CHAPTER 10 TEN

Aggregate Demand I

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 6. 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

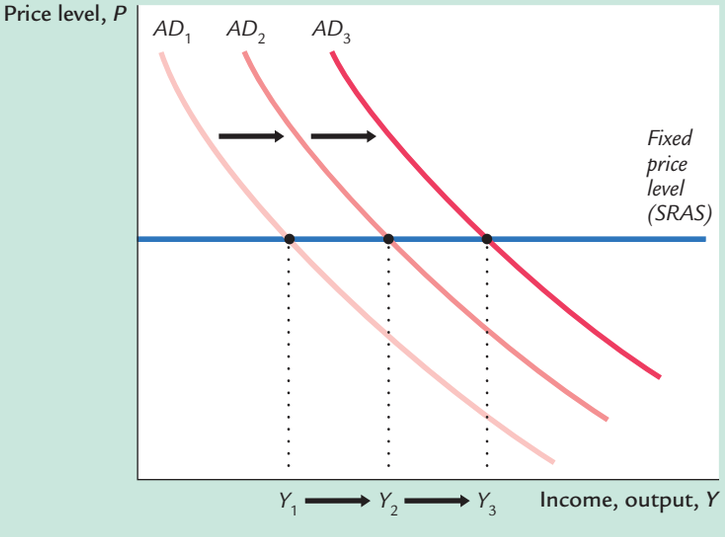
with the model of aggregate demand and aggregate supply introduced in Chapter 9. In the long run, prices are flexible, and aggregate supply determines income. But in the short run, prices are sticky, so changes in aggregate demand influence income.

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 9 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 any given price level. There are two ways to view 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. Or we can view the model as showing what causes the aggregate demand curve to shift. These two views of the model are equivalent: as Figure 10-1 shows, in the short run when the price level is fixed, shifts in the aggregate demand curve lead to changes in 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 4). Because the interest rate influences both investment and money

figure 10-1



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.

demand, it is the variable that links the two halves of the *IS–LM* model. The model shows how interactions between these markets determine the position and slope of the aggregate demand curve and, therefore, the level of national income in the short run.[1]

10-1 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 national income 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 was, in the short run, determined largely by the desire to spend by households, firms, and the 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. Thus, the problem during recessions and depressions, according to Keynes, was 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, 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 E as the sum of consumption C, planned investment I, and government purchases G:

$$E = C + I + G.$$

[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.

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:

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

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

$$G = \overline{G},$$
$$T = \overline{T}.$$

Combining these five equations, we obtain

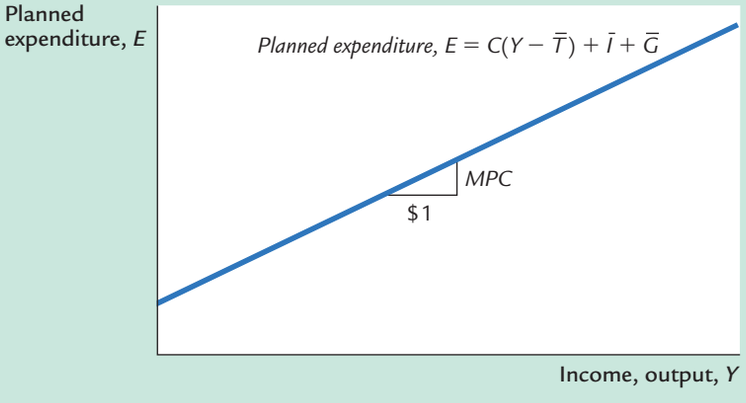
$$E = C(Y - \overline{T}) + \bar{I} + \overline{G}.$$

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

Figure 10-2 graphs planned expenditure as a function of the level of income. This line slopes upward because higher income leads to higher consumption and thus higher planned expenditure. The slope of this line is the marginal propensity to consume, the *MPC:* it shows how much planned expenditure increases when income rises by \$1. This planned-expenditure function is the first piece of the model called 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.

figure 10-2



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

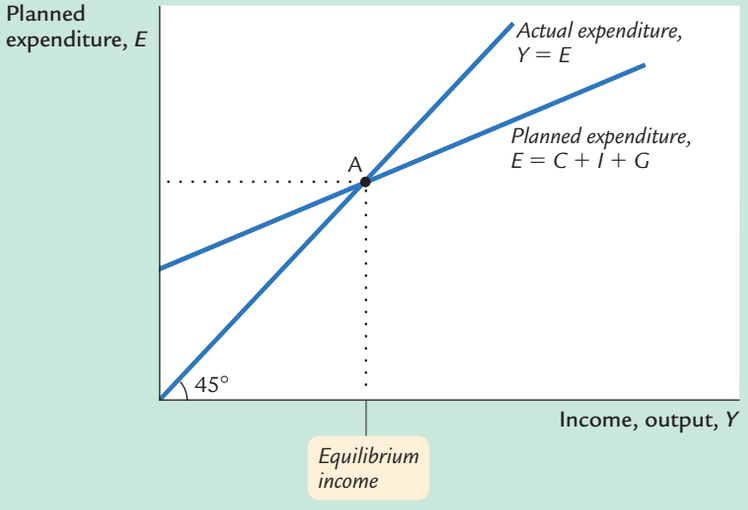
Recalling that Y as GDP equals not only total income but also total actual expenditure on goods and services, we can write this equilibrium condition as

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

The 45-degree line in Figure 10-3 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 the equilibrium? In this model, inventories play an important role in the adjustment process. Whenever the 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 10-3

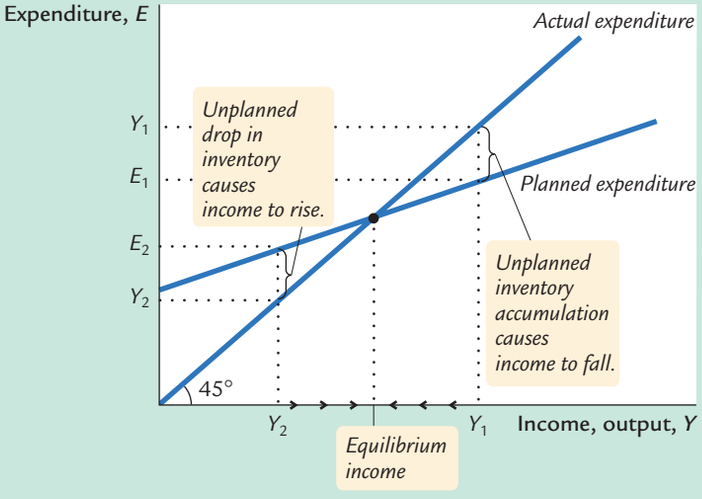


The Keynesian Cross The equilibrium in the Keynesian cross is at point A, where income (actual expenditure) equals planned expenditure.

For example, suppose the economy were ever to find itself with GDP at a level greater than the equilibrium level, such as the level Y_1 in Figure 10-4. In this case, planned expenditure E_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, and 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 were at a level lower than the equilibrium level, such as the level Y_2 in Figure 10-4. In this case, planned expenditure E_2 is greater than production Y_2. Firms meet the high level of sales by drawing down their inventories.

figure 10-4

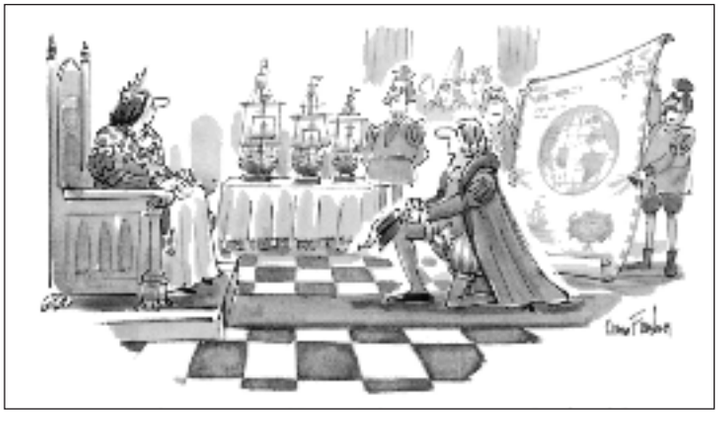


The Adjustment to Equilibrium in the Keynesian Cross If firms were producing at level Y_1, then planned expenditure E_1 would fall short of production, and firms would accumulate inventories. This inventory accumulation would induce firms to reduce production. Similarly, if firms were producing at level Y_2, then planned expenditure E_2 would exceed production, and firms would run down their inventories. This fall in inventories would induce firms to raise production. In both cases, the firms' decisions drive the economy toward equilibrium.

But when firms see their stock of inventories dwindle, they hire more workers and increase production. GDP rises, and the economy approaches the 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 10-5. The equilibrium of the economy moves from point A to point B.

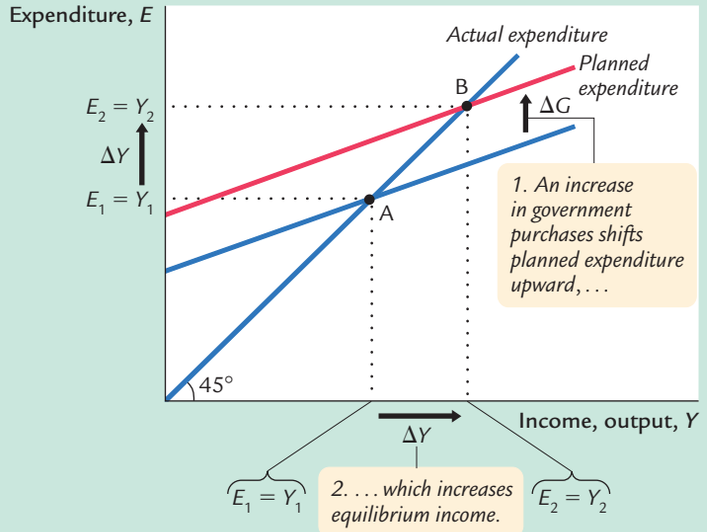


"Your Majesty, my voyage will not only forge a new route to the spices of the East but also create over three thousand new jobs."

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 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?

figure 10-5



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.

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

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

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 Consider now 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 10-6 shows, the planned-expenditure schedule shifts upward by $MPC \times \Delta T$. The equilibrium of the economy moves from point A to point B.

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[2] *Mathematical note:* We prove this algebraic result as follows. 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.

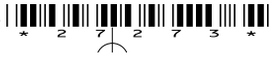
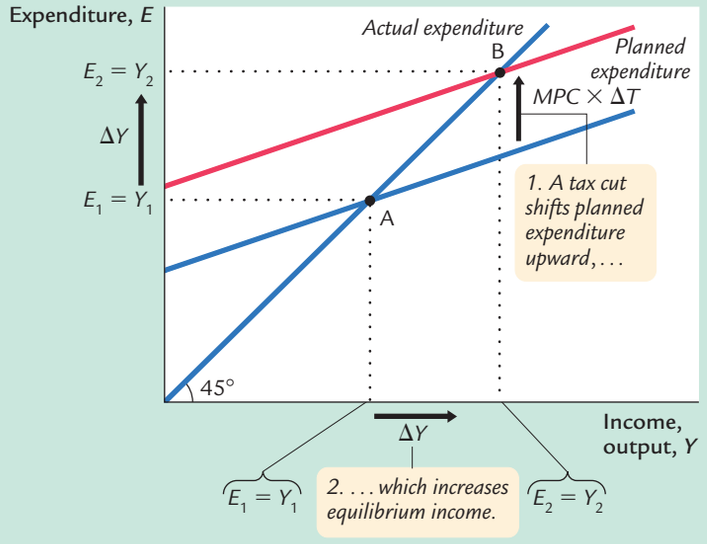


figure 10-6



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. 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

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.[5]

Economists continue to debate the source of this rapid growth in the early 1960s. A group called *supply-siders* argues 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, both views have some truth: *Tax cuts stimuate aggregate supply by improving workers' incentives and expand aggregate demand by raising households' disposable income.*

When George W. Bush was elected president in 2001, 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. During the campaign, when the economy was doing fine, they argued that lower marginal tax rates would improve work incentives. But then the economy started to slow: unemployment rose from 3.9 percent in October 2000 to 4.5 percent in April 2001. The argument shifted to emphasize that the tax cut would stimulate spending and reduce the risk of recession.

Congress passed the tax cut in May 2001. Compared to the original Bush proposal, the bill cut tax rates less in the long run. But it added an immediate tax rebate of $600 per family ($300 for single taxpayers) that was mailed out in the summer of 2001. Consistent with Keynesian theory, the goal of the rebate was to provide an immediate stimulus to aggregate demand.

[5] For an analysis of the 1964 tax cut by one of Kennedy's economists, see Arthur Okun, "Measuring the Impact of the 1964 Tax Reduction," in W. W. Heller, ed., *Perspectives on Economic Growth* (New York: Random House, 1968); reprinted in Arthur M. Okun, *Economics for Policymaking* (Cambridge, MA: MIT Press, 1983), 405–423.

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

The Keynesian cross is only a steppingstone on our path to the *IS*–*LM* model. 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.

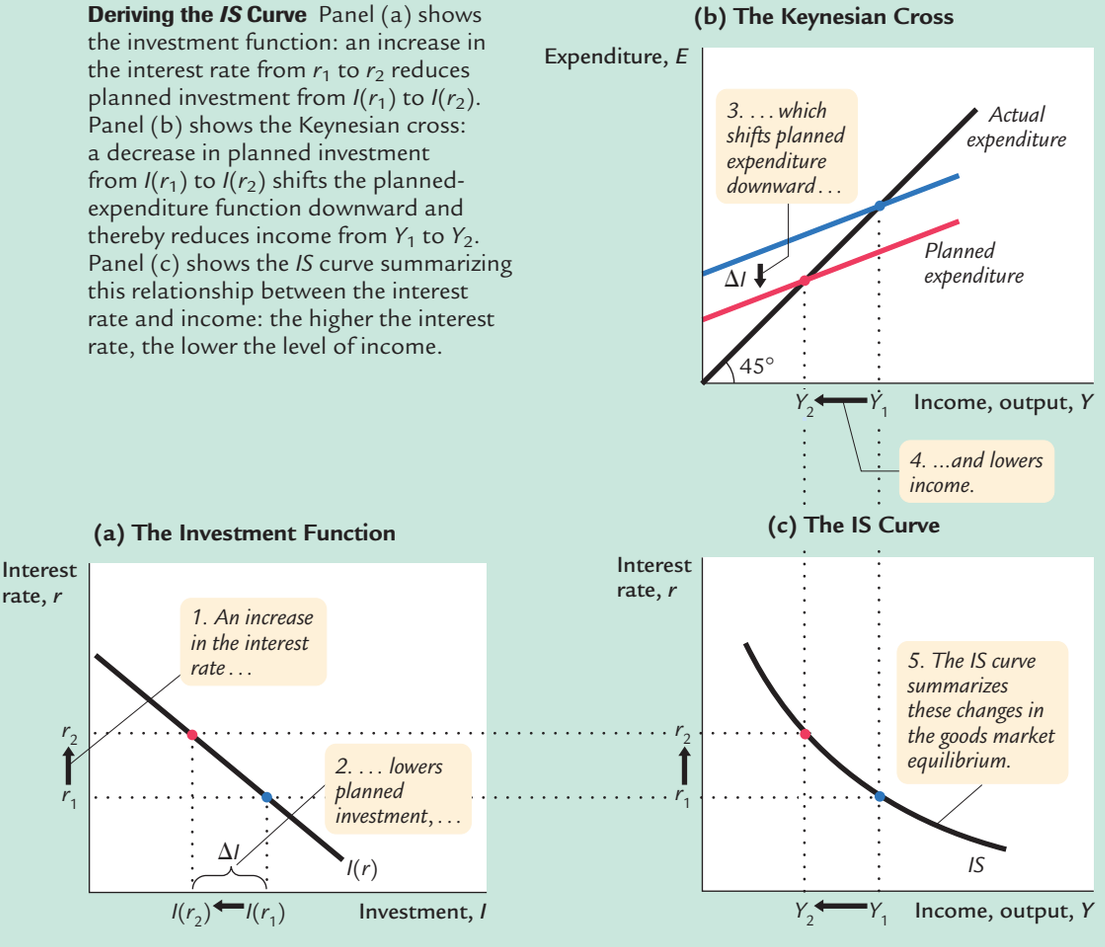
To add this relationship between the interest rate and investment to our model, we write the level of planned investment as

$$I = I(r).$$

This investment function is graphed in panel (a) of Figure 10-7. Because the interest rate is the cost of borrowing to finance investment projects, an increase in

figure 10-7

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.



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 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 10-7. 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 10-7, 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. Because an increase in the interest rate causes planned investment to fall, which in turn causes 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 level of income also depends on fiscal policy. 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 10-8 uses the Keynesian cross to show how an increase in government purchases by 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 shows that this change in fiscal policy raises planned expenditure and thereby increases equilibrium income from Y_1 to Y_2. Therefore, an increase in government purchases shifts the *IS* curve outward.

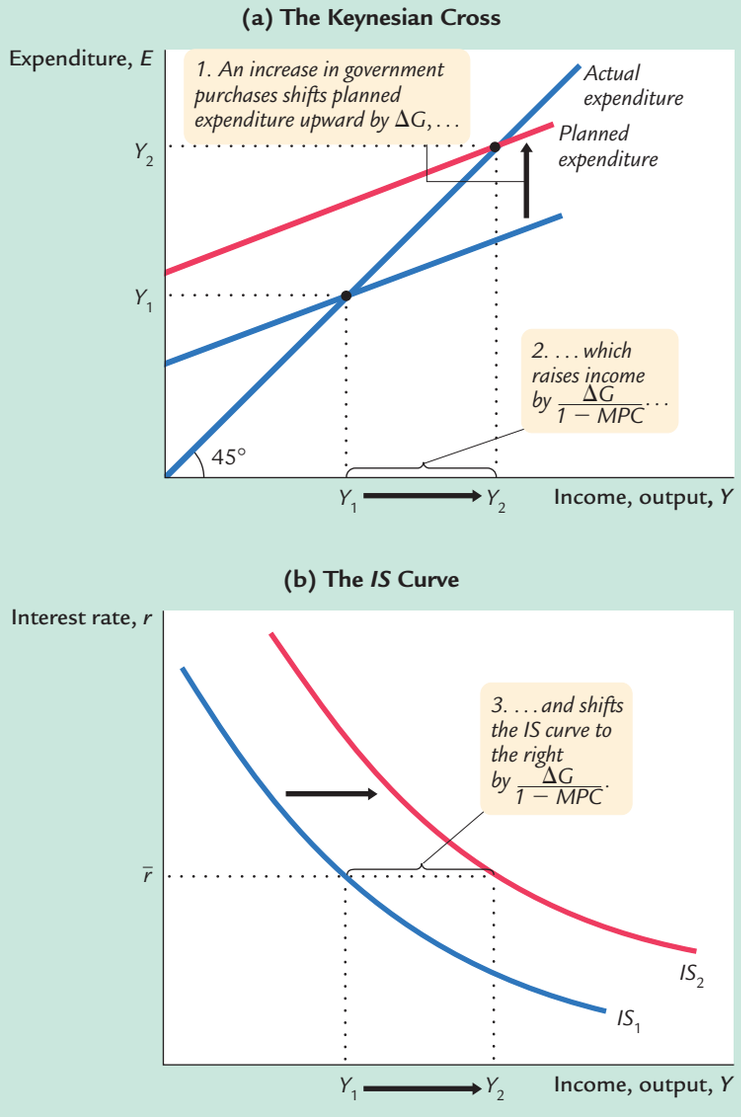
We can use the Keynesian cross to see how other changes in fiscal policy shift the *IS* curve. Because a decrease in taxes also expands expenditure and income, it too shifts the *IS* curve outward. A decrease in government purchases or an increase in taxes reduces income; therefore, such a change in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

A Loanable-Funds Interpretation of the *IS* Curve

When we first studied the market for goods and services in Chapter 3, we noted an equivalence between the supply and demand for goods and services and the supply and demand for loanable funds. This equivalence provides another way to interpret the *IS* curve.

figure 10-8



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.

Recall that the national income accounts identity can be written as

$$Y - C - G = I$$
$$S = I.$$

The left-hand side of this equation is national saving S, and the right-hand side is investment I. National saving represents the supply of loanable funds, and investment represents the demand for these funds.

To see how the market for loanable funds produces the *IS* curve, substitute the consumption function for C and the investment function for I:

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

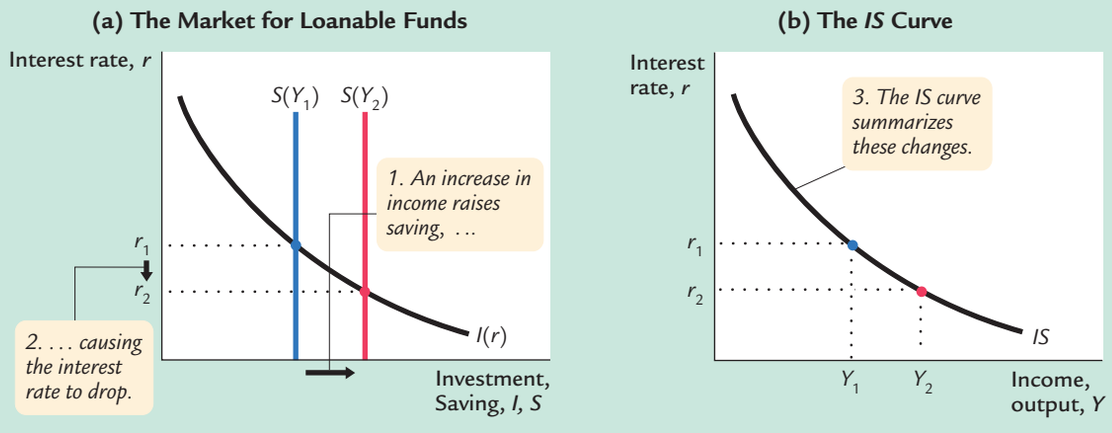
The left-hand side of this equation shows that the supply of loanable funds depends on income and fiscal policy. The right-hand side shows that the demand for loanable funds depends on the interest rate. The interest rate adjusts to equilibrate the supply and demand for loans.

As Figure 10-9 illustrates, we can interpret the *IS* curve as showing the interest rate that equilibrates the market for loanable funds for any given level of income. When income rises from Y_1 to Y_2, national saving, which equals $Y - C - G$, increases. (Consumption rises by less than income, because the marginal propensity to consume is less than 1.) As panel (a) shows, the increased supply of loanable funds drives down the interest rate from r_1 to r_2. The *IS* curve in panel (b) summarizes this relationship: higher income implies higher saving, which in turn implies a lower equilibrium interest rate. For this reason, the *IS* curve slopes downward.

This alternative interpretation of the *IS* curve also explains why a change in fiscal policy shifts the *IS* curve. An increase in government purchases or a decrease in taxes reduces national saving for any given level of income. The reduced supply of loanable funds raises the interest rate that equilibrates the market. Because the interest rate is now higher for any given level of income, the *IS* curve shifts upward in response to the expansionary change in fiscal policy.

Finally, note that the *IS* curve does not determine either income Y or the interest rate r. Instead, the *IS* curve is a relationship between Y and r arising in the

figure 10-9



A Loanable-Funds Interpretation of the *IS* Curve Panel (a) shows that an increase in income from Y_1 to Y_2 raises saving and thus lowers the interest rate that equilibrates the supply and demand for loanable funds. The *IS* curve in panel (b) expresses this negative relationship between income and the interest rate.

market for goods and services or, equivalently, the market for loanable funds. To determine the equilibrium of the economy, we need another relationship between these two variables, to which we now turn.

10-2 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. That 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,

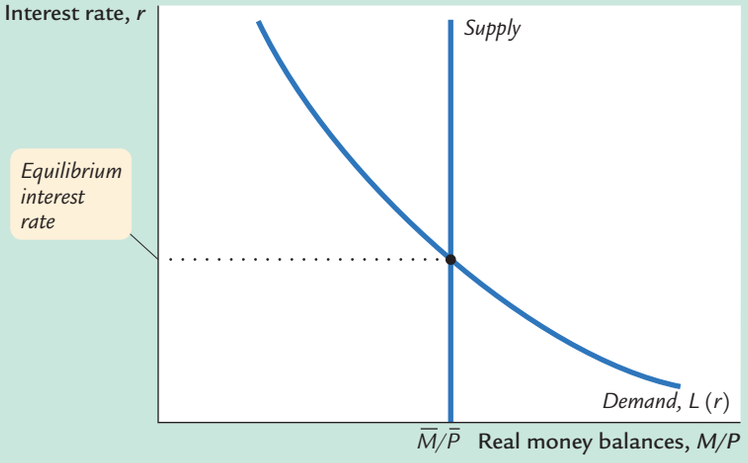
$$(M/P)^s = \overline{M}/\overline{P}.$$

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 10-10, 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 reason is that the interest rate is the 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

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

figure 10-10



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.

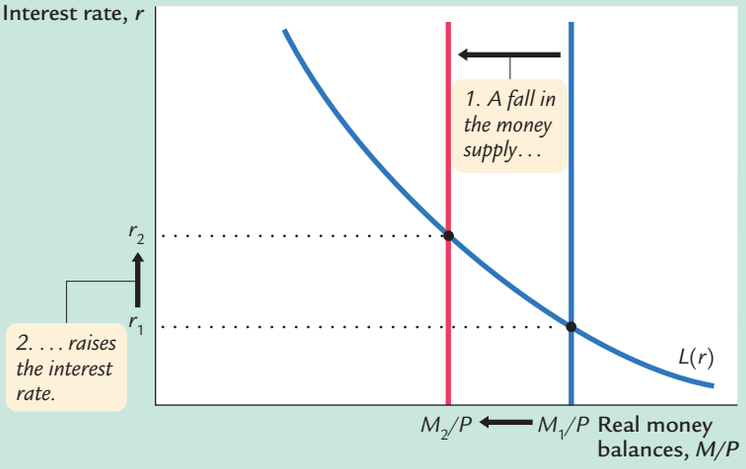
where the function $L(\ )$ shows that the quantity of money demanded depends on the interest rate. Thus, the demand curve in Figure 10-10 slopes downward because higher interest rates reduce the quantity of real money balances demanded.[6]

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 non-interest-bearing money into interest-bearing bank deposits or bonds. Banks and bond issuers, who 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

[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. The role of expected inflation in the *IS–LM* model is explored in Chapter 11.

figure 10-11



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.

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 10-11. 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

Did Paul Volcker's Monetary Tightening Raise or Lower Interest Rates?

The early 1980s saw the largest and quickest reduction in inflation in recent U.S. history. By the late 1970s inflation had reached the double-digit range; in 1979, consumer prices were rising at a rate of 11.3 percent per year. In October 1979, only two months after becoming the chairman of the Federal Reserve, Paul Volcker 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.

How does such a monetary tightening influence 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 4 suggests that in the long run

Volcker's change in monetary policy 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 nominal interest rates.

Both conclusions are consistent with experience. Nominal interest rates did fall in the 1980s as inflation fell. But comparing the year before the October 1979 announcement and the year after, we find that real money balances ($M1$ divided by the CPI) fell 8.3 percent and the nominal interest rate (on short-term commercial loans) rose from 10.1 percent to 11.9 percent. Hence, although a monetary tightening leads to lower nominal interest rates in the long run, it leads to higher nominal interest rates in the short run.

Income, Money Demand, and the *LM* Curve

Having developed the theory of liquidity preference as an explanation for what determines the interest rate, 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 4) 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.

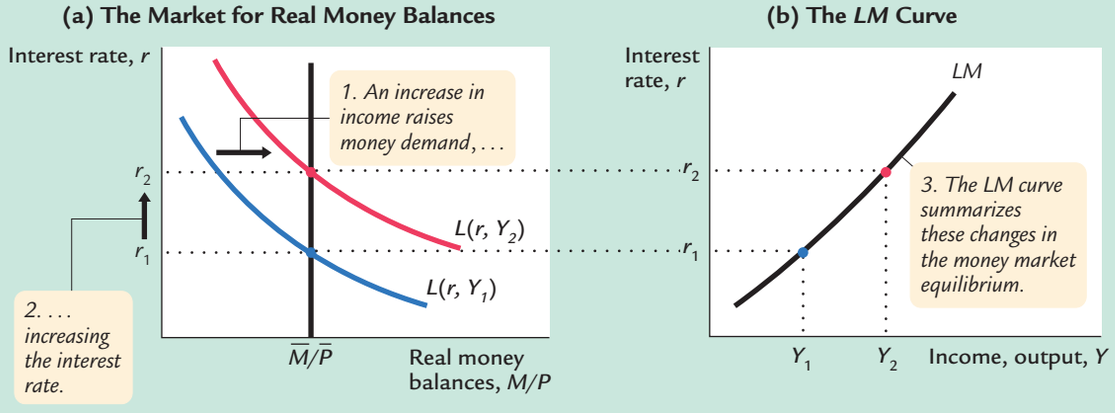
Using the theory of liquidity preference, we can figure out what happens to the equilibrium interest rate when the level of income changes. For example, consider what happens in Figure 10-12 when income increases from Y_1 to Y_2. As panel (a) illustrates, this increase in income shifts the money demand 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 plots this relationship between the level of income and the interest rate. 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, as in panel (b) of Figure 10-12.

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

figure 10-12



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.

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 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 10-13 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.

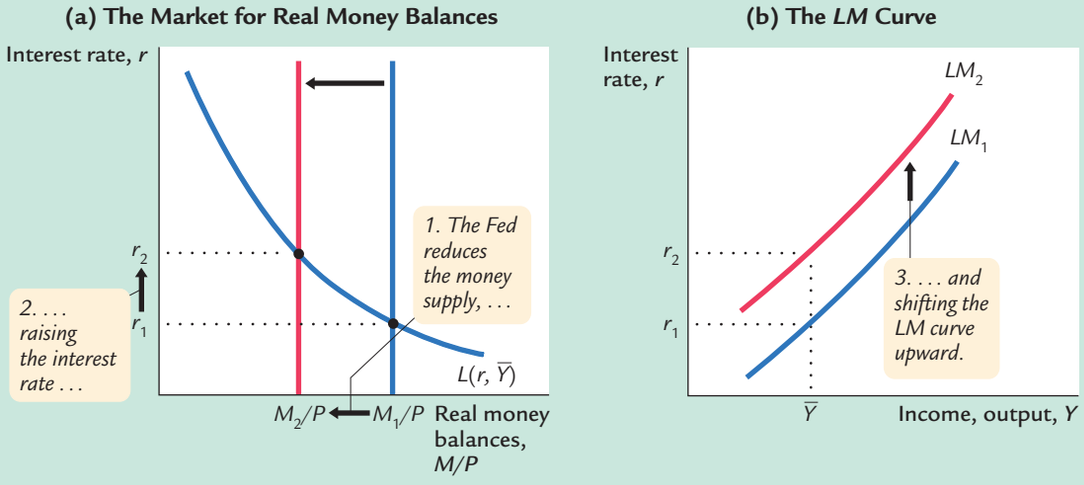
A Quantity-Equation Interpretation of the *LM* Curve

When we first discussed aggregate demand and the short-run determination of income in Chapter 9, we derived the aggregate demand curve from the quantity theory of money. We described the money market with the quantity equation,

$$MV = PY,$$

and assumed that velocity V is constant. This assumption implies that, for any given price level P, the supply of money M by itself determines the level of

figure 10-13



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.

income Y. Because the level of income does not depend on the interest rate, the quantity theory is equivalent to a vertical *LM* curve.

We can derive the more realistic upward-sloping *LM* curve from the quantity equation by relaxing the assumption that velocity is constant. The assumption of constant velocity is based on the assumption that the demand for real money balances depends only on the level of income. Yet, as we have noted in our discussion of the liquidity-preference model, the demand for real money balances also depends on the interest rate: a higher interest rate raises the cost of holding money and reduces money demand. When people respond to a higher interest rate by holding less money, each dollar they do hold must be used more often to support a given volume of transactions—that is, the velocity of money must increase. We can write this as

$$MV(r) = PY.$$

The velocity function $V(r)$ indicates that velocity is positively related to the interest rate.

This form of the quantity equation yields an *LM* curve that slopes upward. Because an increase in the interest rate raises the velocity of money, it raises the level of income for any given money supply and price level. The *LM* curve expresses this positive relationship between the interest rate and income.

This equation also shows why changes in the money supply shift the *LM* curve. For any given interest rate and price level, the money supply and the level of income must move together. Thus, increases in the money supply shift the *LM* curve to the right, and decreases in the money supply shift the *LM* curve to the left.

Keep in mind that the quantity equation is merely another way to express the theory behind the *LM* curve. This quantity-theory interpretation of the *LM* curve is substantively the same as that provided by the theory of liquidity preference. In both cases, the *LM* curve represents a positive relationship between income and the interest rate that arises from the money market.

Finally, remember that the *LM* curve by itself does not determine either income Y or the interest rate r that will prevail in the economy. Like the *IS* curve, the *LM* curve is only a relationship between these two endogenous variables. The *IS* and *LM* curves together determine the economy's equilibrium.

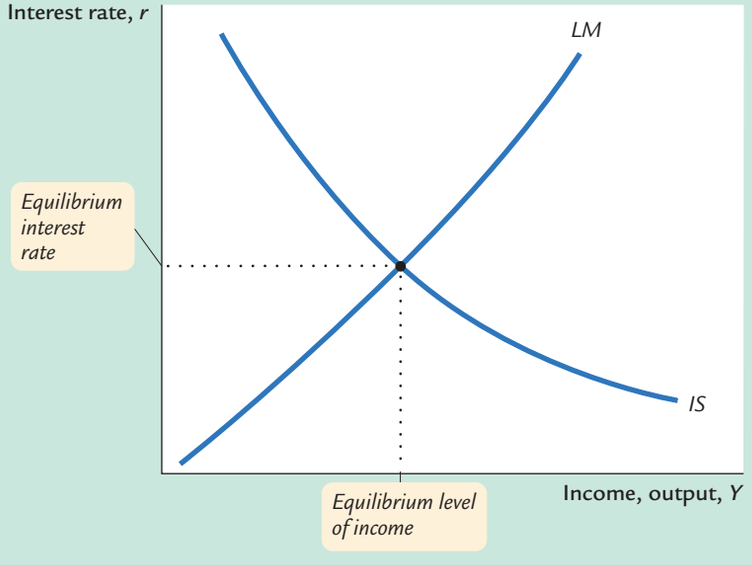
10-3 Conclusion: The Short-Run Equilibrium

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

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

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 10-14.

figure 10-14

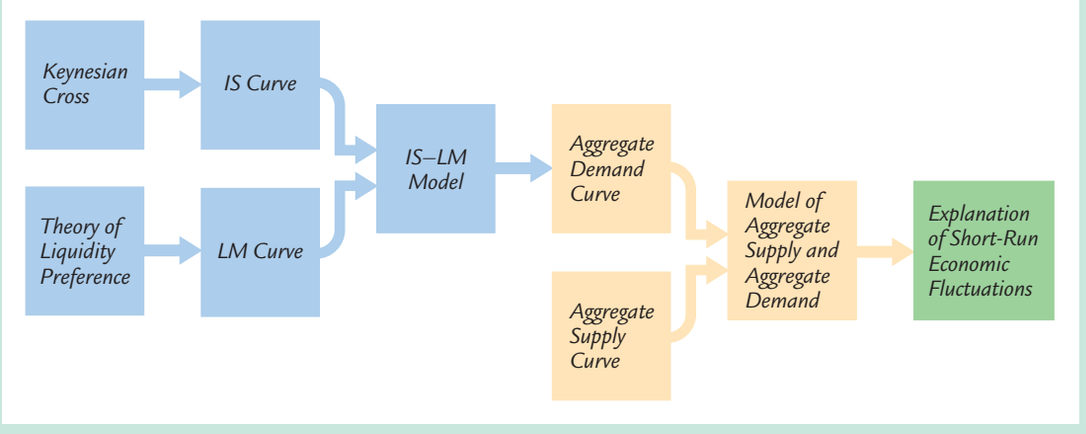


Equilibrium in the *IS–LM* Model The intersection of the *IS* and *LM* curves represents simultaneous equilibrium in the market for goods and services and in the market for real money balances for given values of government spending, taxes, the money supply, and the price level.

The 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 10-15 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 10-15



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.

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 of
   a. An increase in government purchases.
   b. An increase in taxes.
   c. An equal increase in 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, in many countries (including the United States) taxes depend on income. 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

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

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?

CHAPTER 11 ELEVEN

Aggregate Demand II

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 10 we assembled the pieces of the *IS–LM* model. 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). We also examine how various shocks to the goods markets (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 9. In particular, we examine how the *IS–LM* model provides a theory of the slope and position of the aggregate demand curve. Here we relax the assumption that the price level is fixed, and we 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 think 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.

11-1 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.

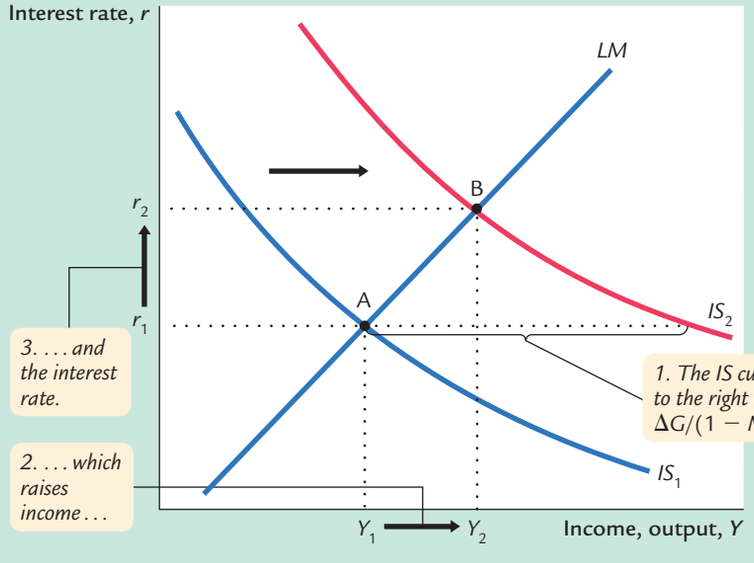
How Fiscal Policy Shifts the *IS* Curve and Changes the Short-Run Equilibrium

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, at any given interest rate, this change in fiscal policy raises the level of income by $\Delta G/(1 - MPC)$. Therefore, as Figure 11-1 shows, the *IS* curve 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 11-1, 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

figure 11-1



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.

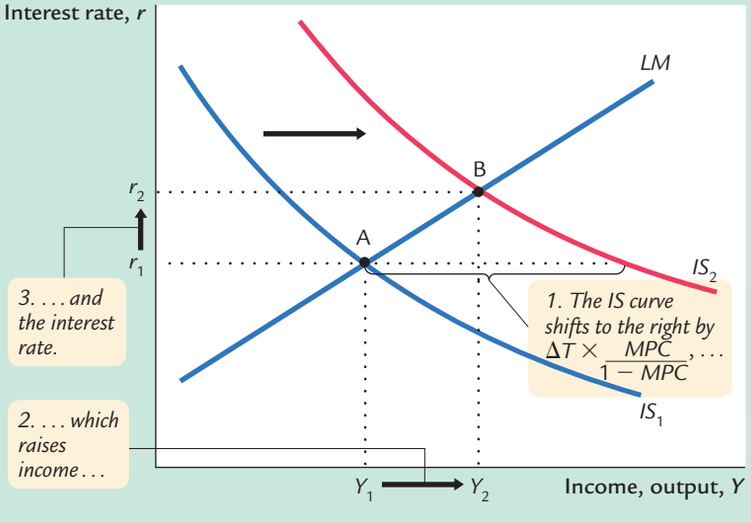
increases its purchases of goods and services, the economy's planned expenditure rises. The increase in planned expenditure stimulates the production of goods and services, which causes total income Y to rise. These effects should be familiar from the Keynesian cross.

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 has not changed, however, 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 11-1. 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 caused by 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, at any given interest rate, this change in policy raises the level of income by $\Delta T \times MPC/(1 - MPC)$. Therefore, as Figure 11-2 illustrates, the *IS* curve shifts to the

figure 11-2



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.

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.

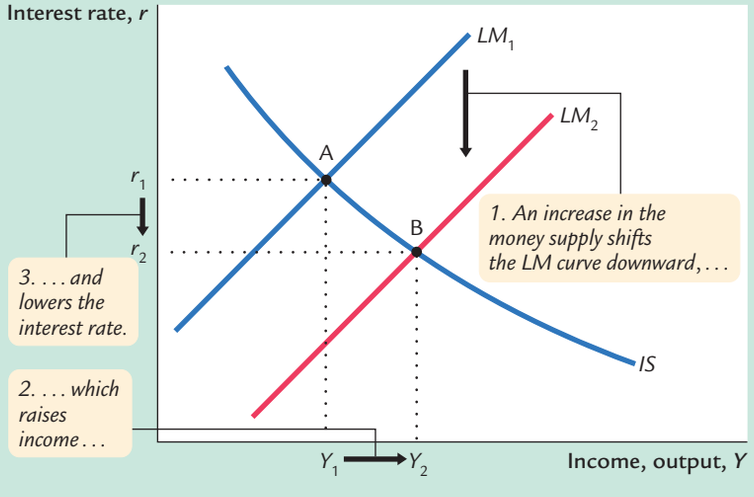
How Monetary Policy Shifts the *LM* Curve and Changes the Short-Run Equilibrium

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, thereby, 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 income, an increase in real money balances leads to a lower interest rate. Therefore, the *LM* curve shifts downward, as in Figure 11-3. 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 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 use 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,

figure 11-3



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.

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 9. 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 that an increase in the money supply lowers the interest rate, which stimulates investment and thereby expands the demand for goods and services.

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 were to raise taxes. What effect should this policy have on the economy? According to the *IS–LM* model, the answer depends on how the Fed responds to the tax increase.

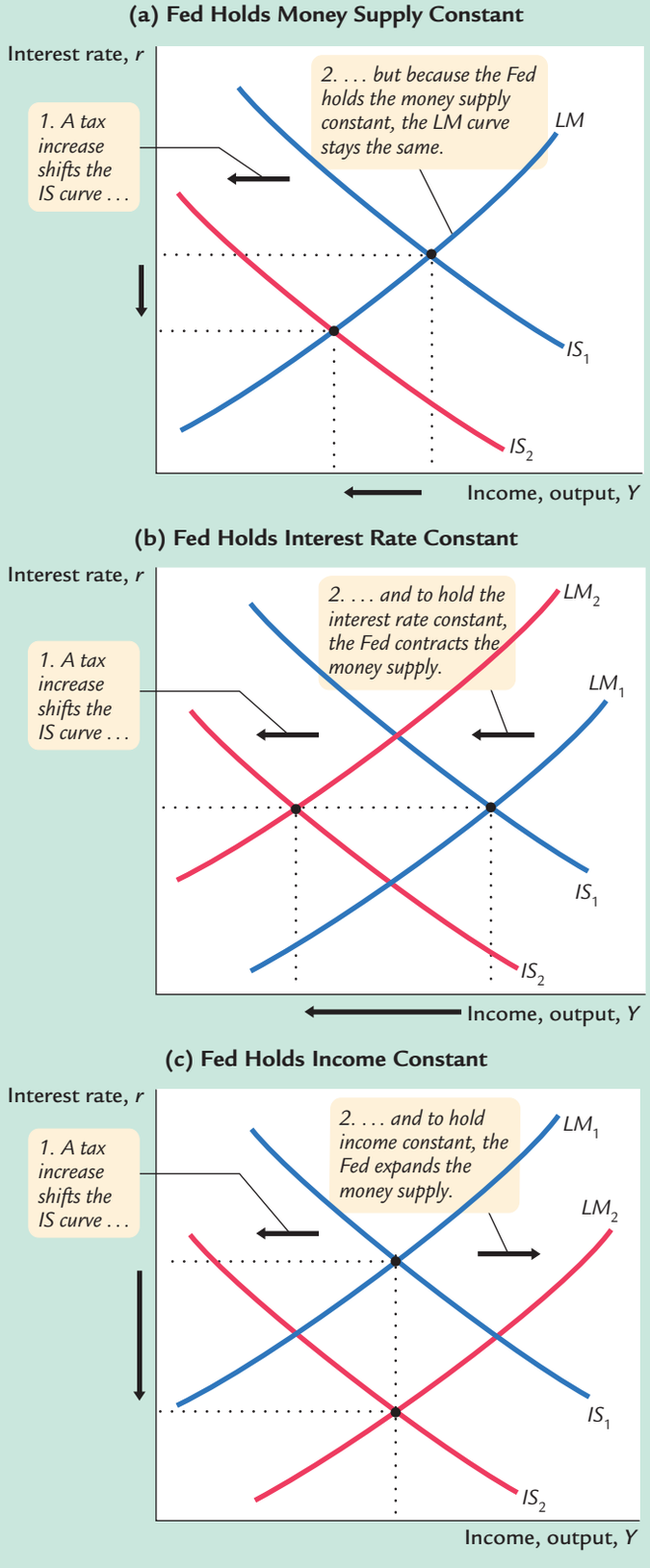
Figure 11-4 shows three of the many possible outcomes. In panel (a), the Fed holds the money supply constant. The tax increase shifts the *IS* curve to the left. Income falls (because higher taxes reduce consumer spending), and the interest rate falls (because lower income reduces the demand for money). 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 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.

figure 11-4



The Response of the Economy to a Tax Increase How the economy responds to a tax increase depends on how the monetary authority 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.

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 only 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.

Table 11-1 shows the fiscal-policy multipliers implied by one widely used 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 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.

table 11-1

The Fiscal-Policy Multipliers in the DRI Model

	VALUE OF MULTIPLIERS	
Assumption About Monetary Policy	$\Delta Y/\Delta G$	$\Delta Y/\Delta T$
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.

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.

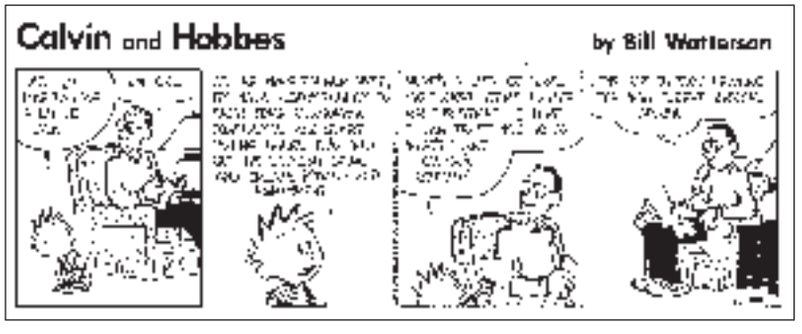
Table 11-1 shows that the fiscal-policy multipliers are very different under the two assumptions about monetary policy. The impact of any change in fiscal policy depends crucially on how the Fed responds to that change.

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. Slowdown of 2001

In 2001, the U.S. economy experienced a pronounced slowdown in economic activity. The unemployment rate rose from 3.9 percent in October 2000 to 4.9 percent in August 2001, and then to 5.8 percent in December 2001. In many ways, the slowdown looked like a typical recession driven by a fall in aggregate demand.

Two notable shocks can help 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 and Washington on September 11, 2001. In the week after the attacks, the stock market fell another 12 percent, its 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 further to the left.

Fiscal and monetary policymakers were quick to respond to these events. Congress passed a tax cut in 2001, including an immediate tax rebate. One goal of the tax cut was to stimulate consumer spending. After the terrorist attacks, Congress increased government spending by appropriating funds to rebuild New York and to bail out the ailing airline industry. Both of these fiscal measures shifted the *IS* curve to the right.

At the same time, the Fed 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 of 2000 to 3.3 percent in August 2001, and then to 2.1 percent in September 2001 in the immediate aftermath of the terrorist attacks.

The magnitude of the slowdown of 2001 was not yet determined as this book was going to press. The big question was whether the policy measures undertaken were sufficient to offset the shocks that the economy had suffered. By the time you are reading this, you may know the answer.

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 simply 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 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 altering the money supply, but the 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.)

Another possible reason for using the interest rate as the short-term policy instrument is that interest rates are easier to measure than the money supply. As we

saw in Chapter 4, the Fed has several different measures of money—*M*1, *M*2, and so on—which sometimes move in different directions. Rather than deciding which measure is best, the Fed avoids the question by using the federal funds rate as its policy instrument.

11-2 *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 9, we now examine what happens in the *IS–LM* model if the price level is allowed to change. As was promised when we began our study of this model, the *IS–LM* model provides a theory to explain the position and slope of the aggregate demand curve.

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

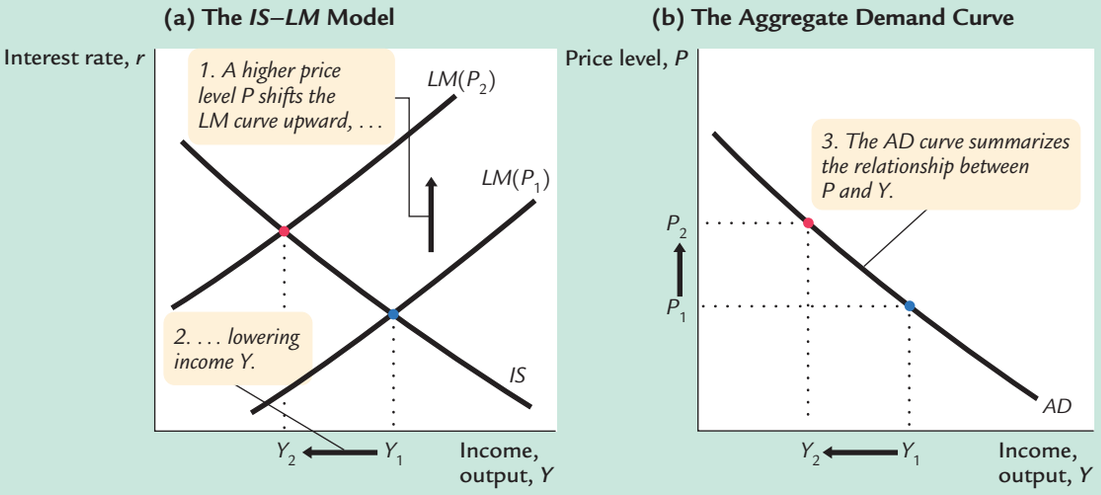
Recall from Chapter 9 that the aggregate demand curve describes a relationship between the price level and the level of national income. In Chapter 9 this relationship was derived from the quantity theory of money. The analysis showed that for a given money supply, a higher price level implies a lower 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 11-5. 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 is merely a summary of 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 *IS–LM* model for any given price level; it thus shifts the

figure 11-5



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.

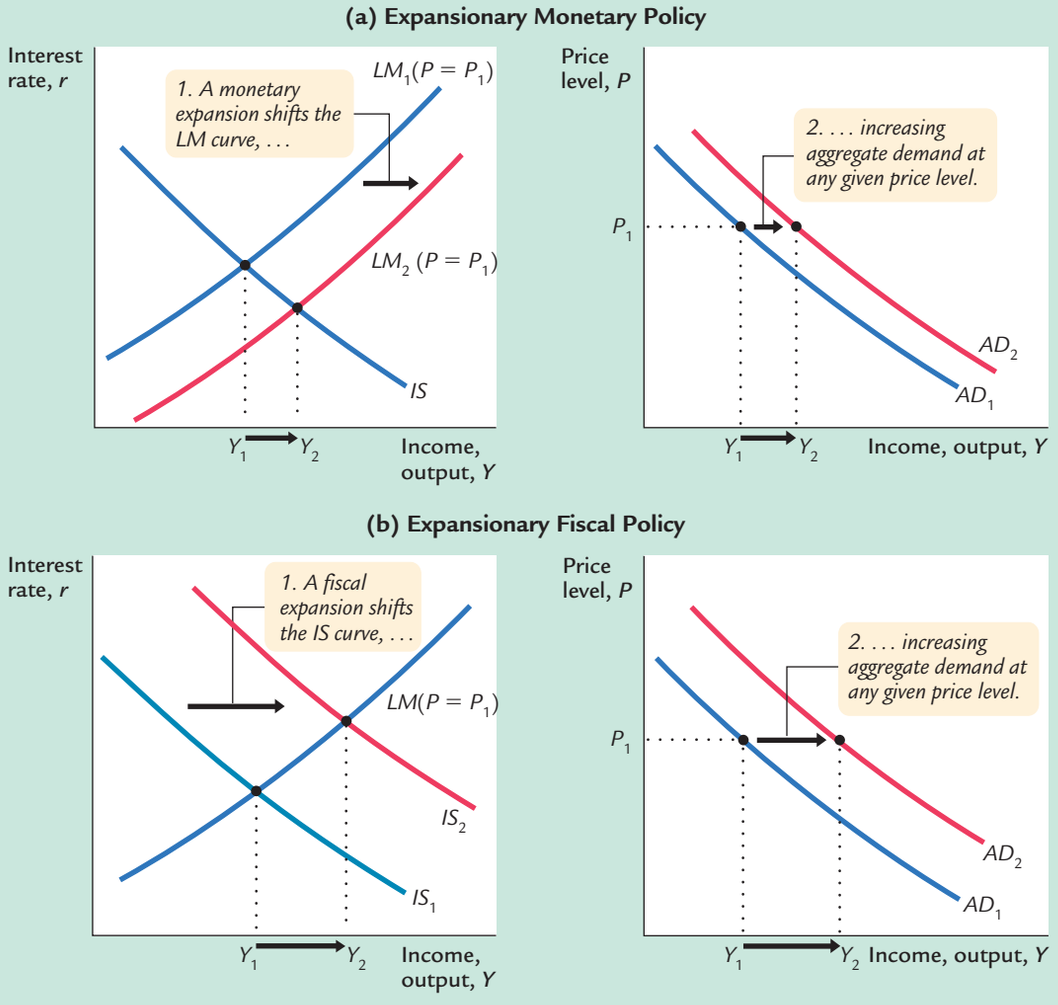
aggregate demand curve to the right, as shown in panel (a) of Figure 11-6. Similarly, an increase in government purchases or a decrease in taxes raises income in the *IS-LM* model for a given price level; it also shifts the aggregate demand curve to the right, as shown in panel (b) of Figure 11-6. Conversely, a decrease in the money supply, a decrease in government purchases, or an increase in taxes lowers income in the *IS–LM* model and shifts the aggregate demand curve to the left.

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 fixed 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.

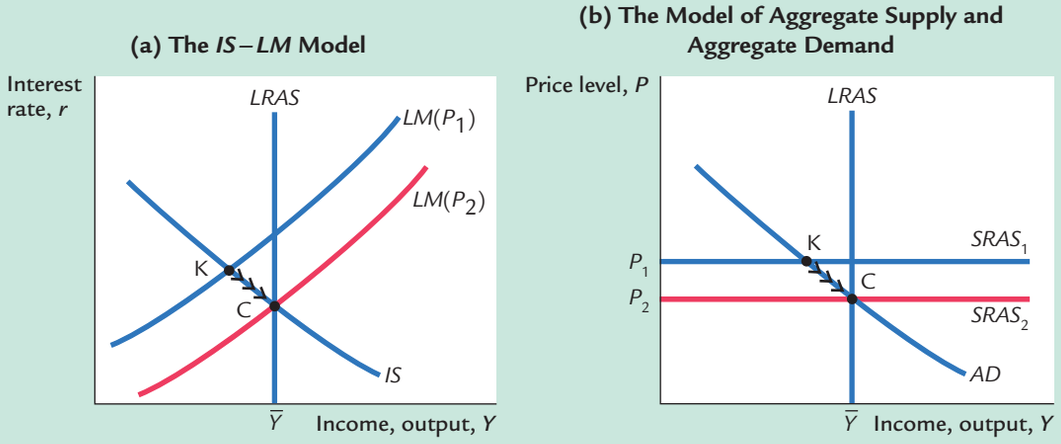
figure 11-6



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.

Panel (a) of Figure 11-7 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 rate of output $\overline{Y}$. The *LM* curve is, as always, drawn for a fixed price level, P_1. The short-run equilibrium of the 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 rate.

figure 11-7



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 rate. The long-run equilibrium is therefore point C.

Panel (b) of Figure 11-7 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 rate. 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 rate 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 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 the natural rate. 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 the natural rate.

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:

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

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

$$P = P_1.$$

This assumption implies that r and Y must adjust to satisfy the *IS* and *LM* equations. The classical approach is to complete the model with the assumption that output reaches the natural rate, so the classical third equation is

$$Y = \overline{Y}.$$

This assumption implies that r and P must adjust to satisfy the *IS* and *LM* equations.

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 4 assumes that output equals the natural rate. The Keynesian assumption best describes the short run. Therefore, our analysis of economic fluctuations relies on the assumption of a fixed price level.

11-3 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 11-2, which presents some statistics regarding the Depression. These 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?

[1] For a flavor of the debate, see Milton Friedman and Anna J. Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, NJ: 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*.

table 11-2

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

The Spending Hypothesis: Shocks to the *IS* Curve

Table 11-2 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 spending 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

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

Paper 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.

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 contractionary shift in the investment function.[2]

In addition, the fiscal policy of the 1930s caused a 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 rates. 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.

[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.

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

Table 11-2 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 defend 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 supply was accompanied by an even greater fall in the price level. Although the monetary contraction may be 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 it is 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.

[4] We discuss the reasons for this large decrease in the money supply in Chapter 18, where we examine the money supply process in more detail. In particular, see the case study "Bank Failures and the Money Supply in the 1930s."

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 4: 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 π^e is expected inflation, then the *ex ante* real interest rate is $i - \pi^e$. We can now write the *IS–LM* model as

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

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

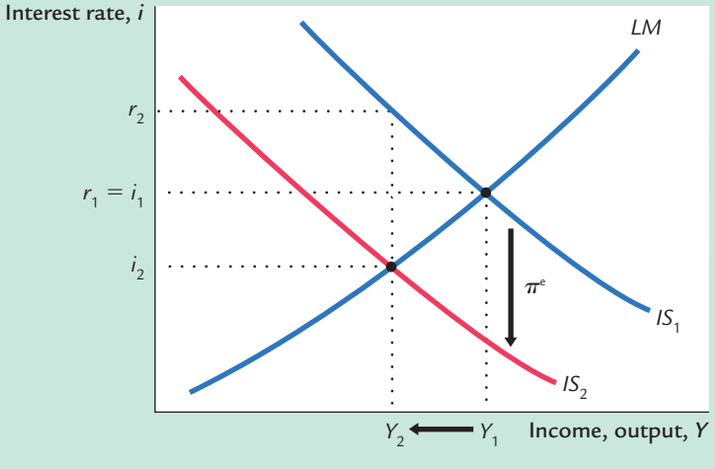
Let's use this extended *IS–LM* model to examine how changes in expected inflation influence the level of income. We begin by assuming that everyone expects the price level to remain the same. In this case, there is no expected inflation ($\pi^e = 0$), and these two equations produce the familiar *IS–LM* model. Figure 11-8 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 π^e 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. 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, whereas 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.

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 give 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.

figure 11-8



Expected Deflation in the *IS–LM* Model An expected deflation (a negative value of π^e) 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.

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 Japanese Slump

During the 1990s, after many years of rapid growth and enviable prosperity, the Japanese economy experienced a prolonged downturn. Real GDP grew at an average rate of only 1.3 percent over the decade, compared with 4.3 percent over the previous twenty years. The unemployment rate, which had historically been very low in Japan, rose from 2.1 percent in 1990 to 4.7 percent in 1999. In August 2001, unemployment hit 5.0 percent, the highest rate since the government began compiling the statistic in 1953.

Although the Japanese slump of the 1990s is not even close in magnitude to the Great Depression of the 1930s, the episodes are similar in several ways. First, both episodes are traced in part to a large decline in stock prices. In Japan, stock prices at the end of the 1990s were less than half the peak level they had reached about a decade earlier. Like the stock market, Japanese land prices had also skyrocketed in the 1980s before crashing in the 1990s. (At the peak of Japan's land bubble, it was said that the land under the Imperial Palace was worth more than the entire state of California.) When stock and land prices collapsed, Japanese citizens saw their wealth plummet. This decline in wealth, like that during the Great Depression, depressed consumer spending.

Second, during both episodes, banks ran into trouble and exacerbated the slump in economic activity. Japanese banks in the 1980s had made many loans that were backed by stock or land. When the value of this collateral fell, borrowers started defaulting on their loans. These defaults on the old loans reduced the banks' ability to make new loans. The resulting "credit crunch" made it harder for firms to finance investment projects and, thus, depressed investment spending.

Third, both episodes saw a fall in economic activity coincide with very low interest rates. In Japan in the 1990s, as in the United States in the 1930s, short-term nominal interest rates were less than 1 percent. This fact suggests that the cause of the slump was primarily a contractionary shift in the *IS* curve, because such a shift reduces both income and the interest rate. The obvious suspects to explain the *IS* shift are the crashes in stock and land prices and the problems in the banking system.

Finally, the policy debate in Japan mirrored the debate over the Great Depression. Some economists recommended that the Japanese government pass large tax cuts to encourage more consumer spending. Although this advice was followed to some extent, Japanese policymakers were reluctant to enact very large tax cuts because, like the U.S. policymakers in the 1930s, they wanted to avoid budget deficits. In Japan, this reluctance to increase government debt arose in part because the government was facing a large unfunded pension liability and a rapidly aging population.

Other economists recommended that the Bank of Japan expand the money supply more rapidly. Even if nominal interest rates could not go much lower, then perhaps more rapid money growth could raise expected inflation, lower real interest rates, and stimulate investment spending. Thus, although economists differed about whether fiscal or monetary policy was more likely to be effective, there was wide agreement that the solution to Japan's slump, like the solution to the Great Depression, rested in more aggressive expansion of aggregate demand.[5]

11-4 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 II and III 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.

[5] To learn more about this episode, see Adam S. Posen, *Restoring Japan's Economic Growth* (Washington, DC: Institute for International Economics, 1998).

FYI The Liquidity Trap

In Japan in the 1990s and the United States in the 1930s, interest rates reached very low levels. As Table 11-2 shows, U.S. interest rates were well under 1 percent throughout the second half of the 1930s. The same was true in Japan during the second half of the 1990s. In 1999, Japanese short-term interest rates fell to about one-tenth of 1 percent.

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 simply hold cash. In this environment, expansionary monetary policy raises the supply of money, making the public more liquid, but because interest rates can't fall any further, the extra liquidity might not have any effect. Aggregate demand, production, and employment may be "trapped" at low levels.

Other economists are skeptical about this argument. One response is that expansionary monetary policy might raise inflation expectations. Even if nominal interest rates cannot fall any further, higher expected inflation can lower real interest rates by making them negative, which would stimulate investment spending. A second response is that monetary expansion would 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 second argument goes beyond the closed-economy *IS–LM* model we have used in this chapter, but it has merit in the open-economy version of the model developed in the next chapter.

Is the liquidity trap something about which monetary policymakers need to worry? Might the tools of monetary policy at times lose their power to influence the economy? There is no consensus about the answers. Skeptics say we shouldn't worry about the liquidity trap. 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, 3 percent, then the central bank can easily push the real interest rate to negative 3 percent by lowering the nominal interest rate toward zero. Thus, moderate inflation gives monetary policymakers more room to stimulate the economy when needed, reducing the risk of falling into a liquidity trap.[6]

Although the model presented in this chapter provides the basic framework for analyzing aggregate demand, it is not the whole story. In later chapters, we examine in more detail the elements of this model and thereby refine our understanding of aggregate demand. In Chapter 16, for example, we study theories of consumption. Because the consumption function is a crucial piece of the *IS–LM* model, a deeper analysis of consumption may modify our view of the impact of monetary and fiscal policy on the economy. The simple *IS–LM* model presented in Chapters 10 and 11 provides the starting point for this further analysis.

[6] 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* (1998): 137–205.

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 a 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 to the interest rate, income, consumption, and investment under the following circumstances?

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 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.

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 much 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 much 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. Explain why each of the following statements is true. Discuss the impact of monetary and fiscal policy in each of these special cases.

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

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

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

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

5. 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? 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 the short-run and 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?

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.

APPENDIX

The Simple Algebra of the *IS–LM* Model and the Aggregate Demand Curve

The chapter analyzes the *IS–LM* model with graphs of the *IS* and *LM* curves. Here we analyze the model algebraically rather than graphically. This alternative presentation offers additional insight into how monetary and fiscal policy influence aggregate demand.

The *IS* Curve

One way to think about the *IS* curve is that it describes the combinations of income Y and the interest rate r that satisfy an equation we first saw in Chapter 3:

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

This equation combines the national income accounts identity, the consumption function, and the investment function. It states that the quantity of goods produced, Y, must equal the quantity of goods demanded, $C + I + G$.

We can learn more about the *IS* curve by considering the special case in which the consumption function and investment function are linear. We begin with the national income accounts identity

$$Y = C + I + G.$$

Now suppose that the consumption function is

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

where a and b are numbers greater than zero, and the investment function is

$$I = c - dr,$$

where c and d also are numbers greater than zero. The parameter b is the marginal propensity to consume, so we expect b to be between zero and one. The parameter d determines how much investment responds to the interest rate; because investment rises when the interest rate falls, there is a minus sign in front of d.

From these three equations, we can derive an algebraic expression for the *IS* curve and see what influences the *IS* curve's position and slope. If we substitute the consumption and investment functions into the national income accounts identity, we obtain

$$Y = [a + b(Y - T)] + (c - dr) + G.$$

Note that Y shows up on both sides of this equation. We can simplify this equation by bringing all the Y terms to the left-hand side and rearranging the terms on the right-hand side:

$$Y - bY = (a + c) + (G - bT) - dr.$$

We solve for Y to get

$$Y = \frac{a + c}{1 - b} + \frac{1}{1 - b}G + \frac{-b}{1 - b}T + \frac{-d}{1 - b}r.$$

This equation expresses the *IS* curve algebraically. It tells us the level of income Y for any given interest rate r and fiscal policy G and T. Holding fiscal policy fixed, the equation gives us a relationship between the interest rate and the level of income: the higher the interest rate, the lower the level of income. The *IS* curve graphs this equation for different values of Y and r given fixed values of G and T.

Using this last equation, we can verify our previous conclusions about the *IS* curve. First, because the coefficient of the interest rate is negative, the *IS* curve slopes downward: higher interest rates reduce income. Second, because the coefficient of government purchases is positive, an increase in government purchases shifts the *IS* curve to the right. Third, because the coefficient of taxes is negative, an increase in taxes shifts the *IS* curve to the left.

The coefficient of the interest rate, $-d/(1 - b)$, tells us what determines whether the *IS* curve is steep or flat. If investment is highly sensitive to the interest rate, then d is large, and income is highly sensitive to the interest rate as well. In this case, small changes in the interest rate lead to large changes in income: the *IS* curve is relatively flat. Conversely, if investment is not very sensitive to the interest rate, then d is small, and income is also not very sensitive to the interest rate. In this case, large changes in interest rates lead to small changes in income: the *IS* curve is relatively steep.

Similarly, the slope of the *IS* curve depends on the marginal propensity to consume b. The larger the marginal propensity to consume, the larger the change in income resulting from a given change in the interest rate. The reason is that a large marginal propensity to consume leads to a large multiplier for changes in investment. The larger the multiplier, the larger the impact of a change in investment on income, and the flatter the *IS* curve.

The marginal propensity to consume b also determines how much changes in fiscal policy shift the *IS* curve. The coefficient of G, $1/(1 - b)$, is the government-purchases multiplier in the Keynesian cross. Similarly, the coefficient of T, $-b/(1 - b)$, is the tax multiplier in the Keynesian cross. The larger the marginal propensity to consume, the greater the multiplier, and thus the greater the shift in the *IS* curve that arises from a change in fiscal policy.

The *LM* Curve

The *LM* curve describes the combinations of income Y and the interest rate r that satisfy the money market equilibrium condition

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

This equation simply equates money supply and money demand.

We can learn more about the *LM* curve by considering the case in which the money demand function is linear—that is,

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

where e and f are numbers greater than zero. The value of e determines how much the demand for money rises when income rises. The value of f determines how much the demand for money falls when the interest rate rises. There is a minus sign in front of the interest rate term because money demand is inversely related to the interest rate.

The equilibrium in the money market is now described by

$$M/P = eY - fr.$$

To see what this equation implies, rearrange the terms so that r is on the left-hand side. We obtain

$$r = (e/f)Y - (1/f)M/P.$$

This equation gives us the interest rate that equilibrates the money market for any values of income and real money balances. The *LM* curve graphs this equation for different values of Y and r given a fixed value of M/P.

From this last equation, we can verify some of our conclusions about the *LM* curve. First, because the coefficient of income is positive, the *LM* curve slopes upward: higher income requires a higher interest rate to equilibrate the money market. Second, because the coefficient of real money balances is negative, decreases in real balances shift the *LM* curve upward, and increases in real balances shift the *LM* curve downward.

From the coefficient of income, e/f, we can see what determines whether the *LM* curve is steep or flat. If money demand is not very sensitive to the level of income, then e is small. In this case, only a small change in the interest rate is necessary to offset the small increase in money demand caused by a change in income: the *LM* curve is relatively flat. Similarly, if the quantity of money demanded is not very sensitive to the interest rate, then f is small. In this case, a shift in money demand caused by a change in income leads to a large change in the equilibrium interest rate: the *LM* curve is relatively steep.

The Aggregate Demand Curve

To find the aggregate demand equation, we must find the level of income that satisfies both the *IS* equation and the *LM* equation. To do this, substitute the *LM* equation for the interest rate r into the *IS* equation to obtain

$$Y = \frac{a + c}{1 - b} + \frac{1}{1 - b}G + \frac{-b}{1 - b}T + \frac{-d}{1 - b}\left(\frac{e}{f}Y - \frac{1}{f}\frac{M}{P}\right).$$

With some algebraic manipulation, we can solve for Y. The final equation for Y is

$$Y = \frac{z(a+c)}{1-b} + \frac{z}{1-b}G + \frac{-zb}{1-b}T + \frac{d}{(1-b)[f+de/(1-b)]}\frac{M}{P},$$

where $z = f/[f + de/(1 - b)]$ is a composite of some of the parameters and is between zero and one.

This last equation expresses the aggregate demand curve algebraically. It says that income depends on fiscal policy G and T, monetary policy M, and the price level P. The aggregate demand curve graphs this equation for different values of Y and P given fixed values of G, T, and M.

We can explain the slope and position of the aggregate demand curve with this equation. First, the aggregate demand curve slopes downward, because an increase in P lowers M/P and thus lowers Y. Second, increases in the money supply raise income and shift the aggregate demand curve to the right. Third, increases in government purchases or decreases in taxes also raise income and shift the aggregate demand curve to the right. Note that, because z is less than one, the multipliers for fiscal policy are smaller in the *IS–LM* model than in the Keynesian cross. Hence, the parameter z reflects the crowding out of investment discussed earlier.

Finally, this equation shows the relationship between the aggregate demand curve derived in this chapter from the *IS–LM* model and the aggregate demand curve derived in Chapter 9 from the quantity theory of money. The quantity theory assumes that the interest rate does not influence the quantity of real money balances demanded. Put differently, the quantity theory assumes that the parameter f equals zero. If f equals zero, then the composite parameter z also equals zero, so fiscal policy does not influence aggregate demand. Thus, the aggregate demand curve derived in Chapter 9 is a special case of the aggregate demand curve derived here.

CASE STUDY

The Effectiveness of Monetary and Fiscal Policy

Economists have long debated whether monetary or fiscal policy exerts a more powerful influence on aggregate demand. According to the *IS–LM* model, the answer to this question depends on the parameters of the *IS* and *LM* curves. Therefore, economists have spent much energy arguing about the size of these parameters. The most hotly contested parameters are those that describe the influence of the interest rate on economic decisions.

Those economists who believe that fiscal policy is more potent than monetary policy argue that the responsiveness of investment to the interest rate—measured by the parameter d—is small. If you look at the algebraic equation for aggregate demand, you will see that a small value of d implies a small effect of the money supply on income. The reason is that when d is small, the *IS* curve is nearly vertical, and shifts in the *LM* curve do not cause much of a

change in income. In addition, a small value of d implies a large value of z, which in turn implies that fiscal policy has a large effect on income. The reason for this large effect is that when investment is not very responsive to the interest rate, there is little crowding out.

Those economists who believe that monetary policy is more potent than fiscal policy argue that the responsiveness of money demand to the interest rate—measured by the parameter f—is small. When f is small, z is small, and fiscal policy has a small effect on income; in this case, the *LM* curve is nearly vertical. In addition, when f is small, changes in the money supply have a large effect on income.

Few economists today endorse either of these extreme views. The evidence indicates that the interest rate affects both investment and money demand. This finding implies that both monetary and fiscal policy are important determinants of aggregate demand.

MORE PROBLEMS AND APPLICATIONS

1. Give an algebraic answer to each of the following questions. Then explain in words the economics that underlies your answer.

a. How does the sensitivity of investment to the interest rate affect the slope of the aggregate demand curve?

b. How does the sensitivity of money demand to the interest rate affect the slope of the aggregate demand curve?

c. How does the marginal propensity to consume affect the response of aggregate demand to changes in government purchases?