Chapter 10

A Model of the Economy: The Aggregate Demand and Aggregate Supply Model

Chapter Introduction

In this chapter we build a model of the overall economy. This model is called the Aggregate Demand-Aggregate Supply (*AD-AS*) model. This model helps us determine the equilibrium output and equilibrium price level. To build this model we utilize the Keynesian Cross diagram, and the money supply and money demand curves. This is a short-run model, meaning that at least one factor of production, and hence at least one cost of production, is fixed. We evaluate the effects of fiscal and monetary policies on the economy. Later in the Chapter we relax the assumption short run and see how the effects of fiscal policy and monetary policy on the economy may change.

The Short-Run Aggregate Supply Curve

We start the building the *AD-AS* model with drawing the short-run aggregate supply curve. Aggregate supply is the total output supplied in a period. We learned about gross domestic product (*GDP*) in Chapter 6. *GDP* is a measure of aggregate supply.

It is usually better to first draw the short-run aggregate supply curve, and then go through the details about its shape. We will denote the short-run aggregate supply curve by AS. The short-run aggregate supply curve is drawn in the price level (P) and output (Y) space. Figure 10.1 draws the *AS* curve.

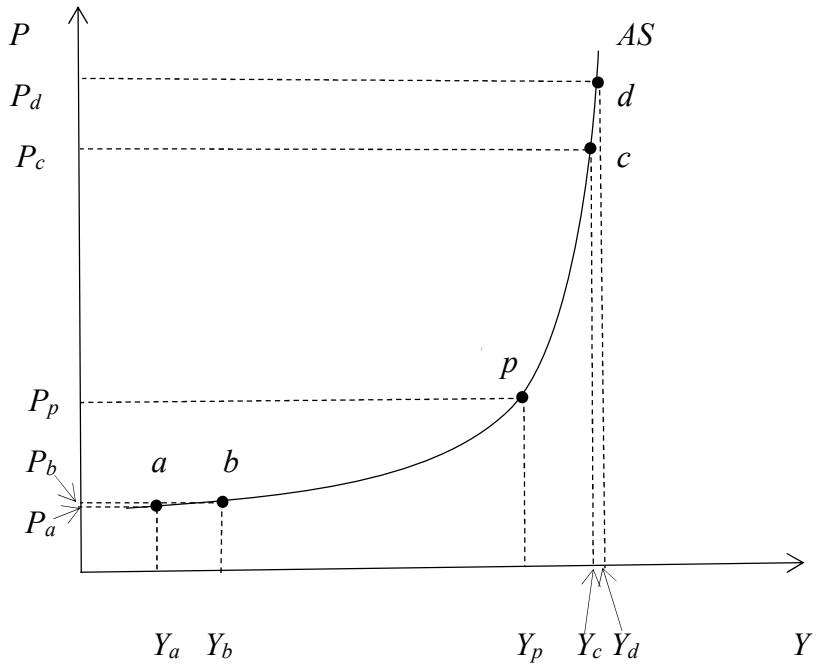

Figure 10.1: The Short-Run Aggregate Supply Curve

Source: M. Ashraf

Figure 10.1: The overall price level (*P*) is on the vertical axis, and the aggregate output or income (*Y*) is on the horizontal axis. The curve *AS* represents the short-run aggregate supply curve.

The short-run aggregate supply curve shows the relationship between the price level (*P*) and the total output or income (*Y*); it is drawn in the price level and total output space, with *P* on the vertical axis and *Y* on the horizontal axis. Notice the shape of the *AS* curve; it starts out almost flat, the slope increases steadily, and then becomes almost vertical, with the overall slope being positive. When output is low, say, at point *a*, and it increases to point *b*, output increase a lot, from Y_a to Y_b, while the change in price level, from P_a to P_b, is barely noticeable. On the other hand, when output is high, say, at point c and it increases to point *d*, the increase in price level is large, from P_c to P_d, while the increase in output, from Y_c to Y_d, is very small.

Why does the *AS* curve have this shape? In other words, why is this the case that at lower levels of output, large changes in output are associated with only small changes in price level, and when output level is high, a small change in output is associated with large changes in price level. Changes in price level and output are proportional around output level Y_p.

The Link Between the Short-Run Aggregate Supply Curve and the Business Cycle

It helps to relate this to the business cycle diagram that we learned in Chapter 5. Let us again draw a business cycle diagram corresponding with Figure 10.1.

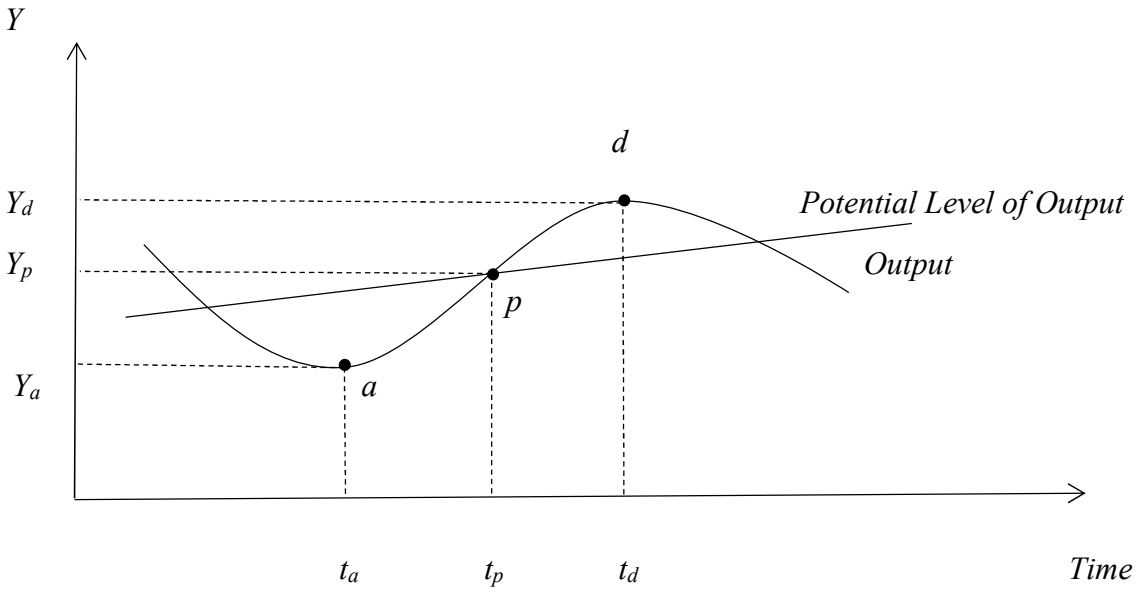

Figure 10.2: Business Cycle Diagram

Source: M. Ashraf.

Figure 10.2: Aggregate output or income (Y) is on the vertical axis, and time is on the horizontal axis. The curve shows the changes in aggregate output or income over time. Point *a* represents the trough, Point *p* represents the potential level of output, and Point *d* represents the peak of the business cycle.

In Figure 10.2, *Time* is on the horizontal axis, and aggregate output or income, Y, is on the vertical axis. The curve shows the changes in aggregate output or income over time. Point *a* represents the trough, Point *p* represents the potential level of output, and Point *d* represents the peak of the business cycle.

As we saw in Chapter 5, drawing a business cycle, we plot *Time* on the horizontal axis and a measure of aggregate output or income, Y, is on the vertical axis. In Chapter 5, Figure 5.1, we used *GDP* as a measure of aggregate output. The straight line represents the potential level of output—the level of output that the economy can maintain in the long run, given the quantity and quality of its resources.

Suppose that the economy is in a recession—*Time* t_a. This is represented by point *a* on the business cycle in Figure 10.2. This corresponds to the output level is Y_a, in both Figure 10.1 (horizontal axis) and Figure 10.2 (vertical axis). When the economy is in a recession, factors of production are either unemployed or under-employed.

Take the example of labor. During a recession, because firms cannot sell their output, inventories start piling up. To reduce output, firms either fire some workers, or reduce their hours, or a

combination of the two. At this level of output, when firms want to increase output and hire more workers, they do not have to pay higher wages. Workers who are unemployed or who are working less than fulltime, and want to work fulltime, are happy to start working fulltime without demanding a wage increase. Since wages are a large part of costs of production, around 60 percent, the overall costs of production do not increase much, if at all.

Same goes for capital. For instance, during a recession, buildings—warehouses, office spaces, etc.—are either empty or partially empty. When the economy gets on the recovery path and existing firms either want to expand and need more space, or new firms open, the owners of buildings are only too happy to rent their office spaces and warehouses, without asking for higher rents. As a result, when the economy starts to get out of recession, and output rebounds, the impact on the overall price level is very limited. In Figure 10.1, this is represented by the movement along the *AS* curve from point *a* to point *b*—output levels Y_a and Y_b, and price levels P_a and P_b, are the corresponding price levels. This is the reason that the shape of the *AS* curve is flat when the economy is in a recession.

Recall that by "potential" level of output we do not mean the *maximum* level of output. The potential level of output is the output level that the economy can maintain in the long run, without putting pressure on price level, given the economy's resources. At the potential level of output, workers are working their normal hours; they are neither involuntarily working part-time, nor they are working overtime. Same goes for machines; machines are neither working overtime nor they are idle. As noted above, in Figure 10.2, the potential level of output is represented by the straight line. It is the output level around which the observed output level fluctuates. The potential level of output depends upon the economy's quantity and quality of resources.

In Figure 10.1, point *p* represents this level of output—Y_p on the horizontal axis. Price level P_p is the corresponding price level. In Figure 10.2, this point is represented by point *p*, at which the business cycle crosses the potential level of output; it is represented by Y_p (vertical axis).

Suppose now that the economy is producing above its potential level of output. In Figure 10.1, at any point to the right of Y_p, and in Figure 10.2, at any point above the potential level of output—above the straight line.

Suppose that, in Figure 10.1, the economy is producing at point *c* on the AS curve; the corresponding output level is Y_c (horizontal axis), and the corresponding price level is P_c (vertical axis). To produce this level of output, the workers and machines are already working overtime. If the firms want to further increase output, they will have to pay workers even higher wages, and the building owners will ask for even higher rents. This leads to an increase in the overall price level, from P_c to P_d.

Note, however, that since there are only 24 hours in a day, workers can work only so much longer; they need sleep. And since machines are working nonstop, they start breaking down more often. Output increases, but barely—it increases from Y_c to Y_d. All this push to further increase output only leads to an increase in price level.

Why can't the economy build more office buildings and warehouses so that the rents do not increase, or why can't the number of workers increase so that wages don't increase, relieving pressure on the overall price level? While discussing the shape of the AS curve, it is important to keep in mind that we are talking about a short-run situation. Short run, by definition, is a period during which at one factor of production, and hence at least one cost of production, is fixed. For instance, it is often the case that wage contracts are signed annually; same goes for rents of buildings. As contracts become due, wages and rents adjust. As we will see shortly, these adjustments lead to shifts in the short-run aggregate supply curve. In the long run—a period during which all factors of production, and hence all costs of production are variable—the aggregate supply curve is vertical at the potential level of output, Y_p. While in the short run, the economy may produce above, or below, the potential level of output, in the long run, the output returns to the potential level. In the long run, absent changes in the factors of production, output returns to its potential and the only change that takes place is in the price level.

A Word of Caution

It is important to note that the aggregate supply curve is not the sum of individual supply curves. That is, the aggregate supply curve is not the market supply curve. Recall from Chapter 3, that while drawing the individual firm's supply curve, or the market supply curve, we held costs of production, along with the prices of related products (i.e., production complements and production substitutes) constant. In the case of the aggregate supply curve, we are looking at the relationship between the overall price level and the aggregate supply, and the overall price level includes prices of related products, along with costs of production.

It is also important to note that most firms make their price and output decisions simultaneously. Take the example of a firm responding to an increase in the demand for its product. To meet the increased demand, the firm increases its output. The increase in the product's demand also gives the firm room to increase the price of the product. Depending upon the share of the firm's price in the overall price level, this action by the firm increases the overall price level accordingly. And since wages tend to lag, the firm's profits increase. Recall that profit is the positive difference between total revenue and total cost. This further gives the firm an incentive to increase its output as well as the price of the product. However, when wage contracts become due, workers ask for raises to meet the increases in costs of living, and so do the supplier of other inputs. This leads to increases in the costs of production. Eventually, changes in total costs of production catchup with changes total revenue. As a result, change in profit due to change in output disappears; it no longer remains beneficial for the firm to change its output.

Another point that this description brings up is that not all firms change their prices at the same time; demand for some firms' goods and services, and hence their pricing and output decisions, may follow, or lead other firms. Same goes for various firms' wage and other input contracts; not every firm renegotiates its contracts at the same time.

In the light of the above explanation of the shape of the short-run aggregate supply curve, it is more accurate to think of the short-run aggregate supply curve as a reflection of firms' output

and pricing decisions in response to the changes in the demand for their products, and in turn, the effects of firms' output and pricing decisions on aggregate supply and the overall price level.

Shifts in the Short-Run Aggregate Supply Curve

Now that we understand what short-run aggregate supply curve represents, it is time see what may shift the *AS*.

Recall that we are drawing the *AS* curve in the price level, *P*, and output, *Y*, space. Any factor that affects the output, but does not affect the price level, will shift the AS curve.

Cost Shocks: A Leftward Shift in the Short-Run Aggregate Supply Curve

An increase in costs of production will shift the *AS* curve to the left. These leftward shifts in the *AS* curve are usually called cost shocks. There are several factors that may increase costs of production. For instance, fossil fuels—oil and natural gas—are major inputs into the generation of electricity, and electricity is used in every production process. If the price of electricity increases, it will lead to an increase in the costs of production, leading to a decline in output. In terms of the *AS* curve, the *AS* curve will shift to the left.

In the US, labor wages constitute major part of costs of production, about 60 percent.[1] Suppose that, for some reason, labor wages increase. Since wage increases will lead to an increase in costs of production, aggregate supply will decrease at any price level, and the short-run aggregate supply curve will shift to the left. Figure 10.3 shows the leftward shift in the short-run aggregate supply curve, from AS_1 to AS_2.

[1] Share of labor compensation. https://fred.stlouisfed.org/series/LABSHPUSA156NRUG. (Accessed: January 24, 2023)

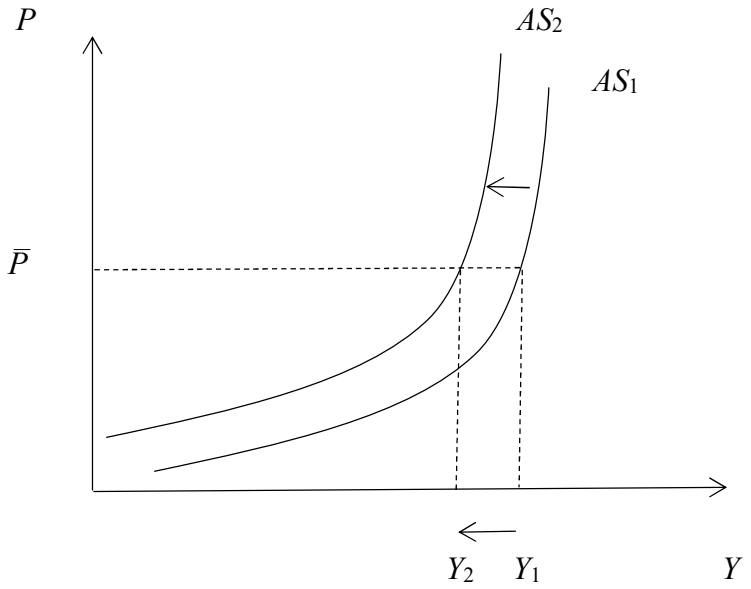

Figure 10.3: Cost Shock: A Leftward Shift in the *AS* Curve

Source: M. Ashraf

Figure 10.3: The overall price level (P) is on the vertical axis, and the aggregate output or income (Y) is on the horizontal axis. Following a cost shock, the short-run aggregates supply curve shifts to the left, from AS_1 to AS_2. At any given price level, $\bar{P}$, output decreases from Y_1 to Y_2.

In Figure 10.3, P is the overall price level, and Y is the aggregate output. Following a cost shock, the short-run aggregates supply curve shifts to the left, from AS_1 to AS_2. At any given price level, $\bar{P}$, output decreases from Y_1 to Y_2. This is shown by the direction of arrows. Note the bar "—" above P, in Figure 10.3. This indicates that overall price level has not changed.

(H2) Supply Shocks: A Rightward Shift in the Short-Run Aggregate Supply Curve

Suppose now that we discover a new oil field. The increase in the supply of oil lowers the price of crude oil, and in turn, the cost of electricity production, and makes electricity cheaper. Since electricity is needed in all production processes, the costs of production decrease, leading to an increase in aggregate output.

As another example, suppose that the US relaxes immigration restrictions, leading to an influx of migrant labor. This will lower wages, resulting in lowered costs of production, and in turn, increased output.

In the economics literature, such events are referred to as supply shocks. In terms of the aggregate supply diagram, we can show a supply shock by shifting the short-run aggregate supply curve to the right. Figure 10.4 shows this shift of the short-run aggregate supply curve.

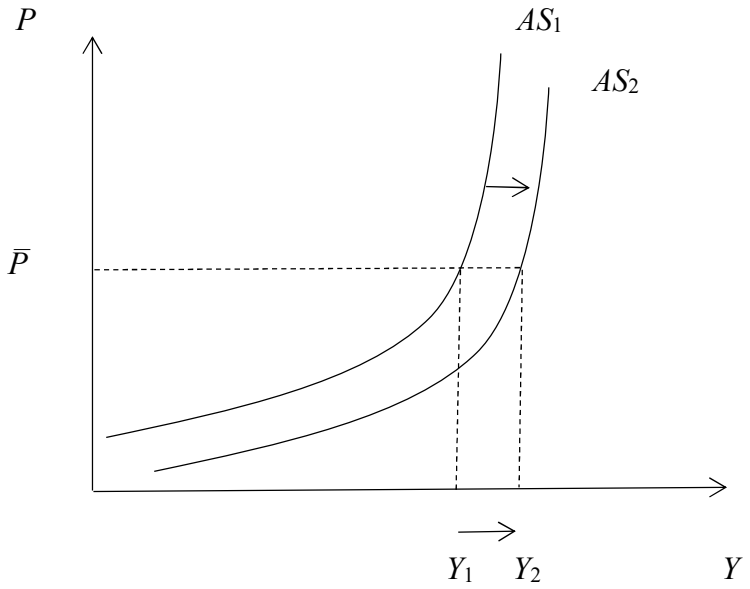

Figure 10.4: Supply Shocks: A Rightward Shift in the AS Curve

Source: M. Ashraf

Figure 10.4: The overall price level (P) is on the vertical axis, and the aggregate output or income (Y) is on the horizontal axis. An increase in aggregate output by shifting the short-run aggregate supply curve to the right, from AS_1 to AS_2. At any given price level, $\bar{P}$, output increases from Y_1 to Y_2.

In Figure 10.4, we show an increase in aggregate output by shifting the short-run aggregate supply curve to the right, from AS_1 to AS_2. At any given price level, $\bar{P}$, output increases from Y_1 to Y_2. This is shown by the direction of arrows. The bar "—" above P, in Figure 10.4, indicates that overall price level has not changed.

In the next section we turn to deriving the aggregate demand (AD) curve. After the derivation of the aggregate demand curve, we put the short-run aggregates supply curve and the aggregate demand curve on the same set of axes to determine the equilibrium overall price level and aggregate output.

The Aggregate Demand Curve

The aggregate demand curve, AD, is plotted in the overall price level, P, and the aggregate output, Y, space. The AD curve helps us connect the financial sector and the goods and services sector of the economy. It plots the points at which the market for money and the goods and services market are in equilibrium.

The derivation of the aggregate demand curve, AD, takes three intermediate steps. In Step 1, we derive the IS curve which links the interest rate to the equilibrium output. In Step 2, we talk about the Federal Reserve's Response Function (FRF), which shows how the Fed decides how to pick the federal funds rate target. In the final step, Step 3, we combine these parts to get the aggregate demand curve, AD.

Step 1: The Derivation of the IS Curve

Recall that in Chapter 9, we used the Keynesian Cross diagram (Chapter 7) to connect goods and services sector with financial sector using the market for money (Chapter 9). This connection was created through the impact of interest rate, which is determined in the market for money, on planned investment spending, which is a part of the planned aggregate expenditure. The resulting relationship between interest rate and aggregate output is called the *IS* curve.

By way of reviewing, I reproduce versions of Figure 9.10 that shows the relationship between interest rate, *i*, and planned investment spending, *I*, and Figure 9.11, the Keynesian Cross diagram, which connects the changes in planned investment spending due to changes in interest rate, with the resulting changes in output, *Y*.

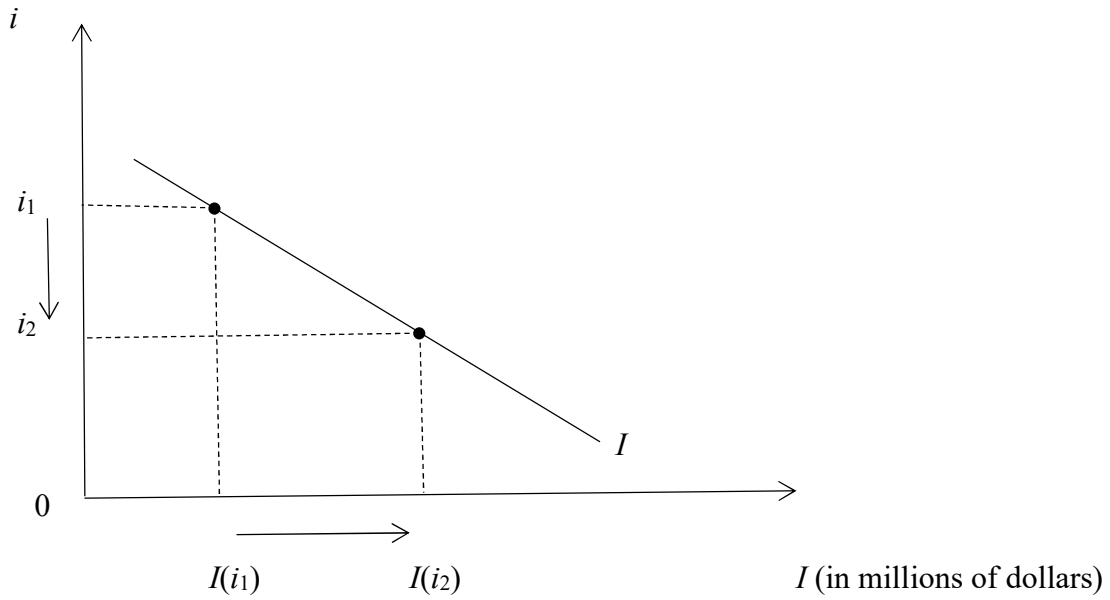

Figure 10.5: Planned Investment Spending in Interest Rate

Source: M. Ashraf

Figure 10.5: The interest rate, *i*, is on the vertical axis, and planned investment spending, *I*, on the horizontal axis. The planned investment spending curve, *I*, is negatively slopped, showing the negative relationship between interest rate and the planned investment spending.

In Figure 10.5, as we saw in Figure 9.11 in Chapter 9, interest rate, *i*, is on the vertical axis, and planned investment spending, *I*, on the horizontal axis. The planned investment spending curve, *I*, is negatively slopped, showing the negative relationship between interest rate and the planned investment spending. For instance, as interest rate decreases, more projects become profitable, and the quantity of planned investment spending increases.

Figure 10.6 is the Keynesian Cross diagram that we learned in Chapter 7. It links planned investment spending, *I*, to the equilibrium output, *Y*, via the planned aggregate expenditure, *AE*.

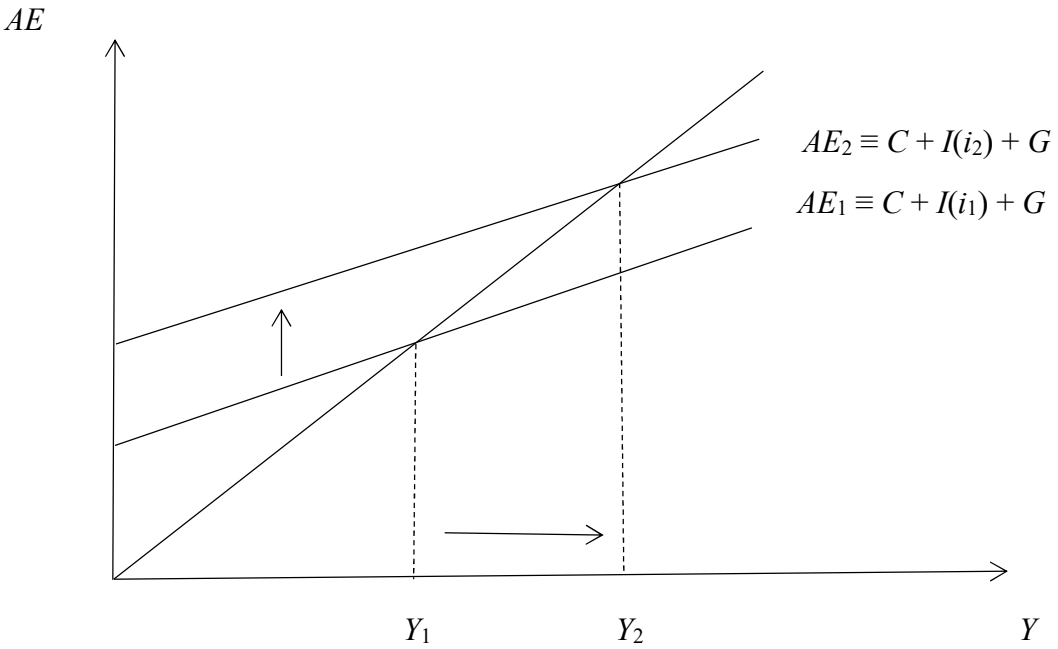

Figure 10.6: Keynesian Cross Diagram: Linking the Financial Sector with the Goods and Services Sector

Source: M. Ashraf

Figure 10.6: Planned aggregate expenditure (AE) is on the vertical axis, and aggregate output or income (Y) is on the horizontal axis. As planned investment spending increases from I_1 to I_2 (Figure 10.5) the *AE* curve in the Keynesian Cross diagram shifts up from $AE_1 \equiv C + I(i_1) + G$ to $AE_2 \equiv C + I(i_2) + G$, and the equilibrium level of output increases from Y_1 to Y_2.

As we saw above, Figure 10.5 (and in Chapter 9, Figure 9.11), that there is an inverse relationship between interest rate, *i*, and planned investment spending, *I*, (see Figure 9.11). Since planned investment spending is part of the planned aggregate expenditure, as planned investment spending increases from I_1 to I_2 (Figure 10.5) the *AE* curve in the Keynesian Cross diagram shifts up from $AE_1 \equiv C + I(i_1) + G$ to $AE_2 \equiv C + I(i_2) + G$, and the equilibrium level of output increases from Y_1 to Y_2. The resulting relationship between the interest rate, *i*, and output, *Y*, is referred to as the *IS* curve. We plot this relationship between interest rate, *i*, and equilibrium output, *Y*, in Figure 10.7.

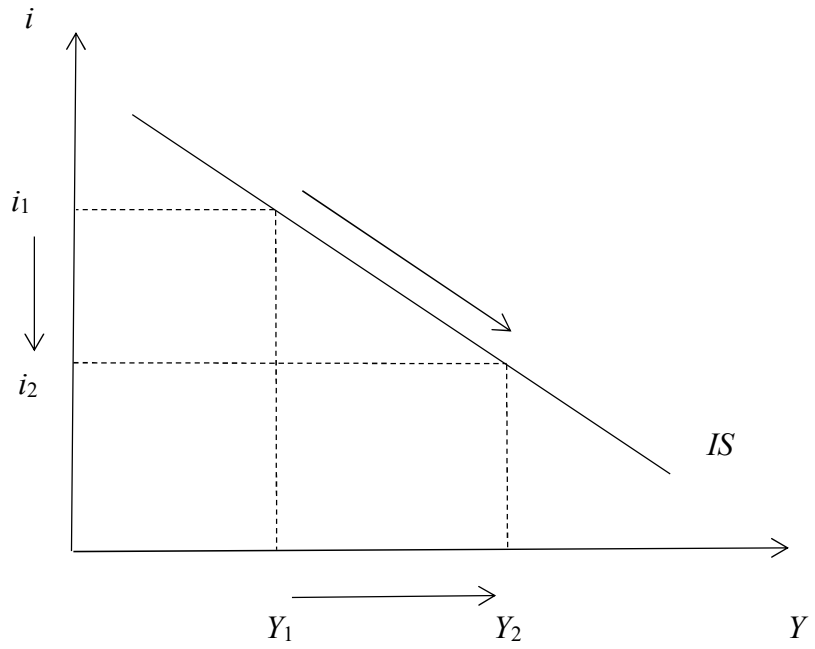

Figure 10.7: The *IS* Curve

Source: M. Ashraf

Figure 10.7: The interest rate, *i*, on the vertical axis, and output, *Y*, on the horizontal axis. The *IS* curve plots the relationship between interest rate and equilibrium output that emerges via planned investment spending, planned aggregate expenditure, and the equilibrium output.

In Figure 10.7 we have interest rate, *i*, on the vertical axis, and output, *Y*, on the horizontal axis. It plots the relationship between interest rate and equilibrium output that emerges via planned investment spending, planned aggregate expenditure, and the equilibrium output. As interest rate decreases, Figure 10.5, quantity of planned investment spending increases, this shifts the planned aggregate expenditure curve, *AE*, up in Figure 10.6, leading to a higher equilibrium output, *Y*.

Shifts in the IS Curve

Which factors may shift the *IS* curve? Note that the *IS* curve is drawn in the interest rate, *i*, and aggregate output, *Y*, space. As we learned in Chapter 3, where we discussed movement along a curve versus shifting the curve, any factors that may change one variable but not the other, will shift the curve. Same goes for the *IS* curve; factors that may changes the aggregate output, without changing the interest rate, will lead to a shift in the *IS* curve.

Consumer Sentiments: Shifts in the Consumption Function and the IS Curve

Suppose that consumers become more, or less optimistic, about the future, and accordingly increase or decrease their consumption, respectively, at any level of income, *Y*. This will lead to a change in the intercept of the consumption function—see Equation 7.6, $C = \alpha + \beta Y$. In the *C* and *Y* space, this will shift the consumption function up or down, respectively—see Figure 7.2.

(If you are unclear about the effects of changes in the intercept of the consumption function, I encourage you to review Chapter 7.) This shift in the consumption function will lead to an equivalent and corresponding shift in the panned aggregate expenditure curve, *AE*, in the Keynesian Cross diagram, resulting in a change in equilibrium output, *Y*, in the Keynesian Cross diagram, accordingly.

Recall that the interest rate, *i*, is not changing; only equilibrium output, *Y*, is changing. (Note the bar " $\bar{}$ " above *i* in Figure 10.8. This indicates that interest rate, *i*, level has not changed.) To show this change in equilibrium output, we shift the *IS* curve. If the consumption function, and as a result the *AE* curve, were to shift up due to an increase in the value of the intercept, α, the *IS* curve will shift to the right. In terms of Figure 10.8, the *IS* curve will shift from IS_1 to IS_2. On the other hand, if the consumption function, and as a result the *AE* curve, were to shift downward due to a decrease in the value of the intercept, α, the *IS* curve will shift to the left. In terms of Figure 10.8, the *IS* curve shift from IS_1 to IS_3.

Producer Sentiments: Shifts in the Planned Investment Spending Function and the IS Curve

Suppose, now, that firms become more, or less, optimistic about the future, leading them to increase or decrease planned investment spending, respectively, at any interest rate. This change in sentiment will shift the planned investment spending curve right or left (up or down), in Figures 9.11 and 10.5, respectively. This shift in the investment function will lead to an equivalent and corresponding shift in the panned aggregate expenditure curve, *AE*, in the Keynesian Cross diagram, resulting in a change in equilibrium output, *Y*, accordingly.

Again, since the interest rate, *i*, is not changing, only equilibrium output, *Y*, is changing, we shift the *IS* curve. If firms were to become optimistic about the future of the economy and as a result increase planned investment spending at any interest rate, this will show up as a rightward (or upward) shift in the planned investment spending curve in Figure 9.11 or Figure 10.5. As a result, there will be an upward shift in the *AE* curve in the Keynesian Cross diagram, leading to an increase in the equilibrium level of output, *Y*. We show this by shifting the *IS* curve to the right (or up). Figure 10.8 shows this by shifting the *IS* curve from IS_1 to IS_2.

The reverse will happen when firms become pessimistic about the future of the economy. This pessimism may lead to a decrease in planned investment spending at any interest rate, leading to a leftward (or downward) shift in the planned investment spending curve. This shift int the planned investment spending curve will lead to a downward shift of the *AE* curve in the Keynesian Cross diagram, leading to a decrease in the equilibrium level of output, *Y*. In Figure 10.8, we show this by shifting the *IS* curve from IS_1 to IS_3.

Fiscal Policy and the IS Curve

Recall that fiscal policy refers to changes in government spending, *G*, and or changes in taxes, *T*. Recall also, that expansionary fiscal policy refers to an increase in *G* and or decrease in *T*, whereas a contractionary fiscal policy refers to a decrease in *G* and or an increase in *T*.

Suppose that the US Congress increases government spending, *G*. This increase in *G* will directly increase the planned aggregate expenditure, *AE*, shifting the *AE* curve in the Keynesian

Cross diagram up. (See Figure 7.10.) The effect of a decrease in taxes, T, will be through the consumption function; a decrease in T will increase disposable income, Y_d ($\equiv Y - T$), which will, in turn, increase consumption. The result will be an upward shift of the AE curve in the Keynesian Cross diagram, leading to an increase in the equilibrium level of output, Y. To show the effect of an increase in G and or a decrease in T, and the resulting increase in equilibrium output, Y, we shift the IS curve in Figure 10.8 from IS_1 to IS_2.

Suppose now that the US Congress engages in a contractionary fiscal policy, and decreases government expenditure, G, and or increases taxes, T. The result of these actions will be a downward shift of the AE curve in the Keynesian Cross diagram, resulting in a decrease in the equilibrium level of output, Y. Again, the impact of a decrease in G will be direct, whereas the effect of an increase in taxes, T, will be through disposable income and consumption. Regardless of the channel, a contractionary fiscal policy will lead to a downward shift of the AE curve in the Keynesian Cross diagram, resulting in a lower equilibrium level of output, Y. To show the decrease in equilibrium output level using the IS curve in Figure 10.8, we shift the IS curve from IS_1 to IS_3.

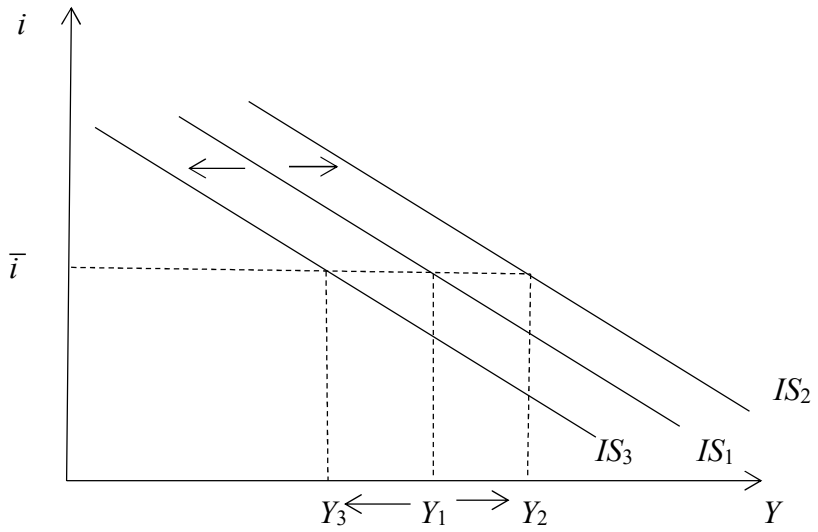

Figure 10.8: Shifts in the *IS* Curve

Source: M. Ashraf

Figure 10.8: The interest rate, i, on the vertical axis, and output, Y, on the horizontal axis. The IS curve plots the relationship between interest rate and equilibrium output that emerges via planned investment spending, planned aggregate expenditure, and the equilibrium output. Factors that increase aggregate output or income (Y) at any given interest rate ($\bar{i}$) lead to a rightward shift in the IS curve, from IS_1 to IS_2. Factors that decrease aggregate output or income (Y) at any given interest rate ($\bar{i}$) lead to a leftward shift in the IS curve, from IS_1 to IS_3.

How large will these changes in equilibrium output be? As we saw in Chapter 7, the size of the impact on the equilibrium output will be determined by the values of the multipliers—planned investment spending multiplier, government spending multiplier, tax multiplier, and the multiplier associated with the consumption function intercept. See Equations 7.19 and 7.25 in Chapter 7.

Step 2: The Federal Reserve's Response Function (FRF)

In Chapter 9, we learned that the Fed sets a target for the federal funds rate, the interest rate banks charge each other for overnight loans, and changes the money supply such that the target is met. We did not address the question of how the Fed picks that target federal funds rate. I turn to this question now.

The Federal Reserve Board developed a large model of the US economy in 1996. It is called the FRB/US model.[2] It has hundreds of equations and thousands of variables. Since our purpose here is to develop a basic understanding of how the Fed responds to the changes in the economy, I present an extremely simplified version of the model that just includes three variables. These are the aggregate output, Y, the overall price level, P, and a composite variable, C, which includes all the other variables that may affect the Fed's decision. That is, any factor other than the overall price level, P, and the aggregate output, Y, that may affect the decisions of the Fed regarding its target federal funds rate. These factors may include a financial crisis, a global pandemic, a war in the Middle East, or the United Kingdom leaving the European Union, and so on. I call this simplified model, the Federal Reserve's Response Function (*FRF*). It takes the following form.

$$FRF: i = \alpha Y + \beta P + \gamma C \tag{10.1}$$

Where i is the interest rate target (i.e., the target federal funds rate), Y is the aggregate output, P is the overall price level, C is a composite variable, and coefficients, α, β, and γ are all positive, and represent the Fed's preferences. That is, the relative size of α, β, and γ represents how strongly the Fed responds to changes in P, Y, and C, respectively. For instance, if the Fed is more concerned about the inflation than it is about the aggregate output level, then the value of α is greater than the value of β.

It is important to remind ourselves, as we saw in Chapter 9, Figure 9.8, that while the levels of various interest rates that prevail in the economy differ, they move in the same direction. This is why we can use the term "the interest rate."

We draw the FRF in the interest rate, i, and the aggregate output, Y, space, as shown in Figure 10.9.

[2] The FRB/US model. https://www.federalreserve.gov/econres/us-models-about.htm (Accessed: January 27, 2023)

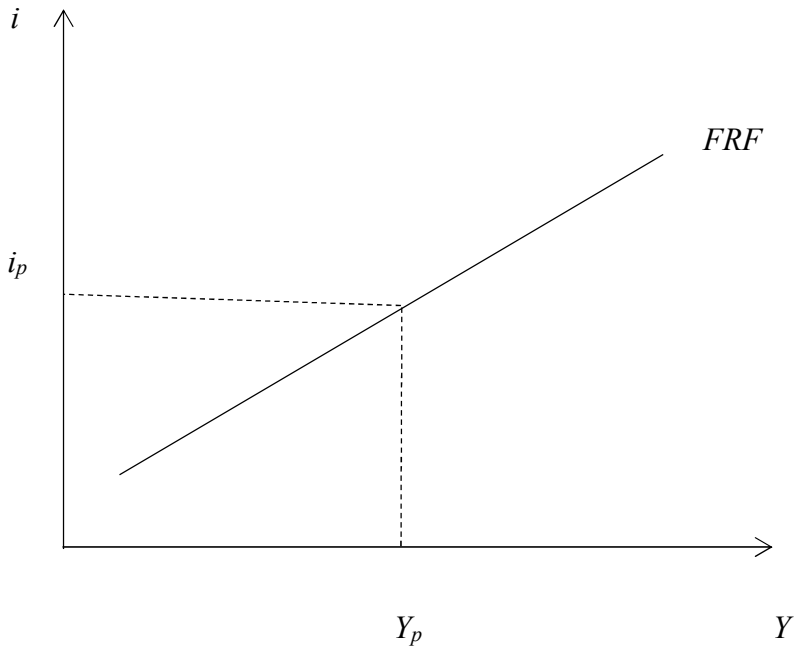

Figure 10.9: The Fed's Response Function (*FRF*)

Source: M. Ashraf

Figure 10.9: The interest rate (i) is on the vertical axis, and aggregate output or income (Y) is on the horizontal axis. The curve *FRF* shows the Fed's response to changes in aggregate output. The curve has a positive slope, indicating that the Fed increases the interest rate target as aggregate output increases, and decreases the interest rate target as aggregate output decreases.

Figure 10.9 plots the Fed's response function (*FRF*) in the interest rate, i, and the aggregate output, Y, space. The *FRF* has a positive slope. Recall that, in Equation 10.1, β is positive. The figure also shows Y_p, representing the potential level of output, and i_p, the federal funds rate target corresponding Y_p. (This output level corresponds to Y_p in Figure 10.1 and Figure 10.2.) When output is greater than the potential level of output, Y_p, the Fed raises the target federal funds rate above i_p, and when output is below Y_p, the Fed lowers the federal funds rate target below i_p. Other interest rates that prevail in the economy follow.

Which factors may shift the *FRF* curve? I turn to this topic next.

Shifts in the Federal Reserve's Response Function (FRF)

Recall that the *FRF*, Equation 10.1, is plotted in the interest rate, i, and aggregate output, Y, space. Other variables included in Equation 10.1 are the overall price level, P, and a composite variable, C. When we want to show the impact of changes in either P or C on Fed's decision to change the target federal funds rate, we shift the *FRF*.

Suppose that the overall price level, P, increases above the price level corresponding to the potential level of output, Y_p. In Figure 10.1, we represented this price level by P_p. The Fed's response function, *FRF*, dictates that the Fed raise its federal funds rate target, say, from i_p to i_1.

Recall that the coefficient β, associated with P in Equation 10.1, is positive. The Fed increases the target federal funds rate accordingly. Note also that the value of the β will determine the magnitude of change in the federal funds rate target. In a diagram, we show this by shifting the Federal Reserve's Response Function upward, from *FRF* to FFR_1. This is shown in Figure 10.10.

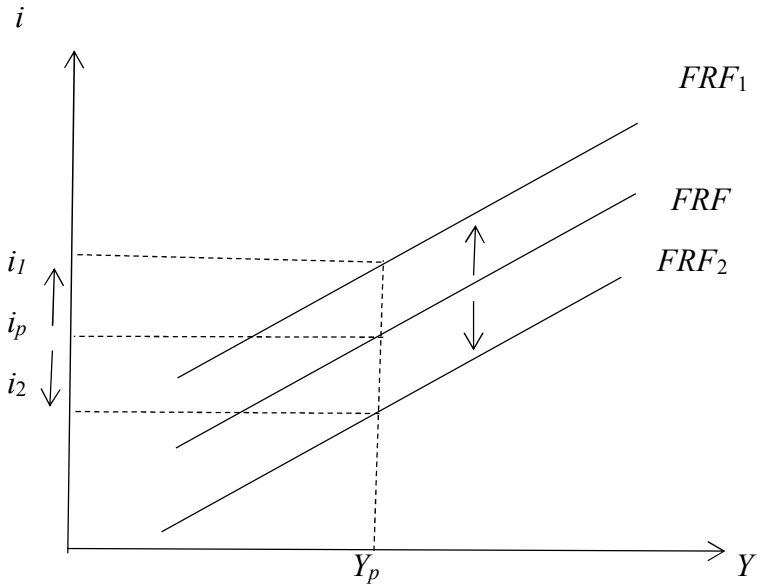

Figure 10.10: Shifts in the Federal Reserve's Response Function (*FRF*)

Source: M. Ashraf

Figure 10.10: As the overall price level increases, the Fed's Response Function dictates that the Fed increase its target federal funds rate from i_p to i_1. Since *FRF* is plotted in the interest rate, i, and aggregate output, Y, space, the Federal Reserve's Response Function from *FRF* to FRF_1. When the overall price level decrease, the Federal Reserve's Response Function shifts from *FRF* to FRF_2.

Figure 10.10 shows the effect of an increase in the overall price level, P. As the overall price level increases, the Fed's Response Function dictates that the Fed increase its target federal funds rate from i_p to i_1. Since *FRF* is plotted in the interest rate, i, and aggregate output, Y, space, we shift the Federal Reserve's Response Function from *FRF* to FRF_1.

What if the overall price level were to decrease? Again, the Federal Reserve's Response Function dictates that the Fed lower the target federal funds rate, say, from i_p to i_2. In terms of Figure 10.10, we shift the Federal Reserve's Response Function from *FRF* to FRF_2.

Changes in the composite variable, C, work the same way. A positive shock to the economy which increases the value of C dictates the Fed to increase federal funds rate target, say, from i_p to i_1. In terms of Figure 10.10, we shift the Federal Funds Response Function from *FRF* to FRF_1. A negative shock to the economy, on the other hand, lowers the value of C. The Federal Reserve's Response Function dictates the Fed to lower the target federal funds rate, say, from i_p

to i_2. In terms of Figure 10.10, we show this by shifting the Federal Reserve's Response Function from *FRF* to FRF_2.

Following the Federal Reserve Response Function's dictates, once the Fed has determined the value of the federal funds rate target, the Fed changes in the money supply such that the target is met. To solidify your understanding of the connection, refer to Figure 9.6 and 9.10.

Step 3: From the Market for Money to Planned Investment Spending, to the Keynesian Cross Diagram, to the IS Curve, to the AD Curve: Connecting the Dots

Now we have all the part needed to draw the aggregate demand (*AD*) curve.

Recall the definition of money demand: It is amount of funds that people want to hold outside interest-bearing accounts. The main reason for holding funds outside interest-bearing account is to make transaction. Recall also that the money demand curve, M_d, is plotted in the interest rate, *i*, and the quantity of money, *M*, space; holding all else constant, as the interest rate increases, the quantity of money demanded decreases, and vice versa. Refer to Figure 9.4 in Chapter 9.

We also learned that the factors that might shift the money demand curve included the overall price level, *P*, and the aggregate output, *Y*. When the overall price level and or aggregate output increase, the money demand curve shifts to the right; the reverse happens when the overall price level and or aggregate output decrease. See Figure 9.5.

Suppose that the overall price level decreases. This will shift the money demand curve to the left. If the Fed does not change the money supply, the equilibrium interest rate will decrease. This is shown in Figure 10.11.

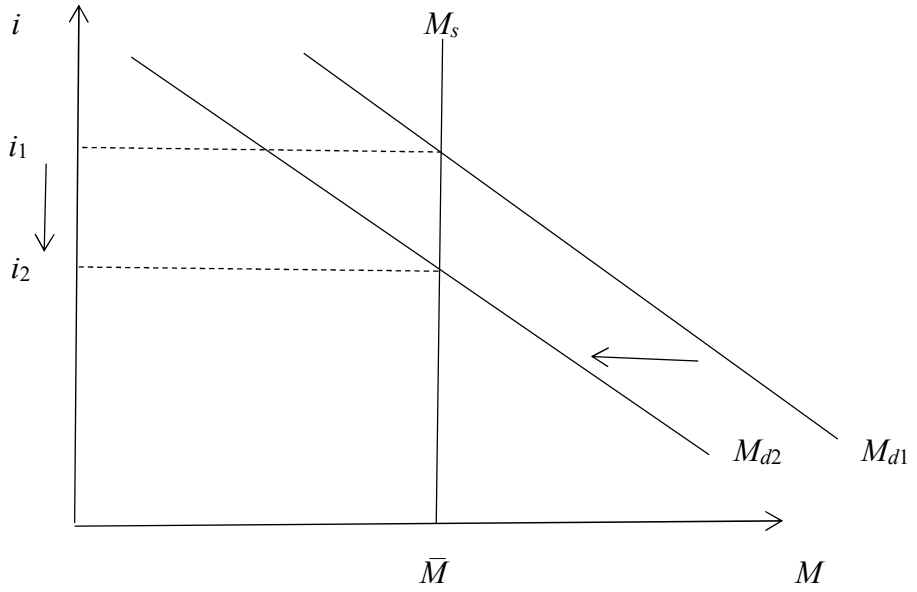

Figure 10.11: The Effect of an Increase in Price Level on the Equilibrium Interest Rate

Source: M. Ashraf

Figure 10.11: The interest rate, i, is on the vertical axis, and the quantity of money, M, is on the horizontal axis. When the overall price level decreases, money demand curve shift to the left, from M_{d1} to M_{d2}. Since the Fed does not change money supply, the money supply curve is vertical at $\bar{M}$, the equilibrium interest rate decreases from i_1 to i_2.

Figure 10.11 shows that when the overall price level decreases, money demand curve shift to the left, from M_{d1} to M_{d2}. Since the Fed does not change money supply, the money supply curve is vertical at $\bar{M}$, the equilibrium interest rate decreases from i_1 to i_2.

To solidify your understanding of how the interest rate moves to a new equilibrium level, I encourage you to review Figure 9.7 in Chapter 9.

As equilibrium interest rate decreases from i_1 to i_2, quantity of planned investment spending increases. In Figure 10.5, we move along the planned investment demand curve, and quantity of planned investment spending increases from $I(i_1)$ to $I(i_2)$. This increase in planned investment spending shows up in the Keynesian Cross diagram, Figure 10.6. The planned aggregate expenditure increases, shifting the planned aggregate expenditure curve up from $AE_1 \equiv C + I(i_1) + G$ to $AE_2 \equiv C + I(i_2) + G$. As a result, equilibrium output increases from Y_1 to Y_2.

If you are rusty on the mechanism of how equilibrium output changes as a result of changes in planned aggregate expenditure, I encourage you to review Chapter 7.

Note that we have created a channel through which changes in the overall price level, *P*, end up generating changes in the equilibrium level of output, *Y*. We may summarize this channel as follows.

Suppose that the overall price level, *P*, decreases.

$P \downarrow \rightarrow M_d \downarrow$ (money demand curve shift to the left) $\rightarrow i \downarrow \rightarrow I \uparrow \rightarrow AE \uparrow$ (planned aggregate expenditure curve shifts up) $\rightarrow Y\uparrow$

The reverse happens when the overall price level, *P*, increases.

$P \uparrow \rightarrow M_d \uparrow$ (money demand curve shift to the right) $\rightarrow i \uparrow \rightarrow I \downarrow \rightarrow AE \downarrow$ (planned aggregate expenditure curve shifts down) $\rightarrow Y \downarrow$

This negative relationship between the overall price level, *P*, and the aggregate output, *Y*, is represented in the aggregate demand curve, *AD*. Figure 10.12 plots the *AD* curve.

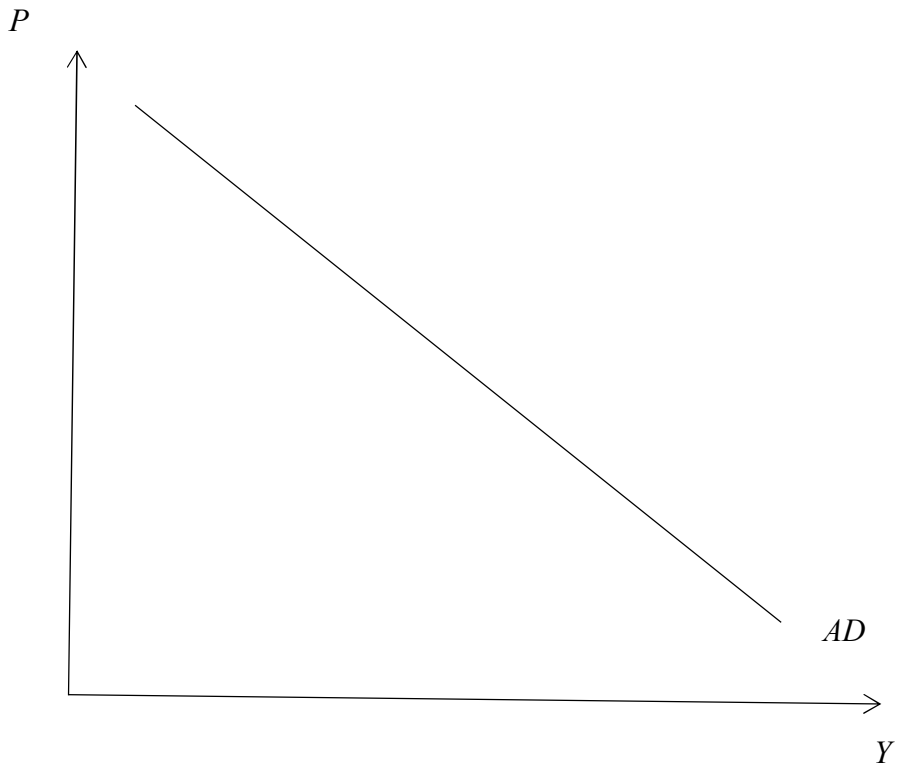

Figure 10.12: The Aggregate Demand Curve (*AD*)

Source: M. Ashraf

Figure 10.12: The overall price level, *P*, is on the vertical axis, and the aggregate output, *Y*, is on the horizontal axis. The curve, *AD*, shows the negative relationship between, the price level and aggregate output.

It is important to note that while the *AD* curve looks like the "regular" product demand curve, the reasons behind the negative slope of the *AD* curve is quite different from those the product demand curve. The *AD* curve shows the negative relationship between the overall price level and the aggregate output, whereas the product demand curve shows the negative relationship between the price of a particular product and its quantity demanded, while holding all other factors, other than the price of the product, that may affect the purchase of the product.

This is not the case in the derivation of the *AD* curve. As we just saw, the negative relationship went through the effect of the overall price level on money demand, which affected the equilibrium interest rate in the market for money. This equilibrium interest rate, in turn, affected the planned investment spending. The planned investment spending, in turn, affected the planned aggregate expenditure. This all came together in the Keynesian Cross diagram, and the equilibrium output was affected.

Shifts in the Aggregate Demand Curve

Now that we understand the derivation of the aggregate demand curve, and hence, movement along the aggregate demand curve, let us turn to the factors that may shift the aggregate demand curve.

Fiscal Policy and the Aggregate Demand Curve

Recall that fiscal policy is related to the changes in government spending, G, and taxation, T. Expansionary fiscal policy refers to an increase in government spending and/or a decrease in taxes. And contractionary fiscal policy refers to a decrease in government spending and/or an increase in taxes.

When government spending increases, planned aggregate expenditure increases, and as a result, output increases. Refer to the Keynesian Cross diagram, Figure 7.10, in Chapter 7, to see this effect. As government spending, G, increases, planned aggregate expenditure increases, and the *AE* curve shift up. The result is an increase in the equilibrium aggregate output, Y.

The effect of a decrease in taxes, T, will be through the consumption function; a decrease in T will increase disposable income, Y_d ($\equiv Y - T$), which will, in turn, increase consumption. The result will be an upward shift of the *AE* curve in the Keynesian Cross diagram, leading to an increase in the equilibrium level of output, Y. Given that the overall price level, P, has not changed but aggregate output, Y, has increased, we shift the aggregate demand curve to the right to show the impact of an increase in government spending and or a decrease in taxes.

The effect of contractionary fiscal policy—a decrease in government spending and/or an increase in taxes—will work in the opposite direction; it will shift the aggregate demand curve, *AD*, to the left. Figure 10.13 shows these shifts in the *AD* curve.

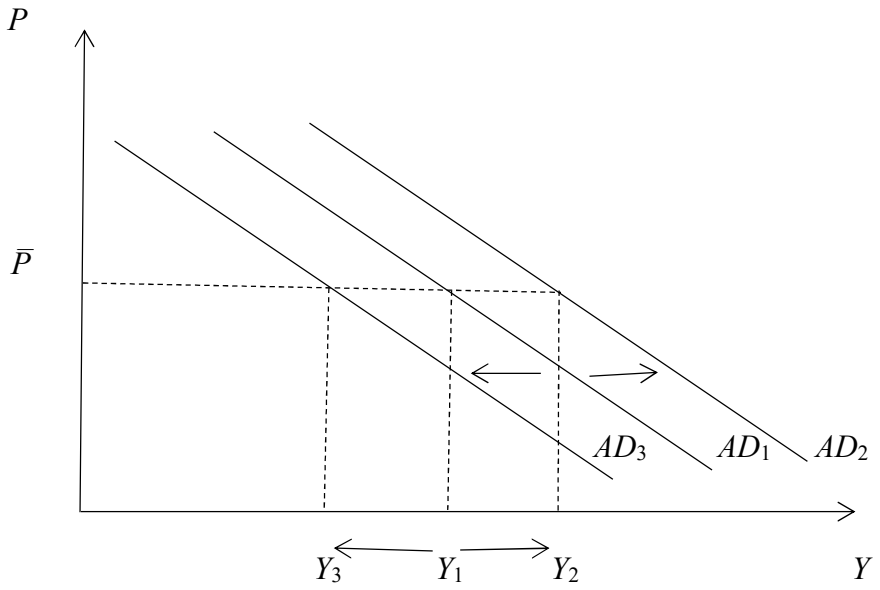

Figure 10.13: Shifts in the Aggregate Demand Curve

Source: M. Ashraf

Figure 10.13: The overall price level, *P*, is on the vertical axis, and the aggregate output, *Y*, is on the horizontal axis. An expansionary fiscal policy increases aggregate output, *Y*. Since the overall price level, *P*, has not changed, we shift the aggregate demand curve to the right, from AD_1 to AD_2. A contractionary fiscal policy decreases aggregate output, *Y*. Since the overall price level, *P*, has not changed, we shift the aggregate demand curve to the left, from AD_1 to AD_3. The bar "—" above *P* indicates that overall price level has not changed.

Figure 10.13 shows the effects of expansionary and contractionary fiscal policies on the aggregate demand curve, *AD*. Suppose that government spending, *G*, increases, and or taxes, *T*, decrease. These actions will shift the planned aggregate expenditure curve, *AE*, in the Keynesian Cross diagram up, leading to an increase in the equilibrium aggregate output to increase. In terms of Figure 10.13, since the overall price level, *P*, has not changed, only the aggregate output has increased, we shift the aggregate demand curve to the right, from AD_1 to AD_2. Note the bar "—" above *P*, in Figure 10.13. This indicates that overall price level has not changed.

What will be the effect of a contractionary fiscal policy, i.e., a decrease in government spending, *G*, and or an increase in taxes, *T*? This will shift the planned aggregate expenditure, *AE*, curve in the Keynesian Cross diagram down, leading to a decrease in the equilibrium level of aggregate output, *Y*. We show this, in terms of Figure 10.13, by shifting the aggregate demand curve to the left, from AD_1 to AD_3.

Consumer Sentiments: Shifts in the Consumption Function and the AD Curve

Suppose that consumers become more, or less optimistic, about the future, and accordingly increase or decrease their consumption, respectively, at any level of income, Y. This will lead to a change in the intercept of the consumption function—see Equation 7.6, $C = \alpha + \beta Y$. In the C and Y space, this will shift the consumption function up or down, respectively—see Figure 7.2. This shift in the consumption function will lead to an equivalent and corresponding shift in the panned aggregate expenditure curve, AE, in the Keynesian Cross diagram, resulting in a change in equilibrium output, Y, in the Keynesian Cross diagram, accordingly. (I encourage you to review Chapter 7 to solidify your understanding of why changes in the intercept of the consumption function affect the planned aggregate expenditure.)

Recall that the overall price level, P, is not changing; only equilibrium output, Y, is changing. To show this change in equilibrium output, we shift the AD curve. If the consumption function, and as a result the AE curve, were to shift up due to an increase in the value of the intercept, α, the aggregate demand curve will shift to the right. In terms of Figure 10.13, the aggregate demand curve will shift from AD_1 to AD_2. On the other hand, if the consumption function, and as a result the AE curve, were to shift downward due to a decrease in the value of the intercept, α, the aggregate demand curve will shift to the left. In terms of Figure 10.13, the aggregate demand curve shift from AD_1 to AD_3.

Producer Sentiments: Shifts in the Planned Investment Spending Function and the AD Curve

Suppose, now, that firms become more, or less, optimistic about the future, leading them to increase or decrease planned investment spending, respectively, at any interest rate. This change in sentiment will shift the planned investment spending curve right or left (up or down), in Figures 9.11 and 10.5, respectively. This shift in the investment function will lead to an equivalent and corresponding shift in the panned aggregate expenditure curve, AE, in the Keynesian Cross diagram, resulting in a change in equilibrium output, Y, accordingly.

Again, since the overall price level, P, is not changing, only equilibrium output, Y, is changing, we shift the aggregate demand curve, as shown in Figure 10.13. If firms were to become optimistic about the future of the economy and as a result increase planned investment spending at any interest rate, this will show up as a rightward (or upward) shift in the planned investment spending curve in Figure 9.11 or Figure 10.5. As a result, there will be an upward shift in the AE curve in the Keynesian Cross diagram, leading to an increase in the equilibrium level of output, Y. In Figure 10.13, we show this by shifting the aggregate demand curve to the right, from AD_1 to AD_2.

The reverse will happen when firms become pessimistic about the future of the economy. This pessimism may lead to a decrease in planned investment spending at any interest rate, leading to a leftward (or downward) shift in the planned investment spending curve. This shift int the planned investment spending curve will lead to a downward shift of the AE curve in the Keynesian Cross diagram, leading to a decrease in the equilibrium level of output, Y. In Figure 10.13, we show this by shifting the aggregate demand curve from AD_1 to AD_3.

It is important to note that the factors that shift the *IS* curve (Figure 10.8), also shift the aggregate demand curve, *AD* (Figure 10.13), and in the same direction.

Combining the Aggregate Demand Curve and the Short-Run Aggregate Supply Curve

Now that we understand what aggregate demand curve and short-run aggregate supply curves represent, we can complete the model by plotting both curves on the same set of axes to find equilibrium output, *Y*, and equilibrium overall price level, *P*. Figure 10.14 plots both the aggregate demand curve and the short-run aggregate supply curve.

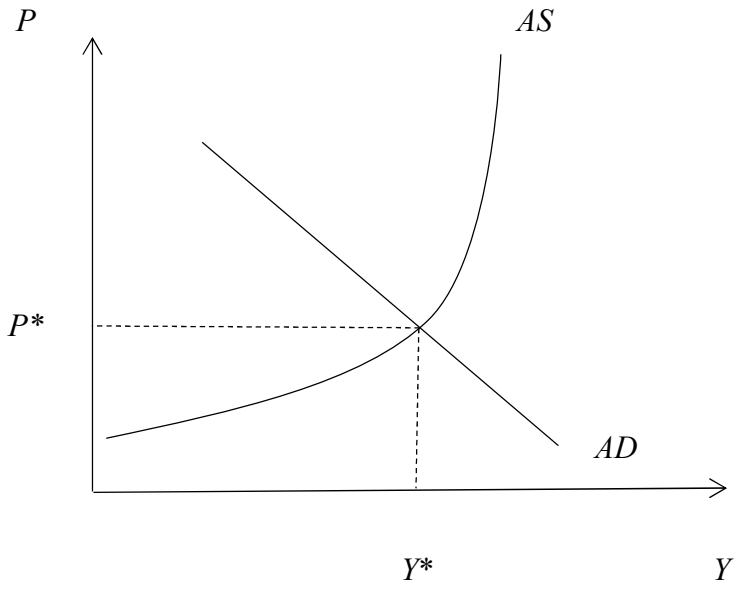

Figure 10.14: Finding the Equilibrium Output and Equilibrium Price Level in the *AD-AS* Model

Source: M. Ashraf

Figure 10.14: The overall price level, *P*, is on the vertical axis, and the aggregate output, *Y*, is on the horizontal axis. The curve, *AD*, is the aggregate demand curve, and the curve, *AS*, is the short-run aggregate supply curve. *P** and *Y** represent equilibrium price level and equilibrium output, respectively.

Figure 10.14 plots both the aggregate demand curve, *AD*, and the short-run aggregate supply curve, *AS*, on the same set of axes. We draw a perpendicular line from the point where *AD* and *AS* intersect to get equilibrium level of aggregate output. In Figure 10.14, this is represented by *Y** on the horizontal axis. And we draw a horizontal line from the point where *AD* and *AS* interest to get the equilibrium value of the overall price level. This is represented by *P** on the vertical axis.

Let us now see the effects of fiscal policy and monetary policy on the equilibrium values of the aggregate output and the overall price level. We start with fiscal policy.

Fiscal Policy and the Equilibrium Output and the Equilibrium Overall Price Level

Suppose that the economy is in a recession. Can expansionary fiscal policy increase output? The answer is, Yes.

As we saw in Figure 10.13, an expansionary fiscal policy—an increase in G and or a decrease in T—would shift the aggregate demand curve to the right. Recall that an increase in government spending shifts the planned aggregate expenditure curve, AE, in the Keynesian Cross diagram up, leading to an increase in equilibrium output, Y. The impact of a decrease in taxes works through the consumption function, via an increase in the disposable income, Y_d ($\equiv Y - T$).

As we saw earlier, an expansionary fiscal policy led to a rightward shift in the aggregate demand curve. Suppose that the economy is recession and is producing at a relatively flat part of the short-run aggregate supply; a point such as this is point a in Figure 10.15 (and in Figure 10.1 and Figure 10.2). A rightward shift in the aggregate demand curve—from AD_a to AD_b—will increase aggregate output a lot, without much impact on the price level; an expansionary fiscal policy will move the economy to a point such as point b. Figure 10.15 shows the effects of an expansionary fiscal policy when the economy is in a recession.

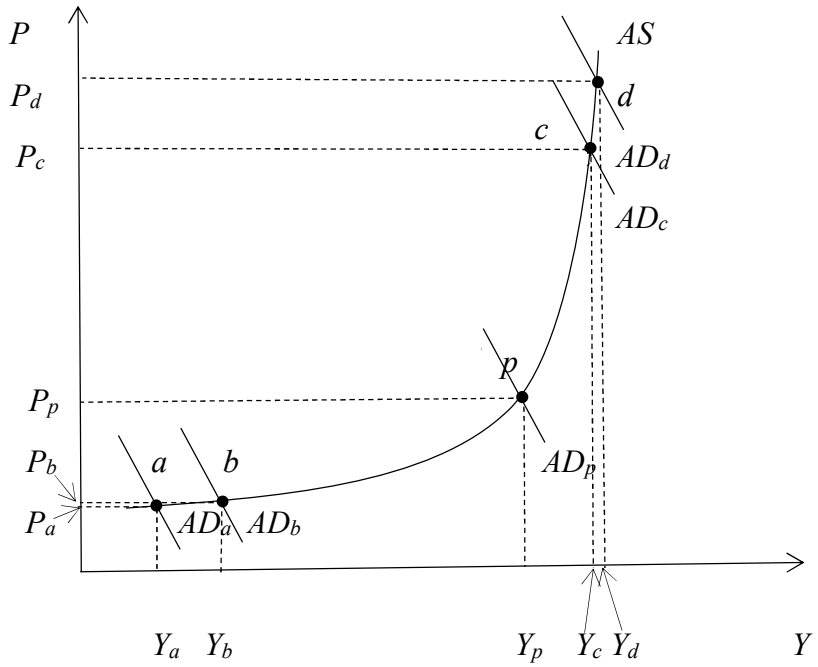

Figure 10.15: Expansionary Fiscal and Monetary Policies

Source: M. Ashraf

Figure 10.15: The overall price level, P, is on the vertical axis, and the aggregate output, Y, is on the horizontal axis. The curve, AD, is the aggregate demand curve, and the curve, AS, is the

short-run aggregate supply curve. An expansionary fiscal policy shifts the aggregate demand curve to the right.

In Figure 10.15, a shift of the aggregated demand curve to the right, from AD_a to AD_b, shows the effect of an expansionary fiscal policy when the economy is in a recession. Note that the impact on output is a lot larger than the impact on the overall price level; the aggregate output increases from Y_a to Y_b, and the overall price level increases from P_a to P_b.

Suppose, now, that the economy is operating at the potential level of output, Y_p, and the overall price level, P_p, is corresponding to the potential level of output. (See the discussion following Figure 10.1 regarding the potential level of output, Y_p, and the corresponding overall price level, P_p.) In terms of Figure 10.15, at this level of output, the aggregate demand curve is AD_p. If the US Congress wants to increase output beyond the potential level of output, the result will be an increase in the overall price level which is larger than the increase in output.

As an example, suppose that the economy is producing at point *c*. If the aggregate demand increases further and the aggregate demand curve shifts from AD_c to AD_d, the result will be a lot higher price level, from P_c to P_d, without much gain in the aggregate output, from Y_c to Y_d.

The impact of a contractionary fiscal policy will the opposite—the aggregate demand curve will shift to the left; it will lead to a decrease in aggregate output, Y, and a decrease in the overall price level, P. The magnitude of these decreases, again, will depend upon where the economy is on the short-run aggregate supply curve.

Monetary Policy and the Equilibrium Output and the Equilibrium Overall Price Level

Can an expansionary monetary policy affect the economy's output? Again, the answer is, Yes.

Before we see how monetary policy affects output, it will be a good idea to review Chapter 9 to solidify your understanding of how changes in money supply affect the economy.

Suppose that the economy is in a recession, at a point such as point *a* on the short-run aggregate supply curve in Figure 10.15 (and in Figure 10.1 and Figure 10.2). To increase planned investment spending, the Fed lowers the federal funds rate target, and increases money supply to meet this target. Since various interest rates in the economy move in similar direction, more projects become profitable, and quantity of planned investment spending increases. This increase in planned investment spending shows up as an increase in the planned aggregate expenditure in the Keynesian Cross diagram; the planned aggregate expenditure curve, AE, shifts up. This leads to an increase in the equilibrium aggregate output, Y. To show this increase in the aggregate output, we shift the aggregate demand curve to the right, from AD_a to AD_b, in Figure 10.15.

The reverse will happen if the Fed were to conduct a contractionary monetary policy.

Suppose that the economy happens to be at a point such as point *d* on the short-run aggregate supply curve At this point, the economy is producing beyond the potential level of output and the price level is high. Recall that the Fed is mandated to have a stable price level and high employment. To lower the price level, the Fed conducts a contractionary monetary policy; it raises the federal funds rate target and decreases money supply to meet this higher target. And

since various interest rates move in similar direction, fewer projects remain profitable. Quantity of planned investment decreases, leading to a corresponding decrease in the planned aggregate expenditure, and shifting the *AE* curve down in the Keynesian Cross diagram. This leads to a decrease in the equilibrium level of aggregate output. To show this in decrease in the aggregate output, we shift the aggregate demand curve to the left. In Figure 10.15, aggregate demand curve shifts from AD_d to AD_c. Note that, as a result, the equilibrium overall price level decreases a lot more than the decrease in the aggregate output.

The Long Run and the Long-Run Aggregate Supply Curve

Can fiscal and monetary policies maintain an output level beyond the potential level of output without leading to an ever-increasing overall price level? That is, can expansionary fiscal and monetary policies keep the output level higher than the potential level of output without generating an inflation? The answer is, No.

Recall that short run is a situation where at least one factor of production, and hence one cost of production, is fixed. In the long run, however, all factors of production, and hence all costs of production, are variable.

Suppose, now, that the economy is producing at the potential level of output. Such a point is represented by point *p* in Figure 10.16.

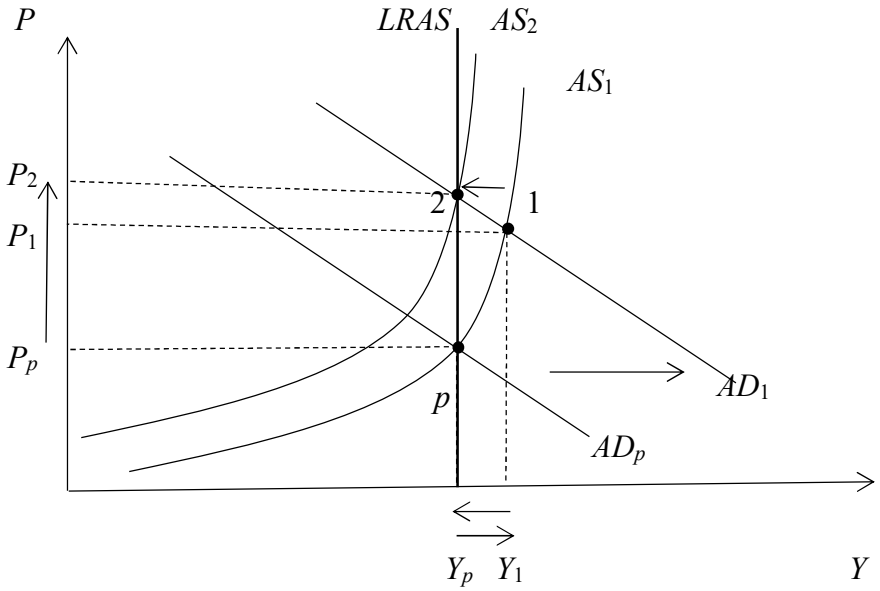

Figure 10.16: The Long Run and the Long-Run Aggregate Supply Curve

Source: M. Ashraf

Figure 10.16: The overall price level, *P*, is on the vertical axis, and the aggregate output, *Y*, is on the horizontal axis. The curve, AD_p and AD_1 are aggregate demand curves. AS_1 and AS_2 are short-run aggregate supply curve. The long-run aggregate supply curve is represented by *LRAS*.

In Figure 10.16, we start with the equilibrium level of aggregate output at its potential level. The short-run aggregate supply curve, AS_1, and aggregate demand curve, AD_p, intersect at point p. The equilibrium level of output is Y_p, and the corresponding overall price level is P_p. An expansionary fiscal and/or an expansionary monetary policy shift the aggregate demand curve to the right, from AD_p to AD_1. The new equilibrium between aggregate demand curve, AD_1 and AS_1, takes place at point 1, with a higher aggregate output level, Y_1, and a higher equilibrium overall price level, P_1. As various inputs' (land, labor, and capital) contracts become due, they demand higher input prices (rents, wages, etc.). These higher input prices increase costs of production, leading to a leftward shift in the short-run aggregate supply curve, from AS_1 to AS_2. (Recall cost shocks, Figure 10.3.) Now the equilibrium between AD_1 and AS_2 takes place at point 2; the equilibrium output is back to Y_p, and the new equilibrium overall price level is P_2, which is even higher.

When we connect point p and point 2, we get the long-run aggregate supply curve, *LRAS*. Note that the long-run aggregate supply curve is vertical at the potential level of output, Y_p. The lesson here is that in the long run, expansionary fiscal and monetary policies cannot affect the real aggregate output. (Recall the distinction between real and nominal variables from Chapter 6); the only variables that change are the nominal variables. In terms of Figure 10.16, the only variable that changes is the overall price level, *P*.

Can the long-run aggregate supply curve shift to the right or to the left? Indeed, it can. In drawing the short-run aggregate supply curve, we linked the potential aggregate output to the trendline in Figures 10.1 and 10.2, respectively. Also note that in Figure 10.2, and in Chapter 5, Figure 5.2, we plotted the curve representing the potential level of aggregate output having a positive slope. That indicated that the potential level of aggregate output increasing over time. In terms of Figure 10.16, this means a rightward shift in the long-run aggregate supply curve.

As we saw in Chapter 5, there was no guarantee that the trendline would have a positive slope. To show this we plotted per capita *GDP* data for Sierra Leone in Figure 5.3. The trendline for Sierra Leone had a negative slope. In terms of Figure 10.16, this means a leftward shift of the long-run aggregate supply curve.

Chapter Conclusion

In this chapter we built the aggregate demand and aggregate supply (*AD-AS*) model. With the help of the *AD-AS* model, we can find out the equilibrium aggregate output and the equilibrium overall price level. We learned about the shape of the short-run aggregate supply curve, and we derived the aggregate demand curve. In the process of deriving the aggregate demand curve, we learned about the *IS* curve and the Federal Reserve's Response function (*FRF*). The *IS* curve shows the relationship between the interest rate and the equilibrium output. The *FRF* shows how the Federal Reserve decides which federal funds rate target to pick. We also learned about the effects of fiscal and monetary policies on the equilibrium level of aggregate output and the overall price level in the short run. Finally, we learned about the long-run aggregate supply curve.

A Review of Terms

- The *AD*-*AS* model helps determine the equilibrium level of aggregate output and the overall price level.
- A short-run aggregate supply curve shows the level of aggregate output of the economy.
- Supply shocks lead to a rightward shift in the short-run aggregate supply curve.
- Cost shocks lead to a leftward shift in the short-run aggregate supply curve.
- The IS curve shows the relationship between the interest rate and the equilibrium level of aggregate output.
- The FRF curve shows how the Federal Reserve decides about the target federal funds rate.
- Expansionary fiscal policy and expansionary monetary policy shift the aggregate demand curve to the right.
- Contractionary fiscal policy and contractionary monetary policy shift the aggregate demand curve to the left.
- The fiscal and monetary policies are effective only in the short run. In the long run, the aggregate level of output returns to its potential level.
- The long-run aggregate supply curve is vertical at the potential level of output.