After studying this chapter, you will be able to:

- Explain how expenditure plans are determined when the price level is fixed
- Explain how real GDP is determined when the price level is fixed
- Explain the expenditure multiplier when the price level is fixed
- Explain the relationship between aggregate expenditure and aggregate demand and explain the multiplier when the price level changes

11

EXPENDITURE MULTIPLIERS: THE KEYNESIAN MODEL

Alicia Keys sings into a microphone in a barely audible whisper and through the magic of electronic amplification, her voice fills Central Park.

Michael Bloomberg, the mayor of New York, and an assistant are being driven to a business meeting along one of the cobblestone streets of downtown Manhattan. The car's wheels bounce and vibrate over the uneven surface, but the assistant's notes are tapped into a BlackBerry without missing a keystroke, thanks to the car's efficient shock absorbers.

Investment and exports fluctuate like the volume of Alicia Keys' voice and the uneven surface of a New York City street. How does the economy react to those fluctuations? Does it behave like an amplifier, blowing up the fluctuations and spreading them out to affect the many millions of participants in an economic rock concert? Or does it react like a limousine, absorbing the shocks and providing a smooth ride for the economy's passengers?

You will explore these questions in this chapter and in *Reading Between the Lines* at the end of the chapter you will see the role played by inventory investment during 2010 as the economy expanded.

Fixed Prices and Expenditure Plans

In the Keynesian model that we study in this chapter, all the firms are like your grocery store: They set their prices and sell the quantities their customers are willing to buy. If they persistently sell a greater quantity than they plan to and are constantly running out of inventory, they eventually raise their prices. And if they persistently sell a smaller quantity than they plan to and have inventories piling up, they eventually cut their prices. But on any given day, their prices are fixed and the quantities they sell depend on demand, not supply.

Because each firm's prices are fixed, for the economy as a whole:

1. The *price level* is fixed, and
2. *Aggregate demand* determines real GDP.

The Keynesian model explains fluctuations in aggregate demand at a fixed price level by identifying the forces that determine expenditure plans.

Expenditure Plans

Aggregate expenditure has four components: consumption expenditure, investment, government expenditure on goods and services, and net exports (exports *minus* imports). These four components of aggregate expenditure sum to real GDP (see Chapter 4, pp. 85–86).

Aggregate planned expenditure is equal to the sum of the *planned* levels of consumption expenditure, investment, government expenditure on goods and services, and exports minus imports. Two of these components of planned expenditure, consumption expenditure and imports, change when income changes and so they depend on real GDP.

A Two-Way Link Between Aggregate Expenditure and Real GDP There is a two-way link between aggregate expenditure and real GDP. Other things remaining the same,

- An increase in real GDP increases aggregate expenditure, and
- An increase in aggregate expenditure increases real GDP.

You are now going to study this two-way link.

Consumption and Saving Plans

Several factors influence consumption expenditure and saving plans. The more important ones are

1. Disposable income
2. Real interest rate
3. Wealth
4. Expected future income

Disposable income is aggregate income minus taxes plus transfer payments. Aggregate income equals real GDP, so disposable income depends on real GDP. To explore the two-way link between real GDP and planned consumption expenditure, we focus on the relationship between consumption expenditure and disposable income when the other three factors listed above are constant.

Consumption Expenditure and Saving The table in Fig. 11.1 lists the consumption expenditure and the saving that people plan at each level of disposable income. Households can only spend their disposable income on consumption or save it, so planned consumption expenditure plus planned saving *always* equals disposable income.

The relationship between consumption expenditure and disposable income, other things remaining the same, is called the **consumption function.** The relationship between saving and disposable income, other things remaining the same, is called the **saving function**.

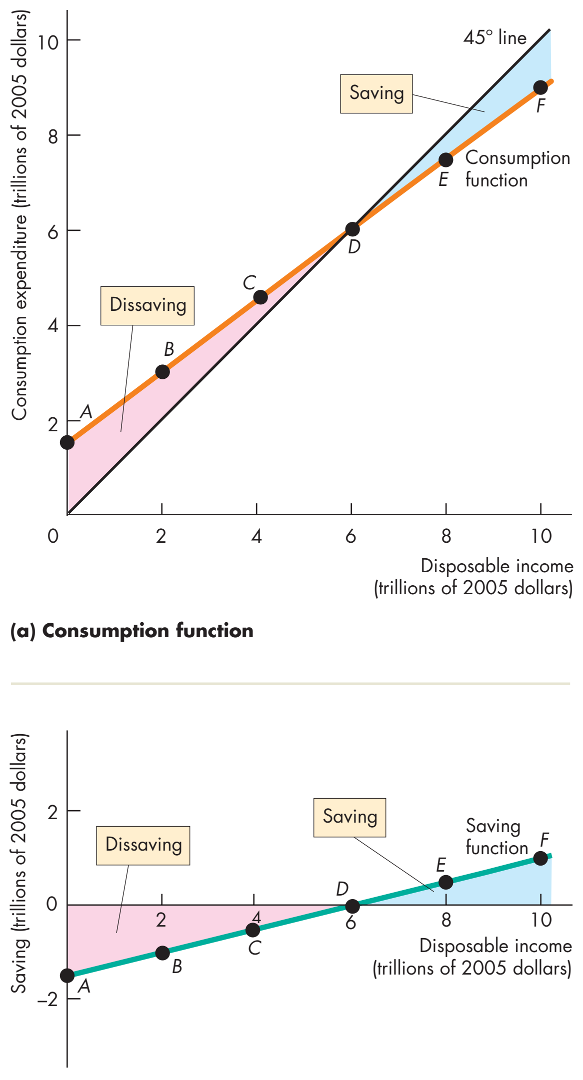
Consumption Function Figure 11.1(a) shows a consumption function. The *y*-axis measures consumption expenditure, and the *x*-axis measures disposable income. Along the consumption function, the points labeled *A* through *F* correspond to the rows of the table. For example, point *E* shows that when disposable income is $8 trillion, consumption expenditure is $7.5 trillion. As disposable income increases, consumption expenditure also increases.

At point *A* on the consumption function, consumption expenditure is $1.5 trillion even though disposable income is zero. This consumption expenditure is called *autonomous consumption*, and it is the amount of consumption expenditure that would take place in the short run even if people had no current income. Consumption expenditure in excess of this amount is called *induced consumption*, which is the consumption expenditure that is induced by an increase in disposable income.

45° Line Figure 11.1(a) also contains a 45° line, the height of which measures disposable income. At each point on this line, consumption expenditure equals disposable income. Between *A* and *D,* consumption expenditure exceeds disposable income, between *D* and *F* consumption expenditure is less than disposable income, and at point *D*, consumption expenditure equals disposable income.

Saving Function Figure 11.1(b) shows a saving function. Again, the points *A* through *F* correspond to the rows of the table. For example, point *E* shows that when disposable income is \$8 trillion, saving is \$0.5 trillion. As disposable income increases, saving increases. Notice that when consumption expenditure exceeds disposable income in part (a), saving is negative, called *dissaving,* in part (b).

FIGURE 11.1 Consumption Function and Saving Function



(a) Consumption function

(b) Saving function

	Disposable income	Planned consumption expenditure	Planned saving
	(trillions of 2005 dollars)		
A	0	1.5	–1.5
B	2	3.0	–1.0
C	4	4.5	–0.5
D	6	6.0	0
E	8	7.5	0.5
F	10	9.0	1.0

The table shows consumption expenditure and saving plans at various levels of disposable income. Part (a) of the figure shows the relationship between consumption expenditure and disposable income (the consumption function). The height of the consumption function measures consumption expenditure at each level of disposable income. Part (b) shows the relationship between saving and disposable income (the saving function). The height of the saving function measures saving at each level of disposable income. Points *A* through *F* on the consumption and saving functions correspond to the rows in the table.

The height of the 45° line in part (a) measures disposable income. So along the 45° line, consumption expenditure equals disposable income. Consumption expenditure plus saving equals disposable income. When the consumption function is above the 45° line, saving is negative (dissaving occurs). When the consumption function is below the 45° line, saving is positive. At the point where the consumption function intersects the 45° line, all disposable income is spent on consumption and saving is zero.

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Marginal Propensities to Consume and Save

The **marginal propensity to consume** (*MPC*) is the fraction of a *change* in disposable income that is spent on consumption. It is calculated as the *change* in consumption expenditure (ΔC) divided by the *change* in disposable income (ΔYD). The formula is

$$MPC = \frac{\Delta C}{\Delta YD}.$$

In the table in Fig. 11.1, when disposable income increases by \$2 trillion, consumption expenditure increases by \$1.5 trillion. The *MPC* is \$1.5 trillion divided by \$2 trillion, which equals 0.75.

The **marginal propensity to save** (*MPS*) is the fraction of a *change* in disposable income that is saved. It is calculated as the *change* in saving (ΔS) divided by the *change* in disposable income (ΔYD). The formula is

$$MPS = \frac{\Delta S}{\Delta YD}.$$

In the table in Fig. 11.1, when disposable income increases by \$2 trillion, saving increases by \$0.5 trillion. The *MPS* is \$0.5 trillion divided by \$2 trillion, which equals 0.25.

Because an increase in disposable income is either spent on consumption or saved, the marginal propensity to consume plus the marginal propensity to save equals 1. You can see why by using the equation:

$$\Delta C + \Delta S = \Delta YD.$$

Divide both sides of the equation by the change in disposable income to obtain

$$\frac{\Delta C}{\Delta YD} + \frac{\Delta S}{\Delta YD} = 1.$$

$\Delta C/\Delta YD$ is the marginal propensity to consume (*MPC*), and $\Delta S/\Delta YD$ is the marginal propensity to save (*MPS*), so

$$MPC + MPS = 1.$$

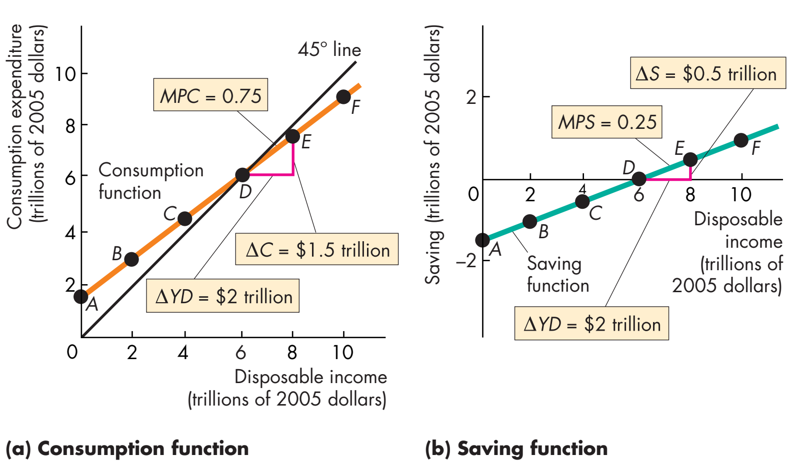
Slopes and Marginal Propensities

The slope of the consumption function is the marginal propensity to consume, and the slope of the saving function is the marginal propensity to save.

Figure 11.2(a) shows the *MPC* as the slope of the consumption function. An increase in disposable income of \$2 trillion is the base of the red triangle. The increase in consumption expenditure that results from this increase in disposable income is \$1.5 trillion and is the height of the triangle. The slope of the consumption function is given by the formula "slope equals rise over run" and is \$1.5 trillion divided by \$2 trillion, which equals 0.75—the *MPC*.

Figure 11.2(b) shows the *MPS* as the slope of the saving function. An increase in disposable income of \$2 trillion (the base of the red triangle) increases saving by \$0.5 trillion (the height of the triangle). The slope of the saving function is \$0.5 trillion divided by \$2 trillion, which equals 0.25—the *MPS*.

FIGURE 11.2 The Marginal Propensities to Consume and Save



The marginal propensity to consume, *MPC*, is equal to the change in consumption expenditure divided by the change in disposable income, other things remaining the same. It is measured by the slope of the consumption function. In part (a), the *MPC* is 0.75.

The marginal propensity to save, *MPS*, is equal to the change in saving divided by the change in disposable income, other things remaining the same. It is measured by the slope of the saving function. In part (b), the *MPS* is 0.25.

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Economics in Action

The U.S. Consumption Function

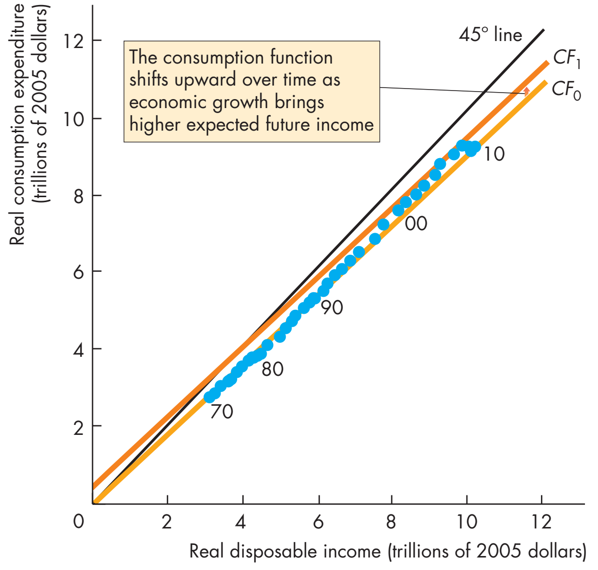
The figure shows the U.S. consumption function. Each point identified by a blue dot represents consumption expenditure and disposable income for a particular year. (The dots are for the years 1970 to 2010, and the dots for five of those years are identified in the figure.)

The U.S. consumption function is CF_0 in 1970 and CF_1 in 2010.

The slope of the consumption function in the figure is 0.9, which means that a $1 increase in disposable income increases consumption expenditure by 90 cents. This slope, which is an estimate of the marginal propensity to consume, is an assumption that is at the upper end of the range of values that economists have estimated for the marginal propensity to consume.

The consumption function shifts upward over time as other influences on consumption expenditure change. Of these other influences, the real interest rate and wealth fluctuate and so bring upward and downward shifts in the consumption function.

But rising wealth and rising expected future income bring a steady upward shift in the consumption function. As the consumption function shifts upward, autonomous consumption increases.



The U.S. Consumption Function

Source of data: Bureau of Economic Analysis.

Consumption as a Function of Real GDP

Consumption expenditure changes when disposable income changes and disposable income changes when real GDP changes. So consumption expenditure depends not only on disposable income but also on real GDP. We use this link between consumption expenditure and real GDP to determine equilibrium expenditure. But before we do so, we need to look at one further component of aggregate expenditure: imports. Like consumption expenditure, imports are influenced by real GDP.

Import Function

Of the many influences on U.S. imports in the short run, U.S. real GDP is the main influence. Other things remaining the same, an increase in U.S. real GDP increases the quantity of U.S. imports.

The relationship between imports and real GDP is determined by the **marginal propensity to import**, which is the fraction of an increase in real GDP that is spent on imports. It is calculated as the change in imports divided by the change in real GDP, other things remaining the same. For example, if an increase in real GDP of $1 trillion increases imports by $0.25 trillion, the marginal propensity to import is 0.25.

REVIEW QUIZ

1. Which components of aggregate expenditure are influenced by real GDP?
2. Define and explain how we calculate the marginal propensity to consume and the marginal propensity to save.
3. How do we calculate the effects of real GDP on consumption expenditure and imports by using the marginal propensity to consume and the marginal propensity to import?

You can work these questions in Study Plan 11.1 and get instant feedback.

Real GDP influences consumption expenditure and imports, which in turn influence real GDP. Your next task is to study this second piece of the two-way link between aggregate expenditure and real GDP and see how all the components of aggregate planned expenditure interact to determine real GDP.

Real GDP with a Fixed Price Level

You are now going to see how, at a given price level, aggregate expenditure plans determine real GDP. We start by looking at the relationship between aggregate planned expenditure and real GDP. This relationship can be described by an aggregate expenditure schedule or an aggregate expenditure curve. The *aggregate expenditure schedule* lists aggregate planned expenditure generated at each level of real GDP. The *aggregate expenditure curve* is a graph of the aggregate expenditure schedule.

Aggregate Planned Expenditure

The table in Fig. 11.3 sets out an aggregate expenditure schedule. To calculate aggregate planned expenditure at a given real GDP, we add the expenditure components together. The first column of the table shows real GDP, and the second column shows the planned consumption at each level of real GDP. A $1 trillion increase in real GDP increases consumption expenditure by $0.7 trillion—the *MPC* is 0.7.

The next two columns show investment and government expenditure on goods and services, both of which are independent of the level of real GDP. Investment depends on the real interest rate and the expected profit (see Chapter 7, p. 166). At a given point in time, these factors generate a given level of investment. Suppose this level of investment is $2.0 trillion. Also, suppose that government expenditure is $2.5 trillion.

The next two columns show exports and imports. Exports are influenced by events in the rest of the world, prices of foreign-produced goods and services relative to the prices of similar U.S.-produced goods and services, and exchange rates. But they are not directly affected by U.S. real GDP. Exports are a constant $2.0 trillion. Imports increase as U.S. real GDP increases. A $1 trillion increase in U.S. real GDP generates a $0.2 trillion increase in imports—the marginal propensity to import is 0.2.

The final column shows aggregate planned expenditure—the sum of planned consumption expenditure, investment, government expenditure on goods and services, and exports minus imports.

Figure 11.3 plots an aggregate expenditure curve. Real GDP is shown on the *x*-axis, and aggregate planned expenditure is shown on the *y*-axis. The aggregate expenditure curve is the red line *AE*. Points *A* through *F* on that curve correspond to the rows of the table. The *AE* curve is a graph of aggregate planned expenditure (the last column) plotted against real GDP (the first column).

Figure 11.3 also shows the components of aggregate expenditure. The constant components—investment (I), government expenditure on goods and services (G), and exports (X)—are shown by the horizontal lines in the figure. Consumption expenditure (C) is the vertical gap between the lines labeled $I + G + X$ and $I + G + X + C$.

To construct the *AE* curve, subtract imports (M) from the $I + G + X + C$ line. Aggregate expenditure is expenditure on U.S.-produced goods and services. But the components of aggregate expenditure—C, I, and G—include expenditure on imported goods and services. For example, if you buy a new cell phone, your expenditure is part of consumption expenditure. But if the cell phone is a Nokia made in Finland, your expenditure on it must be subtracted from consumption expenditure to find out how much is spent on goods and services produced in the United States—on U.S. real GDP. Money paid to Nokia for cell phone imports from Finland does not add to aggregate expenditure in the United States.

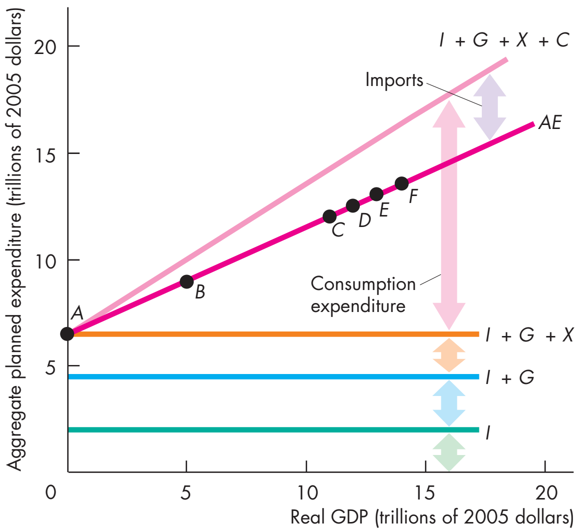
Because imports are only a part of aggregate expenditure, when we subtract imports from the other components of aggregate expenditure, aggregate planned expenditure still increases as real GDP increases, as you can see in Fig. 11.3.

Consumption expenditure minus imports, which varies with real GDP, is called **induced expenditure**. The sum of investment, government expenditure, and exports, which does not vary with real GDP, is called **autonomous expenditure**. Consumption expenditure and imports can also have an autonomous component—a component that does not vary with real GDP. Another way of thinking about autonomous expenditure is that it would be the level of aggregate planned expenditure if real GDP were zero.

In Fig. 11.3, autonomous expenditure is $6.5 trillion—aggregate planned expenditure when real GDP is zero (point *A*). For each $1 trillion increase in real GDP, induced expenditure increases by $0.5 trillion.

The aggregate expenditure curve summarizes the relationship between aggregate *planned* expenditure and real GDP. But what determines the point on the aggregate expenditure curve at which the economy operates? What determines *actual* aggregate expenditure?

FIGURE 11.3 Aggregate Planned Expenditure: The *AE* Curve



Aggregate planned expenditure is the sum of planned consumption expenditure, investment, government expenditure on goods and services, and exports minus imports. For example, in row *C* of the table, when real GDP is \$11 trillion, planned consumption expenditure is \$7.7 trillion, planned investment is \$2.0 trillion, planned government expenditure is \$2.5 trillion, planned exports are \$2.0 trillion, and planned imports are \$2.2 trillion. So when real GDP is \$11 trillion, aggregate planned expenditure is \$12 trillion (\$7.7 + \$2.0 + \$2.5 + \$2.0 – \$2.2). The schedule shows that aggregate planned expenditure increases as real GDP increases. This relationship is graphed as the aggregate expenditure curve *AE*. The components of aggregate expenditure that increase with real GDP are consumption expenditure and imports. The other components—investment, government expenditure, and exports—do not vary with real GDP.

		Planned expenditure					
	Real GDP (*Y*)	**Consumption expenditure (*C*)**	**Investment (*I*)**	**Government expenditure (*G*)**	**Exports (*X*)**	**Imports (*M*)**	**Aggregate planned expenditure (*AE* = *C* + *I* + *G* + *X* − *M*)**
		(trillions of 2005 dollars)					
A	0	0	2.0	2.5	2.0	0.0	6.5
B	5	3.5	2.0	2.5	2.0	1.0	9.0
C	11	7.7	2.0	2.5	2.0	2.2	12.0
D	12	8.4	2.0	2.5	2.0	2.4	12.5
E	13	9.1	2.0	2.5	2.0	2.6	13.0
F	14	9.8	2.0	2.5	2.0	2.8	13.5

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Actual Expenditure, Planned Expenditure, and Real GDP

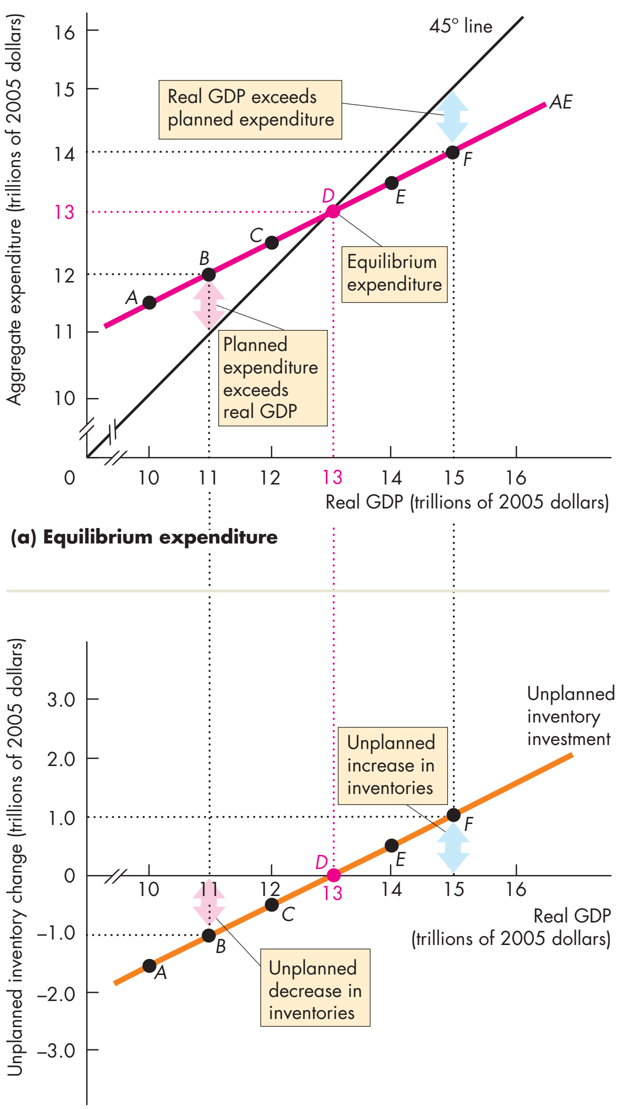
Actual aggregate expenditure is always equal to real GDP, as we saw in Chapter 4 (p. 86). But aggregate *planned* expenditure is not always equal to actual aggregate expenditure and therefore is not always equal to real GDP. How can actual expenditure and planned expenditure differ? The answer is that firms can end up with inventories that are greater or smaller than planned. People carry out their consumption expenditure plans, the government implements its planned expenditure on goods and services, and net exports are as planned. Firms carry out their plans to purchase new buildings, plant, and equipment. But one component of investment is the change in firms' inventories. If aggregate planned expenditure is less than real GDP, firms sell less than they planned to sell and end up with unplanned inventories. If aggregate planned expenditure exceeds real GDP, firms sell more than they planned to sell and end up with inventories being too low.

Equilibrium Expenditure

Equilibrium expenditure is the level of aggregate expenditure that occurs when aggregate *planned* expenditure equals real GDP. Equilibrium expenditure is a level of aggregate expenditure and real GDP at which spending plans are fulfilled. At a given price level, equilibrium expenditure determines real GDP. When aggregate planned expenditure and actual aggregate expenditure are unequal, a process of convergence toward equilibrium expenditure occurs. Throughout this process, real GDP adjusts. Let's examine equilibrium expenditure and the process that brings it about.

Figure 11.4(a) illustrates equilibrium expenditure. The table sets out aggregate planned expenditure at various levels of real GDP. These values are plotted as

FIGURE 11.4 Equilibrium Expenditure



(a) Equilibrium expenditure

(b) Unplanned inventory changes

	Real GDP (*Y*)	Aggregate planned expenditure (*AE*)	Unplanned inventory change (*Y* – *AE*)
		(trillions of 2005 dollars)	
A	10	11.5	–1.5
B	11	12.0	–1.0
C	12	12.5	–0.5
D	**13**	**13.0**	**0**
E	14	13.5	0.5
F	15	14.0	1.0

The table shows expenditure plans at different levels of real GDP. When real GDP is $13 trillion, aggregate planned expenditure equals real GDP.

Part (a) of the figure illustrates equilibrium expenditure, which occurs when aggregate planned expenditure equals real GDP at the intersection of the 45° line and the *AE* curve. Part (b) of the figure shows the forces that bring about equilibrium expenditure. When aggregate planned expenditure exceeds real GDP, inventories decrease—for example, at point *B* in both parts of the figure. Firms increase production, and real GDP increases.

When aggregate planned expenditure is less than real GDP, inventories increase—for example, at point *F* in both parts of the figure. Firms decrease production, and real GDP decreases. When aggregate planned expenditure equals real GDP, there are no unplanned inventory changes and real GDP remains constant at equilibrium expenditure.

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points *A* through *F* along the *AE* curve. The 45° line shows all the points at which aggregate planned expenditure equals real GDP. So where the *AE* curve lies above the 45° line, aggregate planned expenditure exceeds real GDP; where the *AE* curve lies below the 45° line, aggregate planned expenditure is less than real GDP; and where the *AE* curve intersects the 45° line, aggregate planned expenditure equals real GDP. Point *D* illustrates equilibrium expenditure. At this point, real GDP is $13 trillion.

Convergence to Equilibrium

What are the forces that move aggregate expenditure toward its equilibrium level? To answer this question, we must look at a situation in which aggregate expenditure is away from its equilibrium level.

From Below Equilibrium Suppose that in Fig. 11.4, real GDP is $11 trillion. With real GDP at $11 trillion, actual aggregate expenditure is also $11 trillion. But aggregate *planned* expenditure is $12 trillion, point *B* in Fig. 11.4(a). Aggregate planned expenditure exceeds *actual* expenditure. When people spend $12 trillion and firms produce goods and services worth $11 trillion, firms' inventories fall by $1 trillion, point *B* in Fig. 11.4(b). Because the change in inventories is part of investment, *actual* investment is $1 trillion less than *planned* investment.

Real GDP doesn't remain at $11 trillion for very long. Firms have inventory targets based on their sales. When inventories fall below target, firms increase production to restore inventories to the target level. To increase inventories, firms hire additional labor and increase production. Suppose that they increase production in the next period by $1 trillion. Real GDP increases by $1.0 trillion to $12.0 trillion. But again, aggregate planned expenditure exceeds real GDP. When real GDP is $12.0 trillion, aggregate planned expenditure is $12.5 trillion, point *C* in Fig. 11.4(a). Again, inventories decrease, but this time by less than before. With real GDP of $12.0 trillion and aggregate planned expenditure of $12.5 trillion, inventories decrease by $0.5 trillion, point *C* in Fig. 11.4(b). Again, firms hire additional labor and production increases; real GDP increases yet further.

The process that we've just described—planned expenditure exceeds real GDP, inventories decrease, and production increases to restore inventories—ends when real GDP has reached $13 trillion. At this real GDP, there is equilibrium. Unplanned inventory changes are zero. Firms do not change their production.

From Above Equilibrium If in Fig. 11.4, real GDP is $15 trillion, the process that we've just described works in reverse. With real GDP at $15 trillion, actual aggregate expenditure is also $15 trillion. But aggregate planned expenditure is $14 trillion, point *F* in Fig. 11.4(a). Actual expenditure exceeds planned expenditure. When people spend $14 trillion and firms produce goods and services worth $15 trillion, firms' inventories rise by $1 trillion, point *F* in Fig. 11.4(b). Now, real GDP begins to fall. As long as actual expenditure exceeds planned expenditure, inventories rise, and production decreases. Again, the process ends when real GDP has reached $13 trillion, the equilibrium at which unplanned inventory changes are zero and firms do not change their production.

REVIEW QUIZ

1. What is the relationship between aggregate planned expenditure and real GDP at equilibrium expenditure?
2. How does equilibrium expenditure come about? What adjusts to achieve equilibrium?
3. If real GDP and aggregate expenditure are less than equilibrium expenditure, what happens to firms' inventories? How do firms change their production? And what happens to real GDP?
4. If real GDP and aggregate expenditure are greater than equilibrium expenditure, what happens to firms' inventories? How do firms change their production? And what happens to real GDP?

You can work these questions in Study Plan 11.2 and get instant feedback. myeconlab

We've learned that when the price level is fixed, real GDP is determined by equilibrium expenditure. And we have seen how unplanned changes in inventories and the production response they generate bring a convergence toward equilibrium expenditure. We're now going to study *changes* in equilibrium expenditure and discover an economic amplifier called the *multiplier*.

The Multiplier

Investment and exports can change for many reasons. A fall in the real interest rate might induce firms to increase their planned investment. A wave of innovation, such as occurred with the spread of multimedia computers in the 1990s, might increase expected future profits and lead firms to increase their planned investment. An economic boom in Western Europe and Japan might lead to a large increase in their expenditure on U.S.-produced goods and services—on U.S. exports. These are all examples of increases in autonomous expenditure.

When autonomous expenditure increases, aggregate expenditure increases and so does equilibrium expenditure and real GDP. But the increase in real GDP is *larger* than the change in autonomous expenditure. The **multiplier** is the amount by which a change in autonomous expenditure is magnified or multiplied to determine the change in equilibrium expenditure and real GDP.

To get the basic idea of the multiplier, we'll work with an example economy in which there are no income taxes and no imports. So we'll first assume that these factors are absent. Then, when you understand the basic idea, we'll bring these factors back into play and see what difference they make to the multiplier.

The Basic Idea of the Multiplier

Suppose that investment increases. The additional expenditure by businesses means that aggregate expenditure and real GDP increase. The increase in real GDP increases disposable income, and with no income taxes, real GDP and disposable income increase by the same amount. The increase in disposable income brings an increase in consumption expenditure. And the increased consumption expenditure adds even more to aggregate expenditure. Real GDP and disposable income increase further, and so does consumption expenditure. The initial increase in investment brings an even bigger increase in aggregate expenditure because it induces an increase in consumption expenditure. The magnitude of the increase in aggregate expenditure that results from an increase in autonomous expenditure is determined by the *multiplier*.

The table in Fig. 11.5 sets out an aggregate planned expenditure schedule. Initially, when real GDP is $12 trillion, aggregate planned expenditure is $12.25 trillion. For each $1 trillion increase in real GDP, aggregate planned expenditure increases by $0.75 trillion. This aggregate expenditure schedule is shown in the figure as the aggregate expenditure curve AE_0. Initially, equilibrium expenditure is $13 trillion. You can see this equilibrium in row *B* of the table and in the figure where the curve AE_0 intersects the 45° line at the point marked *B*.

Now suppose that autonomous expenditure increases by $0.5 trillion. What happens to equilibrium expenditure? You can see the answer in Fig. 11.5. When this increase in autonomous expenditure is added to the original aggregate planned expenditure, aggregate planned expenditure increases by $0.5 trillion at each level of real GDP. The new aggregate expenditure curve is AE_1. The new equilibrium expenditure, highlighted in the table (row *D*'), occurs where AE_1 intersects the 45° line and is $15 trillion (point *D*'). At this real GDP, aggregate planned expenditure equals real GDP.

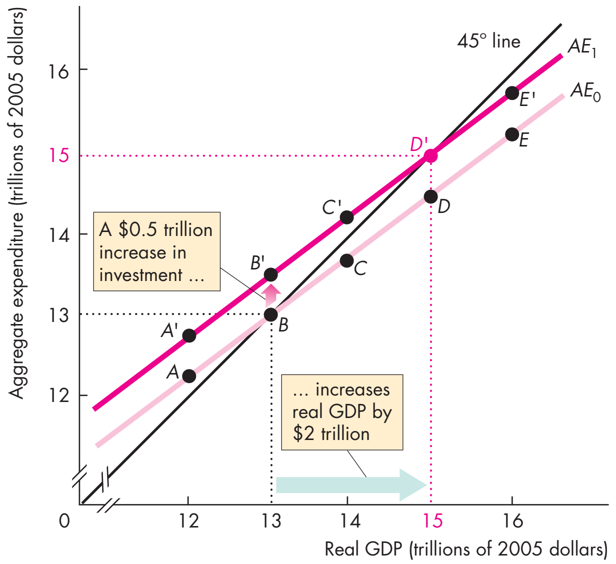
The Multiplier Effect

In Fig. 11.5, the increase in autonomous expenditure of $0.5 trillion increases equilibrium expenditure by $2 trillion. That is, the change in autonomous expenditure leads, like Alicia Keys' electronic equipment, to an amplified change in equilibrium expenditure. This amplified change is the *multiplier effect*—equilibrium expenditure increases by *more than* the increase in autonomous expenditure. The multiplier is greater than 1.

Initially, when autonomous expenditure increases, aggregate planned expenditure exceeds real GDP. As a result, inventories decrease. Firms respond by increasing production so as to restore their inventories to the target level. As production increases, so does real GDP. With a higher level of real GDP, *induced expenditure* increases. Equilibrium expenditure increases by the sum of the initial increase in autonomous expenditure and the increase in induced expenditure. In this example, equilibrium expenditure increases by $2 trillion following the increase in autonomous expenditure of $0.5 trillion, so induced expenditure increases by $1.5 trillion.

Although we have just analyzed the effects of an *increase* in autonomous expenditure, this analysis also applies to a decrease in autonomous expenditure. If initially the aggregate expenditure curve is AE_1, equilibrium expenditure and real GDP are $15 trillion. A decrease in autonomous expenditure of $0.5 trillion shifts the aggregate expenditure curve downward by

FIGURE 11.5 The Multiplier



	Aggregate planned expenditure			
Real GDP (Y)	**Original (AE_0)**		**New (AE_1)**	
(trillions of 2005 dollars)				
12	*A*	12.25	*A'*	12.75
13	***B***	**13.00**	*B'*	13.50
14	*C*	13.75	*C'*	14.25
15	*D*	14.50	***D'***	**15.00**
16	*E*	15.25	*E'*	15.75

A $0.5 trillion increase in autonomous expenditure shifts the *AE* curve upward by $0.5 trillion from AE_0 to AE_1. Equilibrium expenditure increases by $2 trillion from $13 trillion to $15 trillion. The increase in equilibrium expenditure is 4 times the increase in autonomous expenditure, so the multiplier is 4.

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$0.5 trillion to AE_0. Equilibrium expenditure decreases from $15 trillion to $13 trillion. The decrease in equilibrium expenditure ($2 trillion) is larger than the decrease in autonomous expenditure that brought it about ($0.5 trillion).

Why Is the Multiplier Greater Than 1?

We've seen that equilibrium expenditure increases by more than the increase in autonomous expenditure. This makes the multiplier greater than 1. How come? Why does equilibrium expenditure increase by more than the increase in autonomous expenditure?

The multiplier is greater than 1 because induced expenditure increases—an increase in autonomous expenditure *induces* further increases in expenditure. The NASA space shuttle program costs about $5 billion a year. This expenditure adds $5 billion a year directly to real GDP. But that is not the end of the story. Astronauts and engineers now have more income, and they spend part of the extra income on goods and services. Real GDP now rises by the initial $5 billion plus the extra consumption expenditure induced by the $5 billion increase in income. The producers of cars, flat-screen TVs, vacations, and other goods and services now have increased incomes, and they, in turn, spend part of the increase in their incomes on consumption goods and services. Additional income induces additional expenditure, which creates additional income.

How big is the multiplier effect?

The Size of the Multiplier

Suppose that the economy is in a recession. Profit prospects start to look better, and firms are planning a large increase in investment. The world economy is also heading toward expansion. The question on everyone's lips is: How strong will the expansion be? This is a hard question to answer, but an important ingredient in the answer is the size of the multiplier.

The *multiplier* is the amount by which a change in autonomous expenditure is multiplied to determine the change in equilibrium expenditure that it generates. To calculate the multiplier, we divide the change in equilibrium expenditure by the change in autonomous expenditure.

Let's calculate the multiplier for the example in Fig. 11.5. Initially, equilibrium expenditure is $13 trillion. Then autonomous expenditure increases by $0.5 trillion, and equilibrium expenditure increases by $2 trillion, to $15 trillion. Then

$$\text{Multiplier} = \frac{\text{Change in equilibrium expenditure}}{\text{Change in autonomous expenditure}}$$

$$\text{Multiplier} = \frac{\$2 \text{ trillion}}{\$0.5 \text{ trillion}} = 4.$$

The Multiplier and the Slope of the *AE* Curve

The magnitude of the multiplier depends on the slope of the *AE* curve. In Fig. 11.6, the *AE* curve in part (a) is steeper than the *AE* curve in part (b), and the multiplier is larger in part (a) than in part (b). To see why, let's do a calculation.

Aggregate expenditure and real GDP change because induced expenditure and autonomous expenditure change. The change in real GDP (ΔY) equals the change in induced expenditure (ΔN) plus the change in autonomous expenditure (ΔA). That is,

$$\Delta Y = \Delta N + \Delta A.$$

But the change in induced expenditure is determined by the change in real GDP and the slope of the *AE* curve. To see why, begin with the fact that the slope of the *AE* curve equals the "rise," ΔN, divided by the "run," ΔY. That is,

$$\text{Slope of } AE \text{ curve} = \Delta N \div \Delta Y.$$

So

$$\Delta N = \text{Slope of } AE \text{ curve} \times \Delta Y.$$

Now, use this equation to replace ΔN in the first equation above to give

$$\Delta Y = \text{Slope of } AE \text{ curve} \times \Delta Y + \Delta A.$$

Now, solve for ΔY as

$$(1 - \text{Slope of } AE \text{ curve}) \times \Delta Y = \Delta A$$

and rearrange to give

$$\Delta Y = \frac{\Delta A}{1 - \text{Slope of } AE \text{ curve}}.$$

Finally, divide both sides of this equation by ΔA to give

$$\text{Multiplier} = \frac{\Delta Y}{\Delta A} = \frac{1}{1 - \text{Slope of } AE \text{ curve}}.$$

If we use the example in Fig. 11.5, the slope of the *AE* curve is 0.75, so

$$\text{Multiplier} = \frac{1}{1 - 0.75} = \frac{1}{0.25} = 4.$$

Where there are no income taxes and no imports, the slope of the *AE* curve equals the marginal propensity to consume (*MPC*). So

$$\text{Multiplier} = \frac{1}{1 - MPC}.$$

But (1 – *MPC*) equals *MPS*. So another formula is

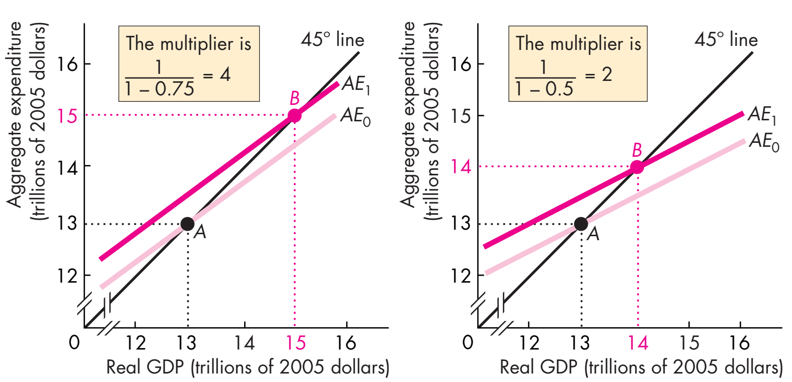
$$\text{Multiplier} = \frac{1}{MPS}.$$

Again using the numbers in Fig. 11.5, we have

$$\text{Multiplier} = \frac{1}{0.25} = 4.$$

Because the marginal propensity to save (*MPS*) is a fraction—a number between 0 and 1—the multiplier is greater than 1.

FIGURE 11.6 The Multiplier and the Slope of the *AE* Curve



(a) Multiplier is 4 **(b) Multiplier is 2**

Imports and income taxes make the *AE* curve less steep and reduce the value of the multiplier. In part (a), with no imports and no income taxes, the slope of the *AE* curve is 0.75 (the marginal propensity to consume) and the multiplier is 4. But with imports and income taxes, the slope of the *AE* curve is less than the marginal propensity to consume. In part (b), the slope of the *AE* curve is 0.5. In this case, the multiplier is 2.

Imports and Income Taxes

Imports and income taxes influence the size of the multiplier and make it smaller than it otherwise would be.

To see why imports make the multiplier smaller, think about what happens following an increase in investment. The increase in investment increases real GDP, which in turn increases consumption expenditure. But part of the increase in expenditure is on imported goods and services. Only expenditure on U.S.-produced goods and services increases U.S. real GDP. The larger the marginal propensity to import, the smaller is the change in U.S. real GDP. The Mathematical Note on pp. 286–289 shows the effects of imports and income taxes on the multiplier.

Income taxes also make the multiplier smaller than it otherwise would be. Again, think about what happens following an increase in investment. The increase in investment increases real GDP. Income tax payments increase so disposable income increases by less than the increase in real GDP and consumption expenditure increases by less than it would if taxes had not changed. The larger the income tax rate, the smaller is the change in real GDP.

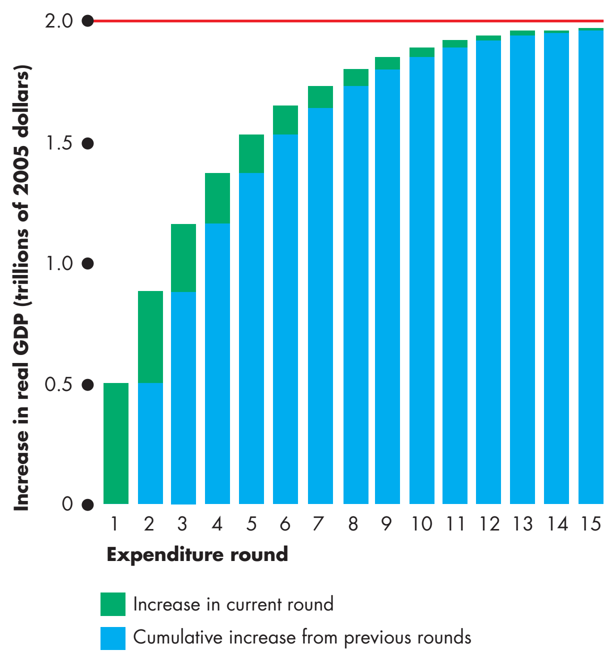
The marginal propensity to import and the income tax rate together with the marginal propensity to consume determine the multiplier. And their combined influence determines the slope of the *AE* curve.

Over time, the value of the multiplier changes as tax rates change and as the marginal propensity to consume and the marginal propensity to import change. These ongoing changes make the multiplier hard to predict. But they do not change the fundamental fact that an initial change in autonomous expenditure leads to a magnified change in aggregate expenditure and real GDP.

The Multiplier Process

The multiplier effect isn't a one-shot event. It is a process that plays out over a few months. Figure 11.7 illustrates the multiplier process. Autonomous expenditure increases by $0.5 trillion and real GDP increases by $0.5 trillion (the green bar in round 1). This increase in real GDP increases induced expenditure in round 2. With the slope of the *AE* curve equal to 0.75, induced expenditure increases by 0.75 times the increase in real GDP, so the increase in real GDP of $0.5 trillion induces a further increase in expenditure of $0.375 trillion. This change in induced expenditure (the green bar in round 2) when added to the previous increase in expenditure (the blue bar in round 2) increases real GDP by $0.875 trillion. The round 2 increase in real GDP induces a round 3 increase in induced expenditure. The process repeats through successive rounds. Each increase in real GDP is 0.75 times the previous increase and eventually real GDP increases by $2 trillion.

FIGURE 11.7 The Multiplier Process



Autonomous expenditure increases by $0.5 trillion. In round 1, real GDP increases by the same amount. With the slope of the *AE* curve equal to 0.75, each additional dollar of real GDP induces an additional 0.75 of a dollar of induced expenditure. The round 1 increase in real GDP brings an increase in induced expenditure of $0.375 trillion in round 2. At the end of round 2, real GDP has increased by $0.875 trillion. The extra $0.375 trillion of real GDP in round 2 brings a further increase in induced expenditure of $0.281 trillion in round 3. At the end of round 3, real GDP has increased by $1.156 trillion. This process continues with real GDP increasing by ever-smaller amounts. When the process comes to an end, real GDP has increased by a total of $2 trillion.

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Economics in Action

The Multiplier in the Great Depression

The aggregate expenditure model and its multiplier were developed during the 1930s by John Maynard Keynes to understand the most traumatic event in economic history, the *Great Depression*.

In 1929, the U.S. and global economies were booming. U.S. real GDP and real GDP per person had never been higher. By 1933, real GDP had fallen to 73 percent of its 1929 level and more than a quarter of the labor force was unemployed.

The table shows the GDP numbers and components of aggregate expenditure in 1929 and 1933.

	1929		1933	
	(billions of 1929 dollars)			
Induced consumption	47		34	
Induced imports	–6		–4	
Induced expenditure		41		30
Autonomous consumption	30		30	
Investment	17		3	
Government expenditure	10		10	
Exports	6		3	
Autonomous expenditure		63		46
GDP		**104**		**76**

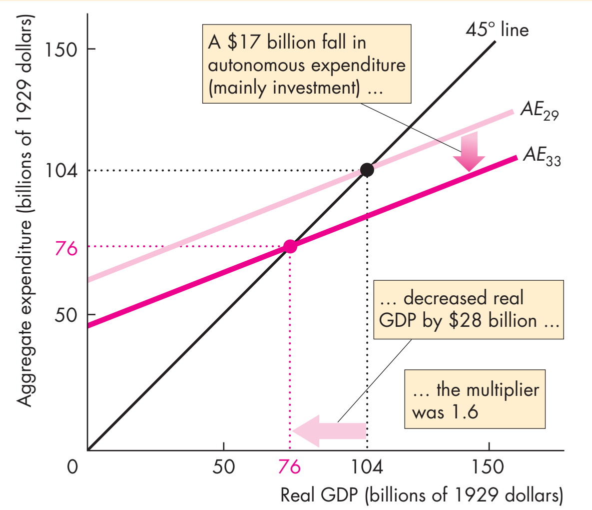
Source of data: Bureau of Economic Analysis.

Autonomous expenditure collapsed as investment fell from \$17 billion to \$3 billion and exports fell by a large amount. Government expenditure held steady.

The figure uses the *AE* model to illustrate the Great Depression. In 1929, with autonomous expenditure of \$63 billion, the *AE* curve was AE_{29}. Equilibrium expenditure and real GDP were \$104 billion.

By 1933, autonomous expenditure had fallen by \$17 billion to \$46 billion and the *AE* curve had shifted downward to AE_{33}. Equilibrium expenditure and real GDP had fallen to \$76 billion.

The decrease in autonomous expenditure of \$17 billion brought a decrease in real GDP of \$28 billion. The multiplier was \$28/\$17 = 1.6. The slope of the *AE* curve is 0.39—the fall in induced expenditure, \$11 billion, divided by the fall in real GDP, \$28 billion. The multiplier formula, 1/(1 – Slope of *AE* curve), delivers a multiplier equal to 1.6.



Aggregate Expenditure in the Great Depression

Business Cycle Turning Points

At business cycle turning points, the economy moves from expansion to recession or from recession to expansion. Economists understand these turning points as seismologists understand earthquakes. They know quite a lot about the forces and mechanisms that produce them, but they can't predict them. The forces that bring business cycle turning points are the swings in autonomous expenditure, such as investment and exports. The multiplier that you've just studied is the mechanism that gives momentum to the economy's new direction.

REVIEW QUIZ

1. What is the multiplier? What does it determine? Why does it matter?
2. How do the marginal propensity to consume, the marginal propensity to import, and the income tax rate influence the multiplier?
3. How do fluctuations in autonomous expenditure influence real GDP?

You can work these questions in Study Plan 11.3 and get instant feedback.

The Multiplier and the Price Level

We have just considered adjustments in spending that occur in the very short run when the price level is fixed. In this time frame, the economy's cobblestones, which are changes in investment and exports, are not smoothed by shock absorbers like those on Michael Bloomberg's car. Instead, they are amplified like Alicia Keys' voice. But these outcomes occur only when the price level is fixed. We now investigate what happens after a long enough time lapse for the price level to change.

Adjusting Quantities and Prices

When firms can't keep up with sales and their inventories fall below target, they increase production, but at some point, they raise their prices. Similarly, when firms find unwanted inventories piling up, they decrease production, but eventually they cut their prices. So far, we've studied the macroeconomic consequences of firms changing their production levels when their sales change, but we haven't looked at the effects of price changes. When individual firms change their prices, the economy's price level changes.

To study the simultaneous determination of real GDP and the price level, we use the *AS-AD model*, which is explained in Chapter 10. But to understand how aggregate demand adjusts, we need to work out the connection between the *AS-AD* model and the aggregate expenditure model that we've used in this chapter. The key to understanding the relationship between these two models is the distinction between the aggregate *expenditure* and aggregate *demand* and the related distinction between the aggregate *expenditure curve* and the aggregate *demand curve*.

Aggregate Expenditure and Aggregate Demand

The aggregate expenditure curve is the relationship between the aggregate planned expenditure and real GDP, all other influences on aggregate planned expenditure remaining the same. The aggregate demand curve is the relationship between the aggregate quantity of goods and services demanded and the price level, all other influences on aggregate demand remaining the same. Let's explore the links between these two relationships.

Deriving the Aggregate Demand Curve

When the price level changes, aggregate planned expenditure changes and the quantity of real GDP demanded changes. The aggregate demand curve slopes downward. Why? There are two main reasons:

- Wealth effect
- Substitution effects

Wealth Effect Other things remaining the same, the higher the price level, the smaller is the purchasing power of wealth. For example, suppose you have \$100 in the bank and the price level is 105. If the price level rises to 125, your \$100 buys fewer goods and services. You are less wealthy. With less wealth, you will probably want to try to spend a bit less and save a bit more. The higher the price level, other things remaining the same, the lower is aggregate planned expenditure.

Substitution Effects For a given expected future price level, a rise in the price level today makes current goods and services more expensive relative to future goods and services and results in a delay in purchases—an *intertemporal substitution*. A rise in the U.S. price level, other things remaining the same, makes U.S.-produced goods and services more expensive relative to foreign-produced goods and services. As a result, U.S. imports increase and U.S. exports decrease—an *international substitution*.

When the price level rises, each of these effects reduces aggregate planned expenditure at each level of real GDP. As a result, when the price level *rises*, the aggregate expenditure curve shifts *downward*. A fall in the price level has the opposite effect. When the price level *falls*, the aggregate expenditure curve shifts *upward*.

Figure 11.8(a) shows the shifts of the *AE* curve. When the price level is 110, the aggregate expenditure curve is AE_0, which intersects the 45° line at point *B*. Equilibrium expenditure is \$13 trillion. If the price level increases to 130, the aggregate expenditure curve shifts downward to AE_1, which intersects the 45° line at point *A*. Equilibrium expenditure decreases to \$12 trillion. If the price level decreases to 90, the aggregate expenditure curve shifts upward to AE_2, which intersects the 45° line at point *C*. Equilibrium expenditure increases to \$14 trillion.

We've just seen that when the price level changes, other things remaining the same, the aggregate expenditure curve shifts and the equilibrium expenditure changes. But when the price level changes, other things remaining the same, there is a movement along the aggregate demand curve.

Figure 11.8(b) shows the movements along the aggregate demand curve. At a price level of 110, the aggregate quantity of goods and services demanded is \$13 trillion—point *B* on the *AD* curve. If the price level rises to 130, the aggregate quantity of goods and services demanded decreases to \$12 trillion. There is a movement up along the aggregate demand curve to point *A*. If the price level falls to 90, the aggregate quantity of goods and services demanded increases to \$14 trillion. There is a movement down along the aggregate demand curve to point *C*.

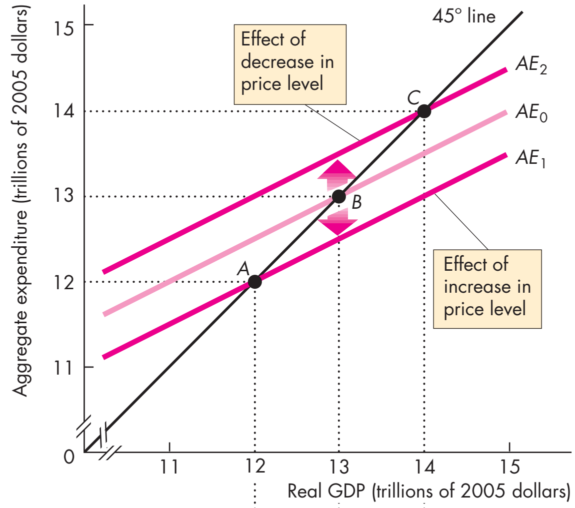
Each point on the aggregate demand curve corresponds to a point of equilibrium expenditure. The equilibrium expenditure points *A, B,* and *C* in Fig. 11.8(a) correspond to the points *A, B,* and *C* on the aggregate demand curve in Fig. 11.8(b).

Changes in Aggregate Expenditure and Aggregate Demand

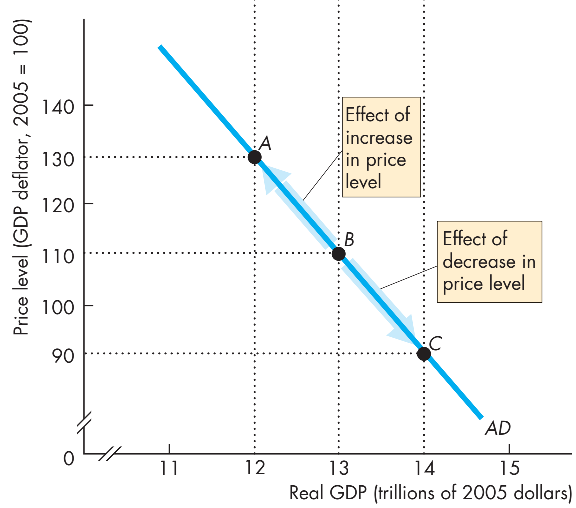
When any influence on aggregate planned expenditure other than the price level changes, both the aggregate expenditure curve and the aggregate demand curve shift. For example, an increase in investment or exports increases both aggregate planned expenditure and aggregate demand and shifts both the *AE* curve and the *AD* curve. Figure 11.9 illustrates the effect of such an increase.

Initially, the aggregate expenditure curve is AE_0 in part (a) and the aggregate demand curve is AD_0 in part (b). The price level is 110, real GDP is \$13 trillion, and the economy is at point *A* in both parts of Fig. 11.9. Now suppose that investment increases by \$1 trillion. At a constant price level of 110, the aggregate expenditure curve shifts upward to AE_1. This curve intersects the 45° line at an equilibrium expenditure of \$15 trillion (point *B*). This equilibrium expenditure of \$15 trillion is the aggregate quantity of goods and services demanded at a price level of 110, as shown by point *B* in part (b). Point *B* lies on

FIGURE 11.8 Equilibrium Expenditure and Aggregate Demand



(a) Equilibrium expenditure



(b) Aggregate demand

A change in the price level *shifts* the *AE* curve and results in a *movement along* the *AD* curve. When the price level is 110, the *AE* curve is AE_0 and equilibrium expenditure is \$13 trillion at point *B*. When the price level rises to 130, the *AE* curve is AE_1 and equilibrium expenditure is \$12 trillion at point *A*. When the price level falls to 90, the *AE* curve is AE_2 and equilibrium expenditure is \$14 trillion at point *C*. Points *A, B,* and *C* on the *AD* curve in part (b) correspond to the equilibrium expenditure points *A, B,* and *C* in part (a).

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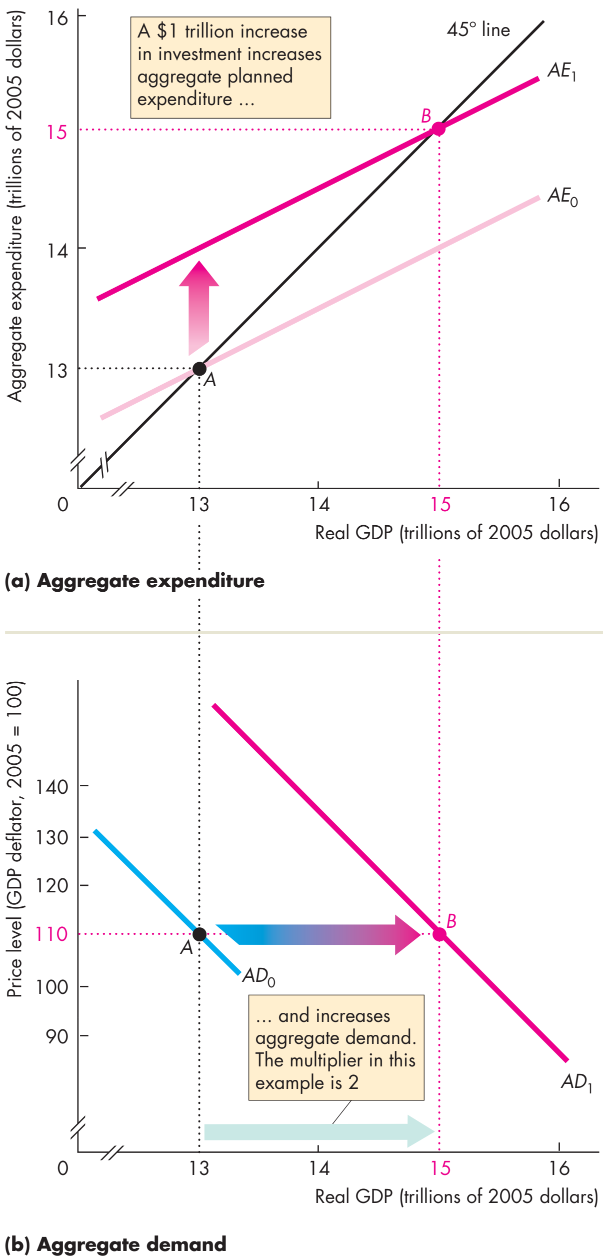
FIGURE 11.9 A Change in Aggregate Demand



The price level is 110. When the aggregate expenditure curve is AE_0 in part (a), the aggregate demand curve is AD_0 in part (b). An increase in autonomous expenditure shifts the *AE* curve upward to AE_1. In the new equilibrium, real GDP is $15 trillion (at point *B*). Because the quantity of real GDP demanded at a price level of 110 increases to $15 trillion, the *AD* curve shifts rightward to AD_1.

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a new aggregate demand curve. The aggregate demand curve has shifted rightward to AD_1.

But how do we know by how much the *AD* curve shifts? The multiplier determines the answer. The larger the multiplier, the larger is the shift in the aggregate demand curve that results from a given change in autonomous expenditure. In this example, the multiplier is 2. A $1 trillion increase in investment produces a $2 trillion increase in the aggregate quantity of goods and services demanded at each price level. That is, a $1 trillion increase in autonomous expenditure shifts the aggregate demand curve rightward by $2 trillion.

A decrease in autonomous expenditure shifts the aggregate expenditure curve downward and shifts the aggregate demand curve leftward. You can see these effects by reversing the change that we've just described. If the economy is initially at point *B* on the aggregate expenditure curve AE_1 and on the aggregate demand curve AD_1, a decrease in autonomous expenditure shifts the aggregate expenditure curve downward to AE_0. The aggregate quantity of goods and services demanded decreases from $15 trillion to $13 trillion, and the aggregate demand curve shifts leftward to AD_0.

Let's summarize what we have just discovered:

If some factor other than a change in the price level increases autonomous expenditure, the *AE* curve shifts upward and the *AD* curve shifts rightward. The size of the *AD* curve shift equals the change in autonomous expenditure multiplied by the multiplier.

Equilibrium Real GDP and the Price Level

In Chapter 10, we learned that aggregate demand and short-run aggregate supply determine equilibrium real GDP and the price level. We've now put aggregate demand under a more powerful microscope and have discovered that a change in investment (or in any component of autonomous expenditure) changes aggregate demand and shifts the aggregate demand curve. The magnitude of the shift depends on the multiplier. But whether a change in autonomous expenditure results ultimately in a change in real GDP, a change in the price level, or a combination of the two depends on aggregate supply. There are two time frames to consider: the short run and the long run. First we'll see what happens in the short run.

An Increase in Aggregate Demand in the Short Run

Figure 11.10 describes the economy. Initially, in part (a), the aggregate expenditure curve is AE_0 and equilibrium expenditure is \$13 trillion—point *A*. In part (b), aggregate demand is AD_0 and the short-run aggregate supply curve is *SAS*. (Chapter 10, pp. 243–245, explains the *SAS* curve.) Equilibrium is at point *A* in part (b), where the aggregate demand and short-run aggregate supply curves intersect. The price level is 110, and real GDP is \$13 trillion.

Now suppose that investment increases by \$1 trillion. With the price level fixed at 110, the aggregate expenditure curve shifts upward to AE_1. Equilibrium expenditure increases to \$15 trillion—point *B* in part (a). In part (b), the aggregate demand curve shifts rightward by \$2 trillion, from AD_0 to AD_1. How far the aggregate demand curve shifts is determined by the multiplier when the price level is fixed.

But with this new aggregate demand curve, the price level does not remain fixed. The price level rises, and as it does, the aggregate expenditure curve shifts downward. The short-run equilibrium occurs when the aggregate expenditure curve has shifted downward to AE_2 and the new aggregate demand curve, AD_1, intersects the short-run aggregate supply curve at point *C* in both part (a) and part (b). Real GDP is \$14.3 trillion, and the price level is 123.

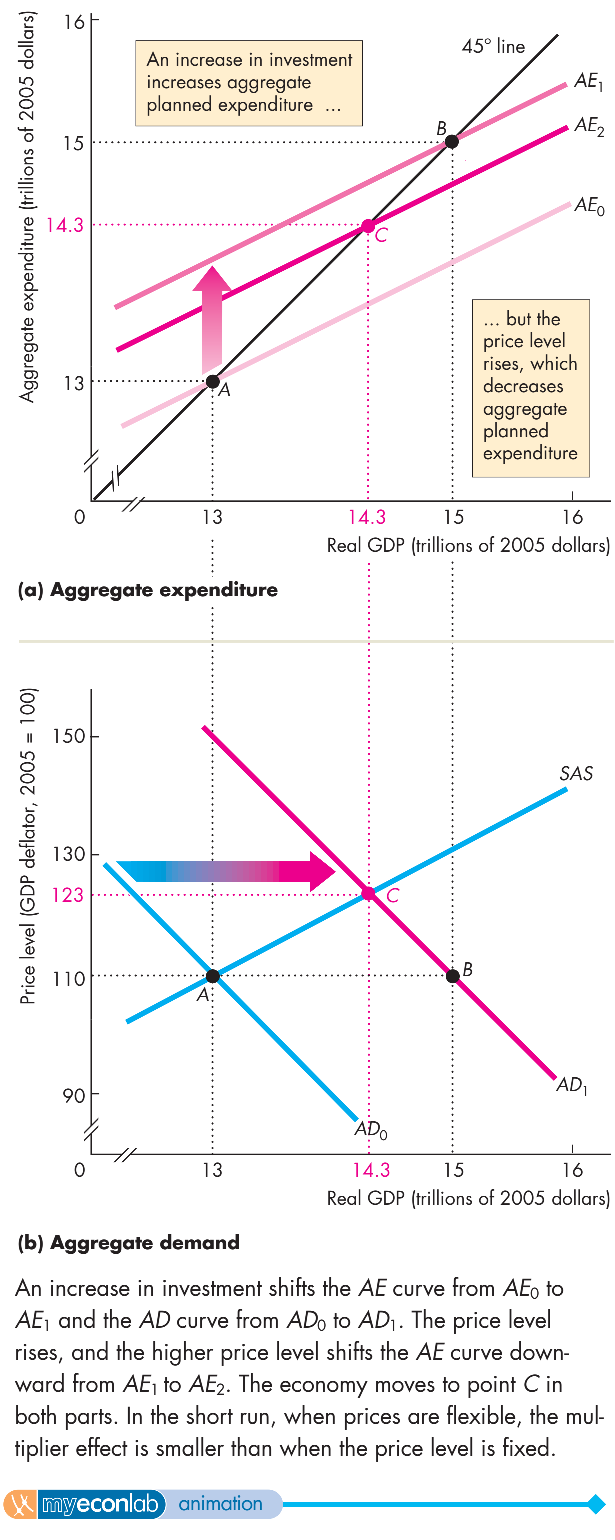
When price level effects are taken into account, the increase in investment still has a multiplier effect on real GDP, but the multiplier is smaller than it would be if the price level were fixed. The steeper the slope of the short-run aggregate supply curve, the larger is the increase in the price level and the smaller is the multiplier effect on real GDP.

An Increase in Aggregate Demand in the Long Run

Figure 11.11 illustrates the long-run effect of an increase in aggregate demand. In the long run, real GDP equals potential GDP and there is full employment. Potential GDP is \$13 trillion, and the long-run aggregate supply curve is *LAS*. Initially, the economy is at point *A* in parts (a) and (b).

Investment increases by \$1 trillion. In Fig. 11.11, the aggregate expenditure curve shifts to AE_1 and the aggregate demand curve shifts to AD_1. With no change in the price level, the economy would move to point *B* and real GDP would increase to \$15 trillion. But in the short run, the price level rises to 123 and real GDP increases to only \$14.3 trillion. With the higher price level, the *AE* curve shifts from AE_1 to

FIGURE 11.10 The Multiplier in the Short Run



An increase in investment shifts the *AE* curve from AE_0 to AE_1 and the *AD* curve from AD_0 to AD_1. The price level rises, and the higher price level shifts the *AE* curve downward from AE_1 to AE_2. The economy moves to point *C* in both parts. In the short run, when prices are flexible, the multiplier effect is smaller than when the price level is fixed.

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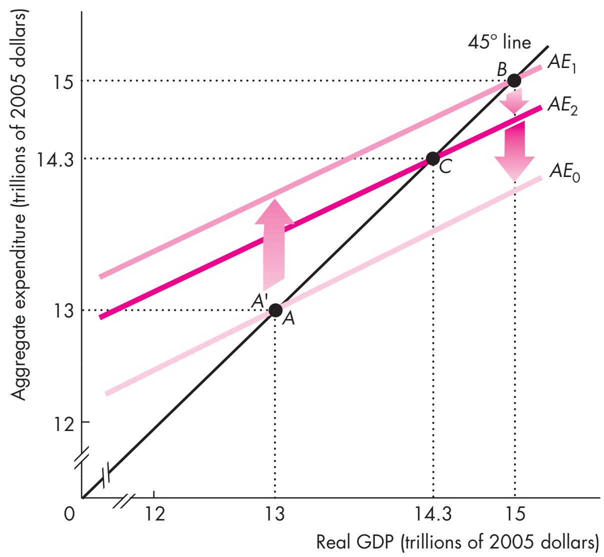
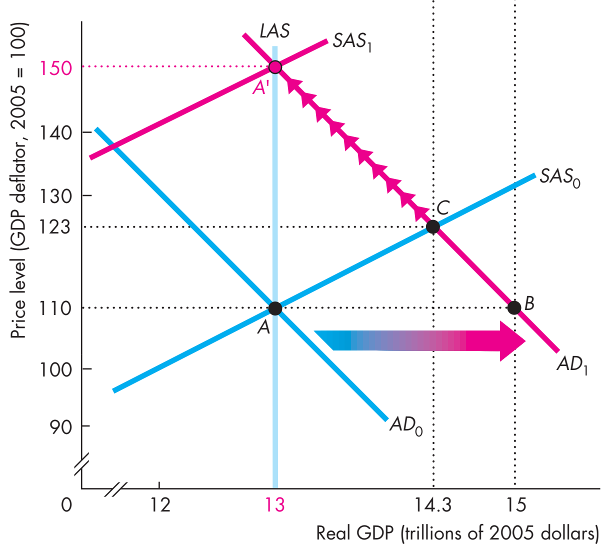
FIGURE 11.11 The Multiplier in the Long Run



(a) Aggregate expenditure



(b) Aggregate demand

Starting from point *A*, an increase in investment shifts the *AE* curve to AE_1 and the *AD* curve to AD_1. In the short run, the economy moves to point *C*. In the long run, the money wage rate rises and the *SAS* curve shifts to SAS_1. As the price level rises, the *AE* curve shifts back to AE_0 and the economy moves to point *A*'. In the long run, the multiplier is zero.

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AE_2. The economy is now in a short-run equilibrium at point *C* in both part (a) and part (b).

Real GDP now exceeds potential GDP. The labor force is more than fully employed, and in the long run, shortages of labor increase the money wage rate. The higher money wage rate increases firms' costs, which decreases short-run aggregate supply and shifts the *SAS* curve leftward to SAS_1. The price level rises further, and real GDP decreases. There is a movement along AD_1, and the *AE* curve shifts downward from AE_2 toward AE_0. When the money wage rate and the price level have increased by the same percentage, real GDP is again equal to potential GDP and the economy is at point *A*'. In the long run, the multiplier is zero.

REVIEW QUIZ

1. How does a change in the price level influence the *AE* curve and the *AD* curve?
2. If autonomous expenditure increases with no change in the price level, what happens to the *AE* curve and the *AD* curve? Which curve shifts by an amount that is determined by the multiplier and why?
3. How does an increase in autonomous expenditure change real GDP in the short run? Does real GDP change by the same amount as the change in aggregate demand? Why or why not?
4. How does real GDP change in the long run when autonomous expenditure increases? Does real GDP change by the same amount as the change in aggregate demand? Why or why not?

You can work these questions in Study Plan 11.4 and get instant feedback. myeconlab

You are now ready to build on what you've learned about aggregate expenditure fluctuations. We'll study the business cycle and the roles of fiscal policy and monetary policy in smoothing the cycle while achieving price stability and sustained economic growth. In Chapter 12 we study the U.S. business cycle and inflation, and in Chapters 13 and 14 we study fiscal policy and monetary policy, respectively. But before you leave the current topic, look at *Reading Between the Lines* on pp. 284–285 and see the aggregate expenditure model in action in the U.S. economy during 2009 and 2010.