-1, it helps to keep in mind the building blocks for the *IS–LM* model from the preceding chapter—the Keynesian cross and the theory of liquidity preference. Here is the story. When the government increases its purchases of goods and services, the economy's planned expenditure rises. The increase in planned expenditure stimulates the production of goods and services, which causes total income Y to rise. These effects should be familiar from the Keynesian cross.

Now consider the money market, as described by the theory of liquidity preference. Because the economy's demand for money depends on income, the rise in total income increases the quantity of money demanded at every interest rate. The supply of money, however, has not changed, so higher money demand causes the equilibrium interest rate r to rise.

The higher interest rate arising in the money market, in turn, has ramifications back in the goods market. When the interest rate rises, firms cut back on their investment plans. This fall in investment partially offsets the expansionary effect of the increase in government purchases. Thus, the increase in income in response to a fiscal expansion is smaller in the *IS–LM* model than it is in the Keynesian cross (where investment is assumed to be fixed). You can see this in Figure 12-1. The horizontal shift in the *IS* curve equals the rise in equilibrium income in the Keynesian cross. This amount is larger than the increase in equilibrium income here in the *IS–LM* model. The difference is explained by the crowding out of investment due to a higher interest rate.

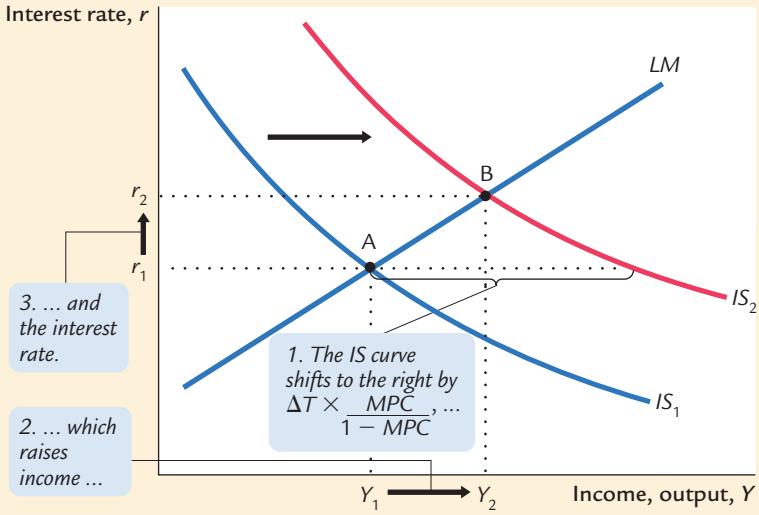
Changes in Taxes In the *IS–LM* model, changes in taxes affect the economy much the same as changes in government purchases do, except that taxes affect expenditure through consumption. Consider, for instance, a decrease in taxes of ΔT. The tax cut encourages consumers to spend more and, therefore, increases planned expenditure. The tax multiplier in the Keynesian cross tells us that this change in policy raises the level of income at any given interest rate by $\Delta T \times MPC/(1 - MPC)$. Therefore, as Figure 12-2 illustrates, the *IS* curve shifts to the right by this amount. The equilibrium of the economy moves from point A to point B. The tax cut raises both income and the interest rate. Once again, because the higher interest rate depresses investment, the increase in income is smaller in the *IS–LM* model than it is in the Keynesian cross.

How Monetary Policy Shifts the *LM* Curve and Changes the Short-Run Equilibrium

We now examine the effects of monetary policy. Recall that a change in the money supply alters the interest rate that equilibrates the money market for any given level of income and, thus, shifts the *LM* curve. The *IS–LM* model shows how a shift in the *LM* curve affects income and the interest rate.

Consider an increase in the money supply. An increase in M leads to an increase in real money balances M/P because the price level P is fixed in the short run. The theory of liquidity preference shows that for any given level of

FIGURE 12-2

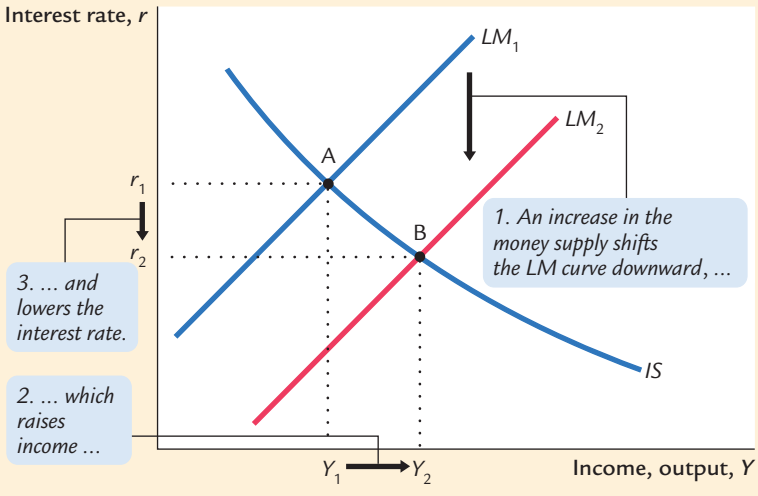


A Decrease in Taxes in the *IS–LM* Model A decrease in taxes shifts the *IS* curve to the right. The equilibrium moves from point A to point B. Income rises from Y_1 to Y_2, and the interest rate rises from r_1 to r_2.

income, an increase in real money balances leads to a lower interest rate. Therefore, the *LM* curve shifts downward, as in Figure 12-3. The equilibrium moves from point A to point B. The increase in the money supply lowers the interest rate and raises the level of income.

Once again, to tell the story that explains the economy's adjustment from point A to point B, we rely on the building blocks of the *IS–LM* model—the Keynesian cross and the theory of liquidity preference. This time, we begin with the money market, where the monetary-policy action occurs. When the

FIGURE 12-3



An Increase in the Money Supply in the *IS–LM* Model An increase in the money supply shifts the *LM* curve downward. The equilibrium moves from point A to point B. Income rises from Y_1 to Y_2, and the interest rate falls from r_1 to r_2.

Federal Reserve increases the supply of money, people have more money than they want to hold at the prevailing interest rate. As a result, they start depositing this extra money in banks or using it to buy bonds. The interest rate r then falls until people are willing to hold all the extra money that the Fed has created; this brings the money market to a new equilibrium. The lower interest rate, in turn, has ramifications for the goods market. A lower interest rate stimulates planned investment, which increases planned expenditure, production, and income Y.

Thus, the *IS–LM* model shows that monetary policy influences income by changing the interest rate. This conclusion sheds light on our analysis of monetary policy in Chapter 10. In that chapter we showed that in the short run, when prices are sticky, an expansion in the money supply raises income. But we did not discuss *how* a monetary expansion induces greater spending on goods and services—a process called the **monetary transmission mechanism**. The *IS–LM* model shows an important part of that mechanism: *An increase in the money supply lowers the interest rate, which stimulates investment and thereby expands the demand for goods and services*. The next chapter shows that in open economies, the exchange rate also has a role in the monetary transmission mechanism; for large economies such as that of the United States, however, the interest rate has the leading role.

The Interaction Between Monetary and Fiscal Policy

When analyzing any change in monetary or fiscal policy, it is important to keep in mind that the policymakers who control these policy tools are aware of what the other policymakers are doing. A change in one policy, therefore, may influence the other, and this interdependence may alter the impact of a policy change.

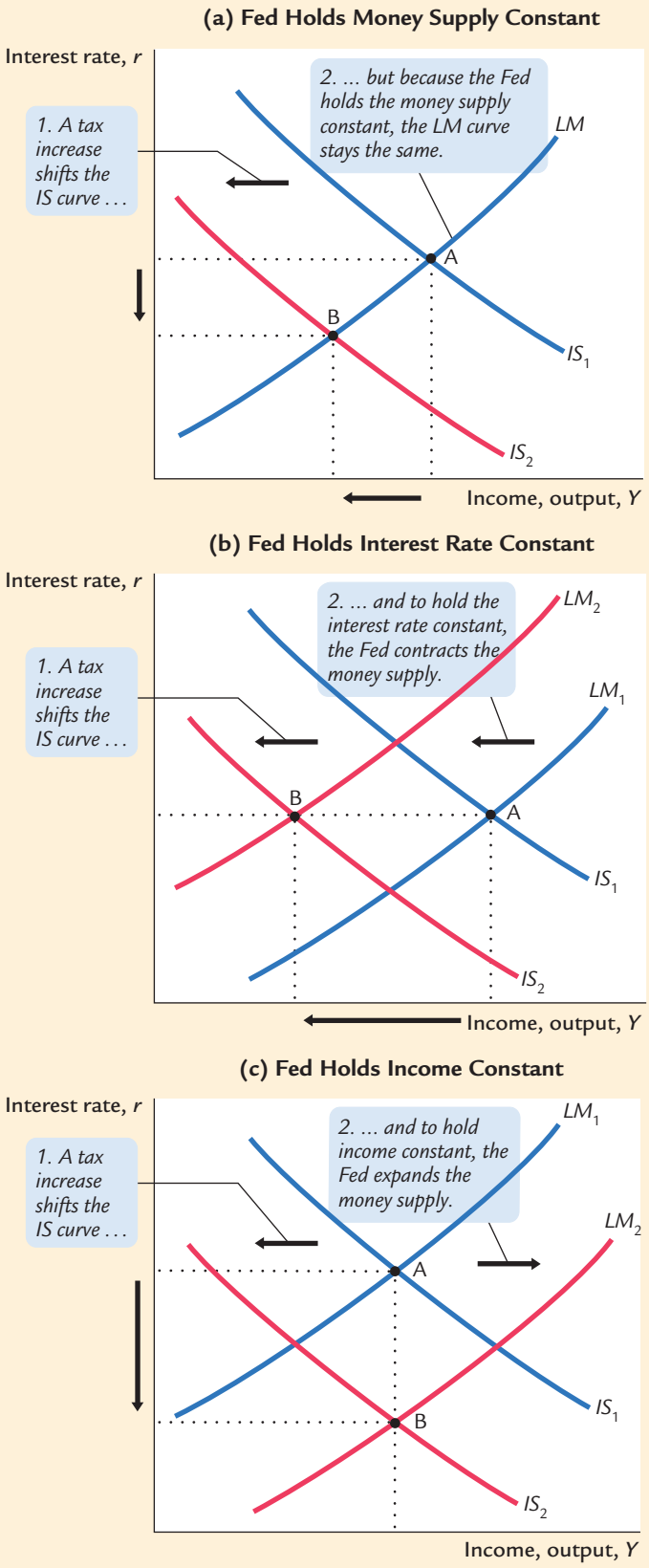
For example, suppose Congress raises taxes. What effect will this policy have on the economy? According to the *IS–LM* model, the answer depends on how the Fed responds to the tax increase.

Figure 12-4 shows three of the many possible outcomes. In panel (a), the Fed holds the money supply constant. The tax increase shifts the *IS* curve to the left. Income falls (because higher taxes reduce consumer spending), and the interest rate falls (because lower income reduces the demand for money). The fall in income indicates that the tax hike causes a recession.

In panel (b), the Fed wants to hold the interest rate constant. In this case, when the tax increase shifts the *IS* curve to the left, the Fed must decrease the money supply to keep the interest rate at its original level. This fall in the money supply shifts the *LM* curve upward. The interest rate does not fall, but income falls by a larger amount than if the Fed had held the money supply constant. Whereas in panel (a) the lower interest rate stimulated investment and partially offset the contractionary effect of the tax hike, in panel (b) the Fed deepens the recession by keeping the interest rate high.

In panel (c), the Fed wants to prevent the tax increase from lowering income. It must, therefore, raise the money supply and shift the *LM* curve downward enough to offset the shift in the *IS* curve. In this case, the tax increase does not cause a recession, but it does cause a large fall in the interest rate. Although the level of income is not changed, the combination of a tax increase and a monetary expansion does change the allocation of the economy's resources. The higher

FIGURE 12-4



The Response of the Economy to a Tax Increase How the economy responds to a tax increase depends on how the central bank responds. In panel (a) the Fed holds the money supply constant. In panel (b) the Fed holds the interest rate constant by reducing the money supply. In panel (c) the Fed holds the level of income constant by raising the money supply. In each case, the economy moves from point A to point B.

taxes depress consumption, while the lower interest rate stimulates investment. Income is not affected because these two effects exactly balance.

From this example we can see that the impact of a change in fiscal policy depends on the policy the Fed pursues—that is, on whether it holds the money supply, the interest rate, or the level of income constant. More generally, whenever analyzing a change in one policy, we must make an assumption about its effect on the other policy. The most appropriate assumption depends on the case at hand and the many political considerations that lie behind economic policymaking.

CASE STUDY

Policy Analysis With Macroeconometric Models

The *IS–LM* model shows how monetary and fiscal policy influence the equilibrium level of income. The predictions of the model, however, are qualitative, not quantitative. The *IS–LM* model shows that increases in government purchases raise GDP and that increases in taxes lower GDP. But when economists analyze specific policy proposals, they need to know not only the direction of the effect but also the size. For example, if Congress increases taxes by $100 billion and if monetary policy is not altered, how much will GDP fall? To answer this question, economists need to go beyond the graphical representation of the *IS–LM* model.

Macroeconometric models of the economy provide one way to evaluate policy proposals. A *macroeconometric model* is a model that describes the economy quantitatively, rather than just qualitatively. Many of these models are essentially more complicated and more realistic versions of our *IS–LM* model. The economists who build macroeconometric models use historical data to estimate parameters such as the marginal propensity to consume, the sensitivity of investment to the interest rate, and the sensitivity of money demand to the interest rate. Once a model is built, economists can simulate the effects of alternative policies with the help of a computer.

When interpreting such an exercise, it is important to keep in mind that the results of such a computer simulation are only as good as the macroeconometric model being simulated. In judging such a model, various questions arise. What assumptions did the model builders make in constructing the model? Are these assumptions appropriate for the issue at hand, or were crucial factors ignored? What data were used to estimate the key parameters? How reliable are these data? Were the statistical techniques used to analyze the data and estimate the parameters the right ones for the task? How precise are the results? Only after addressing these questions can an economist judge how much confidence to put in a model's output.

Table 12-1 shows the fiscal-policy multipliers implied by one prominent macroeconometric model, the Data Resources Incorporated (DRI) model, named for the economic forecasting firm that developed it. The multipliers are given for two assumptions about how the Fed might respond to changes in fiscal policy.

One assumption about monetary policy is that the Fed keeps the nominal interest rate constant. That is, when fiscal policy shifts the *IS* curve to the right or to the left, the Fed adjusts the money supply to shift the *LM* curve in the same direction. Because there is no crowding out of investment due to a changing interest rate, the fiscal-policy multipliers are similar to those from the Keynesian cross. The DRI

TABLE 12-1

The Fiscal-Policy Multipliers in the DRI Model

Assumption About Monetary Policy	Value of Multipliers $\Delta Y/\Delta G$	$\Delta Y/\Delta T$
Nominal interest rate held constant	1.93	−1.19
Money supply held constant	0.60	−0.26

Note: This table gives the fiscal-policy multipliers for a sustained change in government purchases or in personal income taxes. These multipliers are for the fourth quarter after the policy change is made.
Source: Otto Eckstein, *The DRI Model of the U.S. Economy* (New York: McGraw-Hill, 1983), 169.

model indicates that, in this case, the government-purchases multiplier is 1.93, and the tax multiplier is –1.19. That is, a $100 billion increase in government purchases raises GDP by $193 billion, and a $100 billion increase in taxes lowers GDP by $119 billion.

The second assumption about monetary policy is that the Fed keeps the money supply constant so that the *LM* curve does not shift. In this case, the interest rate rises, and investment is crowded out, so the multipliers are much smaller. The government-purchases multiplier is only 0.60, and the tax multiplier is only –0.26. That is, a $100 billion increase in government purchases raises GDP by $60 billion, and a $100 billion increase in taxes lowers GDP by $26 billion.

Table 12-1 shows that the fiscal-policy multipliers are very different under the two assumptions about monetary policy. The impact of any change in fiscal policy depends crucially on how the Fed responds to that change. ■

Shocks in the *IS–LM* Model

Because the *IS–LM* model shows how national income is determined in the short run, we can use the model to examine how various economic disturbances affect income. So far we have seen how changes in fiscal policy shift the *IS* curve and how changes in monetary policy shift the *LM* curve. Similarly, we can group other disturbances into two categories: shocks to the *IS* curve and shocks to the *LM* curve.

Shocks to the *IS* curve are exogenous changes in the demand for goods and services. Some economists, including Keynes, have emphasized that such changes in demand can arise from investors' *animal spirits*—exogenous and perhaps self-fulfilling waves of optimism and pessimism. For example, suppose that firms become pessimistic about the future of the economy and that this pessimism causes them to build fewer new factories. This reduction in the demand for investment goods causes a contractionary shift in the investment function: at every interest rate, firms want to invest less. The fall in investment reduces planned expenditure and shifts the *IS* curve to the left, reducing income and employment. This fall in equilibrium income in part validates the firms' initial pessimism.

Shocks to the *IS* curve may also arise from changes in the demand for consumer goods. Suppose, for instance, that the election of a popular president increases

consumer confidence in the economy. This induces consumers to save less for the future and consume more today. We can interpret this change as an upward shift in the consumption function. This shift in the consumption function increases planned expenditure and shifts the *IS* curve to the right, and this raises income.

Shocks to the *LM* curve arise from exogenous changes in the demand for money. For example, suppose that new restrictions on credit card availability increase the amount of money people choose to hold. According to the theory of liquidity preference, when money demand rises, the interest rate necessary to equilibrate the money market is higher (for any given level of income and money supply). Hence, an increase in money demand shifts the *LM* curve upward, which tends to raise the interest rate and depress income.

In summary, several kinds of events can cause economic fluctuations by shifting the *IS* curve or the *LM* curve. Remember, however, that such fluctuations are not inevitable. Policymakers can try to use the tools of monetary and fiscal policy to offset exogenous shocks. If policymakers are sufficiently quick and skillful (admittedly, a big if), shocks to the *IS* or *LM* curves need not lead to fluctuations in income or employment.

CASE STUDY

The U.S. Recession of 2001

In 2001, the U.S. economy experienced a pronounced slowdown in economic activity. The unemployment rate rose from 3.9 percent in September 2000 to 4.9 percent in August 2001, and then to 6.3 percent in June 2003. In many ways, the slowdown looked like a typical recession driven by a fall in aggregate demand.

Three notable shocks explain this event. The first was a decline in the stock market. During the 1990s, the stock market experienced a boom of historic proportions, as investors became optimistic about the prospects of the new information technology. Some economists viewed the optimism as excessive at the time, and in hindsight this proved to be the case. When the optimism faded, average stock prices fell by about 25 percent from August 2000 to August 2001. The fall in the market reduced household wealth and thus consumer spending. In addition, the declining perceptions of the profitability of the new technologies led to a fall in investment spending. In the language of the *IS–LM* model, the *IS* curve shifted to the left.

The second shock was the terrorist attacks on New York City and Washington, D.C., on September 11, 2001. In the week after the attacks, the stock market fell another 12 percent, which at the time was the biggest weekly loss since the Great Depression of the 1930s. Moreover, the attacks increased uncertainty about what the future would hold. Uncertainty can reduce spending because households and firms postpone some of their plans until the uncertainty is resolved. Thus, the terrorist attacks shifted the *IS* curve farther to the left.

The third shock was a series of accounting scandals at some of the nation's most prominent corporations, including Enron and WorldCom. The result of these scandals was the bankruptcy of some companies that had fraudulently represented themselves as more profitable than they truly were, criminal convictions for the executives who had been responsible for the fraud, and new laws aimed at regulating corporate accounting standards more thoroughly. These events further depressed stock prices and discouraged business investment—a third leftward shift in the *IS* curve.

Fiscal and monetary policymakers responded quickly to these events. Congress passed a major tax cut in 2001, including an immediate tax rebate, and a second major tax cut in 2003. One goal of these tax cuts was to stimulate consumer spending. (See the Case Study on Cutting Taxes in Chapter 11.) In addition, after the terrorist attacks, Congress increased government spending by appropriating funds to assist in New York's recovery and to bail out the ailing airline industry. These fiscal measures shifted the *IS* curve to the right.

At the same time, the Federal Reserve pursued expansionary monetary policy, shifting the *LM* curve to the right. Money growth accelerated, and interest rates fell. The interest rate on three-month Treasury bills fell from 6.4 percent in November 2000 to 3.3 percent in August 2001, just before the terrorist attacks. After the attacks and corporate scandals hit the economy, the Fed increased its monetary stimulus, and the Treasury bill rate fell to 0.9 percent in July 2003—the lowest level in many decades.

Expansionary monetary and fiscal policy had the intended effects. Economic growth picked up in the second half of 2003 and was strong throughout 2004. By July 2005, the unemployment rate was back down to 5.0 percent, and it stayed at or below that level for the next several years. Unemployment would begin rising again in 2008, however, when the economy experienced another recession. The causes of the 2008 recession are examined in another Case Study later in this chapter. ■

What Is the Fed's Policy Instrument—The Money Supply or the Interest Rate?

Our analysis of monetary policy has been based on the assumption that the Fed influences the economy by controlling the money supply. By contrast, when the media report on changes in Fed policy, they often just say that the Fed has raised or lowered interest rates. Which is right? Even though these two views may seem different, both are correct, and it is important to understand why.

In recent years, the Fed has used the *federal funds rate*—the interest rate that banks charge one another for overnight loans—as its short-term policy instrument. When the Federal Open Market Committee meets every six weeks to set monetary policy,

it votes on a target for this interest rate that will apply until the next meeting. After the meeting is over, the Fed's bond traders (who are located in New York) are told to conduct the open-market operations necessary to hit that target. These open-market operations change the money supply and shift the *LM* curve so that the equilibrium interest rate (determined by the intersection of the *IS* and *LM* curves) equals the target interest rate that the Federal Open Market Committee has chosen.

As a result of this operating procedure, Fed policy is often discussed in terms of changing interest rates. Keep in mind, however, that behind these changes in interest rates are the necessary changes in the money supply. A newspaper might report, for instance, that "the Fed has lowered interest rates." To be more precise, we can translate this statement as meaning "the Federal Open Market Committee has instructed the Fed bond traders to buy bonds in open-market operations so as to increase the money supply, shift the *LM* curve, and reduce the equilibrium interest rate to hit a new lower target."

Why has the Fed chosen to use an interest rate, rather than the money supply, as its short-term policy instrument? One possible answer is that shocks to the *LM* curve are more prevalent than shocks to the *IS* curve. When the Fed targets interest rates, it automatically offsets *LM* shocks by adjusting the money supply, although this policy exacerbates *IS* shocks. If *LM* shocks are the more prevalent type, then a policy of targeting the interest rate leads to greater economic stability than a policy of targeting the money supply. (Problem 7 at the end of this chapter asks you to analyze this issue more fully.)

In Chapter 15 we extend our theory of short-run fluctuations to explicitly include a monetary policy that targets the interest rate and that changes its target in response to economic conditions. The *IS–LM* model presented here is a useful foundation for that more complicated and realistic analysis. One lesson from the *IS–LM* model is that when a central bank sets the money supply, it determines the equilibrium interest rate. Thus, in some ways, setting the money supply and setting the interest rate are two sides of the same coin.

12-2 *IS–LM* as a Theory of Aggregate Demand

We have been using the *IS–LM* model to explain national income in the short run when the price level is fixed. To see how the *IS–LM* model fits into the model of aggregate supply and aggregate demand introduced in Chapter 10, we now examine what happens in the *IS–LM* model if the price level is allowed to change. By examining the effects of changing the price level, we can finally deliver what was promised when we began our study of the *IS–LM* model: a theory to explain the position and slope of the aggregate demand curve.

From the *IS–LM* Model to the Aggregate Demand Curve

Recall from Chapter 10 that the aggregate demand curve describes a relationship between the price level and the level of national income. In Chapter 10 this relationship was derived from the quantity theory of money. That analysis showed

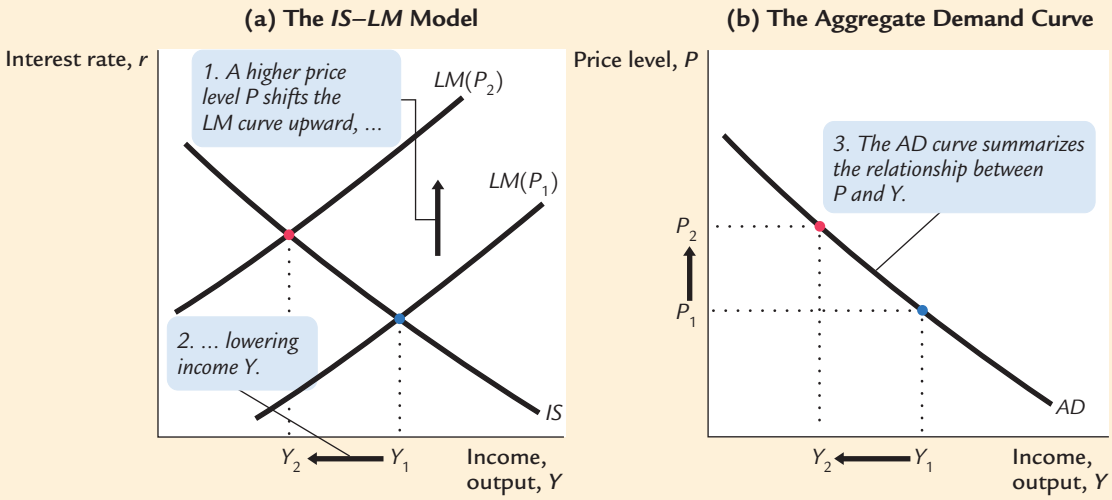
that for a given money supply, a higher price level implies a lower level of income. Increases in the money supply shift the aggregate demand curve to the right, and decreases in the money supply shift the aggregate demand curve to the left.

To understand the determinants of aggregate demand more fully, we now use the *IS–LM* model, rather than the quantity theory, to derive the aggregate demand curve. First, we use the *IS–LM* model to show why national income falls as the price level rises—that is, why the aggregate demand curve is downward sloping. Second, we examine what causes the aggregate demand curve to shift.

To explain why the aggregate demand curve slopes downward, we examine what happens in the *IS–LM* model when the price level changes. This is done in Figure 12-5. For any given money supply M, a higher price level P reduces the supply of real money balances M/P. A lower supply of real money balances shifts the *LM* curve upward, which raises the equilibrium interest rate and lowers the equilibrium level of income, as shown in panel (a). Here the price level rises from P_1 to P_2, and income falls from Y_1 to Y_2. The aggregate demand curve in panel (b) plots this negative relationship between national income and the price level. In other words, the aggregate demand curve shows the set of equilibrium points that arise in the *IS–LM* model as we vary the price level and see what happens to income.

What causes the aggregate demand curve to shift? Because the aggregate demand curve summarizes the results from the *IS–LM* model, events that shift the *IS* curve or the *LM* curve (for a given price level) cause the aggregate demand curve to shift. For instance, an increase in the money supply raises income in the

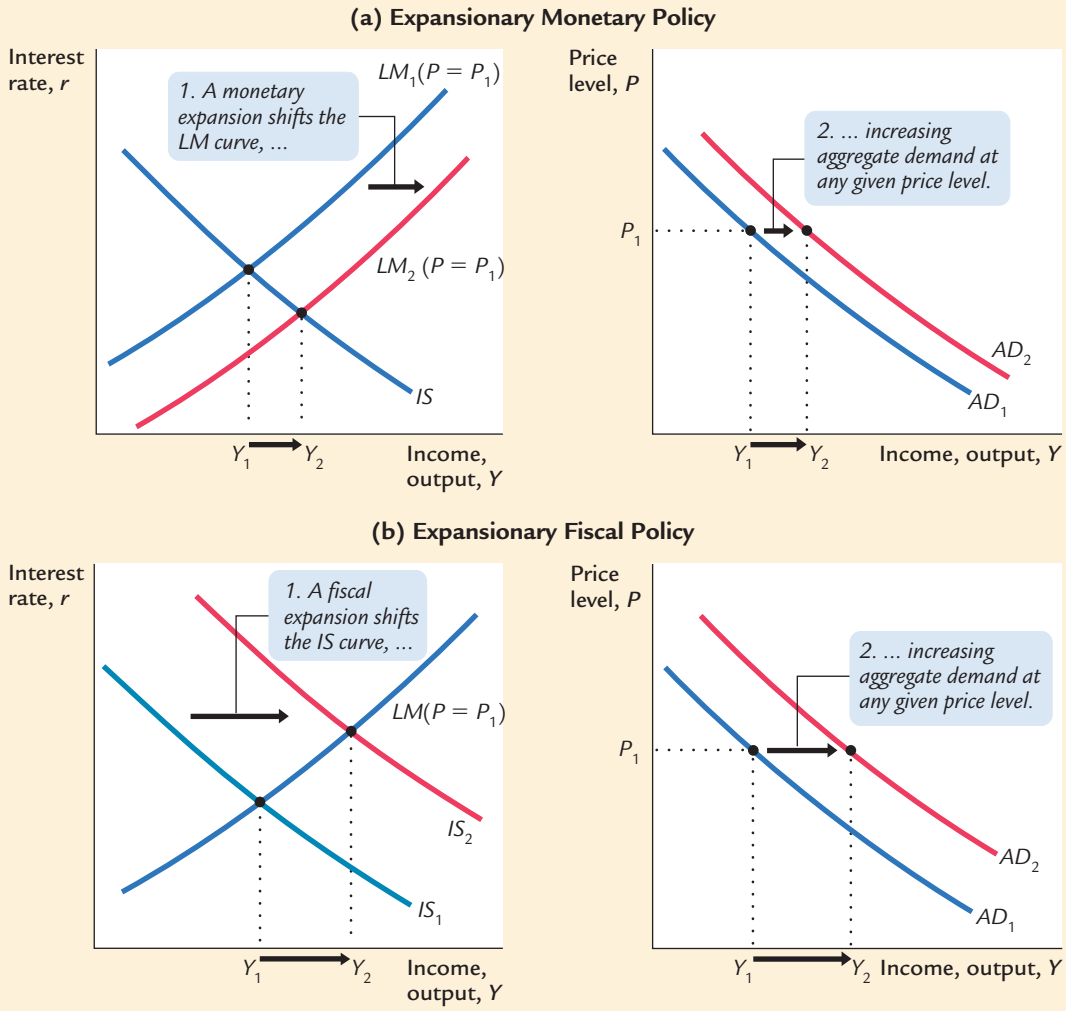
FIGURE 12-5



Deriving the Aggregate Demand Curve with the *IS–LM* Model Panel (a) shows the *IS–LM* model: an increase in the price level from P_1 to P_2 lowers real money balances and thus shifts the *LM* curve upward. The shift in the *LM* curve lowers income from Y_1 to Y_2. Panel (b) shows the aggregate demand curve summarizing this relationship between the price level and income: the higher the price level, the lower the level of income.

IS–LM model for any given price level; it thus shifts the aggregate demand curve to the right, as shown in panel (a) of Figure 12-6. Similarly, an increase in government purchases or a decrease in taxes raises income in the *IS–LM* model for a given price level; it also shifts the aggregate demand curve to the right, as shown in panel (b) of Figure 12-6. Conversely, a decrease in the money supply, a decrease in government purchases, or an increase in taxes lowers income in the *IS–LM*

FIGURE 12-6



How Monetary and Fiscal Policies Shift the Aggregate Demand Curve Panel (a) shows a monetary expansion. For any given price level, an increase in the money supply raises real money balances, shifts the *LM* curve downward, and raises income. Hence, an increase in the money supply shifts the aggregate demand curve to the right. Panel (b) shows a fiscal expansion, such as an increase in government purchases or a decrease in taxes. The fiscal expansion shifts the *IS* curve to the right and, for any given price level, raises income. Hence, a fiscal expansion shifts the aggregate demand curve to the right.

model and shifts the aggregate demand curve to the left. Anything that changes income in the *IS–LM* model other than a change in the price level causes a shift in the aggregate demand curve. The factors shifting aggregate demand include not only monetary and fiscal policy but also shocks to the goods market (the *IS* curve) and shocks to the money market (the *LM* curve).

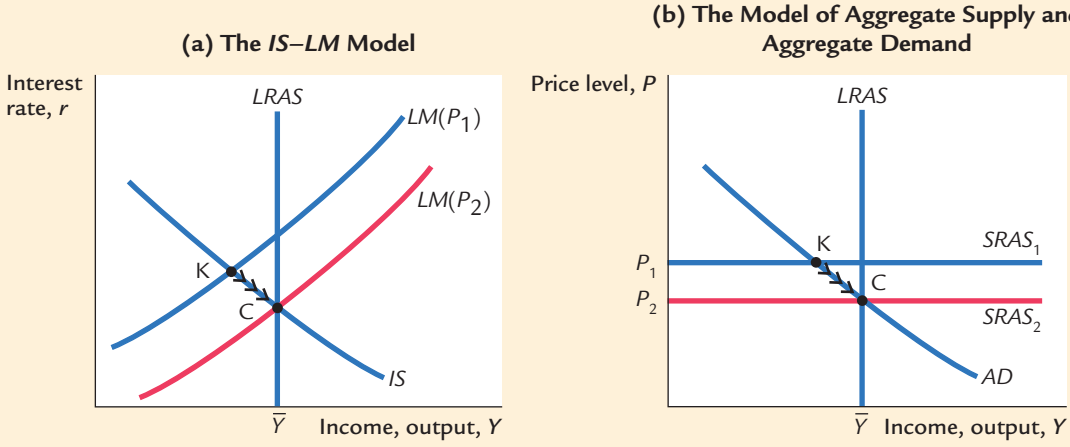
We can summarize these results as follows: *A change in income in the* IS–LM *model resulting from a change in the price level represents a movement along the aggregate demand curve. A change in income in the* IS–LM *model for a given price level represents a shift in the aggregate demand curve.*

The *IS–LM* Model in the Short Run and Long Run

The *IS–LM* model is designed to explain the economy in the short run when the price level is fixed. Yet, now that we have seen how a change in the price level influences the equilibrium in the *IS–LM* model, we can also use the model to describe the economy in the long run when the price level adjusts to ensure that the economy produces at its natural rate. By using the *IS–LM* model to describe the long run, we can show clearly how the Keynesian model of income determination differs from the classical model of Chapter 3.

Panel (a) of Figure 12-7 shows the three curves that are necessary for understanding the short-run and long-run equilibria: the *IS* curve, the *LM* curve, and the vertical line representing the natural level of output $\bar{Y}$. The *LM* curve is, as always, drawn for a fixed price level P_1. The short-run equilibrium of the

FIGURE 12-7



The Short-Run and Long-Run Equilibria We can compare the short-run and long-run equilibria using either the *IS–LM* diagram in panel (a) or the aggregate supply–aggregate demand diagram in panel (b). In the short run, the price level is stuck at P_1. The short-run equilibrium of the economy is therefore point K. In the long run, the price level adjusts so that the economy is at the natural level of output. The long-run equilibrium is therefore point C.

economy is point K, where the *IS* curve crosses the *LM* curve. Notice that in this short-run equilibrium, the economy's income is less than its natural level.

Panel (b) of Figure 12-7 shows the same situation in the diagram of aggregate supply and aggregate demand. At the price level P_1, the quantity of output demanded is below the natural level. In other words, at the existing price level, there is insufficient demand for goods and services to keep the economy producing at its potential.

In these two diagrams we can examine the short-run equilibrium at which the economy finds itself and the long-run equilibrium toward which the economy gravitates. Point K describes the short-run equilibrium, because it assumes that the price level is stuck at P_1. Eventually, the low demand for goods and services causes prices to fall, and the economy moves back toward its natural rate. When the price level reaches P_2, the economy is at point C, the long-run equilibrium. The diagram of aggregate supply and aggregate demand shows that at point C, the quantity of goods and services demanded equals the natural level of output. This long-run equilibrium is achieved in the *IS–LM* diagram by a shift in the *LM* curve: the fall in the price level raises real money balances and therefore shifts the *LM* curve to the right.

We can now see the key difference between the Keynesian and classical approaches to the determination of national income. The Keynesian assumption (represented by point K) is that the price level is stuck. Depending on monetary policy, fiscal policy, and the other determinants of aggregate demand, output may deviate from its natural level. The classical assumption (represented by point C) is that the price level is fully flexible. The price level adjusts to ensure that national income is always at its natural level.

To make the same point somewhat differently, we can think of the economy as being described by three equations. The first two are the *IS* and *LM* equations:

$$\begin{aligned} Y &= C(Y - T) + I(r) + G \qquad IS, \\ M/P &= L(r, Y) \qquad\qquad\qquad\quad LM. \end{aligned}$$

The *IS* equation describes the equilibrium in the goods market, and the *LM* equation describes the equilibrium in the money market. These *two* equations contain *three* endogenous variables: Y, P, and r. To complete the system, we need a third equation. The Keynesian approach completes the model with the assumption of fixed prices, so the Keynesian third equation is

$$P = P_1.$$

This assumption implies that the remaining two variables r and Y must adjust to satisfy the remaining two equations *IS* and *LM*. The classical approach completes the model with the assumption that output reaches its natural level, so the classical third equation is

$$Y = \bar{Y}.$$

This assumption implies that the remaining two variables r and P must adjust to satisfy the remaining two equations *IS* and *LM*. Thus, the classical approach fixes output and allows the price level to adjust to satisfy the goods and money market equilibrium conditions, whereas the Keynesian approach fixes the price level and lets output move to satisfy the equilibrium conditions.

TABLE 12-2

What Happened During the Great Depression?

Year	Unemployment Rate (1)	Real GNP (2)	Consumption (2)	Investment (2)	Government Purchases (2)
1929	3.2	203.6	139.6	40.4	22.0
1930	8.9	183.5	130.4	27.4	24.3
1931	16.3	169.5	126.1	16.8	25.4
1932	24.1	144.2	114.8	4.7	24.2
1933	25.2	141.5	112.8	5.3	23.3
1934	22.0	154.3	118.1	9.4	26.6
1935	20.3	169.5	125.5	18.0	27.0
1936	17.0	193.2	138.4	24.0	31.8
1937	14.3	203.2	143.1	29.9	30.8
1938	19.1	192.9	140.2	17.0	33.9
1939	17.2	209.4	148.2	24.7	35.2
1940	14.6	227.2	155.7	33.0	36.4

Source: *Historical Statistics of the United States, Colonial Times to 1970, Parts I and II* (Washington, DC: U.S. Department of Commerce, Bureau of Census, 1975).
Note: (1) The unemployment rate is series D9. (2) Real GNP, consumption, investment, and government purchases are series F3, F48, F52, and F66, and are measured in billions of 1958 dollars. (3) The interest rate is the prime Commercial Paper

Which assumption is most appropriate? The answer depends on the time horizon. The classical assumption best describes the long run. Hence, our long-run analysis of national income in Chapter 3 and prices in Chapter 5 assumes that output equals its natural level. The Keynesian assumption best describes the short run. Therefore, our analysis of economic fluctuations relies on the assumption of a fixed price level.

12-3 The Great Depression

Now that we have developed the model of aggregate demand, let's use it to address the question that originally motivated Keynes: what caused the Great Depression? Even today, more than half a century after the event, economists continue to debate the cause of this major economic downturn. The Great Depression provides an extended case study to show how economists use the *IS–LM* model to analyze economic fluctuations.[1]

Before turning to the explanations economists have proposed, look at Table 12-2, which presents some statistics regarding the Depression. These

[1]For a flavor of the debate, see Milton Friedman and Anna J. Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, N.J.: Princeton University Press, 1963); Peter Temin, *Did Monetary Forces Cause the Great Depression?* (New York: W. W. Norton, 1976); the essays in Karl Brunner, ed., *The Great Depression Revisited* (Boston: Martinus Nijhoff, 1981); and the symposium on the Great Depression in the Spring 1993 issue of the *Journal of Economic Perspectives*.

Year	Nominal Interest Rate (3)	Money Supply (4)	Price Level (5)	Inflation (6)	Real Money Balances (7)
1929	5.9	26.6	50.6	–	52.6
1930	3.6	25.8	49.3	–2.6	52.3
1931	2.6	24.1	44.8	–10.1	54.5
1932	2.7	21.1	40.2	–9.3	52.5
1933	1.7	19.9	39.3	–2.2	50.7
1934	1.0	21.9	42.2	7.4	51.8
1935	0.8	25.9	42.6	0.9	60.8
1936	0.8	29.6	42.7	0.2	62.9
1937	0.9	30.9	44.5	4.2	69.5
1938	0.8	30.5	43.9	–1.3	69.5
1939	0.6	34.2	43.2	–1.6	79.1
1940	0.6	39.7	43.9	1.6	90.3

rate, 4–6 months, series ×445. (4) The money supply is series ×414, currency plus demand deposits, measured in billions of dollars. (5) The price level is the GNP deflator (1958 = 100), series E1. (6) The inflation rate is the percentage change in the price level series. (7) Real money balances, calculated by dividing the money supply by the price level and multiplying by 100, are in billions of 1958 dollars.

statistics are the battlefield on which debate about the Depression takes place. What do you think happened? An *IS* shift? An *LM* shift? Or something else?

The Spending Hypothesis: Shocks to the *IS* Curve

Table 12-2 shows that the decline in income in the early 1930s coincided with falling interest rates. This fact has led some economists to suggest that the cause of the decline may have been a contractionary shift in the *IS* curve. This view is sometimes called the *spending hypothesis* because it places primary blame for the Depression on an exogenous fall in spending on goods and services.

Economists have attempted to explain this decline in spending in several ways. Some argue that a downward shift in the consumption function caused the contractionary shift in the *IS* curve. The stock market crash of 1929 may have been partly responsible for this shift: by reducing wealth and increasing uncertainty about the future prospects of the U.S. economy, the crash may have induced consumers to save more of their income rather than spend it.

Others explain the decline in spending by pointing to the large drop in investment in housing. Some economists believe that the residential investment boom of the 1920s was excessive and that once this "overbuilding" became apparent, the demand for residential investment declined drastically. Another possible explanation for the fall in residential investment is the reduction in immigration in the 1930s: a more slowly growing population demands less new housing.

Once the Depression began, several events occurred that could have reduced spending further. First, many banks failed in the early 1930s, in part because of inadequate bank regulation, and these bank failures may have exacerbated the fall in investment spending. Banks play the crucial role of getting the funds available for investment to those households and firms that can best use them. The closing of many banks in the early 1930s may have prevented some businesses from getting the funds they needed for capital investment and, therefore, may have led to a further contraction in investment spending.[2]

The fiscal policy of the 1930s also contributed to the contractionary shift in the *IS* curve. Politicians at that time were more concerned with balancing the budget than with using fiscal policy to keep production and employment at their natural levels. The Revenue Act of 1932 increased various taxes, especially those falling on lower- and middle-income consumers.[3] The Democratic platform of that year expressed concern about the budget deficit and advocated an "immediate and drastic reduction of governmental expenditures." In the midst of historically high unemployment, policymakers searched for ways to raise taxes and reduce government spending.

There are, therefore, several ways to explain a contractionary shift in the *IS* curve. Keep in mind that these different views may all be true. There may be no single explanation for the decline in spending. It is possible that all of these changes coincided and that together they led to a massive reduction in spending.

The Money Hypothesis: A Shock to the *LM* Curve

Table 12-2 shows that the money supply fell 25 percent from 1929 to 1933, during which time the unemployment rate rose from 3.2 percent to 25.2 percent. This fact provides the motivation and support for what is called the *money hypothesis*, which places primary blame for the Depression on the Federal Reserve for allowing the money supply to fall by such a large amount.[4] The best-known advocates of this interpretation are Milton Friedman and Anna Schwartz, who defended it in their treatise on U.S. monetary history. Friedman and Schwartz argue that contractions in the money supply have caused most economic downturns and that the Great Depression is a particularly vivid example.

Using the *IS-LM* model, we might interpret the money hypothesis as explaining the Depression by a contractionary shift in the *LM* curve. Seen in this way, however, the money hypothesis runs into two problems.

The first problem is the behavior of *real* money balances. Monetary policy leads to a contractionary shift in the *LM* curve only if real money balances fall. Yet from 1929 to 1931 real money balances rose slightly because the fall in the money

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[2]Ben Bernanke, "Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression," *American Economic Review* 73 (June 1983): 257–276.

[3]E. Cary Brown, "Fiscal Policy in the 'Thirties: A Reappraisal," *American Economic Review* 46 (December 1956): 857–879.

[4]We discussed the reasons for this large decrease in the money supply in Chapter 4, where we examined the money supply process in more detail. In particular, see the Case Study on Bank Failures and the Money Supply in the 1930s.

supply was accompanied by an even greater fall in the price level. Although the monetary contraction may have been responsible for the rise in unemployment from 1931 to 1933, when real money balances did fall, it cannot easily explain the initial downturn from 1929 to 1931.

The second problem for the money hypothesis is the behavior of interest rates. If a contractionary shift in the *LM* curve triggered the Depression, we should have observed higher interest rates. Yet nominal interest rates fell continuously from 1929 to 1933.

These two reasons appear sufficient to reject the view that the Depression was instigated by a contractionary shift in the *LM* curve. But was the fall in the money stock irrelevant? Next, we turn to another mechanism through which monetary policy might have been responsible for the severity of the Depression—the deflation of the 1930s.

The Money Hypothesis Again: The Effects of Falling Prices

From 1929 to 1933 the price level fell 25 percent. Many economists blame this deflation for the severity of the Great Depression. They argue that the deflation may have turned what in 1931 was a typical economic downturn into an unprecedented period of high unemployment and depressed income. If correct, this argument gives new life to the money hypothesis. Because the falling money supply was, plausibly, responsible for the falling price level, it could have been responsible for the severity of the Depression. To evaluate this argument, we must discuss how changes in the price level affect income in the *IS–LM* model.

The Stabilizing Effects of Deflation In the *IS–LM* model we have developed so far, falling prices raise income. For any given supply of money M, a lower price level implies higher real money balances M/P. An increase in real money balances causes an expansionary shift in the *LM* curve, which leads to higher income.

Another channel through which falling prices expand income is called the **Pigou effect**. Arthur Pigou, a prominent classical economist in the 1930s, pointed out that real money balances are part of households' wealth. As prices fall and real money balances rise, consumers should feel wealthier and spend more. This increase in consumer spending should cause an expansionary shift in the *IS* curve, also leading to higher income.

These two reasons led some economists in the 1930s to believe that falling prices would help stabilize the economy. That is, they thought that a decline in the price level would automatically push the economy back toward full employment. Yet other economists were less confident in the economy's ability to correct itself. They pointed to other effects of falling prices, to which we now turn.

The Destabilizing Effects of Deflation Economists have proposed two theories to explain how falling prices could depress income rather than raise it. The first, called the **debt-deflation theory**, describes the effects of unexpected falls in the price level. The second explains the effects of expected deflation.

The debt-deflation theory begins with an observation from Chapter 5: unanticipated changes in the price level redistribute wealth between debtors

and creditors. If a debtor owes a creditor \$1,000, then the real amount of this debt is \$1,000/P, where P is the price level. A fall in the price level raises the real amount of this debt—the amount of purchasing power the debtor must repay the creditor. Therefore, an unexpected deflation enriches creditors and impoverishes debtors.

The debt-deflation theory then posits that this redistribution of wealth affects spending on goods and services. In response to the redistribution from debtors to creditors, debtors spend less and creditors spend more. If these two groups have equal spending propensities, there is no aggregate impact. But it seems reasonable to assume that debtors have higher propensities to spend than creditors—perhaps that is why the debtors are in debt in the first place. In this case, debtors reduce their spending by more than creditors raise theirs. The net effect is a reduction in spending, a contractionary shift in the *IS* curve, and lower national income.

To understand how *expected* changes in prices can affect income, we need to add a new variable to the *IS–LM* model. Our discussion of the model so far has not distinguished between the nominal and real interest rates. Yet we know from previous chapters that investment depends on the real interest rate and that money demand depends on the nominal interest rate. If i is the nominal interest rate and $E\pi$ is expected inflation, then the *ex ante* real interest rate is $i - E\pi$. We can now write the *IS–LM* model as

$$Y = C(Y - T) + I(i - E\pi) + G \qquad IS,$$
$$M/P = L(i, Y) \qquad LM.$$

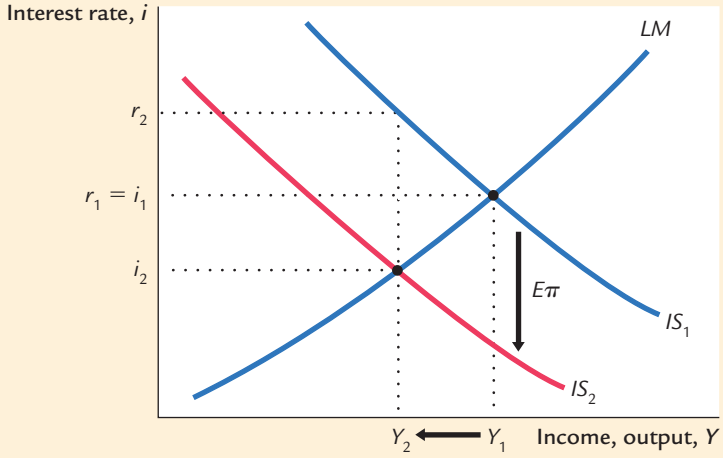
Expected inflation enters as a variable in the *IS* curve. Thus, changes in expected inflation shift the *IS* curve.

Let's use this extended *IS–LM* model to examine how changes in expected inflation influence the level of income. We begin by assuming that everyone expects the price level to remain the same. In this case, there is no expected inflation ($E\pi = 0$), and these two equations produce the familiar *IS–LM* model. Figure 12-8 depicts this initial situation with the *LM* curve and the *IS* curve labeled IS_1. The intersection of these two curves determines the nominal and real interest rates, which for now are the same.

Now suppose that everyone suddenly expects that the price level will fall in the future, so that $E\pi$ becomes negative. The real interest rate is now higher at any given nominal interest rate. This increase in the real interest rate depresses planned investment spending, shifting the *IS* curve from IS_1 to IS_2. (The vertical distance of the downward shift exactly equals the expected deflation.) Thus, an expected deflation leads to a reduction in national income from Y_1 to Y_2. The nominal interest rate falls from i_1 to i_2, while the real interest rate rises from r_1 to r_2.

Here is the story behind this figure. When firms come to expect deflation, they become reluctant to borrow to buy investment goods because they believe they will have to repay these loans later in more valuable dollars. The fall in investment depresses planned expenditure, which in turn depresses income. The fall in income reduces the demand for money, and this reduces the nominal interest rate that equilibrates the money market. The nominal interest rate falls by less than the expected deflation, so the real interest rate rises.

FIGURE 12-8



Expected Deflation in the *IS–LM* Model An expected deflation (a negative value of $E\pi$) raises the real interest rate for any given nominal interest rate, and this depresses investment spending. The reduction in investment shifts the *IS* curve downward. The level of income falls from Y_1 to Y_2. The nominal interest rate falls from i_1 to i_2, and the real interest rate rises from r_1 to r_2.

Note that there is a common thread in these two stories of destabilizing deflation. In both, falling prices depress national income by causing a contractionary shift in the *IS* curve. Because a deflation of the size observed from 1929 to 1933 is unlikely except in the presence of a major contraction in the money supply, these two explanations assign some of the responsibility for the Depression—especially its severity—to the Fed. In other words, if falling prices are destabilizing, then a contraction in the money supply can lead to a fall in income, even without a decrease in real money balances or a rise in nominal interest rates.

Could the Depression Happen Again?

Economists study the Depression both because of its intrinsic interest as a major economic event and to provide guidance to policymakers so that it will not happen again. To state with confidence whether this event could recur, we would need to know why it happened. Because there is not yet agreement on the causes of the Great Depression, it is impossible to rule out with certainty another depression of this magnitude.

Yet most economists believe that the mistakes that led to the Great Depression are unlikely to be repeated. The Fed seems unlikely to allow the money supply to fall by one-fourth. Many economists believe that the deflation of the early 1930s was responsible for the depth and length of the Depression. And it seems likely that such a prolonged deflation was possible only in the presence of a falling money supply.

The fiscal-policy mistakes of the Depression are also unlikely to be repeated. Fiscal policy in the 1930s not only failed to help but actually further depressed aggregate demand. Few economists today would advocate such a rigid adherence to a balanced budget in the face of massive unemployment.

In addition, there are many institutions today that would help prevent the events of the 1930s from recurring. The system of Federal Deposit Insurance

makes widespread bank failures less likely. The income tax causes an automatic reduction in taxes when income falls, which stabilizes the economy. Finally, economists know more today than they did in the 1930s. Our knowledge of how the economy works, limited as it still is, should help policymakers formulate better policies to combat such widespread unemployment.

CASE STUDY

The Financial Crisis and Economic Downturn of 2008 and 2009

In 2008 the U.S. economy experienced a financial crisis, followed by a deep recession. Several of the developments during this time were reminiscent of events during the 1930s, causing many observers to fear that the economy might experience a second Great Depression.

The story of the 2008 crisis begins a few years earlier with a substantial boom in the housing market. The boom had several sources. In part, it was fueled by low interest rates. As we saw in a previous Case Study in this chapter, the Federal Reserve lowered interest rates to historically low levels in the aftermath of the recession of 2001. Low interest rates helped the economy recover, but by making it less expensive to get a mortgage and buy a home, they also contributed to a rise in housing prices.

In addition, developments in the mortgage market made it easier for *subprime borrowers*—those borrowers with higher risk of default based on their income and credit history—to get mortgages to buy homes. One of these developments was *securitization*, the process by which one mortgage originator makes loans and then sells them to an investment bank, which in turn bundles them together into a variety of "mortgage-backed securities" and then sells them to a third financial institution (such as a bank, pension fund, or insurance company). These securities pay a return as long as homeowners continue to repay their loans, but they lose value if homeowners default. Unfortunately, it seems that the ultimate holders of these mortgage-backed securities sometimes failed to fully appreciate the risks they were taking. Some economists blame insufficient regulation for these high-risk loans. Others believe the problem was not too little regulation but the wrong kind: some government policies encouraged this high-risk lending to make the goal of homeownership more attainable for low-income families.

Together, these forces drove up housing demand and housing prices. From 1995 to 2006, average housing prices in the United States more than doubled. Some observers view this rise in housing prices as a speculative bubble, as more people bought homes based on the hope and expectation that the prices would continue to rise.

The high price of housing, however, proved unsustainable. From 2006 to 2009, housing prices nationwide fell about 30 percent. Such price fluctuations should not necessarily be a problem in a market economy. After all, price movements are how markets equilibrate supply and demand. But, in this case, the price decline led to a series of problematic repercussions.

The first of these repercussions was a substantial rise in mortgage defaults and home foreclosures. During the housing boom, many homeowners had bought

their homes with mostly borrowed money and minimal down payments. When housing prices declined, these homeowners were *underwater*: they owed more on their mortgages than their homes were worth. Many of these homeowners stopped paying their loans. The banks servicing the mortgages responded to the defaults by taking the houses away in foreclosure procedures and then selling them off. The banks' goal was to recoup whatever they could. The increase in the number of homes for sale, however, exacerbated the downward spiral of housing prices.

A second repercussion was large losses at the various financial institutions that owned mortgage-backed securities. In essence, by borrowing large sums to buy high-risk mortgages, these companies had bet that housing prices would keep rising; when this bet turned bad, they found themselves at or near the point of bankruptcy. Even healthy banks stopped trusting one another and avoided interbank lending because it was hard to discern which institution would be the next to go out of business. Because of these large losses at financial institutions and the widespread fear and distrust, the ability of the financial system to make loans even to creditworthy customers was impaired. Chapter 20 discusses financial crises, including this one, in more detail.

A third repercussion was a substantial rise in stock market volatility. Many companies rely on the financial system to get the resources they need for business expansion or to help them manage their short-term cash flows. With the financial system less able to perform its normal operations, the profitability of many companies was called into question. Because it was hard to know how bad things would get, stock market volatility reached levels not seen since the 1930s.

Higher volatility, in turn, led to a fourth repercussion: a decline in consumer confidence. In the midst of all the uncertainty, households started putting off spending plans. In particular, expenditure on durable goods plummeted. As a result of all these events, the economy experienced a large contractionary shift in the *IS* curve.

The U.S government responded vigorously as the crisis unfolded. First, the Fed cut its target for the federal funds rate from 5.25 percent in September 2007 to about zero in December 2008. Second, in an even more unusual move in October 2008, Congress appropriated $700 billion for the Treasury to use to rescue the financial system. In large part these funds were used for equity injections into banks. That is, the Treasury put funds into the banking system, which the banks could use to make loans; in exchange for these funds, the U.S. government became a part owner of these banks, at least temporarily. The goal of the rescue (or "bailout," as it was sometimes called) was to stem the financial crisis on Wall Street and prevent it from causing a depression on every other street in America. Finally, as discussed in Chapter 11, one of Barack Obama's first acts when he became president in January 2009 was to support a major increase in government spending to expand aggregate demand.

As this book was going to press, the economy was recovering from the recession, albeit very gradually. Economic growth was positive but well below the rate experienced during previous recoveries. Unemployment remained high. Policymakers could take some credit for having averted another Great Depression. Yet there is no doubt that the financial crisis of 2008–2009 and its aftermath constituted a painful event for many families. ■

F Y I

The Liquidity Trap (Also Known as the Zero Lower Bound)

In the United States in the 1930s, interest rates reached very low levels. As Table 12-2 shows, U.S. interest rates were well under 1 percent throughout the second half of the 1930s. A similar situation occurred during the economic downturn of 2008–2009. In December 2008, the Federal Reserve cut its target for the federal funds rate to the range of zero to 0.25 percent, and it kept the rate at that level for the next several years. On August 9, 2011, the Fed released a statement pledging to keep interest rates low "at least through mid-2013."

Some economists describe this situation as a *liquidity trap*. According to the *IS–LM* model, expansionary monetary policy works by reducing interest rates and stimulating investment spending. But if interest rates have already fallen almost to zero, then perhaps monetary policy is no longer effective. Nominal interest rates cannot fall below zero: rather than making a loan at a negative nominal interest rate, a person would just hold cash. In this environment, expansionary monetary policy increases the supply of money, making the public's asset portfolio more liquid, but because interest rates can't fall any farther, the extra liquidity might not have any effect. Aggregate demand, production, and employment may be "trapped" at low levels. The liquidity trap is sometimes called the problem of the *zero lower bound*.

Other economists are skeptical about the relevance of liquidity traps and believe that central banks continue to have tools to expand the economy, even after its interest rate target hits the lower bound of zero. One possibility is that the central bank could raise inflation expectations by committing itself to future monetary expansion. Even if nominal interest rates cannot fall any farther, higher expected inflation can lower real interest rates by making them negative, which would stimulate investment spending. A second possibility is that monetary expansion could cause the currency to lose value in the market for foreign-currency exchange. This depreciation would make the nation's goods cheaper abroad, stimulating export demand. (This mechanism goes beyond the closed-economy *IS–LM* model we have used in this chapter, but it fits well with the open-economy version of the model developed in the next chapter.) A third possibility is that the central bank could conduct expansionary open-market operations in a larger variety of financial instruments than it normally does. For example, it could buy mortgages and corporate debt and thereby lower the interest rates on these kinds of loans. The Federal Reserve actively pursued this last option in response to the downturn of 2008–2009, a policy sometimes called *quantitative easing*.

How much do monetary policymakers need to worry about the liquidity trap? Might the central bank at times lose its power to influence the economy? There is no consensus about the answers. Skeptics say we shouldn't worry about the liquidity trap because central banks have various tools at their disposal. But others say the possibility of a liquidity trap argues for a target rate of inflation greater than zero. Under zero inflation, the real interest rate, like the nominal interest, can never fall below zero. But if the normal rate of inflation is, say, 4 percent, then the central bank can easily push the real interest rate to negative 4 percent by lowering the nominal interest rate toward zero. Put differently, a higher target for the inflation rate means a higher nominal interest rate in normal times (recall the Fisher effect), which in turn gives the central bank more room to cut interest rates when the economy experiences recessionary shocks. Thus, a higher inflation target gives monetary policymakers more room to stimulate the economy when needed, reducing the likelihood that the economy will hit the zero lower bound and fall into a liquidity trap.[5]

[5]To read more about the liquidity trap, see Paul R. Krugman, "It's Baaack: Japan's Slump and the Return of the Liquidity Trap," *Brookings Panel on Economic Activity* 2 (1998): 137–205.

12-4 Conclusion

The purpose of this chapter and the previous one has been to deepen our understanding of aggregate demand. We now have the tools to analyze the effects of monetary and fiscal policy in the long run and in the short run. In the long run, prices are flexible, and we use the classical analysis of Parts Two and Three of this book. In the short run, prices are sticky, and we use the *IS–LM* model to examine how changes in policy influence the economy.

The model in this and the previous chapter provides the basic framework for analyzing the economy in the short run, but it is not the whole story. In Chapter 13 we examine how international interactions affect the theory of aggregate demand. In Chapter 14 we examine the theory behind short-run aggregate supply. Subsequent chapters further refine the theory and examine various issues that arise as the theory is applied to formulate macroeconomic policy. The *IS–LM* model presented in this and the previous chapter provides the starting point for this further analysis.

Summary

1. The *IS–LM* model is a general theory of the aggregate demand for goods and services. The exogenous variables in the model are fiscal policy, monetary policy, and the price level. The model explains two endogenous variables: the interest rate and the level of national income.
2. The *IS* curve represents the negative relationship between the interest rate and the level of income that arises from equilibrium in the market for goods and services. The *LM* curve represents the positive relationship between the interest rate and the level of income that arises from equilibrium in the market for real money balances. Equilibrium in the *IS–LM* model—the intersection of the *IS* and *LM* curves—represents simultaneous equilibrium in the market for goods and services and in the market for real money balances.
3. The aggregate demand curve summarizes the results from the *IS–LM* model by showing equilibrium income at any given price level. The aggregate demand curve slopes downward because a lower price level increases real money balances, lowers the interest rate, stimulates investment spending, and thereby raises equilibrium income.
4. Expansionary fiscal policy—an increase in government purchases or a decrease in taxes—shifts the *IS* curve to the right. This shift in the *IS* curve increases the interest rate and income. The increase in income represents a rightward shift in the aggregate demand curve. Similarly, contractionary fiscal policy shifts the *IS* curve to the left, lowers the interest rate and income, and shifts the aggregate demand curve to the left.

5. Expansionary monetary policy shifts the *LM* curve downward. This shift in the *LM* curve lowers the interest rate and raises income. The increase in income represents a rightward shift of the aggregate demand curve. Similarly, contractionary monetary policy shifts the *LM* curve upward, raises the interest rate, lowers income, and shifts the aggregate demand curve to the left.

KEY CONCEPTS

Monetary transmission mechanism

Pigou effect

Debt-deflation theory

QUESTIONS FOR REVIEW

1. Explain why the aggregate demand curve slopes downward.
2. What is the impact of an increase in taxes on the interest rate, income, consumption, and investment?
3. What is the impact of a decrease in the money supply on the interest rate, income, consumption, and investment?
4. Describe the possible effects of falling prices on equilibrium income.

PROBLEMS AND APPLICATIONS

1. According to the *IS–LM* model, what happens in the short run to the interest rate, income, consumption, and investment under the following circumstances? Be sure your answer includes an appropriate graph.
   a. The central bank increases the money supply.
   b. The government increases government purchases.
   c. The government increases taxes.
   d. The government increases government purchases and taxes by equal amounts.
2. Use the *IS–LM* model to predict the short-run effects of each of the following shocks on income, the interest rate, consumption, and investment. In each case, explain what the Fed should do to keep income at its initial level.
   a. After the invention of a new high-speed computer chip, many firms decide to upgrade their computer systems.
   b. A wave of credit card fraud increases the frequency with which people make transactions in cash.
   c. A best-seller titled *Retire Rich* convinces the public to increase the percentage of their income devoted to saving.
   d. The appointment of a new "dovish" Federal Reserve chairman increases expected inflation.
3. Consider the economy of Hicksonia.
   a. The consumption function is given by

$$C = 200 + 0.75(Y - T).$$

   The investment function is

$$I = 200 - 25r.$$

   Government purchases and taxes are both 100. For this economy, graph the *IS* curve for r ranging from 0 to 8.
   b. The money demand function in Hicksonia is

$$(M/P)^d = Y - 100r.$$

   The money supply M is 1,000 and the price level P is 2. For this economy, graph the *LM* curve for r ranging from 0 to 8.

c. Find the equilibrium interest rate r and the equilibrium level of income Y.

d. Suppose that government purchases are raised from 100 to 150. How does the *IS* curve shift? What are the new equilibrium interest rate and level of income?

e. Suppose instead that the money supply is raised from 1,000 to 1,200. How does the *LM* curve shift? What are the new equilibrium interest rate and level of income?

f. With the initial values for monetary and fiscal policy, suppose that the price level rises from 2 to 4. What happens? What are the new equilibrium interest rate and level of income?

g. Derive and graph an equation for the aggregate demand curve. What happens to this aggregate demand curve if fiscal or monetary policy changes, as in parts (d) and (e)?

4. Determine whether each of the following statements is true or false, and explain why. For each true statement, discuss the impact of monetary and fiscal policy in that special case.

a. If investment does not depend on the interest rate, the *LM* curve is horizontal.

b. If investment does not depend on the interest rate, the *IS* curve is vertical.

c. If money demand does not depend on the interest rate, the *IS* curve is horizontal.

d. If money demand does not depend on the interest rate, the *LM* curve is vertical.

e. If money demand does not depend on income, the *LM* curve is horizontal.

f. If money demand is extremely sensitive to the interest rate, the *LM* curve is horizontal.

5. Monetary policy and fiscal policy often change at the same time.

a. Suppose that the government wants to raise investment but keep output constant. In the *IS–LM* model, what mix of monetary and fiscal policy will achieve this goal?

b. In the early 1980s, the U.S. government cut taxes and ran a budget deficit while the Fed pursued a tight monetary policy. What effect should this policy mix have?

6. Use the *IS–LM* diagram to describe both the short-run effects and the long-run effects of the following changes on national income, the interest rate, the price level, consumption, investment, and real money balances.

a. An increase in the money supply

b. An increase in government purchases

c. An increase in taxes

7. The Fed is considering two alternative monetary policies:

- holding the money supply constant and letting the interest rate adjust, or
- adjusting the money supply to hold the interest rate constant.

In the *IS–LM* model, which policy will better stabilize output under the following conditions? Explain your answer.

a. All shocks to the economy arise from exogenous changes in the demand for goods and services.

b. All shocks to the economy arise from exogenous changes in the demand for money.

8. Suppose that the demand for real money balances depends on disposable income. That is, the money demand function is

$$M/P = L(r, Y - T).$$

Using the *IS–LM* model, discuss whether this change in the money demand function alters the following.

a. The analysis of changes in government purchases

b. The analysis of changes in taxes

9. This problem asks you to analyze the *IS–LM* model algebraically. Suppose consumption is a linear function of disposable income:

$$C(Y - T) = a + b(Y - T),$$

where $a > 0$ and $0 < b < 1$. The parameter b is the marginal propensity to consume, and the parameter a is a constant sometimes called autonomous consumption. Suppose also that investment is a linear function of the interest rate:

$$I(r) = c - dr,$$

where $c > 0$ and $d > 0$. The parameter d measures the sensitivity of investment to the interest

rate, and the parameter c is a constant sometimes called autonomous investment.

a. Solve for Y as a function of r, the exogenous variables G and T, and the model's parameters a, b, c, and d.

b. How does the slope of the IS curve depend on the parameter d, the interest sensitivity of investment? Refer to your answer to part (a), and explain the intuition.

c. Which will cause a bigger horizontal shift in the IS curve, a \$100 tax cut or a \$100 increase in government spending? Refer to your answer to part (a), and explain the intuition.

Now suppose demand for real money balances is a linear function of income and the interest rate:

$$L(r, Y) = eY - fr,$$

where $e > 0$ and $f > 0$. The parameter e measures the sensitivity of money demand to income, while the parameter f measures the sensitivity of money demand to the interest rate.

d. Solve for r as a function of Y, M, and P and the parameters e and f.

e. Using your answer to part (d), determine whether the LM curve is steeper for large or small values of f, and explain the intuition.

f. How does the size of the shift in the LM curve resulting from a \$100 increase in M depend on

   i. the value of the parameter e, the income sensitivity of money demand?

   ii. the value of the parameter f, the interest sensitivity of money demand?

g. Use your answers to parts (a) and (d) to derive an expression for the aggregate demand curve. Your expression should show Y as a function of P; of exogenous policy variables M, G, and T; and of the model's parameters. This expression should not contain r.

h. Use your answer to part (g) to prove that the aggregate demand curve has a negative slope.

i. Use your answer to part (g) to prove that increases in G and M, and decreases in T, shift the aggregate demand curve to the right. How does this result change if the parameter f, the interest sensitivity of money demand, equals zero? Explain the intuition for your result.

The Open Economy Revisited: The Mundell–Fleming Model and the Exchange-Rate Regime

The world is still a closed economy, but its regions and countries are becoming increasingly open. . . . The international economic climate has changed in the direction of financial integration, and this has important implications for economic policy.

—Robert Mundell, 1963

When conducting monetary and fiscal policy, policymakers often look beyond their own country's borders. Even if domestic prosperity is their sole objective, it is necessary for them to consider the rest of the world. The international flow of goods and services and the international flow of capital can affect an economy in profound ways. Policymakers ignore these effects at their peril.

In this chapter we extend our analysis of aggregate demand to include international trade and finance. The model developed in this chapter, called the **Mundell–Fleming model**, has been described as "the dominant policy paradigm for studying open-economy monetary and fiscal policy." In 1999, Robert Mundell was awarded the Nobel Prize for his work in open-economy macroeconomics, including this model.[1]

The Mundell–Fleming model is a close relative of the *IS–LM* model. Both models stress the interaction between the goods market and the money market. Both models assume that the price level is fixed and then show what causes short-run fluctuations in aggregate income (or, equivalently, shifts in the

[1]The quotation is from Maurice Obstfeld and Kenneth Rogoff, *Foundations of International Macroeconomics* (Cambridge, Mass.: MIT Press, 1996)—a leading graduate-level textbook in open-economy macroeconomics. The Mundell–Fleming model was developed in the early 1960s. Mundell's contributions are collected in Robert A. Mundell, *International Economics* (New York: Macmillan, 1968). For Fleming's contribution, see J. Marcus Fleming, "Domestic Financial Policies Under Fixed and Under Floating Exchange Rates," *IMF Staff Papers* 9 (November 1962): 369–379. Fleming died in 1976, so he was not eligible to share in the Nobel award.

aggregate demand curve). The key difference is that the *IS–LM* model assumes a closed economy, whereas the Mundell–Fleming model assumes an open economy. The Mundell–Fleming model extends the short-run model of national income from Chapters 11 and 12 by including the effects of international trade and finance discussed in Chapter 6.

The Mundell–Fleming model makes one important and extreme assumption: it assumes that the economy being studied is a small open economy with perfect capital mobility. That is, the economy can borrow or lend as much as it wants in world financial markets and, as a result, the economy's interest rate is determined by the world interest rate. Here is how Mundell himself, in his original 1963 article, explained why he made this assumption:

> In order to present my conclusions in the simplest possible way and to bring the implications for policy into sharpest relief, I assume the extreme degree of mobility that prevails when a country cannot maintain an interest rate different from the general level prevailing abroad. This assumption will overstate the case but it has the merit of posing a stereotype towards which international financial relations seem to be heading. At the same time it might be argued that the assumption is not far from the truth in those financial centers, of which Zurich, Amsterdam, and Brussels may be taken as examples, where the authorities already recognize their lessening ability to dominate money market conditions and insulate them from foreign influences. It should also have a high degree of relevance to a country like Canada whose financial markets are dominated to a great degree by the vast New York market.

As we will see, Mundell's assumption of a small open economy with perfect capital mobility will prove useful in developing a tractable and illuminating model.[2]

One lesson from the Mundell–Fleming model is that the behavior of an economy depends on the exchange-rate system it has adopted. Indeed, the model was first developed in large part to understand how alternative exchange-rate regimes work and how the choice of exchange-rate regime impinges on monetary and fiscal policy. We begin by assuming that the economy operates with a floating exchange rate. That is, we assume that the central bank allows the exchange rate to adjust to changing economic conditions. We then examine how the economy operates under a fixed exchange rate. After developing the model, we will be in a position to address an important policy question: what exchange-rate system should a nation adopt?

These issues of open-economy macroeconomics have been very much in the news in recent years. As various European nations, most notably Greece, experienced severe financial difficulties, many observers wondered whether it was wise for much of the continent to adopt a common currency—the most extreme

[2]This assumption—and thus the Mundell–Fleming model—does not apply exactly to a large open economy such as that of the United States. In the conclusion to this chapter (and more fully in the appendix), we consider what happens in the more complex case in which international capital mobility is less than perfect or a nation is so large that it can influence world financial markets.

form of a fixed exchange rate. If each nation had its own currency, monetary policy and the exchange rate could have adjusted more easily to the changing individual circumstances and needs of each nation. Meanwhile, many American policymakers, including both President George W. Bush and President Barack Obama, were objecting that China did not allow the value of its currency to float freely against the U.S. dollar. They argued that China kept its currency artificially cheap, making its goods more competitive on world markets. As we will see, the Mundell–Fleming model offers a useful starting point for understanding and evaluating these often-heated international policy debates.

13-1 The Mundell–Fleming Model

In this section we construct the Mundell–Fleming model, and in the following sections we use the model to examine the impact of various policies. As you will see, the Mundell–Fleming model is built from components we have used in previous chapters. But these pieces are put together in a new way to address a new set of questions.

The Key Assumption: Small Open Economy With Perfect Capital Mobility

Let's begin with the assumption of a small open economy with perfect capital mobility. As we saw in Chapter 6, this assumption means that the interest rate in this economy r is determined by the world interest rate r^*. Mathematically, we can write this assumption as

$$r = r^*.$$

This world interest rate is assumed to be exogenously fixed because the economy is sufficiently small relative to the world economy that it can borrow or lend as much as it wants in world financial markets without affecting the world interest rate.

Although the idea of perfect capital mobility is expressed with a simple equation, it is important not to lose sight of the sophisticated process that this equation represents. Imagine that some event occurred that would normally raise the interest rate (such as a decline in domestic saving). In a small open economy, the domestic interest rate might rise by a little bit for a short time, but as soon as it did, foreigners would see the higher interest rate and start lending to this country (by, for instance, buying this country's bonds). The capital inflow would drive the domestic interest rate back toward r^*. Similarly, if any event started to drive the domestic interest rate downward, capital would flow out of the country to earn a higher return abroad, and this capital outflow would drive the domestic interest rate back up to r^*. Hence, the $r = r^*$ equation represents the assumption that the international flow of capital is rapid enough to keep the domestic interest rate equal to the world interest rate.

The Goods Market and the *IS** Curve

The Mundell–Fleming model describes the market for goods and services much as the *IS–LM* model does, but it adds a new term for net exports. In particular, the goods market is represented with the following equation:

$$Y = C(Y - T) + I(r) + G + NX(e).$$

This equation states that aggregate income Y is the sum of consumption C, investment I, government purchases G, and net exports NX. Consumption depends positively on disposable income $Y - T$. Investment depends negatively on the interest rate. Net exports depend negatively on the exchange rate e. As before, we define the exchange rate e as the amount of foreign currency per unit of domestic currency—for example, e might be 100 yen per dollar.

You may recall that in Chapter 6 we related net exports to the real exchange rate (the relative price of goods at home and abroad) rather than the nominal exchange rate (the relative price of domestic and foreign currencies). If e is the nominal exchange rate, then the real exchange rate ϵ equals eP/P^*, where P is the domestic price level and P^* is the foreign price level. The Mundell–Fleming model, however, assumes that the price levels at home and abroad are fixed, so the real exchange rate is proportional to the nominal exchange rate. That is, when the domestic currency appreciates and the nominal exchange rate rises (from, say, 100 to 120 yen per dollar), the real exchange rate rises as well; thus, foreign goods become cheaper compared to domestic goods, and this causes exports to fall and imports to rise.

The goods-market equilibrium condition above has two financial variables that affect expenditure on goods and services (the interest rate and the exchange rate), but we can simplify matters by using the assumption of perfect capital mobility, $r = r^*$:

$$Y = C(Y - T) + I(r^*) + G + NX(e).$$

Let's call this the *IS** equation. (The asterisk reminds us that the equation holds the interest rate constant at the world interest rate r^*.) We can illustrate this equation on a graph in which income is on the horizontal axis and the exchange rate is on the vertical axis. This curve is shown in panel (c) of Figure 13-1.

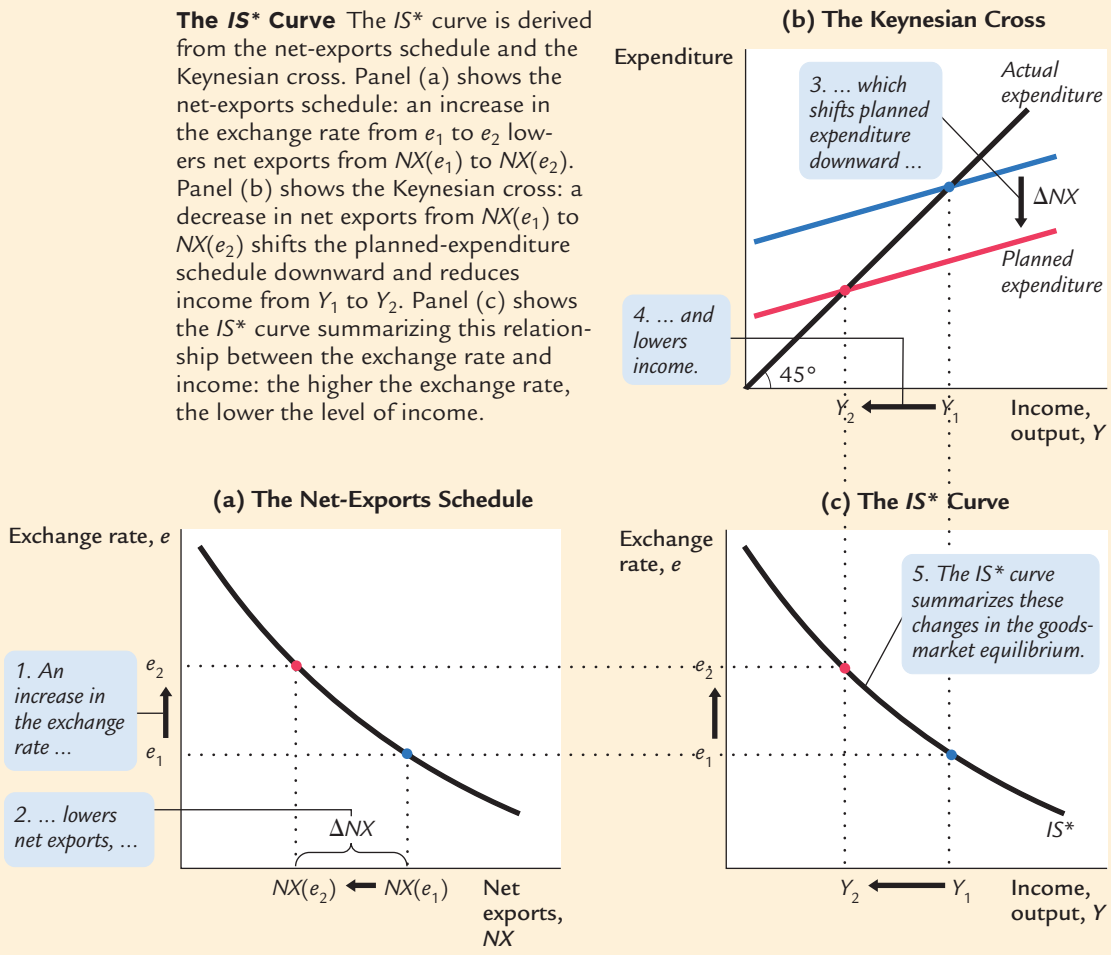
The *IS** curve slopes downward because a higher exchange rate reduces net exports, which in turn lowers aggregate income. To show how this works, the other panels of Figure 13-1 combine the net-exports schedule and the Keynesian cross to derive the *IS** curve. In panel (a), an increase in the exchange rate from e_1 to e_2 lowers net exports from $NX(e_1)$ to $NX(e_2)$. In panel (b), the reduction in net exports shifts the planned-expenditure schedule downward and thus lowers income from Y_1 to Y_2. The *IS** curve summarizes this relationship between the exchange rate e and income Y.

The Money Market and the *LM** Curve

The Mundell–Fleming model represents the money market with an equation that should be familiar from the *IS–LM* model:

$$M/P = L(r, Y).$$

FIGURE 13-1



The *IS Curve** The *IS** curve is derived from the net-exports schedule and the Keynesian cross. Panel (a) shows the net-exports schedule: an increase in the exchange rate from e_1 to e_2 lowers net exports from $NX(e_1)$ to $NX(e_2)$. Panel (b) shows the Keynesian cross: a decrease in net exports from $NX(e_1)$ to $NX(e_2)$ shifts the planned-expenditure schedule downward and reduces income from Y_1 to Y_2. Panel (c) shows the *IS** curve summarizing this relationship between the exchange rate and income: the higher the exchange rate, the lower the level of income.

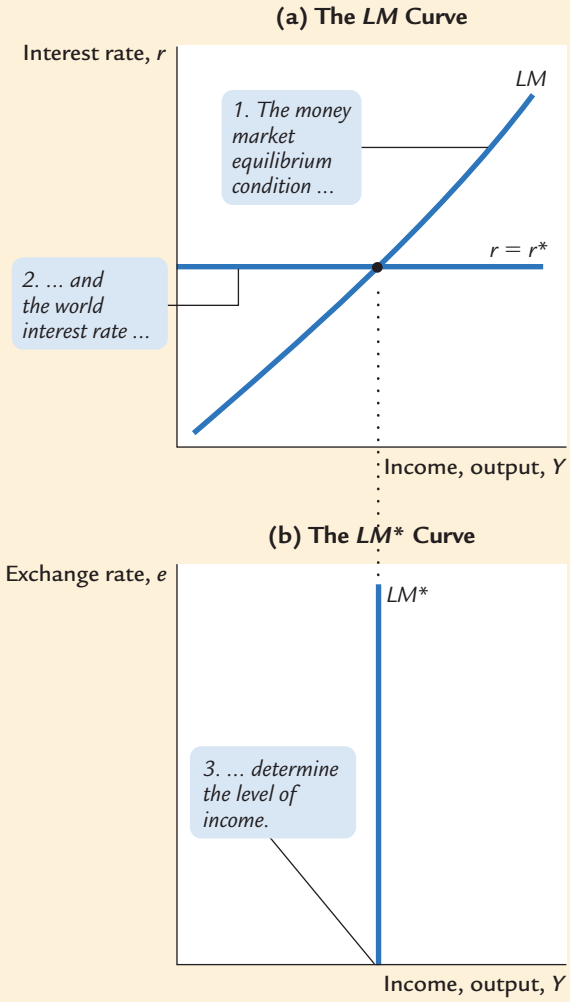
This equation states that the supply of real money balances M/P equals the demand $L(r, Y)$. The demand for real balances depends negatively on the interest rate and positively on income Y. The money supply M is an exogenous variable controlled by the central bank, and because the Mundell–Fleming model is designed to analyze short-run fluctuations, the price level P is also assumed to be exogenously fixed.

Once again, we add the assumption that the domestic interest rate equals the world interest rate, so $r = r^*$:

$$M/P = L(r^*, Y).$$

Let's call this the *LM** equation. We can represent it graphically with a vertical line, as in panel (b) of Figure 13-2. The *LM** curve is vertical because the exchange rate does not enter into the *LM** equation. Given the world interest

FIGURE 13-2



The *LM Curve** Panel (a) shows the standard *LM* curve [which graphs the equation $M/P = L(r, Y)$] together with a horizontal line representing the world interest rate r^*. The intersection of these two curves determines the level of income, regardless of the exchange rate. Therefore, as panel (b) shows, the *LM** curve is vertical.

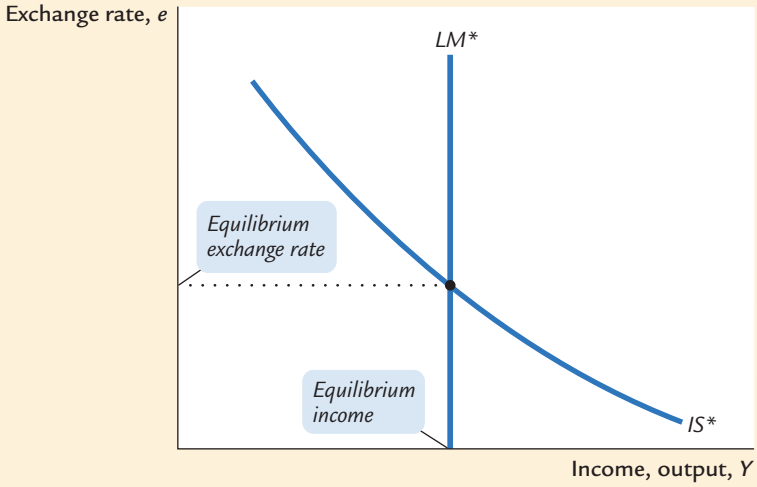
rate, the *LM** equation determines aggregate income, regardless of the exchange rate. Figure 13-2 shows how the *LM** curve arises from the world interest rate and the *LM* curve, which relates the interest rate and income.

Putting the Pieces Together

According to the Mundell–Fleming model, a small open economy with perfect capital mobility can be described by two equations:

$$Y = C(Y - T) + I(r^*) + G + NX(e) \qquad IS^*,$$
$$M/P = L(r^*, Y) \qquad LM^*.$$

FIGURE 13-3



The Mundell–Fleming Model
This graph of the Mundell–Fleming model plots the goods-market equilibrium condition *IS** and the money market equilibrium condition *LM**. Both curves are drawn holding the interest rate constant at the world interest rate. The intersection of these two curves shows the level of income and the exchange rate that satisfy equilibrium both in the goods market and in the money market.

The first equation describes equilibrium in the goods market; the second describes equilibrium in the money market. The exogenous variables are fiscal policy G and T, monetary policy M, the price level P, and the world interest rate r^*. The endogenous variables are income Y and the exchange rate e.

Figure 13-3 illustrates these two relationships. The equilibrium for the economy is found where the *IS** curve and the *LM** curve intersect. This intersection shows the exchange rate and the level of income at which the goods market and the money market are both in equilibrium. With this diagram, we can use the Mundell–Fleming model to show how aggregate income Y and the exchange rate e respond to changes in policy.

13-2 The Small Open Economy Under Floating Exchange Rates

Before analyzing the impact of policies in an open economy, we must specify the international monetary system in which the country has chosen to operate. That is, we must consider how people engaged in international trade and finance can convert the currency of one country into the currency of another.

We start with the system relevant for most major economies today: **floating exchange rates**. Under a system of floating exchange rates, the exchange rate is set by market forces and is allowed to fluctuate in response to changing economic conditions. In this case, the exchange rate e adjusts to achieve simultaneous equilibrium in the goods market and the money market. When something happens to change that equilibrium, the exchange rate is allowed to move to a new equilibrium value.

Let's now consider three policies that can change the equilibrium: fiscal policy, monetary policy, and trade policy. Our goal is to use the Mundell–Fleming model to show the effects of policy changes and to understand the economic forces at work as the economy moves from one equilibrium to another.

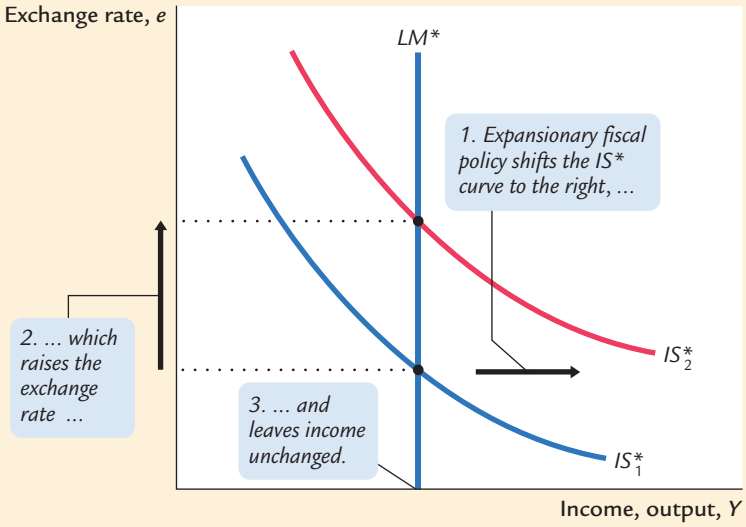
Fiscal Policy

Suppose that the government stimulates domestic spending by increasing government purchases or by cutting taxes. Because such expansionary fiscal policy increases planned expenditure, it shifts the *IS** curve to the right, as in Figure 13-4. As a result, the exchange rate appreciates, while the level of income remains the same.

Notice that fiscal policy has very different effects in a small open economy than it does in a closed economy. In the closed-economy *IS–LM* model, a fiscal expansion raises income, whereas in a small open economy with a floating exchange rate, a fiscal expansion leaves income at the same level. Mechanically, the difference arises because the *LM** curve is vertical, while the *LM* curve we used to study a closed economy is upward sloping. But this explanation is not very satisfying. What are the economic forces that lie behind the different outcomes? To answer this question, we must think through what is happening to the international flow of capital and the implications of these capital flows for the domestic economy.

The interest rate and the exchange rate are the key variables in the story. When income rises in a closed economy, the interest rate rises because higher income increases the demand for money. That is not possible in a small open economy because, as soon as the interest rate starts to rise above the world

FIGURE 13-4



A Fiscal Expansion Under Floating Exchange Rates
An increase in government purchases or a decrease in taxes shifts the *IS** curve to the right. This raises the exchange rate but has no effect on income.

interest rate r^*, capital quickly flows in from abroad to take advantage of the higher return. As this capital inflow pushes the interest rate back to r^*, it also has another effect: because foreign investors need to buy the domestic currency to invest in the domestic economy, the capital inflow increases the demand for the domestic currency in the market for foreign-currency exchange, bidding up the value of the domestic currency. The appreciation of the domestic currency makes domestic goods expensive relative to foreign goods, reducing net exports. The fall in net exports exactly offsets the effects of the expansionary fiscal policy on income.

Why is the fall in net exports so great that it renders fiscal policy powerless to influence income? To answer this question, consider the equation that describes the money market:

$$M/P = L(r, Y).$$

In both closed and open economies, the quantity of real money balances supplied M/P is fixed by the central bank (which sets M) and the assumption of sticky prices (which fixes P). The quantity demanded (determined by r and Y) must equal this fixed supply. In a closed economy, a fiscal expansion causes the equilibrium interest rate to rise. This increase in the interest rate (which reduces the quantity of money demanded) is accompanied by an increase in equilibrium income (which raises the quantity of money demanded); these two effects together maintain equilibrium in the money market. By contrast, in a small open economy, r is fixed at r^*, so there is only one level of income that can satisfy this equation, and this level of income does not change when fiscal policy changes. Thus, when the government increases spending or cuts taxes, the appreciation of the currency and the fall in net exports must be large enough to fully offset the expansionary effect of the policy on income.

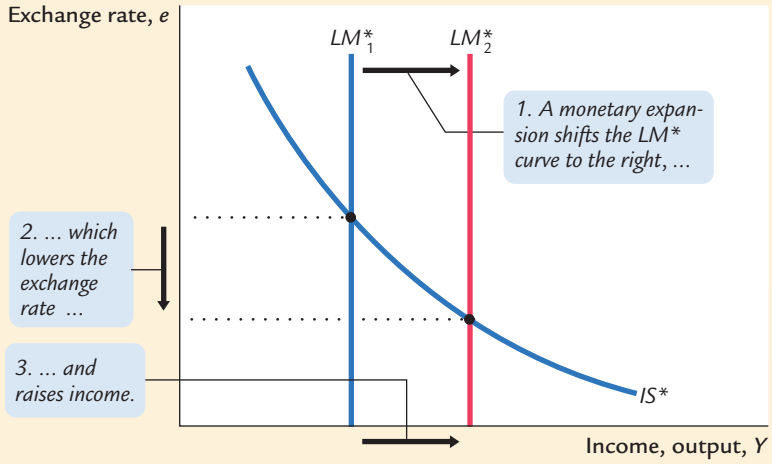
Monetary Policy

Suppose now that the central bank increases the money supply. Because the price level is assumed to be fixed, the increase in the money supply means an increase in real money balances. The increase in real balances shifts the LM^* curve to the right, as in Figure 13-5. Hence, an increase in the money supply raises income and lowers the exchange rate.

Although monetary policy influences income in an open economy, as it does in a closed economy, the monetary transmission mechanism is different. Recall that in a closed economy an increase in the money supply increases spending because it lowers the interest rate and stimulates investment. In a small open economy, this channel of monetary transmission is not available because the interest rate is fixed by the world interest rate. So how does monetary policy influence spending? To answer this question, we once again need to think about the international flow of capital and its implications for the domestic economy.

The interest rate and the exchange rate are again the key variables. As soon as an increase in the money supply starts putting downward pressure on the

FIGURE 13-5



A Monetary Expansion Under Floating Exchange Rates An increase in the money supply shifts the *LM** curve to the right, lowering the exchange rate and raising income.

domestic interest rate, capital flows out of the economy because investors seek a higher return elsewhere. This capital outflow prevents the domestic interest rate from falling below the world interest rate r^*. It also has another effect: because investing abroad requires converting domestic currency into foreign currency, the capital outflow increases the supply of the domestic currency in the market for foreign-currency exchange, causing the domestic currency to depreciate in value. This depreciation makes domestic goods inexpensive relative to foreign goods, stimulating net exports and thus total income. Hence, in a small open economy, monetary policy influences income by altering the exchange rate rather than the interest rate.

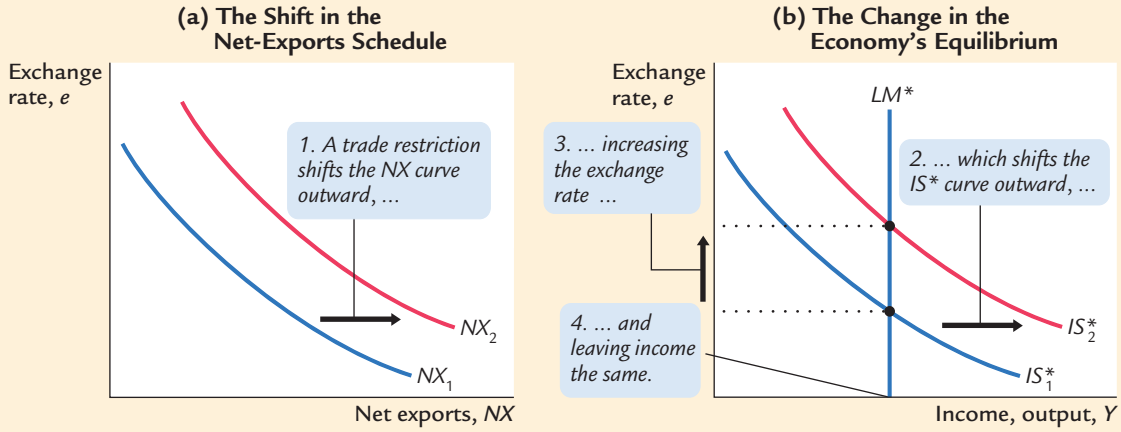
Trade Policy

Suppose that the government reduces the demand for imported goods by imposing an import quota or a tariff. What happens to aggregate income and the exchange rate? How does the economy reach its new equilibrium?

Because net exports equal exports minus imports, a reduction in imports means an increase in net exports. That is, the net-exports schedule shifts to the right, as in Figure 13-6. This shift in the net-exports schedule increases planned expenditure and thus moves the *IS** curve to the right. Because the *LM** curve is vertical, the trade restriction raises the exchange rate but does not affect income.

The economic forces behind this transition are similar to the case of expansionary fiscal policy. Because net exports are a component of GDP, the rightward shift in the net-exports schedule, other things equal, puts upward pressure on income Y; an increase in Y, in turn, increases money demand and puts upward pressure on the interest rate r. Foreign capital quickly responds by flowing into the domestic economy, pushing the interest rate back to the world interest rate r^*

FIGURE 13-6



A Trade Restriction Under Floating Exchange Rates A tariff or an import quota shifts the net-exports schedule in panel (a) to the right. As a result, the *IS** curve in panel (b) shifts to the right, raising the exchange rate and leaving income unchanged.

and causing the domestic currency to appreciate in value. Finally, the appreciation of the currency makes domestic goods more expensive relative to foreign goods, which decreases net exports NX and returns income Y to its initial level.

Restrictive trade policies often have the goal of changing the trade balance NX. Yet, as we first saw in Chapter 6, such policies do not necessarily have that effect. The same conclusion holds in the Mundell–Fleming model under floating exchange rates. Recall that

$$NX(e) = Y - C(Y - T) - I(r^*) - G.$$

Because a trade restriction does not affect income, consumption, investment, or government purchases, it does not affect the trade balance. Although the shift in the net-exports schedule tends to raise NX, the increase in the exchange rate reduces NX by the same amount. The overall effect is simply *less trade*. The domestic economy imports less than it did before the trade restriction, but it exports less as well.

13-3 The Small Open Economy Under Fixed Exchange Rates

We now turn to the second type of exchange-rate system: **fixed exchange rates**. Under a fixed exchange rate, the central bank announces a value for the exchange rate and stands ready to buy and sell the domestic currency to keep the exchange rate at its announced level. In the 1950s and 1960s, most of the world's major economies, including that of the United States, operated within the

Bretton Woods system—an international monetary system under which most governments agreed to fix exchange rates. The world abandoned this system in the early 1970s, and most exchange rates were allowed to float. Yet fixed exchange rates are not merely of historical interest. More recently, China fixed the value of its currency against the U.S. dollar—a policy that, as we will see, was a source of some tension between the two countries.

In this section we discuss how such a system works, and we examine the impact of economic policies on an economy with a fixed exchange rate. Later in the chapter we examine the pros and cons of fixed exchange rates.

How a Fixed-Exchange-Rate System Works

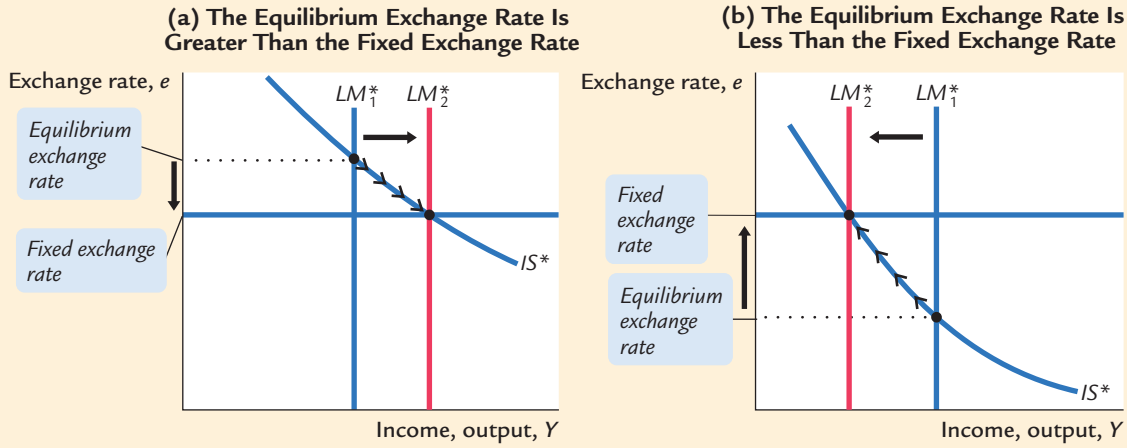
Under a system of fixed exchange rates, a central bank stands ready to buy or sell the domestic currency for foreign currencies at a predetermined price. For example, suppose the Fed announced that it was going to fix the yen/dollar exchange rate at 100 yen per dollar. It would then stand ready to give $1 in exchange for 100 yen or to give 100 yen in exchange for $1. To carry out this policy, the Fed would need a reserve of dollars (which it can print) and a reserve of yen (which it must have purchased previously).

A fixed exchange rate dedicates a country's monetary policy to the single goal of keeping the exchange rate at the announced level. In other words, the essence of a fixed-exchange-rate system is the commitment of the central bank to allow the money supply to adjust to whatever level will ensure that the equilibrium exchange rate in the market for foreign-currency exchange equals the announced exchange rate. Moreover, as long as the central bank stands ready to buy or sell foreign currency at the fixed exchange rate, the money supply adjusts automatically to the necessary level.

To see how fixing the exchange rate determines the money supply, consider the following example. Suppose the Fed decides to fix the exchange rate at 100 yen per dollar, but, in the current equilibrium with the current money supply, the market exchange rate is 150 yen per dollar. This situation is illustrated in panel (a) of Figure 13-7. Notice that there is a profit opportunity: an arbitrageur could buy 300 yen in the foreign-exchange market for $2 and then sell the yen to the Fed for $3, making a $1 profit. When the Fed buys these yen from the arbitrageur, the dollars it pays for them automatically increase the money supply. The rise in the money supply shifts the LM^* curve to the right, lowering the equilibrium exchange rate. In this way, the money supply continues to rise until the equilibrium exchange rate falls to the level the Fed has announced.

Conversely, suppose that when the Fed decides to fix the exchange rate at 100 yen per dollar, the equilibrium has a market exchange rate of 50 yen per dollar. Panel (b) of Figure 13-7 shows this situation. In this case, an arbitrageur could make a profit by buying 100 yen from the Fed for $1 and then selling the yen in the marketplace for $2. When the Fed sells these yen, the $1 it receives automatically reduces the money supply. The fall in the money supply shifts the LM^* curve to the left, raising the equilibrium exchange rate. The money supply continues to fall until the equilibrium exchange rate rises to the announced level.

FIGURE 13-7



How a Fixed Exchange Rate Governs the Money Supply In panel (a), the equilibrium exchange rate initially exceeds the fixed level. Arbitrageurs will buy foreign currency in foreign-exchange markets and sell it to the Fed for a profit. This process automatically increases the money supply, shifting the *LM** curve to the right and lowering the exchange rate. In panel (b), the equilibrium exchange rate is initially below the fixed level. Arbitrageurs will buy foreign currency from the Fed and sell it in foreign-exchange markets for a profit. This process automatically reduces the money supply, shifting the *LM** curve to the left and raising the exchange rate.

It is important to understand that this exchange-rate system fixes the *nominal* exchange rate. Whether it also fixes the real exchange rate depends on the time horizon under consideration. If prices are flexible, as they are in the long run, then the real exchange rate can change even while the nominal exchange rate is fixed. Therefore, in the long run described in Chapter 6, a policy to fix the nominal exchange rate would not influence any real variable, including the real exchange rate. A fixed nominal exchange rate would influence only the money supply and the price level. Yet in the short run described by the Mundell–Fleming model, prices are fixed, so a fixed nominal exchange rate implies a fixed real exchange rate as well.

CASE STUDY

The International Gold Standard

During the late nineteenth and early twentieth centuries, most of the world's major economies operated under the gold standard. Each country maintained a reserve of gold and agreed to exchange one unit of its currency for a specified amount of gold. Through the gold standard, the world's economies maintained a system of fixed exchange rates.

To see how an international gold standard fixes exchange rates, suppose that the U.S. Treasury stands ready to buy or sell 1 ounce of gold for $100, and the Bank of England stands ready to buy or sell 1 ounce of gold for 100 pounds. Together, these policies fix the rate of exchange between dollars and pounds: $1 must trade for 1 pound. Otherwise, the law of one price would be violated, and it would be profitable to buy gold in one country and sell it in the other.

For example, suppose that the market exchange rate is 2 pounds per dollar. In this case, an arbitrageur could buy 200 pounds for $100, use the pounds to buy 2 ounces of gold from the Bank of England, bring the gold to the United States, and sell it to the Treasury for $200—making a $100 profit. Moreover, by bringing the gold to the United States from England, the arbitrageur would increase the money supply in the United States and decrease the money supply in England.

Thus, during the era of the gold standard, the international transport of gold by arbitrageurs was an automatic mechanism adjusting the money supply and stabilizing exchange rates. This system did not completely fix exchange rates, because shipping gold across the Atlantic was costly. Yet the international gold standard did keep the exchange rate within a range dictated by transportation costs. It thereby prevented large and persistent movements in exchange rates.[3] ■

Fiscal Policy

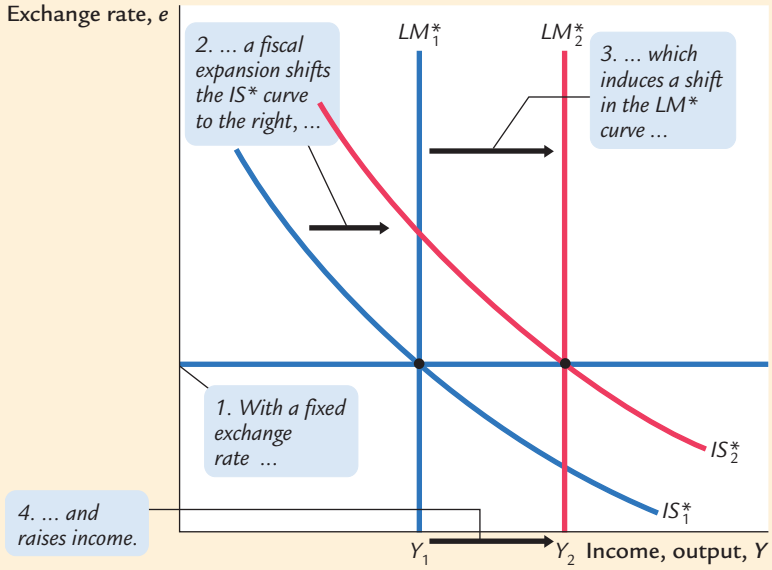
Let's now examine how economic policies affect a small open economy with a fixed exchange rate. Suppose that the government stimulates domestic spending by increasing government purchases or by cutting taxes. This policy shifts the *IS** curve to the right, as in Figure 13-8, putting upward pressure on the market exchange rate. But because the central bank stands ready to trade foreign and domestic currency at the fixed exchange rate, arbitrageurs quickly respond to the rising exchange rate by selling foreign currency to the central bank, leading to an automatic monetary expansion. The rise in the money supply shifts the *LM** curve to the right. Thus, under a fixed exchange rate, a fiscal expansion raises aggregate income.

Monetary Policy

Imagine that a central bank operating with a fixed exchange rate tries to increase the money supply—for example, by buying bonds from the public. What would happen? The initial impact of this policy is to shift the *LM** curve to the right, lowering the exchange rate, as in Figure 13-9. But, because the central bank is committed to trading foreign and domestic currency at a fixed exchange rate, arbitrageurs quickly respond to the falling exchange rate by selling the domestic currency to the central bank, causing the money supply and the *LM** curve to

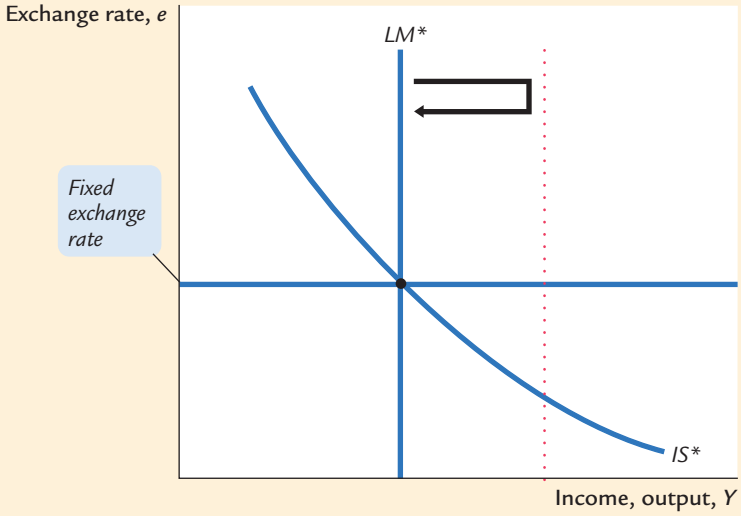
[3]For more on how the gold standard worked, see the essays in Barry Eichengreen, ed., *The Gold Standard in Theory and History* (New York: Methuen, 1985).

FIGURE 13-8



A Fiscal Expansion Under Fixed Exchange Rates A fiscal expansion shifts the *IS** curve to the right. To maintain the fixed exchange rate, the Fed must increase the money supply, thereby shifting the *LM** curve to the right. Hence, in contrast to the case of floating exchange rates, under fixed exchange rates a fiscal expansion raises income.

FIGURE 13-9



A Monetary Expansion Under Fixed Exchange Rates If the Fed tries to increase the money supply—for example, by buying bonds from the public—it will put downward pressure on the exchange rate. To maintain the fixed exchange rate, the money supply and the *LM** curve must return to their initial positions. Hence, under fixed exchange rates, normal monetary policy is ineffectual.

return to their initial positions. Hence, monetary policy as usually conducted is ineffectual under a fixed exchange rate. By agreeing to fix the exchange rate, the central bank gives up its control over the money supply.

A country with a fixed exchange rate can, however, conduct a type of monetary policy: it can decide to change the level at which the exchange rate is fixed. A reduction in the official value of the currency is called a **devaluation**, and

an increase in its official value is called a **revaluation**. In the Mundell–Fleming model, a devaluation shifts the *LM** curve to the right; it acts like an increase in the money supply under a floating exchange rate. A devaluation thus expands net exports and raises aggregate income. Conversely, a revaluation shifts the *LM** curve to the left, reduces net exports, and lowers aggregate income.

CASE STUDY

Devaluation and the Recovery From the Great Depression

The Great Depression of the 1930s was a global problem. Although events in the United States may have precipitated the downturn, all of the world's major economies experienced huge declines in production and employment. Yet not all governments responded to this calamity in the same way.

One key difference among governments was how committed they were to the fixed exchange rate set by the international gold standard. Some countries, such as France, Germany, Italy, and the Netherlands, maintained the old rate of exchange between gold and currency. Other countries, such as Denmark, Finland, Norway, Sweden, and the United Kingdom, reduced the amount of gold they would pay for each unit of currency by about 50 percent. By reducing the gold content of their currencies, these governments devalued their currencies relative to those of other countries.

The subsequent experience of these two groups of countries confirms the prediction of the Mundell–Fleming model. Those countries that pursued a policy of devaluation recovered quickly from the Depression. The lower value of the currency raised the money supply, stimulated exports, and expanded production. By contrast, those countries that maintained the old exchange rate suffered longer with a depressed level of economic activity.

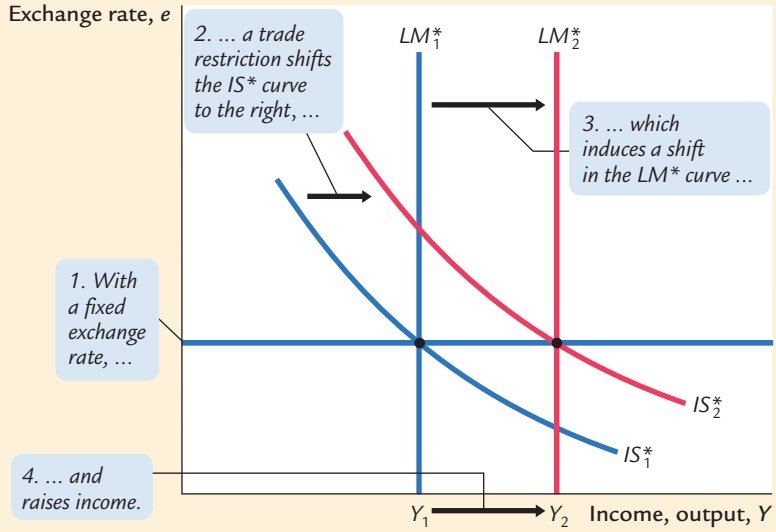
What about the United States? President Herbert Hoover kept the United States on the gold standard, but in a controversial move, President Franklin Roosevelt took the nation off it in June 1933, just three months after taking office. That date roughly coincides with the end of the deflation and the beginning of recovery. Many economic historians believe that removing the nation from the gold standard was the most significant policy action that President Roosevelt took to end the Great Depression.[4] ■

Trade Policy

Suppose that the government reduces imports by imposing an import quota or a tariff. This policy shifts the net-exports schedule to the right and thus shifts the

[4]Barry Eichengreen and Jeffrey Sachs, "Exchange Rates and Economic Recovery in the 1930s," *Journal of Economic History* 45 (December 1985): 925–946.

FIGURE 13-10



A Trade Restriction Under Fixed Exchange Rates A tariff or an import quota shifts the *IS** curve to the right. This induces an increase in the money supply to maintain the fixed exchange rate. Hence, aggregate income increases.

*IS** curve to the right, as in Figure 13-10. The shift in the *IS** curve tends to raise the exchange rate. To keep the exchange rate at the fixed level, the money supply must rise, shifting the *LM** curve to the right.

The result of a trade restriction under a fixed exchange rate is very different from that under a floating exchange rate. In both cases, a trade restriction shifts the net-exports schedule to the right, but only under a fixed exchange rate does a trade restriction increase net exports *NX*. The reason is that a trade restriction under a fixed exchange rate induces monetary expansion rather than an appreciation of the currency. The monetary expansion, in turn, raises aggregate income. Recall the accounting identity

$$NX = S - I.$$

When income rises, saving also rises, and this implies an increase in net exports.

Policy in the Mundell–Fleming Model: A Summary

The Mundell–Fleming model shows that the effect of almost any economic policy on a small open economy depends on whether the exchange rate is floating or fixed. Table 13-1 summarizes our analysis of the short-run effects of fiscal, monetary, and trade policies on income, the exchange rate, and the trade balance. What is most striking is that all of the results are different under floating and fixed exchange rates.

To be more specific, the Mundell–Fleming model shows that the power of monetary and fiscal policy to influence aggregate income depends on the

TABLE 13-1

The Mundell–Fleming Model: Summary of Policy Effects

	EXCHANGE-RATE REGIME					
	FLOATING			FIXED		
	IMPACT ON:					
Policy	***Y***	***e***	***NX***	***Y***	***e***	***NX***
Fiscal expansion	0	↑	↓	↑	0	0
Monetary expansion	↑	↓	↑	0	0	0
Import restriction	0	↑	0	↑	0	↑

Note: This table shows the direction of impact of various economic policies on income *Y*, the exchange rate *e*, and the trade balance *NX*. A "↑" indicates that the variable increases; a "↓" indicates that it decreases; a "0" indicates no effect. Remember that the exchange rate is defined as the amount of foreign currency per unit of domestic currency (for example, 100 yen per dollar).

exchange-rate regime. Under floating exchange rates, only monetary policy can affect income. The usual expansionary impact of fiscal policy is offset by a rise in the value of the currency and a decrease in net exports. Under fixed exchange rates, only fiscal policy can affect income. The normal potency of monetary policy is lost because the money supply is dedicated to maintaining the exchange rate at the announced level.

13-4 Interest Rate Differentials

So far, our analysis has assumed that the interest rate in a small open economy is equal to the world interest rate: $r = r^*$. To some extent, however, interest rates differ around the world. We now extend our analysis by considering the causes and effects of international interest rate differentials.

Country Risk and Exchange-Rate Expectations

When we assumed earlier that the interest rate in our small open economy is determined by the world interest rate, we were applying the law of one price. We reasoned that if the domestic interest rate was above the world interest rate, people from abroad would lend to that country, driving the domestic interest rate down. And if the domestic interest rate was below the world interest rate, domestic residents would lend abroad to earn a higher return, driving the domestic interest rate up. In the end, the domestic interest rate would equal the world interest rate.

Why doesn't this logic always apply? There are two reasons.

One reason is country risk. When investors buy U.S. government bonds or make loans to U.S. corporations, they are fairly confident that they will be repaid with interest. By contrast, in some less-developed countries, it is plausible to fear that a revolution or other political upheaval might lead to a default on loan repayments. Borrowers in such countries often have to pay higher interest rates to compensate lenders for this risk.

Another reason interest rates differ across countries is expected changes in the exchange rate. For example, suppose that people expect the Mexican peso to fall in value relative to the U.S. dollar. Then loans made in pesos will be repaid in a less valuable currency than loans made in dollars. To compensate for this expected fall in the Mexican currency, the interest rate in Mexico will be higher than the interest rate in the United States.

Thus, because of country risk and expectations about future exchange-rate changes, the interest rate of a small open economy can differ from interest rates in other economies around the world. Let's see how this fact affects our analysis.

Differentials in the Mundell–Fleming Model

Consider again the Mundell–Fleming model with a floating exchange rate. To incorporate interest rate differentials into the model, we assume that the interest rate in our small open economy is determined by the world interest rate plus a risk premium θ:

$$r = r^* + \theta.$$

The risk premium is determined by the perceived political risk of making loans in a country and the expected change in the real exchange rate. For our purposes here, we can take the risk premium as exogenous in order to examine how changes in the risk premium affect the economy.

The model is largely the same as before. The two equations are

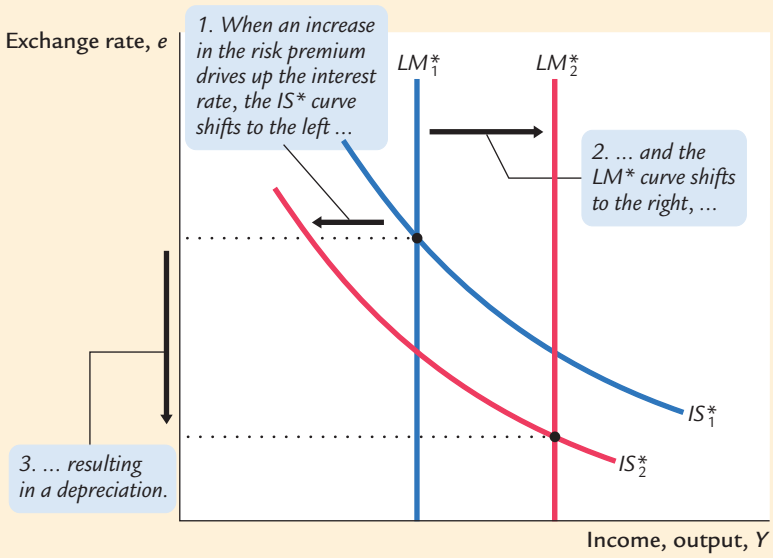
$$Y = C(Y - T) + I(r^* + \theta) + G + NX(e) \qquad IS^*,$$

$$M/P = L(r^* + \theta, Y) \qquad LM^*.$$

For any given fiscal policy, monetary policy, price level, and risk premium, these two equations determine the level of income and exchange rate that equilibrate the goods market and the money market. Holding constant the risk premium, the tools of monetary, fiscal, and trade policy work as we have already seen.

Now suppose that political turmoil causes the country's risk premium θ to rise. Because $r = r^* + \theta$, the most direct effect is that the domestic interest rate r rises. The higher interest rate, in turn, has two effects. First, the IS^* curve shifts to the left because the higher interest rate reduces investment. Second, the LM^* curve shifts to the right because the higher interest rate reduces the demand for money, which in turn implies a higher level of income for any given money supply. [Recall that Y must satisfy the equation $M/P = L(r^* + \theta, Y)$.] As Figure 13-11 shows, these two shifts cause income to rise and the currency to depreciate.

FIGURE 13-11



An Increase in the Risk Premium An increase in the risk premium associated with a country drives up its interest rate. Because the higher interest rate reduces investment, the *IS** curve shifts to the left. Because it also reduces money demand, the *LM** curve shifts to the right. Income rises, and the currency depreciates.

This analysis has an important implication: expectations about the exchange rate are partially self-fulfilling. For example, suppose that for some reason people reduce their expectations of the future value of the Mexican peso. Investors will place a larger risk premium on Mexican assets: θ will rise in Mexico. This expectation will drive up Mexican interest rates and, as we have just seen, will drive down the value of the Mexican currency. *Thus, the expectation that a currency will lose value in the future causes it to lose value today.*

One surprising—and perhaps inaccurate—prediction of this analysis is that an increase in country risk as measured by θ will cause the economy's income to increase. This occurs in Figure 13-11 because of the rightward shift in the *LM** curve. Although higher interest rates depress investment, the depreciation of the currency stimulates net exports by an even greater amount. As a result, aggregate income rises.

There are three reasons why, in practice, such a boom in income does not occur. First, the central bank might want to avoid the large depreciation of the domestic currency and, therefore, may respond by decreasing the money supply *M*. Second, the depreciation of the domestic currency may suddenly increase the price of imported goods, causing an increase in the price level *P*. Third, when some event increases the country risk premium θ, residents of the country might respond to the same event by increasing their demand for money (for any given income and interest rate) because money is often the safest asset available. All three of these changes would tend to shift the *LM** curve toward the left, which mitigates the fall in the exchange rate but also tends to depress income.

Thus, increases in country risk are not desirable. In the short run, they typically lead to a depreciating currency and, through the three channels just described, falling aggregate income. In addition, because a higher interest rate reduces investment, the long-run implication is reduced capital accumulation and lower economic growth.

CASE STUDY

International Financial Crisis: Mexico 1994–1995

In August 1994, a Mexican peso was worth 30 cents. A year later, it was worth only 16 cents. What explains this massive fall in the value of the Mexican currency? Country risk is a large part of the story.

At the beginning of 1994, Mexico was a country on the rise. The recent passage of the North American Free Trade Agreement (NAFTA), which reduced trade barriers among the United States, Canada, and Mexico, made many people confident about the future of the Mexican economy. Investors around the world were eager to make loans to the Mexican government and to Mexican corporations.

Political developments soon changed that perception. A violent uprising in the Chiapas region of Mexico made the political situation in Mexico seem precarious. Then Luis Donaldo Colosio, the leading presidential candidate, was assassinated. The political future looked less certain, and many investors started placing a larger risk premium on Mexican assets.

At first, the rising risk premium did not affect the value of the peso because Mexico was operating with a fixed exchange rate. As we have seen, under a fixed exchange rate, the central bank agrees to trade the domestic currency (pesos) for a foreign currency (dollars) at a predetermined rate. Thus, when an increase in the country risk premium put downward pressure on the value of the peso, the Mexican central bank had to accept pesos and pay out dollars. This automatic exchange-market intervention contracted the Mexican money supply (shifting the LM^* curve to the left) when the currency might otherwise have depreciated.

Yet Mexico's foreign-currency reserves were too small to maintain its fixed exchange rate. When Mexico ran out of dollars at the end of 1994, the Mexican government announced a devaluation of the peso. This decision had repercussions, however, because the government had repeatedly promised that it would not devalue. Investors became even more distrustful of Mexican policymakers and feared further Mexican devaluations.

Investors around the world (including those in Mexico) avoided buying Mexican assets. The country risk premium rose once again, adding to the upward pressure on interest rates and the downward pressure on the peso. The Mexican stock market plummeted. When the Mexican government needed to roll over some of its debt that was coming due, investors were unwilling to buy the new debt. Default appeared to be the government's only option. In just a few months, Mexico had gone from being a promising emerging economy to being a risky economy with a government on the verge of bankruptcy.

Then the United States stepped in. The U.S. government had three motives: to help its neighbor to the south, to prevent the massive illegal immigration that might follow government default and economic collapse, and to prevent the investor pessimism regarding Mexico from spreading to other developing countries. The U.S. government, together with the International Monetary Fund (IMF), led an international effort to bail out the Mexican government. In particular, the United States provided loan guarantees for Mexican government debt, which allowed the Mexican government to refinance the debt that was coming due. These loan guarantees helped restore confidence in the Mexican economy, thereby reducing to some extent the country risk premium.

Although the U.S. loan guarantees may well have stopped a bad situation from getting worse, they did not prevent the Mexican meltdown of 1994–1995 from being a painful experience for the Mexican people. Not only did the Mexican currency lose much of its value, but Mexico also went through a deep recession. Fortunately, by the late 1990s, the worst was over, and aggregate income was growing again. But the lesson from this experience is clear and could well apply again in the future: changes in perceived country risk, often attributable to political instability, are an important determinant of interest rates and exchange rates in small open economies. ■

CASE STUDY

International Financial Crisis: Asia 1997–1998

In 1997, as the Mexican economy was recovering from its financial crisis, a similar story started to unfold in several Asian economies, including those of Thailand, South Korea, and especially Indonesia. The symptoms were familiar: high interest rates, falling asset values, and a depreciating currency. In Indonesia, for instance, short-term nominal interest rates rose above 50 percent, the stock market lost about 90 percent of its value (measured in U.S. dollars), and the rupiah fell against the dollar by more than 80 percent. The crisis led to rising inflation in these countries (because the depreciating currency made imports more expensive) and to falling GDP (because high interest rates and reduced confidence depressed spending). Real GDP in Indonesia fell about 13 percent in 1998, making the downturn larger than any U.S. recession since the Great Depression of the 1930s.

What sparked this firestorm? The problem began in the Asian banking systems. For many years, the governments in the Asian nations had been more involved in managing the allocation of resources—in particular, financial resources—than is true in the United States and other developed countries. Some commentators had applauded this "partnership" between government and private enterprise and had even suggested that the United States should follow the example. Over time, however, it became clear that many Asian banks had been extending loans to those with the most political clout rather than to those with the most profitable investment projects. Once rising default rates started to expose this "crony capitalism," as it was then called, international investors started to lose confidence

in the future of these economies. The risk premiums for Asian assets rose, causing interest rates to skyrocket and currencies to collapse.

International crises of confidence often involve a vicious circle that can amplify the problem. Here is a brief account about what happened in Asia:

1. Problems in the banking system eroded international confidence in these economies.
2. Loss of confidence raised risk premiums and interest rates.
3. Rising interest rates, together with the loss of confidence, depressed the prices of stock and other assets.
4. Falling asset prices reduced the value of collateral being used for bank loans.
5. Reduced collateral increased default rates on bank loans.
6. Greater defaults exacerbated problems in the banking system. Now return to step 1 to complete and continue the circle.

Some economists have used this vicious-circle argument to suggest that the Asian crisis was a self-fulfilling prophecy: bad things happened merely because people expected bad things to happen. Most economists, however, thought the political corruption of the banking system was a real problem, which was then compounded by this vicious circle of reduced confidence.

As the Asian crisis developed, the IMF and the United States tried to restore confidence, much as they had with Mexico a few years earlier. In particular, the IMF made loans to the Asian countries to help them through the crisis; in exchange for these loans, it exacted promises that the governments would reform their banking systems and eliminate crony capitalism. The IMF's hope was that the short-term loans and longer-term reforms would restore confidence, lower the risk premium, and turn the vicious circle into a virtuous one. This policy seems to have worked: the Asian economies recovered quickly from their crisis. ■

13-5 Should Exchange Rates Be Floating or Fixed?

Having analyzed how an economy works under floating and fixed exchange rates, let's consider which exchange-rate regime is better.

Pros and Cons of Different Exchange-Rate Systems

The primary argument for a floating exchange rate is that it allows a nation to use its monetary policy for other purposes. Under fixed rates, monetary policy is committed to the single goal of maintaining the exchange rate at its announced level. Yet the exchange rate is only one of many macroeconomic variables that monetary policy can influence. A system of floating exchange rates leaves monetary policymakers free to pursue other goals, such as stabilizing employment or prices.

"Then it's agreed. Until the dollar firms up, we let the clamshell float."

Advocates of fixed exchange rates argue that exchange-rate uncertainty makes international trade more difficult. After the world abandoned the Bretton Woods system of fixed exchange rates in the early 1970s, both real and nominal exchange rates became (and have remained) much more volatile than anyone had expected. Some economists attribute this volatility to irrational and destabilizing speculation by international investors. Business executives often claim that this volatility is harmful because it increases the uncertainty that accompanies international business transactions. Despite this exchange-rate volatility, however, the amount of world trade has continued to rise under floating exchange rates.

Advocates of fixed exchange rates sometimes argue that a commitment to a fixed exchange rate is one way to discipline a nation's monetary authority and prevent excessive growth in the money supply. Yet there are many other policy rules to which the central bank could be committed. In Chapter 18, for instance, we discuss policy rules such as targets for nominal GDP or the inflation rate. Fixing the exchange rate has the advantage of being simpler to implement than these other policy rules because the money supply adjusts automatically, but this policy may lead to greater volatility in income and employment.

In practice, the choice between floating and fixed rates is not as stark as it may seem at first. Under systems of fixed exchange rates, countries can change the value of their currency if maintaining the exchange rate conflicts too severely with other goals. Under systems of floating exchange rates, countries often use formal or informal targets for the exchange rate when deciding whether to expand or contract the money supply. We rarely observe exchange rates that are completely fixed or completely floating. Instead, under both systems, stability of the exchange rate is usually one among many objectives of the central bank.

CASE STUDY

The Debate Over the Euro

If you have ever driven the 3,000 miles from New York City to San Francisco, you may recall that you never needed to change your money from one form of currency to another. In all 50 U.S. states, local residents are happy to accept the U.S. dollar for the items you buy. Such a *monetary union* is the most extreme form of a fixed exchange rate. The exchange rate between New York dollars and

San Francisco dollars is so irrevocably fixed that you may not even know that there is a difference between the two. (What's the difference? Each dollar bill is issued by one of the dozen local Federal Reserve Banks. Although the bank of origin can be identified from the bill's markings, you don't care which type of dollar you hold because everyone else, including the Federal Reserve system, is ready to trade any dollar from one bank for a dollar from another.)

If you made a similar 3,000-mile trip across Europe during the 1990s, however, your experience was very different. You didn't have to travel far before needing to exchange your French francs for German marks, Dutch guilders, Spanish pesetas, or Italian lire. The large number of currencies in Europe made traveling less convenient and more expensive. Every time you crossed a border, you had to wait in line at a bank to get the local money, and you had to pay the bank a fee for the service.

Today, however, the situation in Europe is more like that in the United States. Many European countries have given up having their own currencies and have formed a monetary union that uses a common currency called the *euro*. As a result, the exchange rate between France and Germany is now as fixed as the exchange rate between New York and California.

The introduction of a common currency has its costs. The most important is that the nations of Europe are no longer able to conduct their own monetary policies. Instead, the European Central Bank, with the participation of all member countries, sets a single monetary policy for all of Europe. The central banks of the individual countries play a role similar to that of regional Federal Reserve Banks: they monitor local conditions but they have no control over the money supply or interest rates. Critics of the move toward a common currency argue that the cost of losing national monetary policy is large. When a recession hits one country but not others in Europe, that country does not have the tool of monetary policy to combat the downturn. This argument is one reason some European nations, such as the United Kingdom and Sweden, have chosen not to give up their own currency in favor of the euro.

Why, according to the euro critics, is monetary union a bad idea for Europe if it works so well in the United States? These economists argue that the United States is different from Europe in two important ways. First, labor is more mobile among U.S. states than among European countries. This is in part because the United States has a common language and in part because most Americans are descended from immigrants, who have shown a willingness to move. Therefore, when a regional recession occurs, U.S. workers are more likely to move from high-unemployment states to low-unemployment states. Second, the United States has a strong central government that can use fiscal policy—such as the federal income tax—to redistribute resources among regions. Because Europe does not have these two advantages, it bears a larger cost when it restricts itself to a single monetary policy.

Advocates of a common currency believe that the loss of national monetary policy is more than offset by other gains. With a single currency in all of Europe, travelers and businesses no longer need to worry about exchange rates, and this encourages more international trade. In addition, a common currency may have the political advantage of making Europeans feel more connected to one another. The twentieth century was marked by two world wars, both of which

were sparked by European discord. If a common currency makes the nations of Europe more harmonious, euro advocates argue, it benefits the entire world.

In recent years, the debate over the euro has become particularly fervent. In 2011, the government of Greece ran into severe financial difficulties. For years, the Greek government had spent much more than it had received in tax revenue, financing the substantial budget deficits by borrowing. Moreover, some of these fiscal problems were hidden by dubious accounting. When the magnitude of the problem came to light, interest rates on Greek government debt skyrocketed because investors around the world began to fear default. The government then had little choice but to alter its fiscal policy—that is, to cut spending and raise taxes—despite widespread protests within the country. We will examine these events more thoroughly in Chapter 20, but one aspect of the situation is relevant here: if Greece had had its own currency, rather than being part of the euro area, it could have offset its contractionary fiscal policy with expansionary monetary policy. An expansionary monetary policy would have weakened the Greek currency and made Greek exports less expensive on world markets; the increase in net exports would have helped maintain aggregate demand and soften the recession that resulted from the fiscal contraction.

As this book was going to press, the future of the euro was uncertain. Many European policymakers remained committed to a common currency as part of a broader agenda of strong political and economic ties within Europe. Some commentators, however, suggested that Europe should reconsider its decision to form a monetary union. ■

Speculative Attacks, Currency Boards, and Dollarization

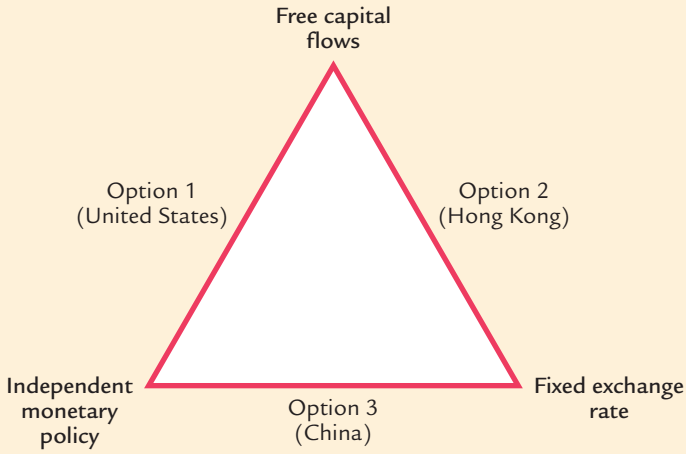
Imagine that you are a central banker of a small country. You and your fellow policymakers decide to fix your currency—let's call it the peso—against the U.S. dollar. From now on, one peso will sell for one dollar.

As we discussed earlier, you now have to stand ready to buy and sell pesos for a dollar each. The money supply will adjust automatically to make the equilibrium exchange rate equal your target. There is, however, one potential problem with this plan: you might run out of dollars. If people come to the central bank to sell large quantities of pesos, the central bank's dollar reserves might dwindle to zero. In this case, the central bank has no choice but to abandon the fixed exchange rate and let the peso depreciate.

This fact raises the possibility of a *speculative attack*—a change in investors' perceptions that makes the fixed exchange rate untenable. Suppose that, for no good reason, a rumor spreads that the central bank is going to abandon the exchange-rate peg. People would respond by rushing to the central bank to convert pesos into dollars before the pesos lose value. This rush would drain the central bank's reserves and could force the central bank to abandon the peg. In this case, the rumor would prove self-fulfilling.

To avoid this possibility, some economists argue that a fixed exchange rate should be supported by a *currency board*, such as that used by Argentina in the 1990s.

FIGURE 13-12



The Impossible Trinity It is impossible for a nation to have free capital flows, a fixed exchange rate, and independent monetary policy. A nation must choose one side of this triangle, giving up the opposite corner.

A currency board is an arrangement by which the central bank holds enough foreign currency to back each unit of the domestic currency. In our example, the central bank would hold one U.S. dollar (or one dollar invested in a U.S. government bond) for every peso. No matter how many pesos turned up at the central bank to be exchanged, the central bank would never run out of dollars.

Once a central bank has adopted a currency board, it might consider the natural next step: it can abandon the peso altogether and let its country use the U.S. dollar. Such a plan is called *dollarization*. It happens on its own in high-inflation economies, where foreign currencies offer a more reliable store of value than the domestic currency. But it can also occur as a matter of public policy, as in Panama. If a country really wants its currency to be irrevocably fixed to the dollar, the most reliable method is to make its currency the dollar. The only loss from dollarization is the seigniorage revenue that a government gives up by relinquishing its control over the printing press. The U.S. government then gets the revenue that is generated by growth in the money supply.[5]

The Impossible Trinity

The analysis of exchange-rate regimes leads to a simple conclusion: you can't have it all. To be more precise, it is impossible for a nation to have free capital flows, a fixed exchange rate, and independent monetary policy. This fact, often called the **impossible trinity** (or sometimes the *trilemma of international finance*), is illustrated in Figure 13-12. A nation must choose one side of this triangle, giving up the institutional feature at the opposite corner.

[5]Dollarization may also lead to a loss in national pride from seeing American portraits on the currency. If it wanted, the U.S. government could fix this problem by leaving blank the center space that now has portraits of George Washington, Abraham Lincoln, and others. Each nation using U.S. currency could insert the faces of its own local heroes.

The first option is to allow free flows of capital and to conduct an independent monetary policy, as the United States has done in recent years. In this case, it is impossible to have a fixed exchange rate. Instead, the exchange rate must float to equilibrate the market for foreign-currency exchange.

The second option is to allow free flows of capital and to fix the exchange rate, as Hong Kong has done in recent years. In this case, the nation loses the ability to conduct an independent monetary policy. The money supply must adjust to keep the exchange rate at its predetermined level. In a sense, when a nation fixes its currency to that of another nation, it is adopting that other nation's monetary policy.

The third option is to restrict the international flow of capital in and out of the country, as China has done in recent years. In this case, the interest rate is no longer fixed by world interest rates but is determined by domestic forces, much as is the case in a completely closed economy. It is then possible to both fix the exchange rate and conduct an independent monetary policy.

History has shown that nations can, and do, choose different sides of the trinity. Every nation must ask itself the following question: Does it want to live with exchange-rate volatility (option 1), does it want to give up the use of monetary policy for purposes of domestic stabilization (option 2), or does it want to restrict its citizens from participating in world financial markets (option 3)? The impossible trinity says that no nation can avoid making one of these choices.

CASE STUDY

The Chinese Currency Controversy

From 1995 to 2005 the Chinese currency, the yuan, was pegged to the dollar at an exchange rate of 8.28 yuan per U.S. dollar. In other words, the Chinese central bank stood ready to buy and sell yuan at this price. This policy of fixing the exchange rate was combined with a policy of restricting international capital flows. Chinese citizens were not allowed to convert their savings into dollars or euros and invest abroad.

By the early 2000s, many observers believed that the yuan was significantly undervalued. They suggested that if the yuan were allowed to float, it would increase in value relative to the dollar. The evidence in favor of this hypothesis was that China was accumulating large dollar reserves in its efforts to maintain the fixed exchange rate. That is, the Chinese central bank had to supply yuan and demand dollars in foreign-exchange markets to keep the yuan at the pegged level. If this intervention in the currency market ceased, the yuan would rise in value compared to the dollar.

The pegged yuan became a contentious political issue in the United States. U.S. producers that competed against Chinese imports complained that the undervalued yuan made Chinese goods cheaper, putting the U.S. producers at a disadvantage. (Of course, U.S. consumers benefited from inexpensive imports, but in the politics of international trade, producers usually shout louder than consumers.) In response to these concerns, President George W. Bush called

on China to let its currency float. Several senators proposed a more drastic step—a steep tariff on Chinese imports until China adjusted the value of its currency.

China no longer completely fixes the exchange rate. In July 2005 China announced a new policy: it would still intervene in foreign-exchange markets to prevent large and sudden movements in the exchange rate, but it would permit gradual changes. Moreover, it would judge the value of the yuan not just relative to the dollar but also relative to a broad basket of currencies. By October 2011, the exchange rate had moved to 6.38 yuan per dollar—a 30 percent appreciation of the yuan. Despite this large change in the exchange rate, China's critics, including President Barack Obama, continue to complain about that nation's intervention in foreign-exchange markets. ■

13-6 From the Short Run to the Long Run: The Mundell–Fleming Model With a Changing Price Level

So far we have used the Mundell–Fleming model to study the small open economy in the short run when the price level is fixed. We now consider what happens when the price level changes. Doing so will show how the Mundell–Fleming model provides a theory of the aggregate demand curve in a small open economy. It will also show how this short-run model relates to the long-run model of the open economy we examined in Chapter 6.

Because we now want to consider changes in the price level, the nominal and real exchange rates in the economy will no longer be moving in tandem. Thus, we must distinguish between these two variables. The nominal exchange rate is e and the real exchange rate is ϵ, which equals eP/P^*, as you should recall from Chapter 6. We can write the Mundell–Fleming model as

$$Y = C(Y - T) + I(r^*) + G + NX(\epsilon) \qquad IS^*,$$

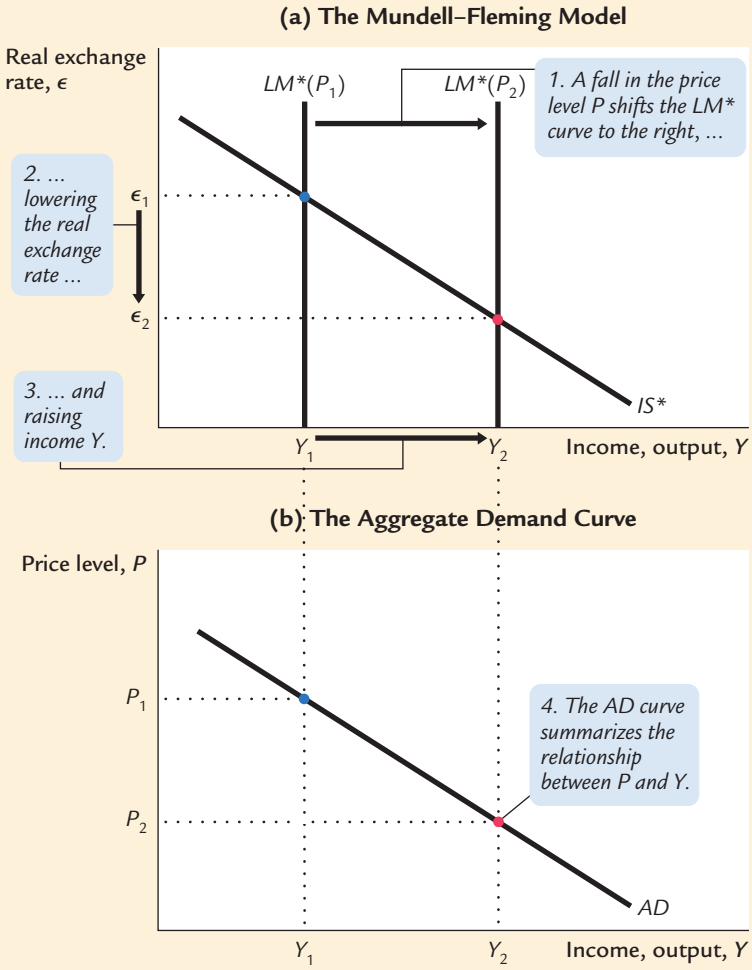
$$M/P = L(r^*, Y) \qquad LM^*.$$

These equations should be familiar by now. The first equation describes the IS^* curve; and the second describes the LM^* curve. Note that net exports depend on the real exchange rate.

Figure 13-13 shows what happens when the price level falls. Because a lower price level raises the level of real money balances, the LM^* curve shifts to the right, as in panel (a). The real exchange rate falls, and the equilibrium level of income rises. The aggregate demand curve summarizes this negative relationship between the price level and the level of income, as shown in panel (b).

Thus, just as the IS–LM model explains the aggregate demand curve in a closed economy, the Mundell–Fleming model explains the aggregate demand curve for a small open economy. In both cases, the aggregate demand curve shows the set of equilibria in the goods and money markets that arise as the price level varies. And in both cases, anything that changes equilibrium income, other

FIGURE 13-13

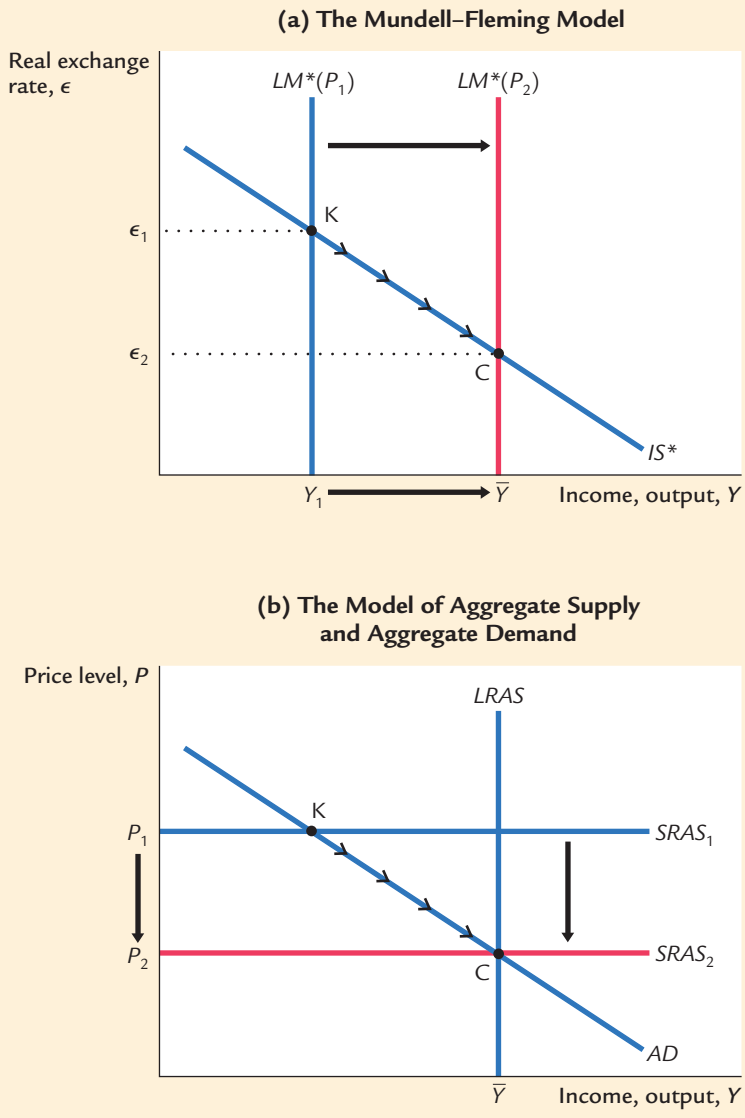


Mundell–Fleming as a Theory of Aggregate Demand Panel (a) shows that when the price level falls, the *LM** curve shifts to the right. The equilibrium level of income rises. Panel (b) shows that this negative relationship between *P* and *Y* is summarized by the aggregate demand curve.

than a change in the price level, shifts the aggregate demand curve. Policies and events that raise income for a given price level shift the aggregate demand curve to the right; policies and events that lower income for a given price level shift the aggregate demand curve to the left.

We can use this diagram to show how the short-run model in this chapter is related to the long-run model in Chapter 6. Figure 13-14 shows the short-run and long-run equilibria. In both panels of the figure, point K describes the short-run equilibrium because it assumes a fixed price level. At this equilibrium, the demand for goods and services is too low to keep the economy producing at its natural level. Over time, low demand causes the price level to fall. The fall in the price level raises real money balances, shifting the *LM** curve to the right. The real exchange rate depreciates, so net exports rise. Eventually, the economy

FIGURE 13-14



The Short-Run and Long-Run Equilibria in a Small Open Economy Point K in both panels shows the equilibrium under the Keynesian assumption that the price level is fixed at P_1. Point C in both panels shows the equilibrium under the classical assumption that the price level adjusts to maintain income at its natural level $\bar{Y}$.

reaches point C, the long-run equilibrium. The speed of transition between the short-run and long-run equilibria depends on how quickly the price level adjusts to restore the economy to the natural level of output.

The levels of income at point K and point C are both of interest. Our central concern in this chapter has been how policy influences point K, the short-run equilibrium. In Chapter 6 we examined the determinants of point C, the long-run equilibrium. Whenever policymakers consider any change in policy, they need to consider both the short-run and long-run effects of their decision.

13-7 A Concluding Reminder

In this chapter we have examined how a small open economy works in the short run when prices are sticky. We have seen how monetary, fiscal, and trade policy influence income and the exchange rate, as well as how the behavior of the economy depends on whether the exchange rate is floating or fixed. In closing, it is worth repeating a lesson from Chapter 6. Many countries, including the United States, are neither closed economies nor small open economies: they lie somewhere in between.

A large open economy, such as that of the United States, combines the behavior of a closed economy and the behavior of a small open economy. When analyzing policies in a large open economy, we need to consider both the closed-economy logic of Chapter 12 and the open-economy logic developed in this chapter. The appendix to this chapter presents a model for a large open economy. The results of that model are, as one would guess, a mixture of the two polar cases we have already examined.

To see how we can draw on the logic of both the closed and small open economies and apply these insights to the United States, consider how a monetary contraction affects the economy in the short run. In a closed economy, a monetary contraction raises the interest rate, lowers investment, and thus lowers aggregate income. In a small open economy with a floating exchange rate, a monetary contraction raises the exchange rate, lowers net exports, and thus lowers aggregate income. The interest rate is unaffected, however, because it is determined by world financial markets.

The U.S. economy contains elements of both cases. Because the United States is large enough to affect the world interest rate and because capital is not perfectly mobile across countries, a monetary contraction does raise the interest rate and depress investment. At the same time, a monetary contraction also raises the value of the dollar, thereby depressing net exports. Hence, although the Mundell–Fleming model does not precisely describe an economy like that of the United States, it does correctly predict what happens to international variables such as the exchange rate, and it shows how international interactions alter the effects of monetary and fiscal policies.

Summary

1. The Mundell–Fleming model is the *IS–LM* model for a small open economy. It takes the price level as given and then shows what causes fluctuations in income and the exchange rate.
2. The Mundell–Fleming model shows that fiscal policy does not influence aggregate income under floating exchange rates. A fiscal expansion causes the currency to appreciate, reducing net exports and offsetting the usual

expansionary impact on aggregate income. Fiscal policy does influence aggregate income under fixed exchange rates.

3. The Mundell–Fleming model shows that monetary policy does not influence aggregate income under fixed exchange rates. Any attempt to expand the money supply is futile because the money supply must adjust to ensure that the exchange rate stays at its announced level. Monetary policy does influence aggregate income under floating exchange rates.
4. If investors are wary of holding assets in a country, the interest rate in that country may exceed the world interest rate by some risk premium. According to the Mundell–Fleming model, if a country has a floating exchange rate, an increase in the risk premium causes the interest rate to rise and the currency of that country to depreciate.
5. There are advantages to both floating and fixed exchange rates. Floating exchange rates leave monetary policymakers free to pursue objectives other than exchange-rate stability. Fixed exchange rates reduce some of the uncertainty in international business transactions, but they may be subject to speculative attack if international investors believe the central bank does not have sufficient foreign-currency reserves to defend the fixed exchange rate. When choosing an exchange-rate regime, policymakers are constrained by the fact that it is impossible for a nation to have free capital flows, a fixed exchange rate, and independent monetary policy.

KEY CONCEPTS

Mundell–Fleming model
Floating exchange rates
Fixed exchange rates
Devaluation
Revaluation
Impossible trinity

QUESTIONS FOR REVIEW

1. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when taxes are raised. What would happen if exchange rates were fixed rather than floating?
2. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when the money supply is reduced. What would happen if exchange rates were fixed rather than floating?
3. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when a quota on imported cars is removed. What would happen if exchange rates were fixed rather than floating?
4. What are the advantages of floating exchange rates and fixed exchange rates?
5. Describe the impossible trinity.

PROBLEMS AND APPLICATIONS

1. Use the Mundell–Fleming model to predict what would happen to aggregate income, the exchange rate, and the trade balance under both floating and fixed exchange rates in response to each of the following shocks. Be sure to include an appropriate graph in your answer.

a. A fall in consumer confidence about the future induces consumers to spend less and save more.

b. The introduction of a stylish line of Toyotas makes some consumers prefer foreign cars over domestic cars.

c. The introduction of automatic teller machines reduces the demand for money.

2. A small open economy with a floating exchange rate is in recession with balanced trade. If policymakers want to reach full employment while maintaining balanced trade, what combination of monetary and fiscal policy should they choose? Use a graph, and be sure to identify the effects of each policy.

3. The Mundell–Fleming model takes the world interest rate r^* as an exogenous variable. Let's consider what happens when this variable changes.

a. What might cause the world interest rate to rise? (*Hint*: The world is a closed economy.)

b. In the Mundell–Fleming model with a floating exchange rate, what happens to aggregate income, the exchange rate, and the trade balance when the world interest rate rises?

c. In the Mundell–Fleming model with a fixed exchange rate, what happens to aggregate income, the exchange rate, and the trade balance when the world interest rate rises?

4. Business executives and policymakers are often concerned about the competitiveness of American industry (the ability of U.S. industries to sell their goods profitably in world markets).

a. How would a change in the nominal exchange rate affect competitiveness in the short run when prices are sticky?

b. Suppose you wanted to make domestic industries more competitive but did not want to alter aggregate income. According to the Mundell–Fleming model, what combination of monetary and fiscal policies should you pursue? Use a graph, and be sure to identify the effects of each policy.

5. Suppose that higher income implies higher imports and thus lower net exports. That is, the net-exports function is

$$NX = NX(e, Y).$$

Examine the effects in a small open economy of a fiscal expansion on income and the trade balance under the following exchange-rate regimes.

a. A floating exchange rate

b. A fixed exchange rate

How does your answer compare to the results in Table 13-1?

6. Suppose that money demand depends on disposable income, so that the equation for the money market becomes

$$M/P = L(r, Y - T).$$

Analyze the short-run impact of a tax cut in a small open economy on the exchange rate and income under both floating and fixed exchange rates.

7. Suppose that the price level relevant for money demand includes the price of imported goods and that the price of imported goods depends on the exchange rate. That is, the money market is described by

$$M/P = L(r, Y),$$

where

$$P = \lambda P_d + (1 - \lambda)P_f/e.$$

Here, P_d is the price of domestic goods, P_f is the price of foreign goods measured in the foreign currency, and e is the exchange rate. Thus, P_f/e is the price of foreign goods measured in the domestic currency. The parameter λ is the share of domestic goods in the price index P. Assume that the price of domestic goods P_d and

the price of foreign goods measured in foreign currency P_f are sticky in the short run.

a. Suppose that we graph the LM^* curve for given values of P_d and P_f (instead of the usual P). Is this LM^* curve still vertical? Explain.

b. What is the effect of expansionary fiscal policy under floating exchange rates in this model? Explain. Contrast with the standard Mundell–Fleming model.

c. Suppose that political instability increases the country risk premium and, thereby, the interest rate. What is the effect on the exchange rate, the price level, and aggregate income in this model? Contrast with the standard Mundell–Fleming model.

8. Use the Mundell–Fleming model to answer the following questions about the state of California (a small open economy).

a. What kind of exchange-rate system does California have with its major trading partners (Alabama, Alaska, Arizona, . . .)?

b. If California suffers from a recession, should the state government use monetary or fiscal policy to stimulate employment? Explain. (*Note:* For this question, assume that the state government can print dollar bills.)

c. If California prohibited the import of wines from the state of Washington, what would happen to income, the exchange rate, and the trade balance? Consider both the short-run and the long-run impacts.

d. Can you think of any important features of the Californian economy that are different from, say, the Canadian economy and that might make the Mundell–Fleming model less useful when applied to California than to Canada?

APPENDIX

A Short-Run Model of the Large Open Economy

When analyzing policies in an economy such as that of the United States, we need to combine the closed-economy logic of the *IS–LM* model and the small-open-economy logic of the Mundell–Fleming model. This appendix presents a model for the intermediate case of a large open economy.

As we discussed in the appendix to Chapter 6, a large open economy differs from a small open economy because its interest rate is not fixed by world financial markets. In a large open economy, we must consider the relationship between the interest rate and the flow of capital abroad. The net capital outflow is the amount that domestic investors lend abroad minus the amount that foreign investors lend here. As the domestic interest rate falls, domestic investors find foreign lending more attractive, and foreign investors find lending here less attractive. Thus, the net capital outflow is negatively related to the interest rate. Here we add this relationship to our short-run model of national income.

The three equations of the model are

$$Y = C(Y - T) + I(r) + G + NX(e),$$
$$M/P = L(r, Y),$$
$$NX(e) = CF(r).$$

The first two equations are the same as those used in the Mundell–Fleming model of this chapter. The third equation, taken from the appendix to Chapter 6, states that the trade balance NX equals the net capital outflow CF, which in turn depends on the domestic interest rate.

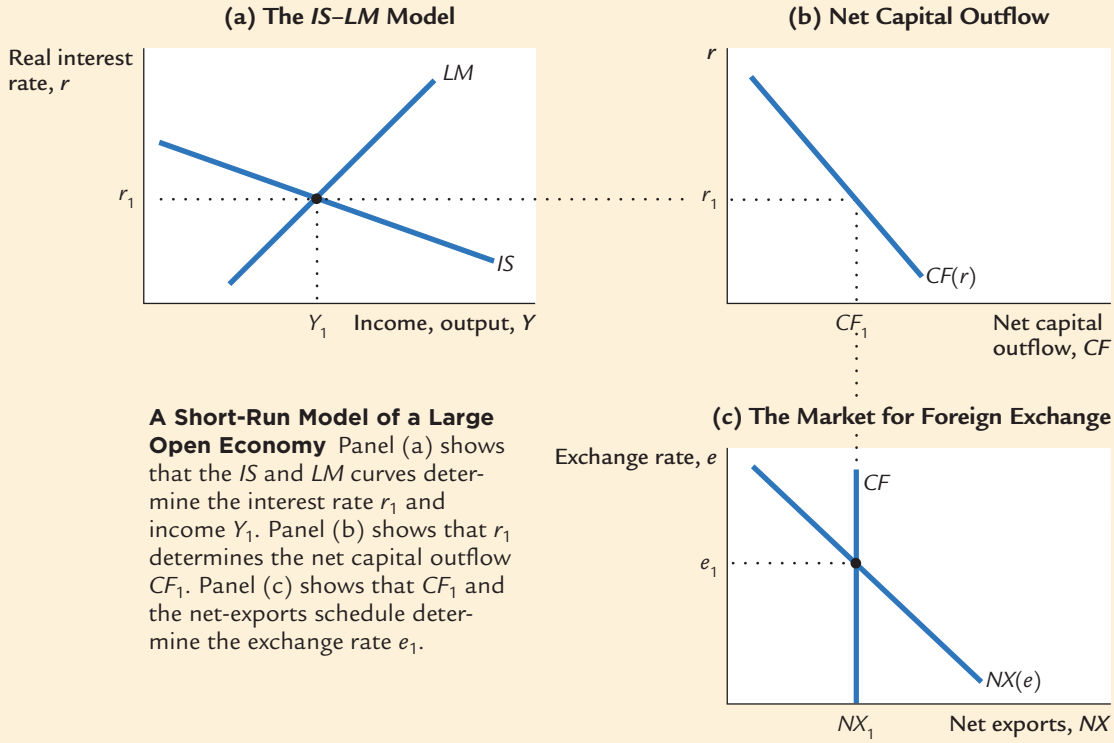
To see what this model implies, substitute the third equation into the first, so the model becomes

$$Y = C(Y - T) + I(r) + G + CF(r) \qquad IS,$$
$$M/P = L(r, Y) \qquad LM.$$

These two equations are much like the two equations of the closed-economy *IS–LM* model. The only difference is that expenditure now depends on the interest rate for two reasons. As before, a higher interest rate reduces investment. But now a higher interest rate also reduces the net capital outflow and thus lowers net exports.

To analyze this model, we can use the three graphs in Figure 13-15. Panel (a) shows the *IS–LM* diagram. As in the closed-economy model in Chapters 11 and 12, the interest rate r is on the vertical axis, and income Y is on the horizontal axis. The *IS* and *LM* curves together determine the equilibrium level of income and the equilibrium interest rate.

FIGURE 13-15



A Short-Run Model of a Large Open Economy Panel (a) shows that the *IS* and *LM* curves determine the interest rate r_1 and income Y_1. Panel (b) shows that r_1 determines the net capital outflow CF_1. Panel (c) shows that CF_1 and the net-exports schedule determine the exchange rate e_1.

The new net-capital-outflow term in the *IS* equation, $CF(r)$, makes this *IS* curve flatter than it would be in a closed economy. The more responsive international capital flows are to the interest rate, the flatter the *IS* curve is. You might recall from the Chapter 6 appendix that the small open economy represents the extreme case in which the net capital outflow is infinitely elastic at the world interest rate. In this extreme case, the *IS* curve is completely flat. Hence, a small open economy would be depicted in this figure with a horizontal *IS* curve.

Panels (b) and (c) show how the equilibrium from the *IS–LM* model determines the net capital outflow, the trade balance, and the exchange rate. In panel (b) we see that the interest rate determines the net capital outflow. This curve slopes downward because a higher interest rate discourages domestic investors from lending abroad and encourages foreign investors to lend here, thereby reducing the net capital outflow. In panel (c) we see that the exchange rate adjusts to ensure that net exports of goods and services equal the net capital outflow.

Now let's use this model to examine the impact of various policies. We assume that the economy has a floating exchange rate because this assumption is correct for most large open economies such as that of the United States.

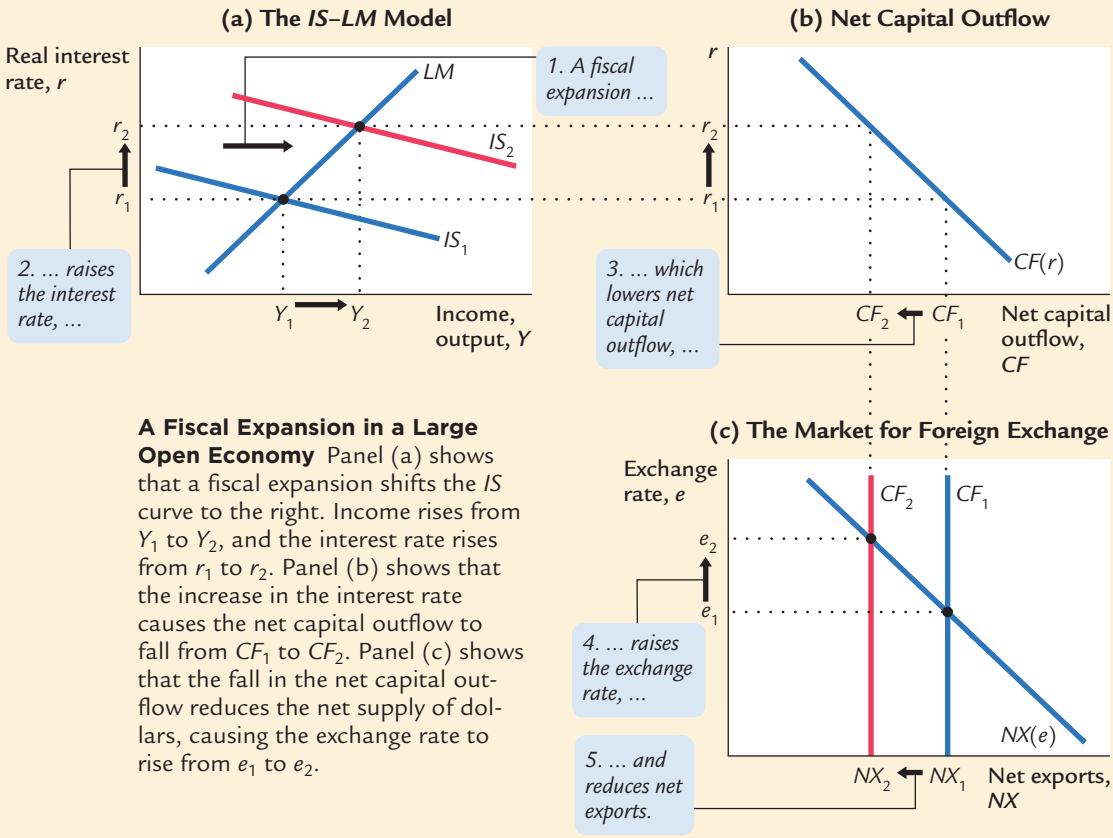
Fiscal Policy

Figure 13-16 examines the impact of a fiscal expansion. An increase in government purchases or a cut in taxes shifts the *IS* curve to the right. As panel (a) illustrates, this shift in the *IS* curve leads to an increase in the level of income and an increase in the interest rate. These two effects are similar to those in a closed economy.

Yet in the large open economy the higher interest rate reduces the net capital outflow, as in panel (b). The fall in the net capital outflow reduces the supply of dollars in the market for foreign exchange. The exchange rate appreciates, as in panel (c). Because domestic goods become more expensive relative to foreign goods, net exports fall.

Figure 13-16 shows that a fiscal expansion does raise income in the large open economy, unlike in a small open economy under a floating exchange rate. The impact on income, however, is smaller than in a closed economy. In a closed economy, the expansionary impact of fiscal policy is partially offset by the crowding out of investment: as the interest rate rises, investment falls, reducing the fiscal-policy multipliers. In a large open economy, there is yet another offsetting factor: as the interest rate rises, the net capital outflow falls, the currency

FIGURE 13-16



A Fiscal Expansion in a Large Open Economy Panel (a) shows that a fiscal expansion shifts the *IS* curve to the right. Income rises from Y_1 to Y_2, and the interest rate rises from r_1 to r_2. Panel (b) shows that the increase in the interest rate causes the net capital outflow to fall from CF_1 to CF_2. Panel (c) shows that the fall in the net capital outflow reduces the net supply of dollars, causing the exchange rate to rise from e_1 to e_2.

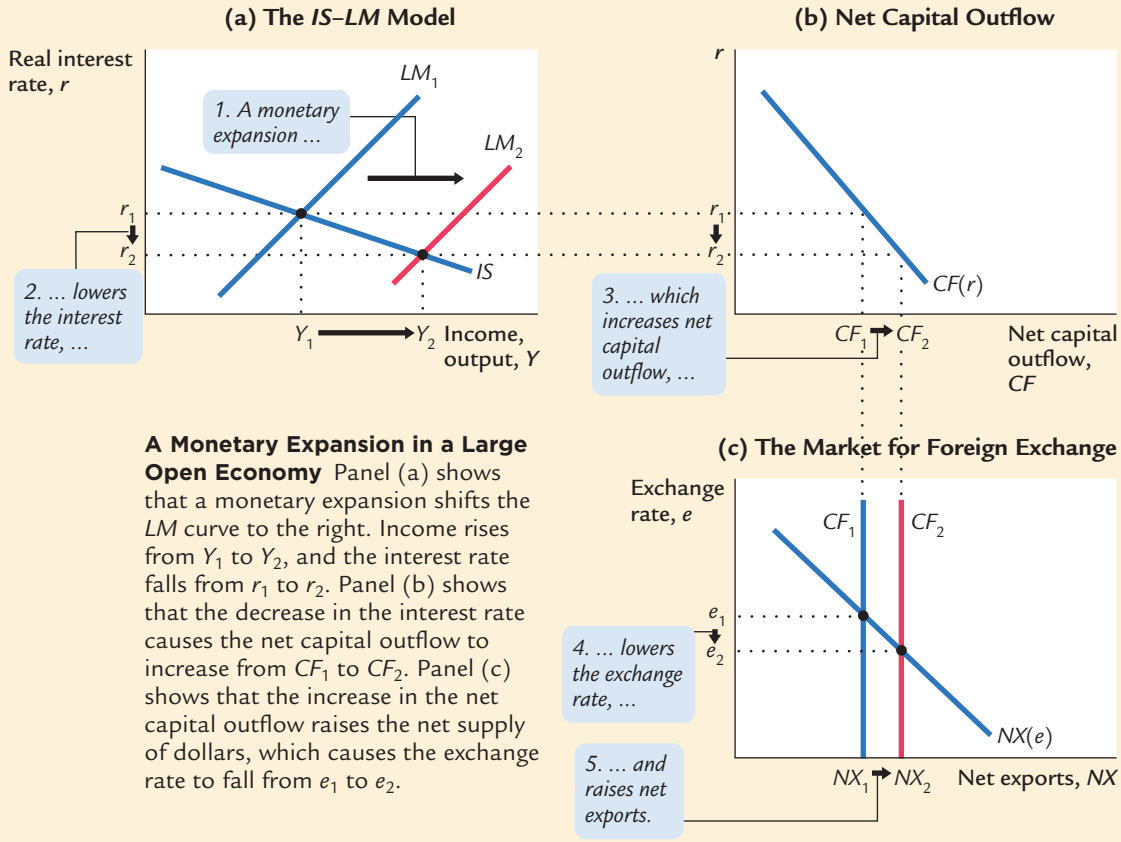
appreciates in the foreign-exchange market, and net exports fall. This reduces the fiscal-policy multiplier even further. (In the figure, this additional channel is manifested by the flatter *IS* curve mentioned earlier: for any given rightward shift in the *IS* curve, a flatter curve implies a smaller expansion in income.) Together these effects are not large enough to make fiscal policy powerless, as it is in a small open economy, but they do reduce the impact of fiscal policy.

Monetary Policy

Figure 13-17 examines the effect of a monetary expansion. An increase in the money supply shifts the *LM* curve to the right, as in panel (a). The level of income rises, and the interest rate falls. Once again, these effects are similar to those in a closed economy.

Yet, as panel (b) shows, the lower interest rate leads to a higher net capital outflow. The increase in *CF* raises the supply of dollars in the market for foreign exchange. The exchange rate falls, as in panel (c). As domestic goods become cheaper relative to foreign goods, net exports rise.

FIGURE 13-17



A Monetary Expansion in a Large Open Economy Panel (a) shows that a monetary expansion shifts the *LM* curve to the right. Income rises from Y_1 to Y_2, and the interest rate falls from r_1 to r_2. Panel (b) shows that the decrease in the interest rate causes the net capital outflow to increase from CF_1 to CF_2. Panel (c) shows that the increase in the net capital outflow raises the net supply of dollars, which causes the exchange rate to fall from e_1 to e_2.

We can now see that the monetary transmission mechanism works through two channels in a large open economy. As in a closed economy, a monetary expansion lowers the interest rate, which stimulates investment. As in a small open economy, a monetary expansion causes the currency to depreciate in the market for foreign exchange, which stimulates net exports. Both effects result in a higher level of aggregate income. Indeed, because the *IS* curve is flatter here than it is in a closed economy, any given shift in the *LM* curve will have a larger impact on income.

A Rule of Thumb

This model of the large open economy describes well the U.S. economy today. Yet it is somewhat more complicated and cumbersome than the model of the closed economy we studied in Chapters 11 and 12 and the model of the small open economy we developed in this chapter. Fortunately, there is a useful rule of thumb to help you determine how policies influence a large open economy without remembering all the details of the model: *The large open economy is an average of the closed economy and the small open economy. To find how any policy will affect any variable, find the answer in the two extreme cases and take an average*.

For example, how does a monetary contraction affect the interest rate and investment in the short run? In a closed economy, the interest rate rises, and investment falls. In a small open economy, neither the interest rate nor investment changes. The effect in the large open economy is an average of these two cases: a monetary contraction raises the interest rate and reduces investment, but only somewhat. The fall in the net capital outflow mitigates the rise in the interest rate and the fall in investment that would occur in a closed economy. But unlike in a small open economy, the international flow of capital is not so strong as to fully negate these effects.

This rule of thumb makes the simple models all the more valuable. Although they do not describe perfectly the world in which we live, they do provide a useful guide to the effects of economic policy.

MORE PROBLEMS AND APPLICATIONS

1. Imagine that you run the central bank in a large open economy with a floating exchange rate. Your goal is to stabilize income, and you adjust the money supply accordingly. Under your policy, what happens to the money supply, the interest rate, the exchange rate, and the trade balance in response to each of the following shocks?

a. The president raises taxes to reduce the budget deficit.

b. The president restricts the import of foreign cars.

2. Over the past several decades, the economies of the world have become more financially integrated. That is, investors in all nations have become more willing and able to take advantage of financial opportunities abroad. Consider how this development affects the ability of monetary policy to influence the economy.

a. If investors become more willing and able to substitute foreign and domestic assets, what happens to the slope of the *CF* function?

b. If the *CF* function changes in this way, what happens to the slope of the *IS* curve?

c. How does this change in the *IS* curve affect the Fed's ability to control the interest rate?

d. How does this change in the *IS* curve affect the Fed's ability to control national income?

3. Suppose that policymakers in a large open economy want to raise the level of investment without changing aggregate income or the exchange rate.

a. Is there any combination of domestic monetary and fiscal policies that would achieve this goal?

b. Is there any combination of domestic monetary, fiscal, and trade policies that would achieve this goal?

c. Is there any combination of monetary and fiscal policies at home and abroad that would achieve this goal?

4. This appendix considers the case of a large open economy with a floating exchange rate, but suppose instead that a large open economy has a fixed exchange rate. That is, the central bank announces a target for the exchange rate and commits itself to adjusting the money supply to ensure that the equilibrium exchange rate equals the target.

a. Describe what happens to income, the interest rate, and the trade balance in response to a fiscal expansion, such as an increase in government purchases. Compare your answer to the case of a small open economy with a fixed exchange rate.

b. Describe what happens to income, the interest rate, and the trade balance if the central bank expands the money supply by buying bonds from the public. Compare your answer to the case of a small open economy with a fixed exchange rate.