**Chapter Key Ideas**

**Economic Amplifier or Shock Absorber?**

A. A voice can be a whisper or fill Central Park, depending on the amplification.
B. A limousine with good shock absorbers can ride smoothly over terrible potholes.
C. Investment and exports can fluctuate like the amplified voice, or the terrible potholes; does the economy react like a limousine, smoothing out the bumps, or like an amplifier, magnifying the fluctuations? These are the questions this chapter addresses.

**Outline**

I. Fixed Prices and Expenditure Plans

A. The Keynesian model of this chapter studies the economy in the very short run.
   1. In the very short run, prices are fixed and the aggregate amount that is sold depends only on the aggregate demand for goods and services.
   2. Therefore in this very short run, we focus on what makes aggregate demand fluctuate.

B. Expenditure Plans

   1. The four components of aggregate expenditure—consumption expenditure, investment, government purchases of goods and services, and net exports—sum to real GDP.
   2. **Aggregate planned expenditure** equals **planned consumption expenditure plus planned investment plus planned government purchases plus planned exports minus planned imports**.
   3. A **two-way link** exists between aggregate expenditure and real GDP:
      a) An increase in aggregate expenditure increases real GDP.
      b) Planned consumption expenditure and planned imports depend on real GDP, so an increase in real GDP increases aggregate planned expenditure.

C. Consumption Function and Saving Function

   1. Consumption and saving depend on the real interest rate, disposable income, wealth, and expected future income.
      a) **Disposable income** is aggregate income minus taxes plus transfer payments.
      b) To explore the two-way link between real GDP and planned consumption

---

* This is Chapter 29 in *Economics.*
expenditure, we focus on the relationship between consumption expenditure and disposable income when the other factors are constant.

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

3. Figure 13.1 illustrates the consumption function and the saving function.

### FIGURE 13.1 Consumption Function and Saving Function

<table>
<thead>
<tr>
<th>Disposable income (trillions of 2000 dollars per year)</th>
<th>Planned consumption expenditure</th>
<th>Planned saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<tr>
<td>B</td>
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<td>3.0</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>6.0</td>
</tr>
<tr>
<td>E</td>
<td>8</td>
<td>7.5</td>
</tr>
<tr>
<td>F</td>
<td>10</td>
<td>9.0</td>
</tr>
</tbody>
</table>

(a) Consumption function

(b) Saving function

### D. Marginal Propensities to Consume and Save

1. The marginal propensity to consume \((MPC)\) is the fraction of a change in disposable income that is consumed. It is calculated as the change in consumption expenditure, \(\Delta C\), divided by the change in disposable income, \(\Delta YD\), that brought it about. That is:

\[
MPC = \frac{\Delta C}{\Delta YD}.
\]

2. 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, \(\Delta S\), divided by the change in disposable income, \(\Delta YD\), that brought it about. That is:

\[
MPS = \frac{\Delta S}{\Delta YD}.
\]
3. The \( MPC \) plus the \( MPS \) equals one. To see why, note that,

\[
\Delta C + \Delta S = \Delta YD.
\]

Then divide this equation by \( \Delta YD \) to obtain,

\[
\frac{\Delta C}{\Delta YD} + \frac{\Delta S}{\Delta YD} = \frac{\Delta YD}{\Delta YD},
\]

which means that

\[
MPC + MPS = 1.
\]

E. Slopes and Marginal Propensities

1. Figure 13.2 shows that the \( MPC \) is the slope of the consumption function and the \( MPS \) is the slope of the saving function.
F. Other Influences on Consumption Expenditure and Saving

1. When an influence other than disposable income changes—the real interest rate, wealth, or expected future income—the consumption function and saving function shift.

2. Figure 13.3 illustrates shifts in the consumption function and the saving function.

![Figure 13.3 Shifts in the Consumption and Saving Functions](image)
G. The U.S. Consumption Function
1. Data for the United States show that the U.S. consumption function has shifted upward over time because economic growth has created greater wealth and higher expected future income.
2. Figure 13.4 illustrates for 1961 to 2003; the assumed MPC in the figure is 0.9.

H. Consumption as a Function of Real GDP
1. Disposable income changes when either real GDP changes or when net taxes change.
2. If tax rates don’t change, real GDP is the only influence on disposable income, so consumption expenditure is a function of real GDP.
3. We use this relationship to determine equilibrium expenditure.

I. Import Function
1. In the short run, imports are influenced primarily by U.S. real GDP.
2. The marginal propensity to import is the fraction of an increase in real GDP that is spent on imports. In recent years, NAFTA and increased integration in the global economy have increased U.S. imports. Removing the effects of these influences, the U.S. marginal propensity to import is probably about 0.2.

II. Real GDP with a Fixed Price Level
A. The relationship between aggregate planned expenditure and real GDP can be described by an aggregate planned expenditure schedule, which lists the level of aggregate expenditure planned at each level of real GDP, or by the aggregate planned expenditure curve, which is a graph of the aggregate planned expenditure schedule.
B. **Aggregate Planned Expenditure and Real GDP**

1. The table in Figure 13.5 shows how the aggregate planned expenditure schedule is constructed from the components of aggregate planned expenditure.

FIGURE 13.5 Aggregate Expenditure

![Graph showing the relationship between real GDP and aggregate expenditure](image)

### Table: Planned Expenditure

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<td>1.5</td>
<td>1.8</td>
<td>1.7</td>
<td>11.0</td>
</tr>
</tbody>
</table>

2. Consumption expenditure minus imports, which varies with real GDP, is **induced expenditure**.

3. The sum of investment, government purchases, and exports, which does not vary with GDP, is **autonomous expenditure**. (Consumption expenditure and imports also have an autonomous component.)

C. **Actual Expenditure, Planned Expenditure, and Real GDP**

1. *Actual* aggregate expenditure is always equal to real GDP.

2. Aggregate *planned* expenditure can differ from actual aggregate expenditure because firms can have *unplanned* changes in inventories.

D. **Equilibrium Expenditure**

1. **Equilibrium expenditure** is the level of aggregate expenditure that occurs when aggregate *planned* expenditure equals real GDP.
2. Figure 13.6 illustrates equilibrium expenditure, which occurs at the point at which the aggregate planned expenditure curve, $AE$, crosses the 45° line so that there are no unplanned changes in business inventories.

E. **Convergence to Equilibrium**

1. Figure 13.6 also illustrates the process of convergence toward equilibrium expenditure. If aggregate planned expenditure is greater than real GDP (the $AE$ curve is above the 45° line), an unplanned decrease in inventories induces firms to hire workers and increase production, so real GDP increases.

2. If aggregate planned expenditure is less than real GDP (the $AE$ curve is below the 45° line), an unplanned increase in inventories induces firms to fire workers and decrease production, so real GDP decreases.

3. If aggregate planned expenditure equals real GDP (the $AE$ curve intersects the 45° line), no unplanned changes in inventories occur, so firms maintain their current production and real GDP remains constant.
III. The Multiplier

A. 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.

B. The Basic Idea of the Multiplier

1. An increase in investment (or any other component of autonomous expenditure) increases aggregate expenditure and real GDP. The increase in real GDP then leads to an increase in induced expenditure.
2. The increase in induced expenditure leads to a further increase in aggregate expenditure and real GDP. So, real GDP increases by more than the initial increase in autonomous expenditure.
3. Figure 13.7 illustrates the multiplier.

C. The Multiplier Effect

1. The amplified change in real GDP that follows an increase in autonomous expenditure is the multiplier effect.
2. When autonomous expenditure increases, inventories have an unplanned decrease, so firms increase production and real GDP increases to a new equilibrium.

D. Why Is the Multiplier Greater than 1?
The multiplier is greater than 1 because an increase in autonomous expenditure induces further increases in expenditure.

E. The Size of the Multiplier

The size of the multiplier is the change in equilibrium expenditure divided by the change in autonomous expenditure.

F. The Multiplier and the Marginal Propensities to Consume and Save

1. Ignoring imports and income taxes, the marginal propensity to consume determines the magnitude of the multiplier.
2. The multiplier equals $1/(1 – \text{MPC})$ or, alternatively, $1/\text{MPS}$. 
3. Figure 13.8 illustrates the multiplier process and shows how the $MPC$ determines the magnitude of the amount of induced expenditure at each round as aggregate expenditure moves toward equilibrium expenditure.

G. Imports and Income Taxes

Income taxes and imports both reduce the size of the multiplier. Including income taxes and imports, the multiplier equals $1/(1 – \text{slope of the } AE \text{ curve})$. Figure 13.9 shows the relationship between the multiplier and the slope of the $AE$ curve.

H. Business Cycle Turning Points

1. Turning points in the business cycle—peaks and troughs—occur when autonomous expenditure changes.

2. A decrease in autonomous expenditure brings an unplanned increase in inventories, which triggers a recession.
3. An increase in autonomous expenditure brings an unplanned decrease in inventories, which triggers an expansion.

IV. The Multiplier and the Price Level

A. In the equilibrium expenditure model, the price level remains constant. But real firms don’t hold their prices constant for long. When they have an unplanned change in inventories, they change production and prices. And the price level changes when firms change prices. The aggregate supply-aggregate demand model explains the simultaneous determination of real GDP and the price level. The equilibrium expenditure and aggregate supply-aggregate demand models are related.

B. Aggregate Expenditure and Aggregate Demand

1. The aggregate expenditure curve is the relationship between aggregate planned expenditure and real GDP, with all other influences on aggregate planned expenditure remaining the same.

2. The aggregate demand curve is the relationship between the quantity of real GDP demanded and the price level, with all other influences on aggregate demand remaining the same.

C. Aggregate Expenditure and the Price Level

1. When the price level changes, a wealth effect and substitution effect change aggregate planned expenditure and change the quantity of real GDP demanded.
   a) An increase in the price level decreases aggregate planned expenditure.
   b) A decrease in the price level increases aggregate planned expenditure.

2. Figure 13.10 illustrates the effects of a change in the price level on the AE curve, equilibrium expenditure, and the quantity of real GDP demanded.
   a) Points A, B, and C on the AD curve correspond to the equilibrium expenditure points A, B, and C at the intersection of the AE curve and the 45º line.
   b) In Figure 29.10(a), a rise in price level from 105 to 125 shifts the AE curve from $AE_0$ downward to $AE_1$, and decreases the equilibrium level of real output from $10$ trillion to $9$ trillion. In Figure 13.10(b), the same rise in the price level that lowers
equilibrium expenditure, brings a movement along the $AD$ curve from point $B$ to point $A$.

c) A fall in price level from 105 to 85 shifts the $AE$ curve from $AE_0$ upward to $AE_2$ and increases equilibrium real GDP from $10$ trillion to $11$ trillion. The same fall in the price level that raises equilibrium expenditure brings a movement along the $AD$ curve from point $B$ to point $C$.

3. Figure 13.11 illustrates the effects of an increase in autonomous expenditure. An increase in autonomous expenditure shifts the aggregate expenditure curve upward and shifts the aggregate demand curve rightward by the multiplied increase in equilibrium expenditure.
D. Equilibrium Real GDP and the Price Level

1. Figure 13.12 shows the effect of an increase in investment in the short run when the prices level changes and the economy moves along its SAS curve.

2. The rise in the price level decreases aggregate planned expenditure and lowers the multiplier effect on real GDP.

3. In Figure 13.12(b), the AD curve shifts rightward by the amount of the multiplier effect but equilibrium real GDP increases by less than this amount because of the rise in the price level. In Figure 13.12(b) real GDP increases from $10 trillion from $11.3 trillion, instead of to $12 trillion as it would with a fixed price level.
4. Figure 13.13 illustrates the long-run effects of an increase in autonomous expenditure at full employment. If the increase in autonomous expenditure takes real GDP above potential GDP, the money wage rate rises, the SAS curve shifts leftward, and real GDP decreases until it is back at potential real GDP. The long-run multiplier is zero.

**Reading Between the Lines**
The article discusses how firms started rebuilding depleted inventories in 2003, suggesting a boost in production and the start of the multiplier process in an expansion. Inventories were depleted in 2003 because planned expenditure exceeded real GDP. As firms sought to replenish inventories, production increased, which set in motion the multiplier effect that is part of a business cycle expansion.

**New in the Seventh Edition**
The data have been updated, and the scales for disposable income and real GDP made more appropriate. Reading Between the Lines (pages 250-251) examines the role of inventory changes in an expansion.
Teaching Suggestions

1. Fixed Prices and Expenditure Plans

The consumption function and saving function. In Chapter 8, the student learned about the influences on saving. They learned there that households divide their disposable income between consumption expenditure and saving. And they learned that the factors that affect saving are the real interest rate, disposable income, wealth, and expected future income. These same ideas repeat in this chapter but with a different emphasis. Be sure that the students see that they are talking about exactly the same stuff by they are looking at it from a different angle. In Chapter 8, the focus was on the saving part of the allocation; here it is primarily on the consumption part. In Chapter 8, we held disposable income constant and studied the saving supply curve—the relationship between saving and the real interest rate, other things remaining the same. Here, we hold the real interest rate constant and study the saving and consumption functions—the relationships between saving (and consumption) and disposable income, other things remaining the same.

An analogy might help. Ask the students if they have ever been to a ball game (could be any fast-moving game) and disagreed with a referee’s (or umpire’s) ruling. Almost everyone has. Both the referee and the spectator were at the same event, but they viewed it from a different angle. That’s what we’re doing here. We’ve viewing the allocation of disposable income between saving and consumption from a different angle. But we’re at the same ball game that we were at in Chapter 8.

The 45° line. Don’t assume that the student immediately understands the 45° line! Spend a bit of time explaining how to “read” it. Fundamentally, the line is that along which \( x = y \). This line happens to be a 45° line when the scales along the \( x \)-axis and the \( y \)-axis are the same. Then point out that the horizontal distance to a point along the \( x \)-axis equals the vertical distance from that point to the 45° line. So at all points along the 45° line, \( x = y \). If you wish, you can go on to show the students how the \( x = y \) line changes its appearance if we stretch or squeeze the scale on the \( y \)-axis holding the scale on the \( x \)-axis constant. Emphasize that \( x \) and \( y \) can be anything. In Figure 13.1, \( x \) is disposable income and \( y \) is consumption expenditure; in Figure 13.6(a), \( x \) is real GDP and \( y \) is aggregate planned expenditure.

Marginal and average propensities. The text defines the \( MPC \) and \( MPS \), and shows that they sum to one because disposable income can only be consumed or saved. The textbook does not define and explain the \( APC \) and \( APS \). The reason is that these concepts have no operational significance. They are not worth any of the student’s attention.

2. Real GDP with a Fixed Price Level

Historical background. If you want to talk about Keynes and his contribution to economics, this is probably the best place to do it. A comprehensive Keynes biographical sketch can be found at [http://cepa.newschool.edu/het/profiles/keynes.htm](http://cepa.newschool.edu/het/profiles/keynes.htm).

The model, now generally called the aggregate expenditure model, presented in this section is the essence of Keynes General Theory. According to Don Patinkin, a leading historian of economic thought and Keynes scholar says that the innovation of the General Theory was to replace price with income (GDP) as the equilibrating variable. This version of the model cannot be found in the General Theory, mainly because Keynes was writing before the national income accounting system had been developed. So he made up his own aggregates, based on employment and a money wage measure of the price level. But the words and equations of the General Theory can be translated readily into the textbook version of the model. This version of the model first appeared in The Elements of Economics, a textbook authored by Lorie Tarshis published in 1947. It was popularized by Paul Samuelson in the first edition of his celebrated text published in 1948.

The main difference between the Keynesian cross model of the 1940s and the aggregate expenditure model of today is that from the 1940s through the mid-1960s, economists believed that the fixed price level assumption was an acceptable (if not exactly accurate) description of reality, so the model
was seen as actually determining real GDP, and the multiplier was seen as an empirically relevant phenomenon. In contrast, today, we see the model as part of the aggregate demand story. The value of the model today—and it is valuable today and not, as some people claim, eclipsed by the AS-AD model and irrelevant—is that it explains the multiplier that translates a change in autonomous expenditure into a shift of the AD curve and it explains the multiplier convergence process that pulls the economy toward the AD curve. (When an unintended change in inventories occurs, the economy is off the AD curve but moving toward it.)

**Convergence toward equilibrium.** The treatment of the aggregate expenditure model in this textbook plays up Patinkin’s modern interpretation the role of changes in income signaled by unintended inventory changes, as the force that generates equilibrium expenditure. Figure 13.5 that generates the AE curve and Figure 13.6 that explains convergence toward equilibrium are the core of the model.

3. The Multiplier

**The basic idea and practice.** Students need quite a lot of practice using multipliers. One good problem involves working out the effects on consumption as well as GDP of a change in investment (when the price level is fixed). The best way to present this problem to the students seems to be sequentially. Begin by giving them the data necessary to deduce how real GDP changes from an increase in investment. Tell them there is no foreign trade, so that there are no exports or imports, and no income taxes. Tell them that the marginal propensity to consume is \( b \) (pick any valid number you like), and that investment has changed by \( \Delta I \) (pick any valid number you like). Then, after the students have computed the change in GDP, ask them what the change in consumption expenditure is.

Review their attempts to answer this question as follows: The change in GDP, \( \Delta Y \), is given by the equation: \( \Delta Y = \Delta C + \Delta I \). Given \( \Delta I \) from the initial statement of the problem and \( \Delta Y \) from the first set of calculations, the students can readily calculate \( \Delta C \). Focusing the students’ attention on the change in consumption is important because it reinforces the point that a change in autonomous expenditure (investment in this example) leads to an induced change in consumption expenditure and that this increase in consumption expenditure is the source of the multiplier.

**The multiplier and the circular flow.** Some instructors like to illustrate the multiplier, and give context to Figure 13.8, by using a circular flow diagram to trace out the effect round by round of an initial change in autonomous expenditure. If you do this exercise, use the concrete numbers of Figure 13.8 and initially omit consideration of government and the rest of the world.

**The math of the multiplier process.** Some instructors like to illustrate that the multiplier is the sum of the increments at each “round” in the multiplier process. This illustration teaches the student the neat facts about the sum of a convergent geometric series:

\[
\Delta Y = \Delta I + b\Delta I + b^2\Delta I + b^3\Delta I + b^4\Delta I + b^5\Delta I + \ldots.
\]

Multiply by \( b \) to obtain

\[
b\Delta Y = b\Delta I + b^2\Delta I + b^3\Delta I + b^4\Delta I + b^5\Delta I + \ldots.
\]

Note that \( b^n \) approaches zero as \( n \) becomes large so \( b^{(n+1)} \equiv b^n \). Subtract the second equation from the first to obtain

\[
\Delta Y - b\Delta Y = \Delta I,
\]

or

\[
(1 - b)\Delta Y = \Delta I,
\]

so that

\[
\Delta Y = \Delta I/(1 - b).
\]

Use the numbers in Figure 29.8 and the data in the figure caption to reinforce the algebra.
The general multiplier with taxes and foreign trade. You might want provide a more thorough and detailed derivation of the general multiplier formula, which the textbook presents in its simplest form as “one divided by one minus the slope of the AE curve.” To do so, you can use the math note on pp. 328-331 (in Economics, 700-703). Show your students that the slope of the AE curve is \[ b(1 - \tau) - m \] so that the multiplier is \[ \frac{1}{1 - b(1 - \tau) + m}. \]

4. The Multiplier and the Price Level

The key point. Emphasize the key point of this section: That the AE model and the multiplier tell us how far the AD curve shifts when autonomous expenditure changes and the multiplier process as expenditure and GDP respond to unplanned changes in inventories bring real GDP and the price level to a new equilibrium.

The mechanics of the relationship between the AE and AD curves. Students need a lot of help and clear explanation of the mechanics of the link between these two curves. Here’s what to stress:

1. The AE curve shows how aggregate planned expenditure depends on real GDP (through the effects of disposable income), other things remaining the same.
2. The AD curve shows how equilibrium aggregate expenditure depends on the price level, other things remaining the same.

The next two points are really hard for students:

3. A change in the price level changes autonomous expenditure, which shifts the AE curve, generates a new level of equilibrium expenditure, and generates a new point on the AD curve—Figure 13.10.
4. A change in autonomous expenditure at a given price level shifts the AE curve, generates a new level of equilibrium expenditure, and shifts the AD curve by an amount equal to the change in autonomous expenditure multiplied by the multiplier.

Explain these last two points very painstakingly and illustrate them with Figure 13.10 and Figure 13.11.

The multiplier in the short run. By doing a careful job in explaining the effects of a change in autonomous expenditure on the AE curve, equilibrium expenditure, and the AD curve, you’ve laid the ground for your students to see how the multiplier is modified by a change in the price level in the adjustment to a new short-run equilibrium. Using Figure 13.12 as the illustration, tell the story like this:

1. The initial equilibrium is at point \( A \) on \( AE_0 \) and \( AD_0 \).
2. An increase in autonomous expenditure shifts the AE curve to \( AE_1 \) and shifts the AD curve to \( AD_1 \).
3. At the initial equilibrium price level, equilibrium expenditure and real GDP are at point \( B \).
4. The economy is still at point \( A \), but the new expenditure equilibrium is at point \( B \).
5. Because firms are producing at point \( A \) but planned expenditure has increased, an unplanned decrease in inventories occurs.
6. With lower than planned inventories, firms increase production and raise prices. The economy moves along the \( SAS \) curve as real GDP increases and the price level rises.
7. The rising price level lowers aggregate planned expenditure and the AE curve shifts downward from \( AE_1 \) toward \( AE_2 \).
8. So long as real GDP is to the left of the AD curve, aggregate planned expenditure exceeds actual expenditure, there is an unplanned decrease in inventories, and real GDP rises.
9. Eventually, real GDP increases and the price level rises to point \( C \), where there is a new short-run equilibrium.
The multiplier in the long run. This analysis is a repeat of what you covered earlier in the AS-AD chapter and is reinforcement. The key point to emphasize is that there is no multiplier if we start at full employment. The multiplier is not an empirically relevant concept until it is combined with information about the state of the economy relative to full employment.

Reading Between the Lines

Revisit the second half 2003 GDP changes and check whether, in the light of developments in 2004, the assumptions made in the analysis still look correct. Encourage the students to find a similar news article for the current quarter.

The Big Picture

Where we have been

Chapter 13 uses the background provided in Chapters 5 and 7 to focus on aggregate expenditure and aggregate demand. It builds on the division of GDP into $C + I + G + X – M$ explained in Chapter 5 and then derives the aggregate demand curve previously used in Chapter 7.

Where we are going

Chapter 13 examines the details of the AS-AD model by focusing on the factors that determine the $AD$ curve. The $AD$ curve is important in all the core macroeconomic chapters. The material in this chapter is used in Chapters 14-16 on the business cycle, fiscal policy, and monetary policy.

Overhead Transparencies

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<td>The Multiplier in the Long Run</td>
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**Electronic Supplements**

**MyEconLab**

*MyEconLab* provides pre- and post-tests for each chapter so that students can assess their own progress. Results on these tests feed an individualized study plan that helps students focus their attention in the areas where they most need help.

Instructors can create and assign tests, quizzes, or graded homework assignments that incorporate graphing questions. Questions are automatically graded and results are tracked using an online grade book.

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*PowerPoint Electronic Lecture Notes* with speaking notes are available and offer a full summary of the chapter.

*PowerPoint Electronic Lecture Notes* for students are available in MyEconLab.

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This CD-ROM contains Computerized Test Bank Files, Test Bank, and Instructor’s Manual files in Microsoft Word, and PowerPoint files. All test banks are available in Test Generator Software.

**Additional Discussion Questions**

1. Why is there a “two-way” link between consumption and GDP?
2. How does an increase in disposable income affect the consumption function? An increase in expected future income?
3. If the consumption function shifts upward, what happens to the saving function? Why?
4. When is actual aggregate expenditure different from planned aggregate expenditure? What happens to bring the two back to equality?
5. What does the 45° line measure? Why is the expenditure equilibrium the point at which the aggregate expenditure line crosses the 45° line?
6. What role do inventories play in determining the equilibrium level of expenditure?
7. Explain why marginal tax rates reduce the size of the expenditure multiplier.
8. Carefully explain the difference between the aggregate expenditure curve and the aggregate demand curve.
9. In the AS-AD model, an increase in investment causes a (short-run) increase in equilibrium real GDP. How does the increase in equilibrium GDP compare with the increase in GDP obtained from the aggregate expenditure/45° line model? If the amount is the same, why? If it differs, why?
10. Suppose that exports (autonomously) increase. What happens to the aggregate expenditure curve? The equilibrium level of aggregate expenditure? The aggregate demand curve?
11. Suppose that each $1 billion of real GDP requires a fixed number of imported barrels of oil to produce in the short run. If the price of imported oil doubled, what would that do to the equilibrium level of real GDP? To the size of the multiplier?
12. Suppose the economy is at full employment and there is an increase in government defense expenditure with no increase in taxes. What will happen to real GDP immediately? In the short run? In the long run? Explain each stage.
Answers to the Review Quizzes

Page 311 (page 683 in Economics)
1. Consumption expenditure and imports are influenced by real GDP. Both increase when real GDP increases.
2. The marginal propensity to consume is the proportion of an increase in disposable income that is consumed. In terms of a formula, the marginal propensity to consume or MPC equals \( \Delta C/\Delta YD \). where \( \Delta \) means “change in.” The student’s marginal propensity to consume currently is most likely quite high. For most students, most, if not all, income received is spent on consumption. Once the student graduates, his or her marginal propensity to consume likely will decline because, at that time, part of any increased income will go toward saving (possibly by paying back student loans!)
3. The effects of real GDP on consumption expenditure and imports are determined by the marginal propensity to consume and the marginal propensity to import. In particular, the effect of a change in real GDP on consumption expenditure equals the marginal propensity to consume multiplied by the change in real GDP. Similarly, the effect of a change in real GDP on imports equals the marginal propensity to import multiplied by the change in real GDP.

Page 315 (page 687 in Economics)
1. Equilibrium expenditure occurs when aggregate planned expenditure equals real GDP.
2. Equilibrium expenditure results from adjustments in real GDP. For instance, if aggregate planned expenditure exceeds real GDP, firms find that their inventories are below their targets. As a result, to meet their inventory targets, firms increase production. And, as production increases, real GDP increases. The increase in real GDP increases aggregate planned expenditure, but by less than one-to-one. Eventually real GDP increases sufficiently so that it equals aggregate planned expenditure and, at that point, equilibrium expenditure occurs.
3. If real GDP and aggregate expenditure are less than their equilibrium levels, an unplanned fall in inventories occurs. The unplanned decrease in inventories leads firms to increase their production to restore their inventories to their planned levels. The increase in production causes real GDP to increase.
4. If real GDP and aggregate expenditure are greater than their equilibrium levels, an unplanned rise in inventories occurs. The unplanned increase in inventories leads firms to decrease their production to restore their inventories to their planned levels. The decrease in production means that real GDP decreases.

Page 320 (page 692 in Economics)
1. The multiplier is the amount by which a change in autonomous expenditure is multiplied by in order to determine the change in equilibrium expenditure and real GDP. A change in autonomous expenditure changes real GDP by an amount determined by the multiplier. The multiplier matters because it tells by how much a change in autonomous expenditure changes equilibrium expenditure and real GDP.
2. The marginal propensity to consume, the marginal propensity to import, and the marginal tax rate all influence the magnitude of the multiplier. The multiplier is larger the greater the marginal propensity to consume, smaller the larger the marginal propensity to import, and smaller the larger the marginal tax rate.
3. Fluctuations in autonomous expenditure bring business cycle turning points, that is, when autonomous expenditure changes, the economy moves from one part of the business cycle to
another. If autonomous expenditure decreases, equilibrium expenditure and real GDP decrease and, as a result, the economy enters the recession phase of the business cycle.

Page 325 (page 697 in *Economics*)

1. A change in the price level shifts the \( AE \) curve. A change in the price level brings a movement along the \( AD \) curve.

2. A change in autonomous expenditure that is not caused by a change in the price level shifts both the \( AE \) curve and the \( AD \) curve. The multiplier determines the magnitude of the shift in the \( AD \) curve. The multiplier determines the change in equilibrium real GDP when the price level is constant and this amount is the amount by which the \( AD \) curve shifts.

3. In the short run, an increase in aggregate expenditure increases real GDP. However, the increase in real GDP is less than the increase in aggregate demand because the price level rises. The more the price level rises (the steeper the \( SAS \) curve) the smaller the increase in real GDP.

4. In the long run, an increase in aggregate expenditure has no effect on real GDP, that is, real GDP does not change. The change in real GDP—zero—is less than the change in aggregate demand. The change in GDP is nil because, in the long run, the economy returns to its long-run aggregate supply curve. Hence, in the long run, an increase in aggregate expenditure raises the price level but has no effect on real GDP.
Answers to the Problems

1. a. The marginal propensity to consume is 0.5.
   The marginal propensity to consume is the fraction of a change in disposable income that is consumed. On Heron Island, when disposable income increases by $10 million per year, consumption expenditure increases by $5 million per year. The marginal propensity to consume is 0.5.
   b. The table that shows Heron Island’s saving lists disposable income from zero to 40 in increments of 10. Against each level of disposable income are the amounts of saving, which equal disposable income minus consumption expenditure. These amounts run from 25 at zero disposable income to 15 at a disposable income of 40. For each increase in disposable income of $1, saving increases by 50 cents.
   c. The marginal propensity to save is 0.5.

<table>
<thead>
<tr>
<th>Disposable income (millions of dollars)</th>
<th>Saving (millions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-5</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>40</td>
<td>15</td>
</tr>
</tbody>
</table>

   The marginal propensity to consume plus the marginal propensity to save equals 1. Because consumption expenditure and saving exhaust disposable income, 0.5 of each dollar increase in disposable income is consumed and the remaining part (0.5) is saved.

2. a. The marginal propensity to save is 0.1.
   The marginal propensity to save is the fraction of a change in disposable income that is saved. On Spendthrift Island, when disposable income increases by $50 million per year, saving increases by $5 million per year. The marginal propensity to save is 0.1.
   b. The table to the right shows Spendthrift Island’s consumption expenditure. It lists disposable income from zero to $300 million. Against each level of disposable income are the amounts of consumption expenditure, which equal disposable income minus saving. For each increase in disposable income of $1, consumption expenditure increases by 90 cents.
   c. The marginal propensity to consume is 0.9.
   The marginal propensity to consume plus the marginal propensity to save equals 1. Because consumption expenditure and saving exhaust disposable income, 0.9 of each dollar increase in disposable income is consumed and the remaining part (0.1) is saved.
   d. Spendthrift Island is aptly named because the marginal propensity to consume is quite large. As the answer to the last part pointed out, from each additional dollar of income, 90 cents is spent on consumption expenditure and only 10 cents is saved.

3. a. Autonomous expenditure is $2 billion.
   Autonomous expenditure is expenditure that does not depend on real GDP. Autonomous expenditure equals the value of aggregate planned expenditure when real GDP is zero.
   b. The marginal propensity to consume is 0.6.
   When the country has no imports or exports and no income taxes, the slope of the $AE$ curve equals the marginal propensity to consume. When income increases from 0 to $6 billion, aggregate planned expenditure increases from $2 billion to $5.6 billion. That is, when real GDP
increases by $6 billion, aggregate planned expenditure increases by $3.6 billion. The marginal propensity to consume is $3.6 billion/$6 billion, which is 0.6.

c. From the graph, aggregate planned expenditure is $5.6 billion when real GDP is $6 billion. Equilibrium expenditure is $4 billion.
Equilibrium expenditure is the level of aggregate expenditure at which aggregate planned expenditure equals real GDP. In terms of the graph, equilibrium expenditure occurs at the intersection of the $AE$ curve and the $45^\circ$ line. Draw in the $45^\circ$ line, and you’ll see that the intersection occurs at $4$ billion.

d. There is no change in inventories.
When the economy is at equilibrium expenditure, inventories equal the planned level and there is no unplanned change in inventories.

e. Firms are accumulating inventories. That is, unplanned inventory investment is positive. When real GDP is $6 billion, aggregate planned expenditure is less than real GDP, so firms cannot sell all that they produce. Inventories pile up.

f. The multiplier is 2.5.
The multiplier equals $1/(1 - MPC)$. The marginal propensity to consume is 0.6, so the multiplier equals $1/(1 - 0.6)$, which equals 2.5.

4. a. Autonomous expenditure equals the value of aggregate planned expenditure when real GDP is zero. Because the spreadsheet does not list GDP of zero, the student must extrapolate to calculate the value of consumption expenditure and imports when GDP equals zero. From the spreadsheet, consumption expenditure falls by 60 billion cloves for every 100 billion clove decrease in GDP. Hence when GDP equals zero, autonomous consumption expenditure is 50 billion cloves. Similarly, from the spreadsheet, imports decrease by 15 billion cloves for every 100 billion clove decrease in GDP. Therefore when GDP equals zero, imports equal zero. Thus autonomous expenditure is 50 billion cloves (consumption expenditure) plus 50 billion cloves (investment) plus 60 billion cloves (government purchases) plus 60 billion cloves (exports) or 220 billion cloves.

b. The marginal propensity to consume is 0.6.
When income increases from 100 billion cloves to 200 billion cloves, consumption expenditure increases from 110 billion cloves to 170 billion cloves. Thus a 100 billion clove increase in GDP increases consumption expenditure by 60 billion cloves. Therefore the marginal propensity to consume is 60 billion cloves/100 billion cloves, which is 0.6.

c. Aggregate planned expenditure is 310 billion cloves.
Aggregate planned expenditure is the sum of consumption expenditure (170 billion cloves) plus planned investment (50 billion cloves) plus government purchases (60 billion cloves) plus exports (60 billion cloves) minus imports (20 billion cloves) or 310 billion cloves.

d. Inventories are decreasing so that unplanned inventory investment is negative.
When real GDP is 200 billion cloves, aggregate planned expenditure is 310 billion cloves. Because aggregate planned expenditure exceeds real GDP, firms sell all that they produce and more so that inventories are depleted.

e. Firms are accumulating inventories so that unplanned inventory investment is positive.
When real GDP is 500 billion cloves, aggregate planned expenditure is 445 billion cloves. Firms cannot sell all that they produce so that unplanned inventories pile up.

f. The multiplier equals 2.5.
The multiplier equals $1/(1 - MPC)$. The marginal propensity to consume is 0.6, so the multiplier equals $1/(1 - 0.6)$, which equals 2.5.

5. a. The consumption function is $C = 100 + 0.9(Y - T)$. 
The consumption function is the relationship between consumption expenditure and disposable income, other things remaining the same.

b. The equation to the \( AE \) curve is \( AE = 600 + 0.9Y \), where \( Y \) is real GDP.

Aggregate planned expenditure is the sum of consumption expenditure, investment, government purchases, and net exports. Using the symbol \( AE \) for aggregate planned expenditure, aggregate planned expenditure is:

\[
AE = 100 + 0.9(Y - 400) + 460 + 400 \\
AE = 100 + 0.9Y - 360 + 460 + 400 \\
AE = 600 + 0.9Y
\]

c. Equilibrium expenditure is $6,000 billion.

Equilibrium expenditure is the level of aggregate expenditure that occurs when aggregate planned expenditure equals real GDP. That is, \( AE = 600 + 0.9Y \) and \( AE = Y \)

Solving these two equations for \( Y \) gives equilibrium expenditure of $6,000 billion.

d. Equilibrium real expenditure decreases by $1,000 billion, and the multiplier is 10.

The multiplier equals \( 1/(1 - \text{the slope of the } AE \text{ curve}) \). The equation of the \( AE \) curve tells us that the slope of the \( AE \) curve is 0.9. So the multiplier is \( 1/(1 - 0.9) \), which is 10. Then, the change in equilibrium expenditure equals the change in investment multiplied by 10.

6. a. The consumption function is \( C = 1 + 0.9(Y - T) \) where the “1” is 1 billion.

The consumption function is the relationship between consumption expenditure and disposable income, other things remaining the same. The constant in the consumption function is autonomous consumption, $1 billion. The slope parameter of the consumption function is the MPC, 0.9 in the case at hand.

b. The equation of the \( AE \) curve is \( AE = 6.4 + 0.9Y \), where \( Y \) is real GDP.

Aggregate planned expenditure is the sum of consumption expenditure, investment, government purchases, and net exports. Net exports are zero. Then, using the symbol \( AE \) for aggregate planned expenditure, aggregate planned expenditure is:

\[
AE = 1 + 0.9(Y - 4) + 5 + 4 \\
AE = 1 + 0.9Y - 3.6 +5 + 4 \\
AE = 6.4 + 0.9Y
\]

c. Equilibrium expenditure is $64 billion.

Equilibrium expenditure is the level of aggregate expenditure that occurs when aggregate planned expenditure equals real GDP. That is, \( AE = 6.4 + 0.9Y \) and \( AE = Y \)

Solving these two equations for \( Y \) gives equilibrium expenditure of $64 billion.

d. Equilibrium real expenditure decreases by $30 billion (to $34 billion), and the multiplier is 10.

The multiplier equals \( 1/(1 - \text{the slope of the } AE \text{ curve}) \). The equation of the \( AE \) curve tells us that the slope of the \( AE \) curve is 0.9. So the multiplier is \( 1/(1 - 0.9) \), which is 10. Then, the change in equilibrium expenditure equals the change in investment, $-3 billion, multiplied by 10.

7. a. The quantity demanded increases by $1,000 billion.

The increase in investment shifts the aggregate demand curve rightward by the change in investment times the multiplier. The multiplier is 10 and the change in investment is $100 billion, so the aggregate demand curve shifts rightward by $1,000 billion.

b. In the short-run, real GDP increases by less than $1,000 billion
Real GDP is determined by the intersection of the $AD$ curve and the $SAS$ curve. In the short run, the price level will rise and real GDP will increase but by an amount less than the shift of the $AD$ curve.

c. In the long-run, real GDP will equal potential GDP, so real GDP does not increase.

Real GDP is determined by the intersection of the $AD$ curve and the $SAS$ curve. After the initial increase in investment, money wages increase, the $SAS$ curve shifts leftward, and in the long run, real GDP moves back to potential GDP.

d. In the short run, the price level rises.

e. In the long run, the price level rises.

8. a. The quantity demanded increases by $10$ billion.

The increase in investment shifts the aggregate demand curve rightward by the change in investment times the multiplier. The multiplier is 10 and the change in investment is $1$ billion. Thus the aggregate demand curve shifts rightward by $20$ billion.

b. In the long-run, real GDP equals potential GDP, so in the long run real GDP does not increase.

In the long run, the $SAS$ curve shifts so that real GDP is determined by the intersection of the $AD$ curve and the $LAS$ curve. After the initial increase in investment, money wages increase and, as a result, the $SAS$ curve shifts leftward. Eventually in the long run, real GDP moves back to equal potential GDP.

c. In the short run, the price level rises.