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# The Determination of Aggregate Output, the Price Level, and the Interest Rate

## CHAPTER OUTLINE

### **The Aggregate Supply (AS) Curve**

Define the aggregate supply curve and discuss shifts in the short-run AS curve.

### **The Aggregate Demand (AD) Curve**

Derive the aggregate demand curve and explain why the AD curve is downward sloping.

### **The Final Equilibrium**

Explain why the intersection of the AD and AS curves is an equilibrium point.

### **Other Reasons for a Downward-Sloping AD Curve**

Give two additional reasons why the AD curve may slope down.

### **The Long-Run AS Curve**

Discuss the shape of the long-run aggregate supply curve and explain long run market adjustment to potential GDP.

## DETAILED CHAPTER OUTLINE

### I. Introduction

- A. Chapters 26 and 27 assemble the models built in Chapters 23–25.
- B. The complete *AD-AS* model is developed and investigated in these two chapters.

### II. The Aggregate Supply Curve

#### A. Introduction:

1. *Aggregate supply* is the total supply of all goods and services in an economy.
2. The *aggregate supply curve* is a graph that shows the relationship between the aggregate quantity of output supplied by all firms in an economy and the overall price level.
  - a. The *AS* curve is *not* a market supply curve and it is *not* the sum of all the individual supply curves in the economy.
  - b. When we derived the supply curve for a firm we assumed per unit production costs were constant in the short run. Firms set prices instead of simply responding to them. In other words, we are assuming imperfect competition for most firms in the economy. And since firms in imperfect competition have no supply curves, we cannot simply add the firms' individual supply curves to get a market supply curve—there is nothing to add.
  - c. The *AS* curve is a *price/output response* curve. It traces out the price decisions and output decisions of all the markets and firms in the economy given a set of circumstances.

#### B. Aggregate Supply in the Short Run

1. The short-run aggregate supply curve slopes upward. When an economy is in a deep recession, the short-run aggregate supply curve may be fairly flat. The deeper the economy sinks into a recession, the flatter the short-run *AS* curve (usually). *AS* becomes steeper at high levels of output. As the economy approaches full employment, increases in aggregate demand cause smaller increases in output and larger increases in the price level.
2. Why an Upward Slope?
  - a. If all prices, including input prices (particularly wages) changed at the same rate, there would not be any output response. The short-run aggregate supply curve would be vertical.
  - b. But if there are any prices that are “sticky” the *AS* curve may slope upward. Often the sticky price is the wage rate.
  - c. Generally, some input prices will rise when *AD* increases. That would shift the *AS* curve up. We assume that these input costs are small relative to wage costs. If wages are a large fraction of input costs and wage changes lag behind price changes, we have an upward-sloping *AS* curve.
3. Why the Particular Shape?
  - a. In two words, capacity constraints. To understand this shape, consider the response of firms to increases in aggregate demand. This response

depends on capacity utilization and how fast input prices respond to increases in the overall price level.

- b. At low levels of capacity utilization, increases in demand result in increases in output with little impact on the price level. Wages are likely to be even stickier upward if firms have kept excess workers during the downturn to preserve worker morale.
- c. When the economy is producing at its maximum level of output (at capacity) the AS curve becomes steep because additional increases in aggregate demand mainly induce a higher price level with only a small impact on output.

### C. Shifts of the Short-Run Aggregate Supply Curve

- 1. Technological progress and increases in the size of the labor force both shift the AS curve.
  - a. This can be the result of increases in the supply of labor, the stock of capital, labor quality (human capital), or technological improvements.
  - b. The text correctly notes that immigration can be a major cause of increases in the quantity of labor available for production.
  - c. The influx of women into the labor force since the mid-1960s also shifted the AS curve.
- 2. Cost Shocks (Supply Shocks)
  - a. A *cost shock* (*supply shock*) is a change cost that shifts the short-run aggregate supply (AS) curve.
  - b. For the last 40 years a major source of supply shocks has been dramatic changes in energy prices. These changes induce changes in the prices of substitutes, namely other forms of energy such as natural gas.
  - c. Cost shocks can be negative (detrimental, a shift of AS to the left) or positive (beneficial, a shift to the right).

## III. The Aggregate Demand (AD) Curve

### A. Planned Aggregate Expenditure and the Interest Rate

- 1.  $AE = C + I + G$ .
- 2. Since planned investment ( $I$ ) is an inverse function of the interest rate, planned aggregate expenditure ( $AE$ ) must also be an inverse function of the interest rate.
- 3. When the interest rate rises, planned investment falls, shifting the  $AE$  curve down (Figure 11.3 [26.3]). This causes equilibrium income to fall.
- 4. The relationship between aggregate output and the interest rate in the goods market is called the *IS curve* (Figure 26.4).
- 5. An increase in  $G$  shifts the  $IS$  curve to the right. For now, the interest rate is assumed to remain constant.

B. The Behavior of the Fed

1. From the previous chapter, we know that the Fed controls the interest rate.
2. The FOMC meets every six weeks to discuss the state of the economy and set an interest rate target. They issue a directive to the New York Fed that specifies a target interest rate.
3. The Fed's policy goals are high levels of output and employment, along with low inflation.
4. While the process sounds mechanical, FOMC members and Fed presidents are experts in economics, finance, and related subjects. There is considerable brainpower in the room at an FOMC meeting. Many factors are taken into account when setting monetary policy. We call these factors the  $Z$  factors. They are exogenous.
5. The *Fed rule* is an equation that shows how the Fed's interest rate decision depends on the state of the economy:

$$r = aY + bP + gZ$$

6. The coefficients  $a$ ,  $b$ , and  $g$  are assumed to be positive.
  - a. High output or a high price level should cause the Fed to raise the interest rate.
  - b. By defining the  $Z$  variables appropriately, we can assume  $g$  is positive without loss of generality.
7. Figure 26.6 shows how the Fed rule interacts with the  $IS$  curve:

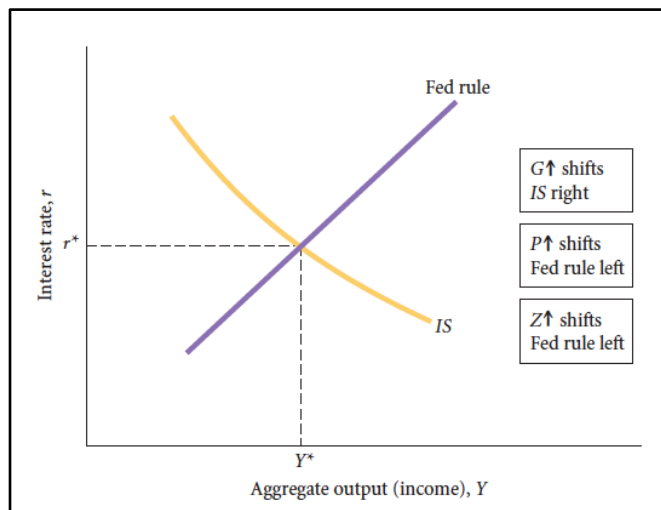


Figure 26.6

C. Deriving the  $AD$  Curve

1. The  $AD$  Curve Slopes Downward
  - a. Suppose there is an increase in  $P$ . The Fed rule curve shifts left (Figure 26.6). The Fed rule says that an increase in  $P$  must cause  $r$  to also rise.
  - b. The interest rate rises and equilibrium output falls. Thus, as  $P$  rises equilibrium  $Y$  falls. This is the basis for the downward-sloping  $AD$  curve.

- c. An increase in  $G$  shifts  $IS$  and  $AD$  to the right. An increase in  $Z$  shifts the Fed rule curve and the  $AD$  curve to the left. (Remember, this is how  $Z$  was defined.)
2. The Aggregate Demand Curve: A Warning
  - a. The  $AD$  curve is not a market demand curve and is not the sum of all market demand curves in an economy.
  - b. Aggregate demand is a function of the overall price level, not the price of any single product. An increase in the price level causes the demand for money to rise, increasing the interest rate and decreasing aggregate expenditure.
3. Figure 26.7 summarizes the  $AD$  curve:

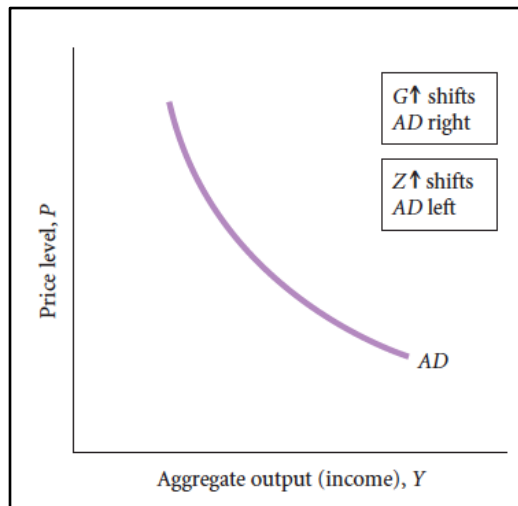


Figure 26.7

4. Figure 26.8 summarizes the  $AD$ - $AS$  model:

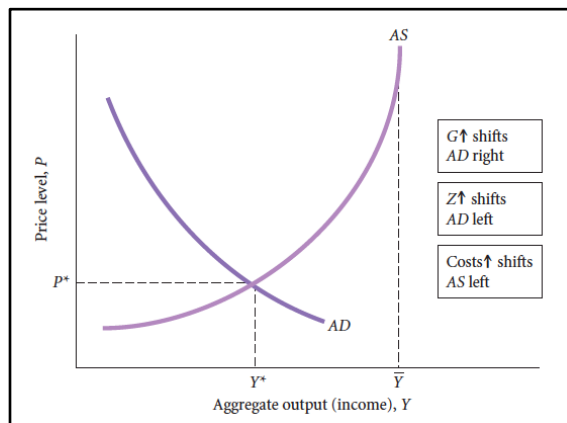


Figure 26.8

#### IV. The Final Equilibrium

- A. At every point on the  $AS$  curve, firms make price and output decisions that maximize profits.

- B. At every point on the *AD* curve there is equilibrium in both the goods and money markets.
  - C. At equilibrium, values of other endogenous variables (*r*, *C*, *I*) are determined.
  - D. The exogenous variables include *G*, *T*, *Z*, and exogenous cost changes that shift the *AS* curve.
- V. Other Reasons for a Downward-Sloping *AD* Curve
- A. In addition to planned investment, consumption spending also falls as the interest rate rises.
  - B. The *real wealth effect* is the change in consumption brought about by a change in real wealth that results from a change in the price level.
- VI. The Long-Run Aggregate Supply Curve
- A. Variable production costs per unit lag behind price-level changes in the short run, but will eventually catch up with the overall price level. If costs and prices move in tandem in the long run, the long-run *AS* is vertical.
  - B. *Potential GDP* (*potential output*) is the level of aggregate output that can be sustained in the long run without inflation.
    - 1. Potential GDP lies to the left of the level of output at which the short-run *AS* curve becomes vertical.
      - a. A vertical short-run *AS* curve implies the economy is operating at 100 percent capacity. This is not sustainable in the long run since plants need some downtime for preventive maintenance.
      - b. As the economy approaches 100 percent capacity, wages begin to rise faster, causing the short-run *AS* curve to shift upward and moving the equilibrium back toward potential GDP.
    - 2. Short-Run Equilibrium Below Potential GDP
      - a. The economy can be in a short-run equilibrium below potential GDP. (Equilibrium simply means planned spending equals actual output. That may or may not happen at potential GDP.)
      - b. If the economy is in a short-run equilibrium below potential GDP, the level of GDP may eventually rise. Below potential GDP there is cyclical unemployment meaning the labor market is not in equilibrium. The excess supply of labor will cause real wages to fall shifting *AS* to the right. This automatic adjustment works only if input prices fall when excess capacity and unemployment exist. (Economists are pretty sure the economy works like this. The remaining issue is how long it takes for the economy to return to full employment equilibrium on its own.)

## EXTENDED APPLICATION

### Application 1: Budget Deficits and the Money Supply

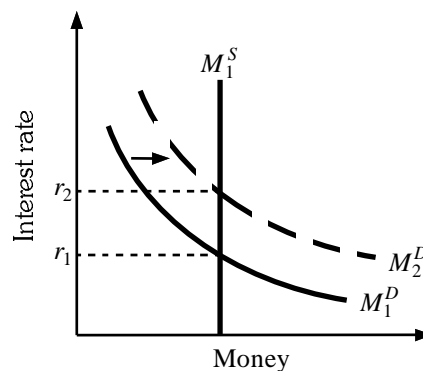
It is easy to become confused about the link between budget deficits and the money supply. Students often hear that governments finance their budget deficits by “printing money.” The

recent hyperinflations in the nations of Eastern Europe serve to reinforce this idea. Remind In many countries the central bank is part of the government. Since the government directly controls both fiscal and monetary policy, they can, in effect, finance a deficit by printing money. The government simply sells the newly issued bonds directly to the central bank.

In these countries, the ability to raise tax revenue is limited by poor enforcement and accounting standards, and the ability to borrow is constrained by lack of faith in the government's ability to honor its debts. Thus, when government spending exceeds tax revenue, these governments simply order more money to be issued by their central banks.

In the United States (and many other developed countries) the link between budget deficits and the money supply is not so simple. In the United States, if the Treasury spends more than it collects in tax revenue, it must finance the resulting deficit by borrowing funds from the public, which it does by selling U.S. Government bonds. As students have learned in Chapter 23, only the Federal Reserve can create money. The Fed is not part of the U.S. government. The fact that the government is operating with a deficit does not necessarily mean that the Fed will choose to increase the money supply. However, the Fed may very well be pressured to increase the money supply in response to a budget deficit. Whether this pressure will be effective depends on the strength and independence of the Fed chairman. Hence, there may sometimes be an indirect link between the U.S. budget deficit and money creation.

To better understand this link, consider an economy that begins with a balanced budget, but now runs a deficit by increasing government spending or reducing taxes. This will stimulate output, and the increase in output (income) will increase money demand. In the following diagram, the money demand curve shifts to the right (from  $M_1^D$  to  $M_2^D$ ) and the interest rate rises (from  $r_1$  to  $r_2$ ). The rise in the interest rate will crowd out private-sector investment spending (and also consumption of durable goods). Thus, even though aggregate output is increasing, in some industries output will decrease and workers will be laid off. (Industries sensitive to interest rate changes include automobile and housing as well as the industries that serve them, e.g., steel, rubber, and cement.) These sectors of the economy are highly unionized and their representatives—union leaders and industry associations—will begin to put pressure on the Fed to increase the money supply and force interest rates back down.



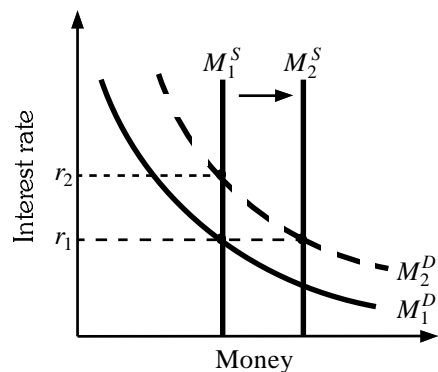
This is close to what happened during the early 1980s. The Reagan administration, with congressional approval, increased government spending (mostly for defense) and lowered taxes, thus creating a large budget deficit. At the same time, Fed chairman Paul Volcker was tightening the money supply in an attempt to fight inflation. The result was skyrocketing interest rates and a severe recession, with the greatest impact in the automobile, housing, and heavy industrial sectors. These sectors began pushing for easier money and lower interest rates. In one public

relations campaign, the housing industry convinced citizens to mail to Paul Volcker “the keys to the new house you can’t afford to buy.” Thousands of keys arrived on Volcker’s desk.

But what makes the Fed respond to this pressure to increase the money supply? Isn’t the Fed an independent agency? The answer is yes, but the Fed was created by an act of Congress, and it can also be destroyed or altered by an act of Congress. In periods of rising interest rates, it isn’t long before some senator or congressman introduces a bill designed to limit the independence of the U.S. Federal Reserve. Recent proposals have included allowing the U.S. president to appoint the presidents of the Fed’s 12 regional banks; requiring the Federal Open Market Committee (FOMC) to release timely, detailed minutes of its private meetings; requiring the Fed to invite representatives of the U.S. Treasury to FOMC meetings; and even giving the U.S. secretary of the Treasury an automatic seat on the Fed board of governors.

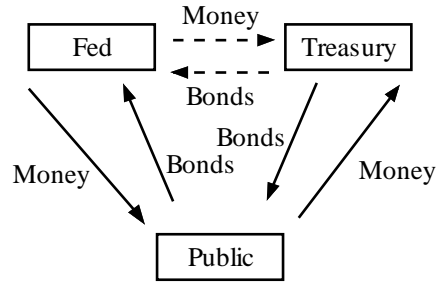
Another approach that has been taken from time to time is raising legal issues surrounding the Federal Reserve Act itself. Many constitutional scholars believe the Federal Reserve Act is unconstitutional. The U.S. Constitution gives Congress the power to “coin money.” In the Federal Reserve Act Congress has delegated this authority to the Fed. Other similar situations have been declared unconstitutional by the Supreme Court. No test case has made it to the Supreme Court (so far). It will be interesting to see what the Court decides if such a case ever is appealed to them.

Fed officials view their independence as the key to keeping inflation rates low in the United States. Thus, even though they know that increasing the money supply in an inflationary economy will likely exacerbate the inflation, they sometimes succumb to pressure. This is illustrated in the diagram following, where the money supply curve shifts rightward (from  $M_1^S$  to  $M_2^S$ ), bringing the interest rate back down to  $r_1$ , and thus preventing any crowding out in interest-sensitive sectors of the economy.



When the Fed increases the money supply to purchase part of the new debt caused by a current government budget deficit they are “monetizing the deficit.” In many ways, the final result of monetization is very similar to what happens in less-developed countries, where the link between the deficit and money creation is more direct. To see this similarity, recall from Chapter 10 [23] that the Fed’s chief tool for changing the money supply is open market operations. In this case, to increase the money supply the Fed would purchase government bonds from the public and replace them with reserves (money). These government bonds are the very same bonds that the U.S. Treasury issued to finance its deficit! The process is illustrated in the next diagram.





To finance its deficit, the U.S. Treasury has sold bonds to the public in exchange for money. To monetize the deficit, the Fed now buys back these bonds from the public in exchange for money. In the diagram, these actual exchanges are shown with solid arrows. But the net result is that the Treasury's bonds end up at the Fed, and the money created by the Fed ends up at the Treasury. It is almost as if the Treasury and the Fed—two parts of the government—simply made the exchange with each other. This “as if” result is illustrated with dashed arrows in the diagram.

To conclude, an increase in the budget deficit does indeed often lead to an increase in the money supply. But in developed countries like the United States, the process is not as simple as “the government printing additional money to finance its deficit.” First, only a portion of the government's deficit is typically monetized. Second, the link between budget deficits and the money supply is an indirect one, resulting from the interaction of economic, institutional, and political forces.