MyLab Economics

CHAPTER

1 The *ISLM* Model

Preview

In the media, you often see forecasts of GDP and interest rates by economists and government agencies. At times, these forecasts seem to come from a crystal ball, but economists actually make their predictions using a variety of economic models. One model widely used by economic forecasters is the *ISLM* model, which was developed by Sir John Hicks in 1937 and is based on the analysis in John Maynard Keynes's influential book *The General Theory of Employment, Interest, and Money*, published in 1936. The *ISLM* model explains how interest rates and total output produced in the economy (aggregate output or, equivalently, aggregate income) are determined, given a fixed price level (a reasonable assumption in the short run).

The *ISLM* model is valuable not only because it can be used in economic forecasting but also because it provides a deeper understanding of how government policy can affect aggregate economic activity. We use it to evaluate the effects of monetary and fiscal policy on the economy and to learn some lessons about how monetary policy might best be conducted.

KEYNES'S FIXED PRICE LEVEL ASSUMPTION AND THE *IS* CURVE

In Chapter 21, we developed the *IS* curve, which is the first building block of the *ISLM* model. However, it is important to note that Keynes's analysis was fleshed out during the Great Depression period, when inflation was not a serious problem. As a result, Keynes assumed that output could change without causing a change in prices. ***ISLM analysis assumes that the price level is fixed and therefore inflation is zero***. Thus, the analysis also assumes that the nominal interest rate and the real interest rate are equal, and so there is no need to distinguish between the two. Hence in *ISLM* analysis, the *IS* curve we discussed in Chapter 21 is viewed as describing the relationship between equilibrium output and the nominal interest rate.

The *LM* Curve

We now include money and interest rates in the Keynesian framework to develop the more intricate *ISLM* model of how aggregate output is determined, in which monetary policy plays an important role. The *ISLM* model will help us understand how monetary

policy affects economic activity and interacts with fiscal policy (changes in government spending and taxes) to produce a certain level of aggregate output and how the level of interest rates is affected by changes in autonomous spending as well as by changes in monetary and fiscal policy.

Equilibrium in the Market for Money: The *LM* Curve

Just as the *IS* curve is derived from the equilibrium condition in the goods market (aggregate output equals aggregate demand), the ***LM* curve** is derived from the equilibrium condition in the market for money, which occurs when the quantity of money demanded equals the quantity of money supplied. The main building block in Keynes's analysis of the market for money is the demand for money that he called *liquidity preference*. Let's briefly review his theory of the demand for money (discussed at length in Chapters 5 and 20).

Keynes's liquidity preference theory states that the demand for money in real terms M^d/P depends on income Y (aggregate output) and (nominal) interest rates i. The demand for money is positively related to income for two reasons. First, a rise in income raises the level of transactions in the economy, which in turn raises the demand for money because money is used to carry out these transactions. Second, a rise in income increases the demand for money because it increases the wealth of individuals who want to hold more assets, one of which is money. The opportunity cost of holding money is the interest sacrificed by not holding other assets (such as bonds) instead. As interest rates rise, the opportunity cost of holding money rises, and the demand for money falls. According to the liquidity preference theory, the demand for money is positively related to aggregate output and negatively related to interest rates.

Deriving the *LM* Curve

In Keynes's analysis, the level of interest rates is determined by equilibrium in the market for money (the point at which the quantity of money demanded equals the quantity of money supplied). Figure 1 depicts what happens to equilibrium in the market for money as the level of output changes. Because the *LM* curve is derived with the real money supply held at a fixed level, it is fixed at the level of $\bar{M}/P$ in panel (a).[1] Each level of aggregate output has its own money demand curve because as aggregate output changes, the level of transactions and wealth in the economy changes, which in turn changes the demand for money.

When aggregate output is at Y_1, the money demand curve is at $M^d(Y_1)$: The curve slopes downward because a lower interest rate means that the opportunity cost of holding money is lower, and so the quantity of money demanded is higher. Equilibrium in the market for money occurs at point 1, at which the interest rate is i_1. When aggregate output increases to Y_2, the money demand curve shifts rightward to $M^d(Y_2)$ because the higher level of output means that the quantity of money demanded is higher at any given interest rate. Equilibrium in the market for money now occurs at point 2, where the interest rate is at the higher level of i_2. Similarly, a still higher level of aggregate output, Y_3, results in an even higher level of the equilibrium interest rate i_3.

Panel (b) plots the equilibrium interest rates that correspond to the different output levels, with points 1, 2, and 3 corresponding to the equilibrium points 1, 2, and 3 in panel (a). The line connecting these points is the *LM* curve, which shows the

[1]As pointed out in earlier chapters on the money supply process, the money supply is positively related to interest rates, so the M^s curve in panel (a) should actually have a positive slope. The M^s curve is drawn as a vertical line in panel (a) to simplify the graph, but allowing for a positive slope leads to results in the same direction.

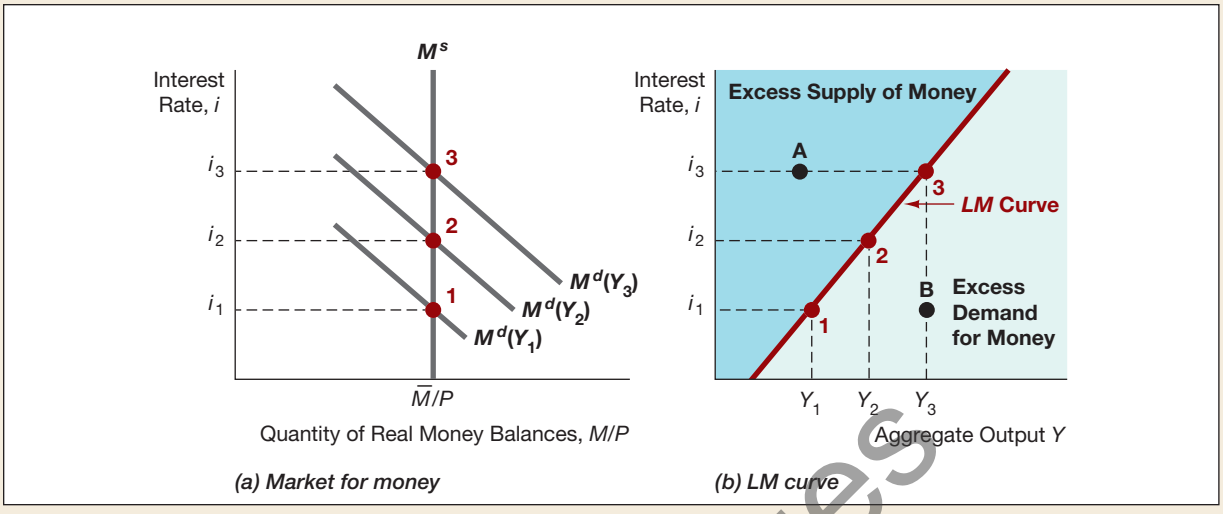


FIGURE 1 **Deriving the *LM* Curve**

Panel (a) shows the equilibrium levels of the interest rate in the market for money when aggregate output is at Y_1, Y_2, and Y_3. Panel (b) plots the three levels of the equilibrium interest rate i_1, i_2, and i_3 corresponding to these three levels of output; the line that connects these points is the *LM* curve.

combinations of interest rates and output for which the market for money is in equilibrium. The slope of the *LM* curve is positive because higher output raises the demand for money and thus raises the equilibrium interest rate.

What the *LM* Curve Tells Us The *LM* curve traces out the points that satisfy the equilibrium condition, which occurs when the quantity of money demanded equals the quantity of money supplied. For each given level of aggregate output, the *LM* curve tells us what the interest rate must be for equilibrium to exist in the market for money. As aggregate output rises, the demand for money increases and the interest rate rises, so that money demanded equals money supplied and the market for money is in equilibrium.

Just as the economy tends to move toward the equilibrium points represented by the *IS* curve, it also moves toward the equilibrium points on the *LM* curve. If the economy is located in the area to the left of the *LM* curve, an excess supply of money is present. At point A, for example, the interest rate is at i_3 and aggregate output is at Y_1. The interest rate is above the equilibrium level, and people are holding more money than they wish to. To eliminate their excess money balances, they will purchase bonds, which will cause the price of the bonds to rise and their interest rate to fall. (The inverse relationship between the price of a bond and its interest rate is discussed in Chapter 4.) As long as an excess supply of money exists, the interest rate will fall until it comes to rest at point 1 on the *LM* curve.

If the economy is located in the area to the right of the *LM* curve, an excess demand for money is present. At point B, for example, the interest rate i_1 is below the equilibrium level, and people want to hold more money than they currently do. To acquire this money, they will sell bonds and drive down bond prices, and the interest rate will rise. This process will stop only when the interest rate rises to an equilibrium point 3 on the *LM* curve.

ISLM APPROACH TO AGGREGATE OUTPUT AND INTEREST RATES

Now that we have derived the *IS* and *LM* curves, we can put them into the same diagram (Figure 2) to produce a model that enables us to determine both aggregate output and the interest rate. The only point at which the goods market and the market for money are in simultaneous equilibrium is at the intersection of the *IS* and *LM* curves, point E. At this point, aggregate output equals aggregate demand (*IS*), and the quantity of money demanded equals the quantity of money supplied (*LM*). At any other point in the diagram, at least one of these equilibrium conditions is not satisfied, and market forces move the economy toward the general equilibrium, point E.

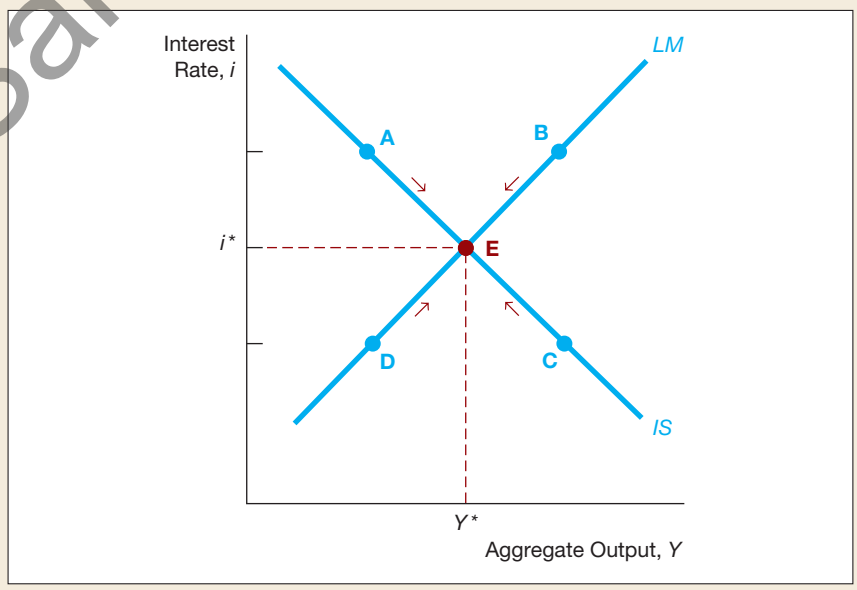
To learn how this model works, let's consider what happens if the economy is at point A, which is on the *IS* curve but not the *LM* curve. Even though at point A the goods market is in equilibrium, so that aggregate output equals aggregate demand, the interest rate is above its equilibrium level, and so the demand for money is less than the supply. Because people have more money than they wish to hold, they will try to get rid of it by buying bonds. The resulting rise in bond prices will cause a fall in interest rates, which in turn will cause both planned investment spending and net exports to rise, thereby increasing aggregate output. The economy then will move down along the *IS* curve, and the process will continue until the interest rate has fallen to i^* and aggregate output has risen to Y^*—that is, until the economy is at equilibrium point E.

If the economy is on the *LM* curve but off the *IS* curve at point B, it will also head toward the equilibrium at point E. At point B, even though money demand equals money supply, output is higher than the equilibrium level and exceeds aggregate demand. Firms are unable to sell all their output, and unplanned inventory accumulates, prompting firms to cut production and lower output. The decline in output

FIGURE 2

***ISLM* Diagram: Simultaneous Determination of Output and the Interest Rate**

Only at point E, where the interest rate is at i^* and output is at Y^*, is there simultaneous equilibrium in both the goods market (as measured by the *IS* curve) and the market for money (as measured by the *LM* curve). At other points, such as A, B, C, or D, one of the two markets is not in equilibrium, and there will be a tendency for that market to move toward equilibrium, point E.



causes the demand for money to fall, lowering interest rates. The economy then moves down along the *LM* curve until it reaches equilibrium point E.

We have finally developed a model, the *ISLM* model, that tells us how both interest rates and aggregate output are determined when the price level is fixed. Although we have demonstrated that the economy will head toward an aggregate output level of Y^*, there is no reason to assume that the economy is at full employment at this level of aggregate output. If the unemployment rate is too high, government policymakers might want to increase aggregate output to decrease unemployment. The *ISLM* apparatus indicates that they can do this by manipulating monetary and fiscal policy.

FACTORS THAT CAUSE THE *LM* CURVE TO SHIFT

In Chapter 21, we examined the factors that cause the *IS* curve to shift. What factors cause the *LM* curve to shift? Only two factors cause it to shift: changes in the money supply and autonomous changes in money demand. How do changes in these two factors affect the *LM* curve?

1. *Changes in the Money Supply*. A rise in the money supply shifts the *LM* curve to the right, as shown in Figure 3. To see how this shift occurs, suppose the *LM* curve is initially at LM_1 in panel (a) and the Federal Reserve conducts open market purchases that increase the money supply. If we consider point A, which is on the initial LM_1 curve, we can examine what happens to the equilibrium level of the interest rate, holding output constant at Y_A.

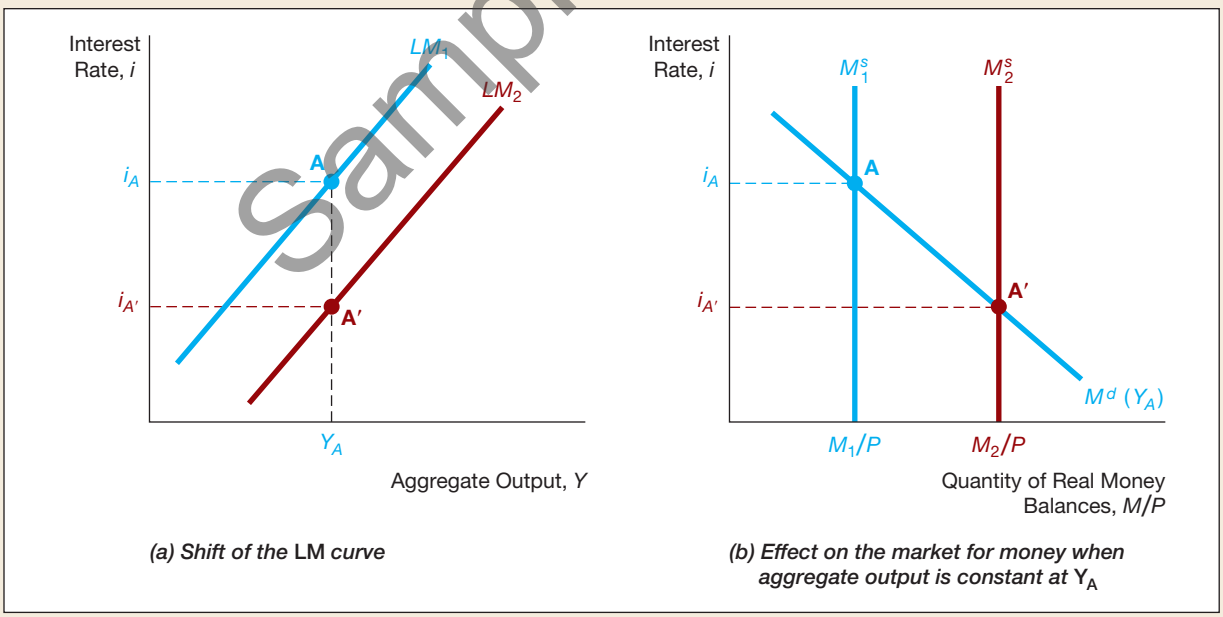


FIGURE 3 **Shift in the *LM* Curve from an Increase in the Money Supply**
The *LM* curve shifts to the right from LM_1 to LM_2 when the money supply increases because, as indicated in panel (b), at any given level of aggregate output (say, Y_A), the equilibrium interest rate falls (from point A to A′).

In panel (b), which depicts a supply and demand diagram for the market for money, the equilibrium interest rate initially lies at i_A, at the intersection of the supply curve for money M_1^s and the demand curve for money M^d. The rise in the quantity of money supplied shifts the supply curve rightward to M_2^s and, with output held constant at Y_A, the equilibrium interest rate falls to $i_{A'}$. In panel (a), this decline in the equilibrium interest rate from i_A to $i_{A'}$ is shown as a movement from point A to point A′. The same analysis can be applied to every point on the initial LM_1 curve, leading to the conclusion that at any given level of aggregate output, the equilibrium interest rate falls when the money supply increases. Thus LM_2 lies below and to the right of LM_1.

Reversing this reasoning, a decrease in the money supply shifts the *LM* curve to the left. A decline in the money supply results in a shortage of money at points on the initial *LM* curve. This condition of excess demand for money can be eliminated by a rise in the interest rate, which reduces the quantity of money demanded until it again equals the quantity of money supplied.

2. *Autonomous Changes in Money Demand*. The theory of portfolio choice outlined in Chapter 5 indicates that an autonomous rise in money demand (that is, a change not caused by a change in the price level, aggregate output, or the interest rate) is possible. For example, an increase in the volatility of bond returns would make bonds riskier relative to money and would increase the quantity of money demanded at any given interest rate, price level, or amount of aggregate output. The resulting autonomous increase in the demand for money would shift the *LM* curve to the left, as shown in Figure 4. Consider point A on the initial LM_1 curve. Suppose a massive financial panic occurs, sending many companies into bankruptcy. Because bonds have now become a riskier asset, people will want to shift

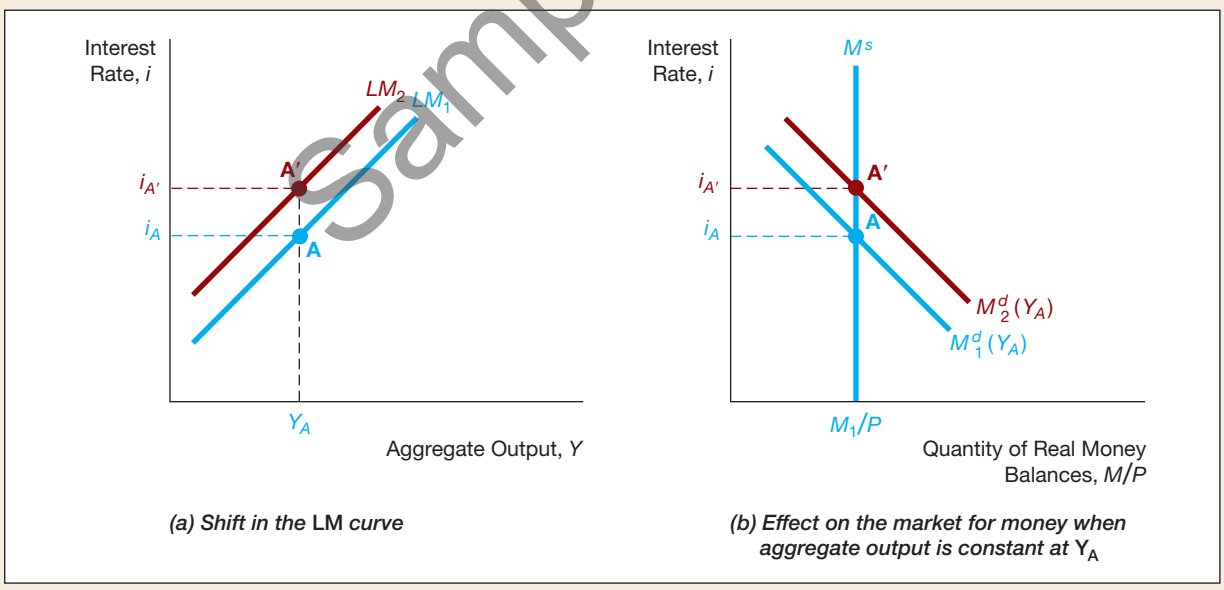


FIGURE 4 **Shift in the *LM* Curve When Money Demand Increases**

The *LM* curve shifts to the left from LM_1 to LM_2 when money demand increases because, as indicated in panel (b), the equilibrium interest rate rises (from point A to A′) at any given level of aggregate output (say, Y_A).

from holding bonds to holding money; they will hold more money at all interest rates and output levels. The resulting increase in money demand at an output level of Y_A is shown by the shift of the money demand curve from M_1^d to M_2^d in panel (b). The new equilibrium in the market for money indicates that if aggregate output is constant at Y_A, then the equilibrium interest rate will rise to $i_{A'}$ and the point of equilibrium will move from A to A'.

Conversely, an autonomous decline in money demand leads to a rightward shift of the *LM* curve. The fall in money demand creates an excess supply of money, which is eliminated by a rise in the quantity of money demanded resulting from a decline in the interest rate.

CHANGES IN EQUILIBRIUM LEVEL OF THE INTEREST RATE AND AGGREGATE OUTPUT

We can now use our knowledge of the factors that cause the *IS* and *LM* curves to shift to analyze how the equilibrium levels of the interest rate and aggregate output change in response to alterations in monetary and fiscal policies.

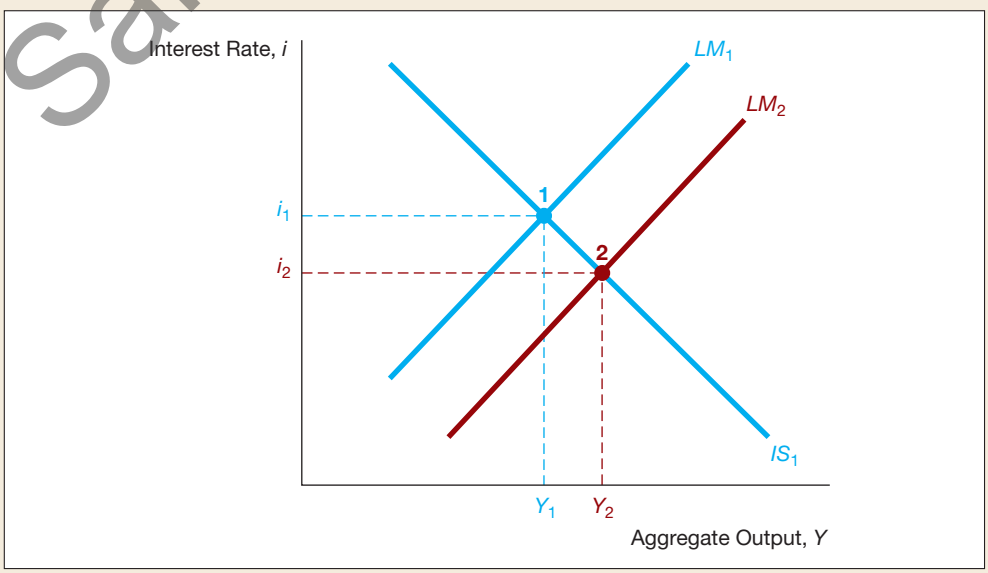
Response to a Change in Monetary Policy

Figure 5 illustrates the response of output and the interest rate to an increase in the money supply. Initially, the economy is in equilibrium for both the goods market and the market for money, as indicated by point 1 at the intersection of IS_1 and LM_1. Suppose that at the resulting level of aggregate output Y_1, the economy is suffering from an unemployment rate of 10%, and the Federal Reserve decides it should try to raise output and reduce unemployment by raising the money supply. Will the Fed's change in monetary policy have the intended effect?

FIGURE 5

Response of Aggregate Output and the Interest Rate to an Increase in the Money Supply

The increase in the money supply shifts the *LM* curve to the right, from LM_1 to LM_2; the economy moves to point 2, where output has increased to Y_2 and the interest rate has declined to i_2.



The increase in the money supply causes the *LM* curve to shift rightward to LM_2, and the equilibrium point for both the goods market and the market for money moves to point 2 (intersection of IS_1 and LM_2). The increase in the money supply causes the interest rate to decline to i_2, as we found in Figure 3, and aggregate output rises to Y_2; the Fed's policy has been successful in improving the health of the economy.

To understand clearly why aggregate output rises and the interest rate declines, think about exactly what happens when we move from point 1 to point 2 in Figure 5. When the economy is at point 1, the increase in the money supply (rightward shift of the *LM* curve) creates an excess supply of money, resulting in a decline in the interest rate. The decline causes investment spending and net exports to increase, which in turn raises aggregate demand and aggregate output. The excess supply of money is eliminated when the economy reaches point 2 because the rise in output and the fall in the interest rate have raised the quantity of money demanded to the new, higher level of the money supply.

A decline in the money supply reverses the process: it shifts the *LM* curve to the left, causing the interest rate to rise and output to fall. Accordingly, ***aggregate output is positively related to the money supply***; aggregate output expands when the money supply increases and falls when it decreases.

Response to a Change in Fiscal Policy

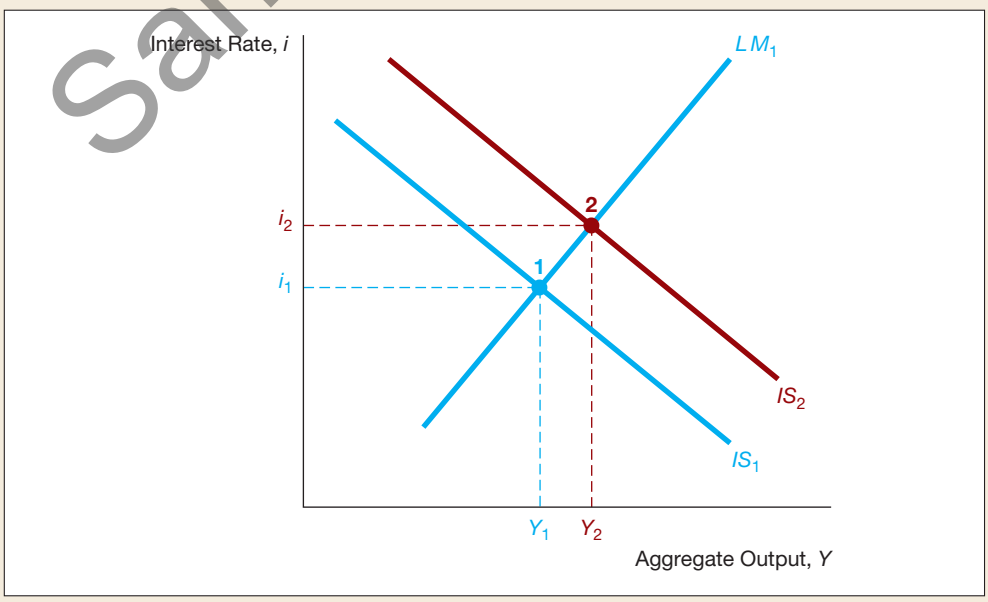
Suppose that the Federal Reserve is not willing to increase the money supply when the economy is suffering from a 10% unemployment rate (at point 1). Can the federal government come to the rescue and manipulate government spending and taxes to raise aggregate output and reduce the massive unemployment?

The *ISLM* model demonstrates that it can. Figure 6 depicts the response of output and the interest rate to an expansionary fiscal policy (an increase in government

FIGURE 6

Response of Aggregate Output and the Interest Rate to an Expansionary Fiscal Policy

Expansionary fiscal policy (a rise in government spending or a decrease in taxes) shifts the *IS* curve to the right, from IS_1 to IS_2; the economy moves to point 2, aggregate output increases to Y_2, and the interest rate rises to i_2.



spending or a decrease in taxes). An increase in government spending or a decrease in taxes will cause the *IS* curve to shift to IS_2, and the equilibrium point for both the goods market and the market for money will move to point 2 (intersection of IS_2 and LM_1). The result of the change in fiscal policy is a rise in aggregate output to Y_2 and a rise in the interest rate to i_2. Note the difference between an expansionary fiscal policy and an expansionary monetary policy in their effects on the interest rate. In the case of an expansionary fiscal policy, the interest rate rises, whereas in the case of an expansionary monetary policy, the interest rate falls.

Why does an increase in government spending or a decrease in taxes move the economy from point 1 to point 2, causing a rise in both aggregate output and the interest rate? An increase in government spending raises aggregate demand directly; a decrease in taxes makes more income available for spending and thus raises aggregate demand by raising consumer expenditure. The resulting increase in aggregate demand causes aggregate output to rise. The higher level of aggregate output raises the quantity of money demanded, creating an excess demand for money, which in turn causes the interest rate to rise. At point 2, the excess demand for money created by the rise in aggregate output has been eliminated by a rise in the interest rate, which lowers the quantity of money demanded.

A contractionary fiscal policy (a decrease in government spending or an increase in taxes) reverses the process described in Figure 6; it causes aggregate demand to fall, which shifts the *IS* curve to the left and causes both aggregate output and the interest rate to fall. ***Aggregate output and the interest rate are positively related to government spending and negatively related to taxes.***

As a study aid, Summary Table 1 indicates the effects on aggregate output and interest rates of a change in the seven factors that shift the *IS* and *LM* curves.

APPLICATION The Economic Stimulus Act of 2008

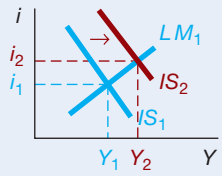
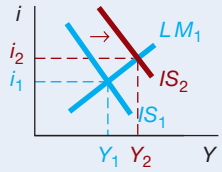
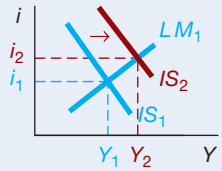
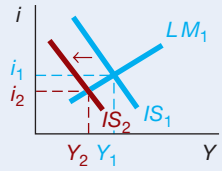
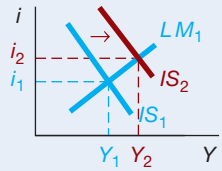
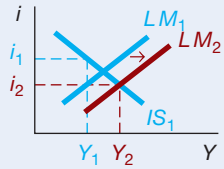
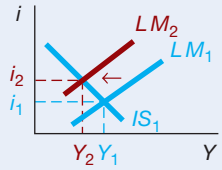
In February 2008, the U.S. Congress passed the Economic Stimulus Act of 2008 in order to counter the contractionary effects on the economy of the global financial crisis. The most important feature of the legislation was the issuance of over $100 billion of rebate checks to low- and middle-income taxpayers, although the bill also included tax incentives for businesses to encourage investment and help for homeowners who were facing foreclosure.

We can use our *ISLM* analysis to model the likely impact of this legislation. The tax rebates act exactly like a tax cut, similar to the situation depicted in Figure 6, which shows the response of the economy to expansionary fiscal policy. The *IS* curve would shift to the right, which would raise both interest rates and aggregate output. In addition, the tax incentives for businesses in the stimulus package would lead to a rise in investment, which would provide another reason for the *IS* curve to shift to the right, and interest rates and output would rise.

Although economists have estimated that the stimulus package did increase spending a little bit and so had some of the effects described in Figure 6, the continuing deterioration in credit market conditions overwhelmed the expansionary effects of the stimulus package. As a result, aggregate spending actually fell rather than rose. Consequently, the *IS* curve shifted to the left rather than to the right, and aggregate output and interest rates ended up falling rather than rising during this period. ◆

SUMMARY TABLE 1

Effects from Factors That Shift the *IS* and *LM* Curves

Factor	Autonomous Change in Factors	Response	Reason	
Consumer expenditure, C	↑	$Y\uparrow$, $i\uparrow$	$\bar{C}\uparrow \Rightarrow Y^{ad}\uparrow \Rightarrow$ *IS* shifts right	
Investment, I	↑	$Y\uparrow$, $i\uparrow$	$\bar{I}\uparrow \Rightarrow Y^{ad}\uparrow \Rightarrow$ *IS* shifts right	
Government spending, G	↑	$Y\uparrow$, $i\uparrow$	$\bar{G}\uparrow \Rightarrow Y^{ad}\uparrow \Rightarrow$ *IS* shifts right	
Taxes, T	↑	$Y\downarrow$, $i\downarrow$	$\bar{T}\uparrow \Rightarrow C\downarrow \Rightarrow Y^{ad}\downarrow \Rightarrow$ *IS* shifts left	
Net exports, NX	↑	$Y\uparrow$, $i\uparrow$	$\overline{NX}\uparrow \Rightarrow Y^{ad}\uparrow \Rightarrow$ *IS* shifts right	
Money supply, M^s	↑	$Y\uparrow$, $i\downarrow$	$M^s\uparrow \Rightarrow i\downarrow \Rightarrow$ *LM* shifts right	
Money demand, M^d	↑	$Y\downarrow$, $i\uparrow$	$M^d\uparrow \Rightarrow i\uparrow \Rightarrow$ *LM* shifts left	

Note: Only increases (↑) in the factors are shown. The effect of decreases in the factors would be the opposite of those indicated in the "Response" column.

EFFECTIVENESS OF MONETARY VERSUS FISCAL POLICY

Our discussion of the effects of fiscal and monetary policy suggests that a government can easily lift an economy out of a recession by implementing any of a number of policies (changing the money supply, government spending, or taxes). But how can policymakers decide which of these policies to use when faced with too much unemployment? Should they decrease taxes, increase government spending, raise the money supply, or do all three? And if they decide to increase the money supply, then by how much should they raise it? Economists do not pretend to have all the answers, and although the *ISLM* model will not clear the path to aggregate economic bliss, it can help policymakers decide which policies are likely to be most effective under certain circumstances.

Monetary Policy Versus Fiscal Policy: The Case of Complete Crowding Out

The *ISLM* model developed so far in this chapter shows that both monetary policy and fiscal policy affect the level of aggregate output. To understand when monetary policy is more effective than fiscal policy, we will examine a special case of the *ISLM* model in which money demand is unaffected by the interest rate (money demand is said to be "interest-inelastic"), so that monetary policy affects output but fiscal policy does not.

Consider the slope of the *LM* curve when the demand for money is unaffected by changes in the interest rate. If point 1 in panel (a) of Figure 7 represents a point at which the quantity of money demanded is equal to the quantity of money supplied, then it is on the *LM* curve. If the interest rate rises to, say, i_2, the quantity of money demanded is unaffected, and it will continue to equal the *unchanged* quantity of money supplied only if aggregate output remains *unchanged* at Y_1 (point 2). Equilibrium in the market for money will occur at the same level of aggregate output regardless of the interest rate, and the *LM* curve will be vertical, as shown in both panels of Figure 7.

Suppose the economy is suffering from a high rate of unemployment, which policymakers would like to eliminate through either expansionary fiscal or expansionary monetary policy. Panel (a) depicts what happens when an expansionary fiscal policy (an increase in government spending or a cut in taxes) is implemented, shifting the *IS* curve to the right from IS_1 to IS_2. As you can see in panel (a), the fiscal expansion has no effect on output; aggregate output remains at Y_1 when the economy moves from point 1 to point 2.

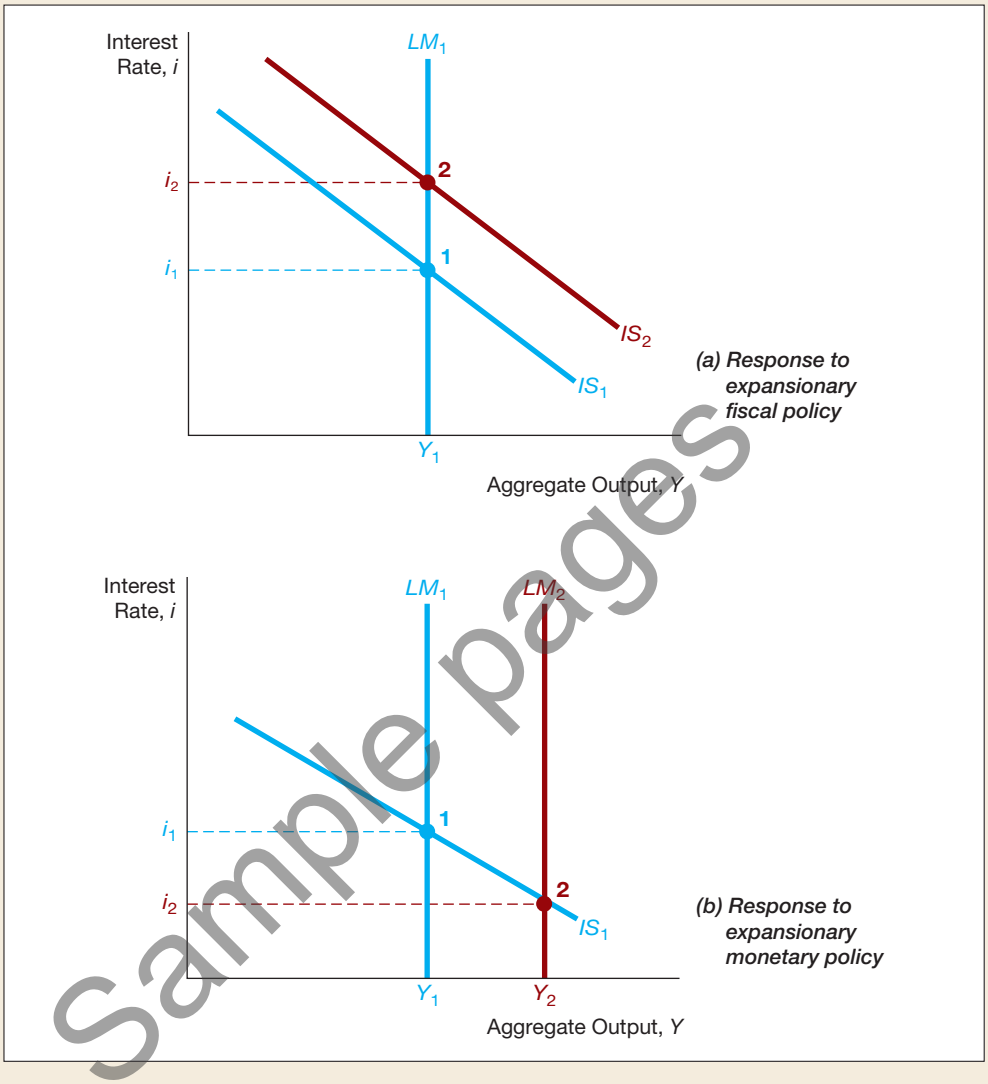
In our earlier analysis, expansionary fiscal policy always increased aggregate demand and raised the level of output. Why does panel (a) show a different result? The answer is that because the *LM* curve is vertical, the rightward shift of the *IS* curve raises the interest rate to i_2, which causes investment spending and net exports to fall enough to offset completely the increased spending resulting from the expansionary fiscal policy. Put another way, increased spending resulting from expansionary fiscal policy has *crowded out* investment spending and net exports, which decrease because of the rise in the interest rate. This situation, in which expansionary fiscal policy does not lead to a rise in output, is frequently referred to as a case of **complete crowding out**.[2]

[2]When the demand for money is affected by the interest rate—the usual case in which the *LM* curve slopes upward but is not vertical—some crowding out occurs. The rightward shift of the *IS* curve also raises the interest rate, which causes investment spending and net exports to fall somewhat. However, as indicated in Figure 6, the rise in the interest rate is not sufficient to reduce investment spending and net exports to the point where aggregate output does not increase. Thus expansionary fiscal policy increases aggregate output, and only partial crowding out occurs.

FIGURE 7

Effectiveness of Monetary and Fiscal Policy When Money Demand Is Unaffected by the Interest Rate

When the demand for money is unaffected by the interest rate, the *LM* curve is vertical. In panel (a), an expansionary fiscal policy (an increase in government spending or a cut in taxes) shifts the *IS* curve from IS_1 to IS_2 and leaves aggregate output unchanged at Y_1. In panel (b), an increase in the money supply shifts the *LM* curve from LM_1 to LM_2 and raises aggregate output from Y_1 to Y_2. Therefore, monetary policy is effective, but fiscal policy is not.



Panel (b) shows what happens when the Federal Reserve tries to eliminate high unemployment through an expansionary monetary policy (an increase in the real money supply, *M/P*). Here, the *LM* curve shifts to the right from LM_1 to LM_2 because, at each interest rate, output must rise so that the quantity of money demanded will rise to match the increase in the money supply. Aggregate output rises from Y_1 to Y_2 (the economy moves from point 1 to point 2), and expansionary monetary policy does affect aggregate output in this case.

We conclude from the analysis in Figure 7 that if the demand for money is unaffected by changes in the interest rate (money demand is interest-inelastic), monetary policy is effective but fiscal policy is not. An even more general conclusion can be

reached: ***The less interest-sensitive money demand is, the more effective monetary policy is relative to fiscal policy.***[3]

Because the interest sensitivity of money demand is important to policymakers' decisions regarding the use of monetary or fiscal policy to influence economic activity, the subject has been studied extensively by economists and has been the focus of many debates. Findings on the interest sensitivity of money demand are discussed in Chapter 20.

APPLICATION Targeting Money Supply Versus Interest Rates

In the 1970s and early 1980s, central banks in many countries pursued a strategy of *monetary targeting*—that is, they used their policy tools to try to achieve a money supply equal to a target value. However, with the breakdown of the stable relationship between the money supply and economic activity, many of these central banks abandoned monetary targeting in the 1980s and pursued interest-rate targeting instead. The *ISLM* model gives us important information about which variable a central bank should target, and we can apply it to explain why central banks have abandoned monetary targeting and switched to interest-rate targeting.[4]

As we saw in Chapter 17, when the Federal Reserve attempts to hit a reserve aggregate or a money supply target, it cannot at the same time pursue an interest-rate target; it can hit one target or the other, but not both. Consequently, it needs to know which of these two targets will produce more effective control of aggregate output.

In contrast to the textbook world that you have been inhabiting, in which the *IS* and *LM* curves are assumed to be fixed, the real world is one of great uncertainty. In the real world, *IS* and *LM* curves shift because of unanticipated changes in autonomous spending and money demand. To understand whether the Fed should use a money supply target or an interest-rate target, we need to look at two cases: one in which uncertainty about the *IS* curve is far greater than uncertainty about the *LM* curve, and another in which uncertainty about the *LM* curve is far greater than uncertainty about the *IS* curve.

The *ISLM* diagram in Figure 8 illustrates the outcomes of the two targeting strategies when the *IS* curve is unstable and uncertain, so that it fluctuates around its expected value of IS^* from IS' to IS'', and the *LM* curve is stable and certain, so that it stays at LM^*. Because the central bank knows that the expected position of the *IS* curve is at IS^* and desires aggregate output of Y^*, it will set its interest-rate target at i^*. This policy is represented by the line labeled "Interest-Rate Target" in Figure 8.

How can the central bank keep the interest rate at its target level of i^*? Recall from the chapter on the tools of monetary policy that when the interest rate differs from i^*, the Fed can hit the interest-rate target by buying and selling bonds. When the *IS* curve

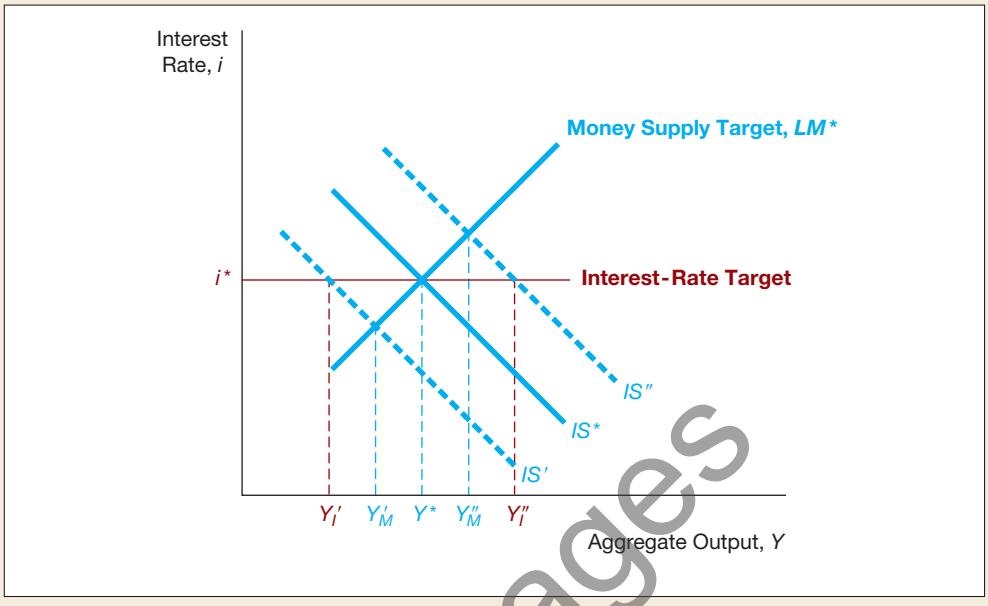
[3]This result and many others in this chapter can be obtained more directly by using algebra. An algebraic treatment of the *ISLM* model is given in an appendix to this chapter.

[4]The classic paper on this topic is William Poole, "The Optimal Choice of Monetary Policy Instruments in a Simple Macro Model," *Quarterly Journal of Economics* 84 (1970): 192–216. A less mathematical version of his analysis, far more accessible to students, is contained in William Poole, "Rules of Thumb for Guiding Monetary Policy," in *Open Market Policies and Operating Procedures: Staff Studies* (Washington, DC: Board of Governors of the Federal Reserve System, 1971).

FIGURE 8

Money Supply and Interest-Rate Targets When the *IS* Curve Is Unstable and the *LM* Curve Is Stable

The unstable *IS* curve fluctuates between *IS′* and *IS″*. The money supply target produces smaller fluctuations in output (Y'_M to Y''_M) than the interest-rate target (Y'_I to Y''_I). Therefore, the money supply target is preferred over the interest-rate target.



shifts out to *IS″*, the interest rate rises above i^*, with the money supply unchanged. To counter this rise in interest rates, the central bank will need to buy bonds just until their price is driven back up enough so that the interest rate comes back down to i^*. (As we saw in Chapter 15, the result of these open market purchases is a rise in both the monetary base and the money supply until the *LM* curve shifts to the right to intersect the *IS″* curve at i^*—not shown in the diagram, for simplicity.) When the interest rate is below i^*, the central bank needs to sell bonds in order to lower their price and raise the interest rate back up to i^*. (These open market sales reduce the monetary base and the money supply until the *LM* curve shifts to the left to intersect the *IS* curve at i^*—again, not shown in the diagram.) Pursuit of the interest-rate target causes aggregate output to fluctuate between Y'_I and Y''_I in Figure 8.

If, instead, the Fed decides to pursue a money supply target, it will set the money supply target such that the resulting *LM* curve *LM** intersects the *IS** curve at the desired output level of Y^*. This policy is represented by the line labeled "Money Supply Target." Because the money supply is held constant and so the *LM* curve is fixed at *LM**, aggregate output fluctuates between Y'_M and Y''_M under the money supply target policy.

As you can see in Figure 8, the money supply target leads to smaller output fluctuations around the desired level than the interest-rate target. Given a money supply target, a rightward shift of the *IS* curve (to *IS″*, for example) will cause the interest rate to rise, and this rise in the interest rate will lead to a lower level of investment spending and net exports and hence to a smaller increase in aggregate output than would occur under an interest-rate target. Because smaller output fluctuations are desirable, the conclusion is that ***if the IS curve is more unstable than the LM curve, a money supply target is preferred over an interest-rate target***.

FIGURE 9

Money Supply and Interest-Rate Targets When the *LM* Curve Is Unstable and the *IS* Curve Is Stable

The unstable *LM* curve fluctuates between *LM′* and *LM″*. The money supply target then produces bigger fluctuations in output (Y'_M to Y''_M) than the interest-rate target (which leaves output fixed at Y^*). Therefore, in this case, the interest-rate target is preferred.

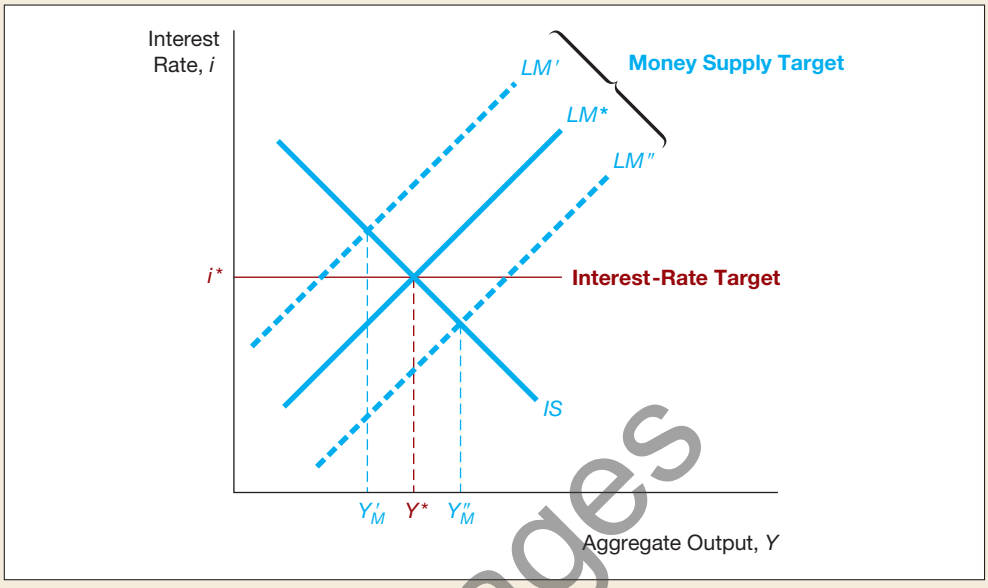


Figure 9 illustrates the outcomes of the two targeting strategies when the *IS* curve is stable and the *LM* curve is unstable (because of unanticipated changes in money demand). Again, the interest-rate and money supply targets are set such that the expected level of aggregate output is equal to the desired level Y^*. Because the *LM* curve is now unstable, it fluctuates between *LM′* and *LM″* even when the money supply is fixed, causing aggregate output to fluctuate between Y'_M and Y''_M.

The interest-rate target, by contrast, is not affected by uncertainty about the *LM* curve, because it is determined by the Fed's adjustment of the money supply whenever the interest rate tries to depart from i^*. When the interest rate begins to rise above i^* because of an increase in money demand, the central bank just buys bonds, driving up their price and bringing the interest rate back down to i^*. The result of these open market purchases is a rise in both the monetary base and the money supply. Similarly, if the interest rate falls below i^*, the central bank sells bonds to lower their price and to raise the interest rate back to i^*, thereby causing declines in the monetary base and the money supply. The only effect of the fluctuating *LM* curve, then, is that the money supply fluctuates more as a result of the interest-rate target policy. With the interest-rate target, output is exactly at the desired level, with no fluctuations.

Because smaller output fluctuations are desirable, the conclusion from Figure 9 is that ***if the LM curve is more unstable than the IS curve, an interest-rate target is preferred over a monetary target***.

We can now see why many central banks decided to abandon monetary targeting for interest-rate targeting in the 1980s. With the rapid proliferation of new financial instruments whose presence affected the demand for money, money demand (which is embodied in the *LM* curve) became highly unstable in many countries. Thus central

banks in these countries recognized that their economies were more likely to be in the situation depicted in Figure 9 and decided that they would be better off with an interest-rate target than a money supply target.[5] ◆

ISLM MODEL IN THE LONG RUN

So far in our *ISLM* analysis, we have assumed that the price level is fixed so that nominal values and real values are the same. This is a reasonable assumption for the short run, but in the long run the price level does change. To see what happens in the *ISLM* model in the long run, we make use of the concept of *natural rate of output*, more often referred to as *potential output*: the rate of output at which the price level has no tendency to rise or fall. Potential output (denoted by Y^P) is the level to which the economy settles in the long run. When output is above potential output, the booming economy will cause prices to rise; when output is below potential output, the slack in the economy will cause prices to fall.

Because we now want to examine what happens when the price level changes, we can no longer assume that real and nominal values are the same. The spending variables that affect the *IS* curve (consumer expenditure, investment spending, government spending, and net exports) describe the demand for goods and services *in real terms*; they describe the physical quantities of goods that people want to buy. Because these quantities do not change when the price level changes, an alteration in the price level has no effect on the *IS* curve, which describes *in real terms* the combinations of the interest rate and aggregate output that satisfy goods market equilibrium.

Figure 10 shows what happens in the *ISLM* model when output rises above potential output, which is marked by a vertical line at Y^P. Suppose that the *IS* and *LM* curves initially intersect at point 1, where output $Y = Y^P$. Panel (a) examines what happens to output and interest rates when the money supply increases. As we saw in Figure 3, the increase in the money supply causes the *LM* curve to shift rightward to LM_2, and the equilibrium moves to point 2 (the intersection of IS_1 and LM_2), where the interest rate falls to i_2 and output rises to Y_2. However, as we can see in panel (a), the level of output at Y_2 is greater than potential output at Y^P, and so the price level begins to rise.

[5]It is important to recognize, however, that the crucial factor in deciding which target is preferable is the *relative* instability of the *IS* and *LM* curves. Although the *LM* curve has been unstable recently, the evidence supporting a stable *IS* curve is also weak. Instability in the money demand function does not automatically mean that money supply targets should be abandoned for interest-rate targets. Furthermore, the analysis so far has been conducted under the assumption that the price level is fixed. More realistically, when the price level is allowed to change, there is uncertainty about expected inflation and so the case for an interest-rate target is less strong. As we learned in Chapters 4 and 5, the interest rate that is more relevant to investment decisions is not the nominal interest rate but the real interest rate (the nominal interest rate minus expected inflation). Hence, when expected inflation rises, the real interest rate falls at each given nominal interest rate, and investment and net exports rise, shifting the *IS* curve to the right. Similarly, a fall in expected inflation raises the real interest rate at each given nominal interest rate, lowers investment and net exports, and shifts the *IS* curve to the left. In the real world, expected inflation undergoes large fluctuations, so the IS curve in Figure 9 will undergo substantial fluctuations, making it less likely that the interest-rate target is preferable to the money supply target.

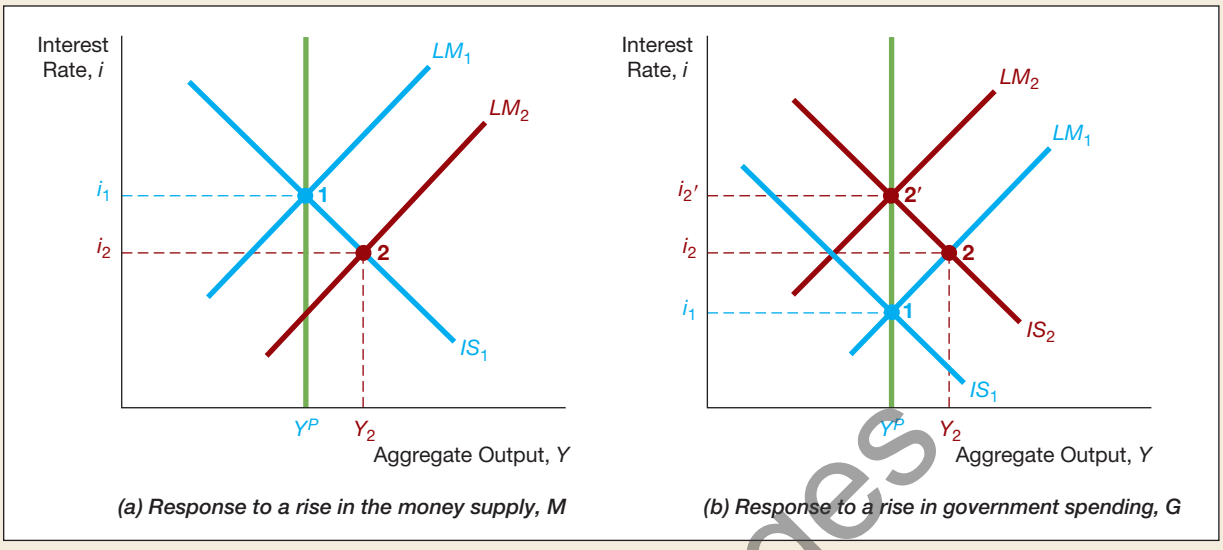


FIGURE 10 ***ISLM* Model in the Long Run**

In panel (a), an increase in the money supply causes the *LM* curve to shift rightward to LM_2, and the equilibrium moves to point 2, where the interest rate falls to i_2 and output rises to Y_2. Because output at Y_2 is above potential output Y^P, the price level rises, the real money supply falls, and the *LM* curve shifts back to LM_1; the economy has returned to the original equilibrium at point 1. In panel (b), an increase in government spending shifts the *IS* curve to the right to IS_2, and the economy moves to point 2, where the interest rate has risen to i_2 and output has risen to Y_2. Because output at Y_2 is above potential output Y^P, the price level begins to rise, real money balances *M/P* begin to fall, and the *LM* curve shifts to the left to LM_2. The long-run equilibrium at point 2′ has an even higher interest rate at $i_{2'}$, and output has returned to Y^P.

In contrast to the *IS* curve, which is unaffected by a rise in the price level, the *LM* curve is affected by the price level rise because the liquidity preference theory states that the demand for money *in real terms* depends on real income and interest rates. This theory makes sense because money is valued in terms of what it can buy. However, the money supply reported in dollars by the media is not the money supply in real terms; it is a nominal quantity. As the price level rises, the quantity of money *in real terms* falls, and the effect on the *LM* curve is identical to a fall in the nominal money supply with the price level fixed. The lower value of the real money supply creates an excess demand for money, causing the interest rate to rise at any given level of aggregate output, and the *LM* curve shifts back to the left. As long as the level of output exceeds potential output, the price level will continue to rise, shifting the *LM* curve to the left, until finally output is back at potential output Y^P. This occurs when the *LM* curve has returned to LM_1, where real money balances *M/P* have returned to the original level and the economy has returned to the original equilibrium at point 1. In the long run, the level of output and interest rates are unchanged by the expansion in the money supply.

The fact that an increase in the money supply leaves output and interest rates unchanged in the long run is referred to as **long-run monetary neutrality**. The only result of the increase in the money supply is a higher price level, which has increased proportionally to the increase in the money supply, so that real money balances *M/P* are unchanged.

Panel (b) looks at what happens to output and interest rates under expansionary fiscal policy, such as an increase in government spending. As we saw earlier, the increase in government spending shifts the *IS* curve to the right to IS_2, and in the short run the economy moves to point 2 (the intersection of IS_2 and LM_1), where the interest rate has risen to i_2 and output has risen to Y_2. Because output at Y_2 is above potential output Y^P, the price level begins to rise, real money balances *M/P* begin to fall, and the *LM* curve shifts to the left. Only when the *LM* curve has shifted to LM_2 and the equilibrium has reached point 2′, where output is again at potential output Y^P, does the price level stop rising and the *LM* curve come to rest. The resulting long-run equilibrium at point 2′ is characterized by an even higher interest rate at $i_{2'}$, and output has not risen from Y^P. Indeed, what has occurred in the long run is complete crowding out: The rise in the price level, which has shifted the *LM* curve to LM_2, has caused the interest rate to rise to $i_{2'}$, causing investment and net exports to fall enough to offset the increased government spending completely. We have discovered that even though complete crowding out does not occur in the short run in the *ISLM* model (unless the *LM* curve is vertical), it does occur in the long run.

We can conclude from our study of the effects of monetary and fiscal policy on the *ISLM* model that ***although monetary and fiscal policy can affect output in the short run, neither affects output in the long run.*** Clearly, in order to use monetary and fiscal policy effectively to raise output, policymakers must know where output is relative to potential output and how soon the long run occurs.

SUMMARY

1. The *ISLM* model uses the *IS* and *LM* curves to determine aggregate output and the interest rate at a fixed price level. The *IS* curve traces out the combinations of the interest rate and aggregate output for which the goods market is in equilibrium, and the *LM* curve traces out the combinations for which the market for money is in equilibrium. The *IS* curve slopes downward because higher interest rates lower planned investment spending and net exports and so lower equilibrium output. The *LM* curve slopes upward because higher aggregate output raises the demand for money and so raises the equilibrium interest rate.
2. The intersection point of the *IS* and *LM* curves gives the simultaneous output and interest rates at which both the goods market and the market for money are in equilibrium. At any other level of interest rates and output, at least one of the markets will be out of equilibrium, and economic forces will move the economy toward the general equilibrium point at the intersection of the *IS* and *LM* curves.
3. The *LM* curve is shifted to the right by a rise in the money supply or an autonomous fall in money demand; it is shifted to the left by a fall in the money supply or an autonomous rise in money demand.
4. A rise in the money supply raises equilibrium output but lowers the equilibrium interest rate. Expansionary fiscal policy (a rise in government spending or a fall in taxes) raises equilibrium output but, in contrast to expansionary monetary policy, also raises the interest rate.
5. The less interest-sensitive money demand is, the more effective monetary policy is relative to fiscal policy.
6. The *ISLM* model leads us to the following conclusion about the conduct of monetary policy: When the *IS* curve is more unstable than the *LM* curve, a money supply target provides smaller output fluctuations than an interest-rate target and so is the preferred target; when the *LM* curve is more unstable than the *IS* curve, an interest-rate target leads to smaller output fluctuations than a money supply target and so is the preferred target.
7. By examining the effects of expansionary monetary or fiscal policy on the *ISLM* model, we can conclude that although monetary and fiscal policy can affect output in the short run, neither affects output in the long run.