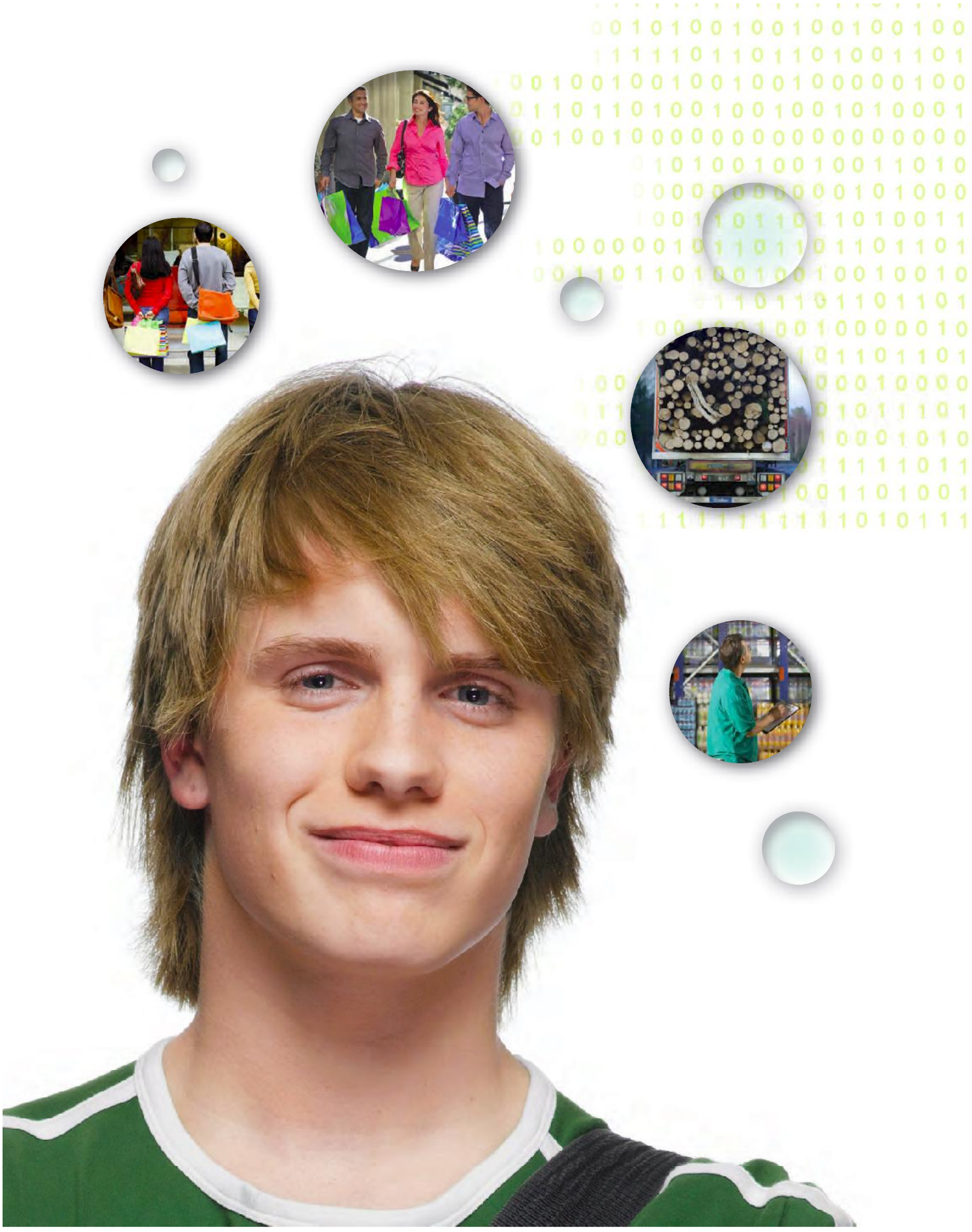

SECTION 19

Module 60: The Multiplier
Module 61: Consumption and Investment Spending
Module 62: The Income–Expenditure Model

Income and Expenditure

FROM BOOM TO BUST

Ft. Myers, Florida, was a boom town from 2003 to 2005. Jobs were plentiful: the unemployment rate in the Ft. Myers–Cape Coral metropolitan area was less than 3%. Shopping malls were humming, and new stores were opening everywhere.

But then the boom went bust. Jobs became scarce, and by the middle of 2010, the unemployment rate was above 13%. Stores had few customers, and many were closing. One new business was flourishing, however. As the local economy plunged, real estate agents began offering "foreclosure tours": visits to homes that had been seized by banks after the owners were unable to make mortgage payments—and were available at bargain prices.

What happened? Ft. Myers boomed because of a surge in home construction, fueled in part by speculators who bought houses not to live in, but to resell at much higher prices. Home construction gave jobs to construction workers, electricians, roofers, real estate agents, and others. These workers, in turn, spent money locally, creating jobs for waiters, gardeners, pool cleaners, sales people, and more. These workers, in turn, also spent money locally, creating further expansion, and so on.

The boom turned into a bust when home construction suddenly came to a virtual halt. It turned out that speculation had been feeding on itself: people were buying houses as investments, then selling them to others who were also buying houses as investments, and prices had risen to levels far beyond what people who actually wanted to live in houses were willing to pay.

The local economy then collapsed, as the process that had created the earlier boom operated in reverse. The jobs created by home construction went away, leading to a fall in local spending, leading to a loss of other local jobs, leading to further declines in spending, and so on.

The boom and bust in Ft. Myers illustrates, on a small scale, the way booms and busts happen for the economy as a whole. The business cycle is often driven by ups or downs in investment spending—either residential investment spending (that is, home construction) or nonresidential investment spending (such as the construction of office buildings, factories, and shopping malls). Changes in investment spending, in turn, indirectly lead to changes in consumer spending, which magnify—or, as economists usually say, *multiply*—the effect of the investment spending changes on the economy as a whole.

In this section we'll study how this process works, showing how *multiplier* analysis helps us understand the business cycle.

MODULE 60

The Multiplier

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WHAT YOU WILL LEARN

1. The significance of the marginal propensity to consume
2. The nature of the multiplier, which shows how initial changes in spending lead to further changes in spending

The Multiplier: An Informal Introduction

The story of the boom and bust in Ft. Myers that opens this section involves a sort of chain reaction in which an initial rise or fall in aggregate spending leads to changes in income, which lead to further changes in aggregate spending, and so on. Let's examine that chain reaction more closely, this time thinking through the effects of changes in aggregate spending in the economy as a whole.

For the sake of this analysis, we'll make four simplifying assumptions that we'll revisit later.

1. We assume that *producers are willing to supply additional output at a fixed price.* That is, if consumers or businesses buying investment goods decide to spend an additional $1 billion, that will translate into the production of $1 billion worth of additional goods and services without driving up the overall level of prices. As a result, *changes in aggregate spending translate into changes in aggregate output,* as measured by real GDP. As we'll learn, this assumption isn't too unrealistic in the short run, but it needs to be changed when we think about the long-run effects of changes in demand.
2. We take the interest rate as given.
3. We assume that there is no government spending and no taxes.
4. We assume that exports and imports are zero.

Given these simplifying assumptions, consider what happens if there is a change in investment spending. Specifically, imagine that for some reason home builders decide to spend an extra $100 billion on home construction over the next year.

The direct effect of this increase in investment spending will be to increase income and the value of aggregate output by the same amount. That's because each dollar

spent on home construction translates into a dollar's worth of income for construction workers, suppliers of building materials, electricians, and so on. If the process stopped there, the increase in housing investment spending would raise overall income by exactly $100 billion.

But the process doesn't stop there. The increase in aggregate output leads to an increase in disposable income that flows to households in the form of profits and wages. The increase in households' disposable income leads to a rise in consumer spending, which, in turn, induces firms to increase output yet again. This generates another rise in disposable income, which leads to another round of consumer spending increases, and so on. So there are multiple rounds of increases in aggregate output.

How large is the total effect on aggregate output if we sum the effect from all these rounds of spending increases? To answer this question, we need to introduce the concept of the **marginal propensity to consume,** or ***MPC:*** the increase in consumer spending when disposable income rises by $1. When consumer spending changes because of a rise or fall in disposable income, *MPC* is the change in consumer spending divided by the change in disposable income:

The **marginal propensity to consume,** or ***MPC,*** is the increase in consumer spending when disposable income rises by $1.

The **marginal propensity to save,** or ***MPS,*** is the increase in household savings when disposable income rises by $1.

$$\textbf{(60-1)}\quad MPC = \frac{\Delta \text{ Consumer spending}}{\Delta \text{ Disposable income}}$$

where the symbol Δ (delta) means "change in." For example, if consumer spending goes up by $6 billion when disposable income goes up by $10 billion, *MPC* is $6 billion/$10 billion = 0.6.

Because consumers normally spend part but not all of an additional dollar of disposable income, *MPC* is a number between 0 and 1. The additional disposable income that consumers don't spend is saved; the **marginal propensity to save,** or ***MPS,*** is the fraction of an additional dollar of disposable income that is saved. *MPS* is equal to 1 – *MPC*.

Because we assumed that there are no taxes and no international trade, each $1 increase in aggregate spending raises both real GDP and disposable income by $1. So the $100 billion increase in investment spending initially raises real GDP by $100 billion. This leads to a second-round increase in consumer spending, which raises real GDP by a further *MPC* × $100 billion. It is followed by a third-round increase in consumer spending of *MPC* × *MPC* × $100 billion, and so on. After an infinite number of rounds, the total effect on real GDP is:

$$\begin{aligned}
&\text{Increase in investment spending} && = \$100 \text{ billion}\\
&+ \text{Second-round increase in consumer spending} && = MPC \times \$100 \text{ billion}\\
&+ \text{Third-round increase in consumer spending} && = MPC^2 \times \$100 \text{ billion}\\
&+ \text{Fourth-round increase in consumer spending} && = MPC^3 \times \$100 \text{ billion}\\
&\quad\vdots && \quad\vdots\\
&\text{Total increase in real GDP} && = (1 + MPC + MPC^2 + MPC^3 + \ldots) \times \$100 \text{ billion}
\end{aligned}$$

So the $100 billion increase in investment spending sets off a chain reaction in the economy. The net result of this chain reaction is that a $100 billion increase in investment spending leads to a change in real GDP that is a *multiple* of the size of that initial change in spending.

How large is this multiple? It's a mathematical fact that an infinite series of the form $1 + x + x^2 + x^3 + \ldots$, where x is between 0 and 1, is equal to $1/(1 - x)$. So the total effect of a $100 billion increase in investment spending, *I,* taking into account all the subsequent increases in consumer spending (and assuming no taxes and no international trade), is given by:

$$\textbf{(60-2)}\quad \text{Total increase in real GDP from a \$100 billion rise in } I = \frac{1}{1 - MPC} \times \$100 \text{ billion}$$

TABLE 60-1

Rounds of Increases of Real GDP When *MPC* = 0.6

	Increase in real GDP (billions)	Total increase in real GDP (billions)
First round	$100	$100
Second round	60	160
Third round	36	196
Fourth round	21.6	217.6
…	…	…
Final round	0	250

Let's consider a numerical example in which *MPC* = 0.6: each $1 in additional disposable income causes a $0.60 rise in consumer spending. In that case, a $100 billion increase in investment spending raises real GDP by $100 billion in the first round. The second-round increase in consumer spending raises real GDP by another 0.6 × $100 billion, or $60 billion. The third-round increase in consumer spending raises real GDP by another 0.6 × $60 billion, or $36 billion.

Table 60-1 shows the successive stages of increases, where ". . . " means the process goes on an infinite number of times. In the end, real GDP rises by $250 billion as a consequence of the initial $100 billion rise in investment spending:

$$\frac{1}{1-0.6} \times \$100 \text{ billion} = 2.5 \times \$100 \text{ billion} = \$250 \text{ billion}$$

Notice that even though there are an infinite number of rounds of expansion of real GDP, the total rise in real GDP is limited to $250 billion. The reason is that at each stage some of the rise in disposable income "leaks out" because it is saved. How much of an additional dollar of disposable income is saved depends on *MPS*, the marginal propensity to save.

We've described the effects of a change in investment spending, but the same analysis can be applied to any other change in aggregate spending. The important thing is to distinguish between the initial change in aggregate spending, before real GDP rises, and the additional change in aggregate spending caused by the change in real GDP as the chain reaction unfolds.

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Spending by one person or firm has a domino effect that leads to progressively more spending in the economy.

For example, suppose that a boom in housing prices makes consumers feel richer and that, as a result, they become willing to spend more at any given level of disposable income. This will lead to an initial rise in consumer spending, before real GDP rises. But it will also lead to second and later rounds of higher consumer spending as real GDP rises.

An initial rise or fall in aggregate spending at a given level of real GDP is called an **autonomous change in aggregate spending.** It's autonomous—which means "self-governing"—because it's the cause, not the result, of the chain reaction we've just described.

Formally, the **multiplier** is the ratio of the total change in real GDP caused by an autonomous change in aggregate spending to the size of that autonomous change. If we let ΔAAS stand for autonomous change in aggregate spending and ΔY stand for the change in real GDP, then the multiplier is equal to $\Delta Y/\Delta AAS$. And we've already seen how to find the value of the multiplier. Assuming no taxes and no trade, the change in real GDP caused by an autonomous change in spending is:

$$\textbf{(60-3)} \quad \Delta Y = \frac{1}{1-MPC} \times \Delta AAS$$

An **autonomous change in aggregate spending** is an initial change in the desired level of spending by firms, households, or government at a given level of real GDP.

The **multiplier** is the ratio of the total change in real GDP caused by an autonomous change in aggregate spending to the size of that autonomous change.

So the multiplier is:

$$\textbf{(60-4)} \quad \text{Multiplier} = \frac{\Delta Y}{\Delta AAS} = \frac{1}{1-MPC}$$

Notice that the size of the multiplier depends on *MPC*. If the marginal propensity to consume is high, so is the multiplier. This is true because the size of *MPC* determines how large each round of expansion is compared with the previous round. To put it another way, the higher *MPC* is, the less disposable income "leaks out" into savings at each round of expansion.

In later modules we'll use the concept of the multiplier to analyze the effects of fiscal and monetary policies. We'll also see that the formula for the multiplier changes when we introduce various complications, including taxes and foreign trade. First we need to look more deeply at what determines consumer spending.

ECONOMICS IN ACTION

THE MULTIPLIER AND THE GREAT DEPRESSION

The concept of the multiplier was originally devised by economists trying to understand the greatest economic disaster in history, the collapse of output and employment from 1929 to 1933, which began the Great Depression. Most economists believe that the slump from 1929 to 1933 was driven by a collapse in investment spending. But as the economy shrank, consumer spending also fell sharply, multiplying the effect on real GDP.

TABLE 60-2

Investment Spending, Consumer Spending, and Real GDP in the Great Depression (billions of 2005 dollars)

	1929	1933	Change
Investment spending	$101.4	$18.9	–$82.5
Consumer spending	736.3	600.8	–135.5
Real GDP	976.1	715.8	–260.3

Source: Bureau of Economic Analysis.

Table 60-2 shows what happened to investment spending, consumer spending, and GDP during those four terrible years. What we see is that investment spending imploded, falling by more than 80%. But consumer spending also fell drastically and actually accounted for more of the fall in real GDP. (The total fall in real GDP was larger than the combined fall in consumer and investment spending, mainly because of technical accounting issues.)

The numbers in Table 60-2 suggest that at the time of the Great Depression, the multiplier was around 3. Most current estimates put the size of the multiplier considerably lower—but there's a reason for that change. In 1929, government in the United States was very small by modern standards: taxes were low and major government programs like Social Security and Medicare had not yet come into being. In the modern U.S. economy, taxes are much higher, and so is government spending. Why does this matter? Because taxes and some government programs act as *automatic stabilizers,* reducing the size of the multiplier.

MODULE 60 Review

Solutions appear at the back of the book.

Check Your Understanding

1. Explain why a decline in investment spending caused by a change in business expectations leads to a fall in consumer spending.
2. What is the multiplier if the marginal propensity to consume is 0.5? What is it if *MPC* is 0.8?
3. As a percentage of GDP, savings accounts for a larger share of the economy in the country of Scania compared to the country of Amerigo. Which country is likely to have the larger multiplier? Explain.

Multiple-Choice Questions

1. A $100 million increase in investment spending will cause real GDP to
   a. decrease by $100 million.
   b. increase by $100 million.
   c. decrease by less than $100 million.
   d. increase by less than $100 million.
   e. increase by more than $100 million.

2. The marginal propensity to consume measures the
   a. increase in consumer spending when disposable income rises by $1.
   b. increase in consumer spending when investment spending rises by $1.
   c. increase in consumer spending when taxes rise by $1.
   d. increase in disposable income when consumer spending rises by $1.
   e. increase in disposable income when investment spending rises by $1.

3. Assuming no taxes and no trade, the multiplier is equal to:
   a. MPC
   b. $\frac{1}{1 - MPC}$
   c. $\frac{1}{1 + MPC}$
   d. $\frac{1}{MPC}$
   e. $1 - MPC$

4. If the marginal propensity to consume is 0.5, then a $100 million increase in investment spending will increase real GDP by
   a. $100 million.
   b. $200 million.
   c. $50 million.
   d. $150 million.
   e. $300 million.

5. When income is $1,000, the level of consumption spending is equal to $850. When income rises to $1,200, the level of consumption spending is equal to $1,000. In this case the value of the marginal propensity to consume is
   a. 0.85.
   b. 0.83.
   c. 0.75.
   d. 0.50.
   e. 0.80.

Critical-Thinking Question

Explain how an autonomous change in aggregate spending affects real GDP, making reference to the multiplier concept.

MODULE 61

Consumption and Investment Spending

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Johner Images/Alamy

WHAT YOU WILL LEARN

1. The meaning of the aggregate consumption function, which shows how current disposable income affects consumer spending
2. How expected future income and aggregate wealth affect consumer spending
3. The determinants of investment spending
4. Why investment spending is a leading indicator of the future state of the economy

Consumer Spending

Should you splurge on a restaurant meal or save money by eating at home? Should you buy a new car and, if so, how expensive a model? Should you redo that bathroom or live with it for another year? In the real world, households are constantly confronted with such choices—not just about the consumption mix, but also about how much to spend in total. These choices, in turn, have a powerful effect on the economy: consumer spending normally accounts for two-thirds of total spending on final goods and services. In particular, the decision about how much of an additional dollar in income to spend—the marginal propensity to consume—determines the size of the multiplier, which determines the ultimate effect on the economy of autonomous changes in spending.

But what determines how much consumers spend?

Current Disposable Income and Consumer Spending

The most important factor affecting a family's consumer spending is its current disposable income—income after taxes are paid and government transfers are received. It's obvious from daily life that people with high disposable incomes on average drive more expensive cars, live in more expensive houses, and spend more on meals and clothing than people with lower disposable incomes. And the relationship between current disposable income and spending is clear in the data.

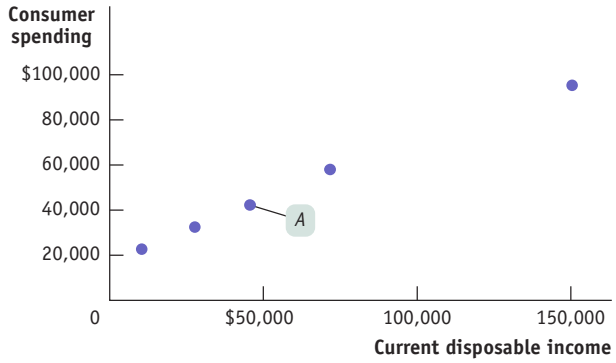
The Bureau of Labor Statistics (BLS) collects annual data on family income and spending. Families are grouped by levels of before-tax income, and after-tax income for each group is also reported. Since the income figures include transfers from the government, what the BLS calls a household's after-tax income is equivalent to its current disposable income.

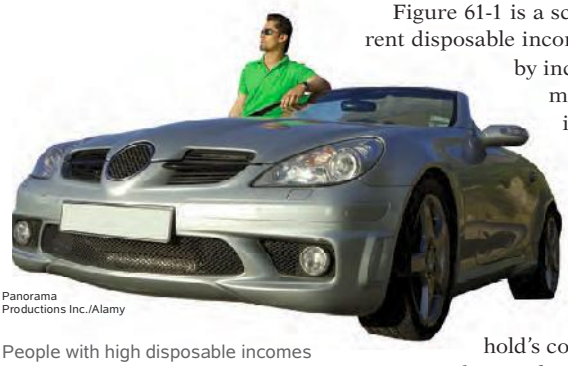
FIGURE 61-1

Current Disposable Income and Consumer Spending for American Households in 2012

For each income group of households, average current disposable income in 2012 is plotted versus average consumer spending in 2012. For example, the middle income group, with an annual income of $36,134 to $59,514, is represented by point *A*, indicating a household average current disposable income of $46,777 and average household consumer spending of $43,004. The data clearly show a positive relationship between current disposable income and consumer spending: families with higher current disposable income have higher consumer spending.

Source: Bureau of Labor Statistics.





Panorama Productions Inc./Alamy

People with high disposable incomes tend to spend more than those with lower disposable incomes.

Figure 61-1 is a scatter diagram showing the relationship between household current disposable income and household consumer spending for American households by income group in 2012. For example, point *A* shows that in 2012 the middle fifth of the population had an average current disposable income of $46,777 and average spending of $43,004. The pattern of the dots slopes upward from left to right, making it clear that households with higher current disposable income had higher consumer spending.

It's very useful to represent the relationship between an individual household's current disposable income and its consumer spending with an equation. The **consumption function** is an equation showing how an individual household's consumer spending varies with the household's current disposable income. The simplest version of a consumption function is a linear equation:

The **consumption function** is an equation showing how an individual household's consumer spending varies with the household's current disposable income.

(61-1) $c = a + MPC \times yd$

where lowercase letters indicate variables measured for an individual household.

In this equation, c is individual household consumer spending and yd is individual household current disposable income. Recall that *MPC*, the marginal propensity to consume, is the amount by which consumer spending rises if current disposable income rises by $1. Finally, a is a constant term—individual household *autonomous consumer spending*, the amount of spending a household would do if it had zero disposable income. We assume that a is greater than zero because a household with zero disposable income is able to fund some consumption by borrowing or using its savings.

Notice, by the way, that we're using y for income. That's standard practice in macroeconomics, even though *income* isn't actually spelled "yncome." The reason is that I is reserved for investment spending.

Recall that we expressed *MPC* as the ratio of a change in consumer spending to the change in current disposable income. We've rewritten it for an individual household as Equation 61-2:

(61-2) $MPC = \Delta c/\Delta yd$

Multiplying both sides of Equation 61-2 by Δyd, we get:

(61-3) $MPC \times \Delta yd = \Delta c$

Equation 61-3 tells us that when yd goes up by $1, c goes up by $MPC \times \$1$.

FIGURE 61-2 The Consumption Function

The consumption function relates a household's current disposable income to its consumer spending. The vertical intercept, *a*, is individual household autonomous consumer spending: the amount of a household's consumer spending if its current disposable income is zero. The slope of the consumption function line, *cf*, is the marginal propensity to consume, or *MPC:* of every additional $1 of current disposable income, *MPC* × $1 is spent.

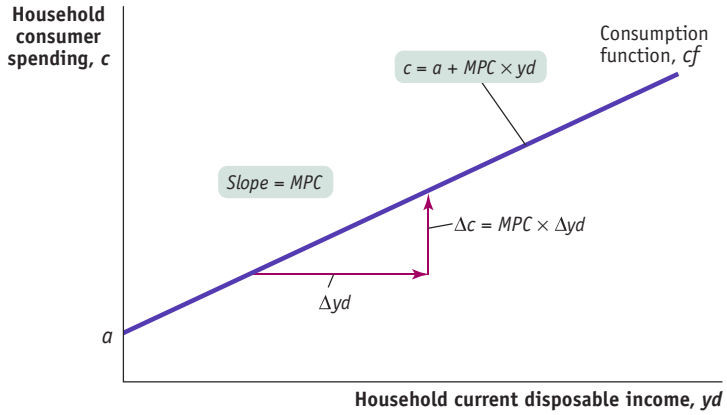


Figure 61-2 shows what Equation 61-1 looks like graphically, plotting *yd* on the horizontal axis and *c* on the vertical axis. Individual household autonomous consumer spending, *a,* is the value of *c* when *yd* is zero—it is the vertical *intercept* of the consumption function, *cf. MPC* is the *slope* of the line, measured by rise over run. If current disposable income rises by Δyd, household consumer spending, *c,* rises by Δc. Since *MPC* is defined as $\Delta c/\Delta yd$, the slope of the consumption function is:

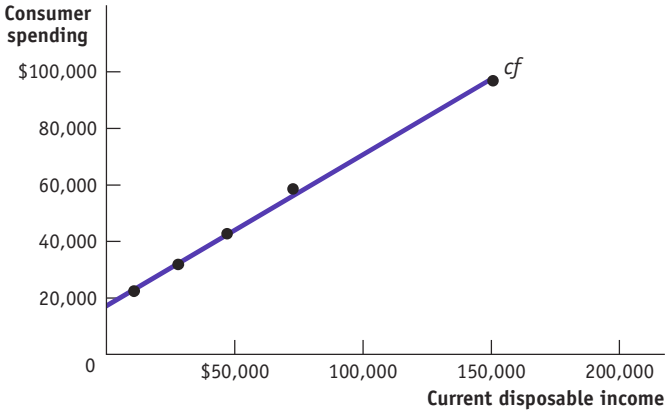
(61-4) Slope of consumption function
= Rise over run
= $\Delta c/\Delta yd$
= *MPC*

In reality, actual data never fit Equation 61-1 perfectly, but the fit can be pretty good. Figure 61-3 shows the data from Figure 61-1 again, together with a line drawn to fit the data as closely as possible. According to the data on households' consumer

FIGURE 61-3 A Consumption Function Fitted to Data

The data from Figure 61-1 are reproduced here, along with a line drawn to fit the data as closely as possible. For American households in 2012, the best estimate of the average household's autonomous consumer spending, *a*, is $18,478 and the best estimate of *MPC* is approximately 0.520.

Source: Bureau of Labor Statistics.



The **aggregate consumption function** is the relationship for the economy as a whole between aggregate current disposable income and aggregate consumer spending.

spending and current disposable income, the best estimate of a is $18,478 and of MPC is 0.520. So the consumption function fitted to the data is:

$$c = \$18{,}478 + 0.520 \times yd$$

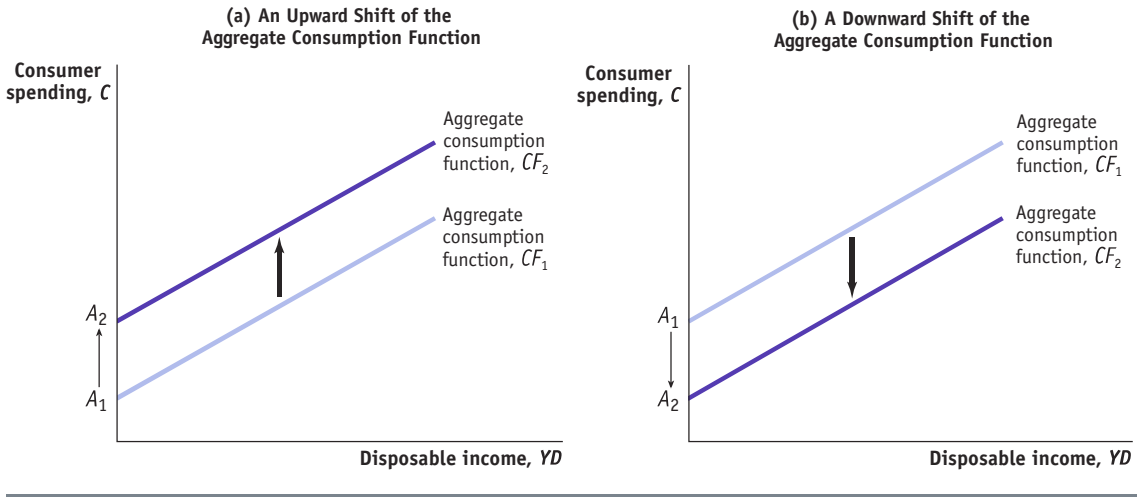
That is, the data suggest a marginal propensity to consume of approximately 0.52. This implies that the marginal propensity to save (MPS)—the amount of an additional $1 of disposable income that is saved—is approximately 0.48, and the multiplier is approximately 1/0.48 = 2.08.

It's important to realize that Figure 61-3 shows a *microeconomic* relationship between the current disposable income of individual households and their spending on goods and services. However, macroeconomists assume that a similar relationship holds *for the economy as a whole:* that there is a relationship, called the **aggregate consumption function,** between aggregate current disposable income and aggregate consumer spending. We'll assume that it has the same form as the household-level consumption function:

(61-5) $C = A + MPC \times YD$

Here, C is aggregate consumer spending (called just "consumer spending"); YD is aggregate current disposable income (called, for simplicity, just "disposable income"); and A is aggregate autonomous consumer spending, the amount of consumer spending when YD equals zero. This is the relationship represented in Figure 61-4 by CF, analogous to cf in Figure 61-3.

FIGURE 61-4 **Shifts of the Aggregate Consumption Function**



Panel (a) illustrates the effect of an increase in expected aggregate future disposable income. Consumers will spend more at every given level of aggregate current disposable income, YD. As a result, the initial aggregate consumption function CF_1, with aggregate autonomous consumer spending A_1, shifts up to a new position at CF_2 and aggregate autonomous consumer spending A_2. An increase in aggregate wealth will also shift the aggregate consumption function up. Panel (b), in contrast, illustrates the effect of a reduction in expected aggregate future disposable income. Consumers will spend less at every given level of aggregate current disposable income, YD. Consequently, the initial aggregate consumption function CF_1, with aggregate autonomous consumer spending A_1, shifts down to a new position at CF_2 and aggregate autonomous consumer spending A_2. A reduction in aggregate wealth will have the same effect.

Shifts of the Aggregate Consumption Function

The aggregate consumption function shows the relationship between disposable income and consumer spending for the economy as a whole, other things equal. When things other than disposable income change, the aggregate consumption function shifts. There are two principal causes of shifts of the aggregate consumption function: changes in expected future disposable income and changes in aggregate wealth.

CHANGES IN EXPECTED FUTURE DISPOSABLE INCOME Suppose you land a really good, well-paying job on graduating from college in May—but the job, and the paychecks, won't start until September. So your disposable income hasn't risen yet. Even so, it's likely that you will start spending more on final goods and services right away—maybe buying nicer work clothes than you originally planned—because you know that higher income is coming.

Conversely, suppose you have a good job but learn that the company is planning to downsize your division, raising the possibility that you may lose your job and have to take a lower-paying one somewhere else. Even though your disposable income hasn't gone down yet, you might well cut back on spending even while still employed, to save for a rainy day.

Both of these examples show how expectations about future disposable income can affect consumer spending. The two panels of Figure 61-4, which plot disposable income against consumer spending, show how changes in expected future disposable income affect the aggregate consumption function. In both panels, CF_1 is the initial aggregate consumption function. Panel (a) shows the effect of good news: information that leads consumers to expect higher disposable income in the future than they did before. Consumers will now spend more at any given level of current disposable income, *YD*, corresponding to an increase in *A*, aggregate autonomous consumer spending, from A_1 to A_2. The effect is to shift the aggregate consumption function up, from CF_1 to CF_2.

Panel (b) shows the effect of bad news: information that leads consumers to expect lower disposable income in the future than they did before. Consumers will now spend less at any given level of current disposable income, *YD*, corresponding to a fall in *A* from A_1 to A_2. The effect is to shift the aggregate consumption function down, from CF_1 to CF_2.

CHANGES IN AGGREGATE WEALTH Imagine two individuals, Maria and Mark, both of whom expect to earn $30,000 this year. Suppose, however, that they have different histories. Maria has been working steadily for the past 10 years, owns her own home, and has $200,000 in the bank. Mark is the same age as Maria, but he has been in and out of work, hasn't managed to buy a house, and has very little in savings. In this case, Maria has something that Mark doesn't have: wealth. Even though they have the same disposable income, other things equal, you'd expect Maria to spend more on consumption than Mark. That is, *wealth* has an effect on consumer spending.

Consumers tend to avoid high-priced brand-name goods and seek out less expensive alternatives when aggregate wealth declines.

Joseph Sohm/Alamy

The effect of wealth on spending is emphasized by an influential economic model of how consumers make choices about spending versus saving called the *life-cycle hypothesis*. According to this hypothesis, consumers plan their spending over a lifetime, not just in response to their current disposable income. As a result, people try to smooth their consumption over their lifetimes—they save some of their current disposable income during their years of peak earnings (typically occurring during a worker's 40s and 50s) and during their retirement live off the wealth they accumulated while working.

We won't go into the details of the life-cycle hypothesis but will simply point out that it implies an important role for wealth in determining consumer spending. For example, a middle-aged couple

who have accumulated a lot of wealth—who have paid off the mortgage on their house and already own plenty of stocks and bonds—will, other things equal, spend more on goods and services than a couple who have the same current disposable income but still need to save for their retirement.

Because wealth affects household consumer spending, changes in wealth across the economy can shift the aggregate consumption function. A rise in aggregate wealth—say, because of a booming stock market—increases the vertical intercept *A*, aggregate autonomous consumer spending. This, in turn, shifts the aggregate consumption function up in the same way as does an expected increase in future disposable income. A decline in aggregate wealth—say, because of a fall in housing prices—reduces *A* and shifts the aggregate consumption function down.

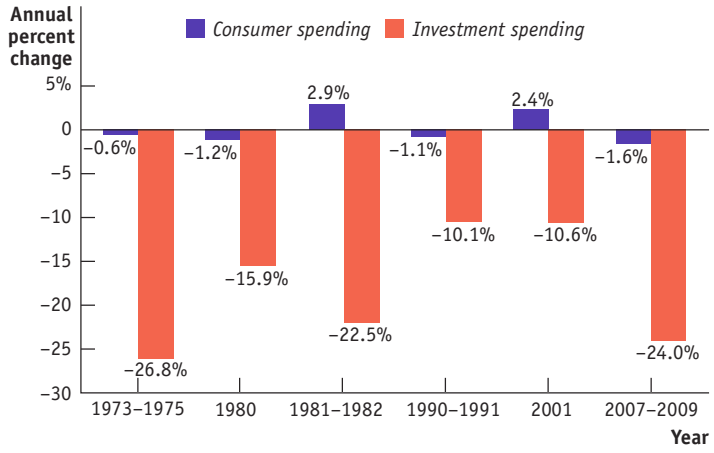
Investment Spending

Although consumer spending is much larger than investment spending, booms and busts in investment spending tend to drive the business cycle. In fact, most recessions originate as a fall in investment spending. Figure 61-5 illustrates this point; it shows the annual percent change of investment spending and consumer spending in the United States, measured in real terms, during six recessions from 1973 to 2009. As you can see, swings in investment spending are much more dramatic than those in consumer spending. In addition, due to the multiplier process, economists believe that declines in consumer spending are usually the result of a process that begins with a slump in investment spending. Soon we'll examine in more detail how a slump in investment spending generates a fall in consumer spending through the multiplier process.

FIGURE 61-5 **Fluctuations in Investment Spending and Consumer Spending**

The bars illustrate the annual percent change in investment spending and consumer spending during six recent recessions. As the lengths of the bars show, swings in investment spending were much larger in percentage terms than those in consumer spending. This pattern has led economists to believe that recessions typically originate as a slump in investment spending.

Source: Bureau of Economic Analysis.



Before we do that, however, let's analyze the factors that determine investment spending, which are somewhat different from those that determine consumer spending. The most important ones are the interest rate and expected future real GDP.

It's also important to note that the level of investment spending businesses *actually* carry out is sometimes not the same level as **planned investment spending,** the investment spending that firms *intend* to undertake during a given period. Planned investment spending depends on three principal factors: the interest rate, the expected future level of real GDP, and the current level of production capacity. First, we'll analyze the effect of the interest rate.

Planned investment spending is the investment spending that businesses intend to undertake during a given period.

The Interest Rate and Investment Spending

Interest rates have their clearest effect on one particular form of investment spending: spending on residential construction—that is, on the construction of homes. The reason is straightforward: home builders only build houses they think they can sell, and houses are more affordable—and so more likely to sell—when the interest rate is low.

Consider a potential home-buying family that needs to borrow $150,000 to buy a house. At an interest rate of 7.5%, a 30-year home mortgage will mean payments of $1,048 per month. At an interest rate of 5.5%, those payments would be only $851 per month, making houses significantly more affordable. As described in the upcoming Economics in Action, lower interest rates helped set off the great housing boom described in the section-opening story.

Interest rates also affect other forms of investment spending. Firms with investment spending projects will only go ahead with a project if they expect a rate of return higher than the cost of the funds they would have to borrow to finance that project. As the interest rate rises, fewer projects will pass that test, and as a result investment spending will be lower.

Photodisc

Interest rates directly impact whether or not construction companies decide to invest in the building of new homes.

You might think that the trade-off a firm faces is different if it can fund its investment project with its past profits rather than through borrowing. Past profits used to finance investment spending are called *retained earnings*. But even if a firm pays for investment spending out of retained earnings, the trade-off it must make in deciding whether or not to fund a project remains the same because it must take into account the opportunity cost of its funds. For example, instead of purchasing new equipment, the firm could lend out the funds and earn interest. The forgone interest earned is the opportunity cost of using retained earnings to fund an investment project.

So the trade-off the firm faces when comparing a project's rate of return to the market interest rate has not changed when it uses retained earnings rather than borrowed funds, which means that regardless of whether a firm funds investment spending through borrowing or retained earnings, a rise in the market interest rate makes any given investment project less profitable. Conversely, a fall in the interest rate makes some investment projects that were unprofitable before profitable at the now lower interest rate. So some projects that had been unfunded before will be funded now.

So planned investment spending—spending on investment projects that firms voluntarily decide whether or not to undertake—is negatively related to the interest rate. Other things equal, a higher interest rate leads to a lower level of planned investment spending.

Expected Future Real GDP, Production Capacity, and Investment Spending

Suppose a firm has enough capacity to continue to produce the amount it is currently selling but doesn't expect its sales to grow in the future. Then it will engage in investment spending only to replace existing equipment and structures that wear out or are rendered obsolete by new technologies. But if, instead, the firm expects its sales to grow rapidly in the future, it will find its existing production capacity insufficient for its future production needs. So the firm will undertake investment spending to meet those needs. This implies that, other things equal, firms will undertake more investment spending when they expect their sales to grow.

Now suppose that the firm currently has considerably more capacity than necessary to meet current production needs. Even if it expects sales to grow, it won't have to undertake investment spending for a while—not until the growth in sales catches up with its excess capacity. This illustrates the fact that, other things equal, the current

According to the **accelerator principle,** a higher growth rate of real GDP leads to higher planned investment spending, but a lower growth rate of real GDP leads to lower planned investment spending.

Inventories are stocks of goods held to satisfy future sales.

Inventory investment is the value of the change in total inventories held in the economy during a given period.

Unplanned inventory investment occurs when actual sales are more or less than businesses expected, leading to unplanned changes in inventories.

Actual investment spending is the sum of planned investment spending and unplanned inventory investment.

level of productive capacity has a negative effect on investment spending: other things equal, the higher the current capacity, the lower the investment spending.

If we put together the effects on investment spending of growth in expected future sales and the size of current production capacity, we can see one situation in which we can be reasonably sure that firms will undertake high levels of investment spending: when they expect sales to grow rapidly. In that case, even excess production capacity will soon be used up, leading firms to resume investment spending.

What is an indicator of high expected growth of future sales? It's a high expected future growth rate of real GDP. A higher expected future growth rate of real GDP results in a higher level of planned investment spending, but a lower expected future growth rate of real GDP leads to lower planned investment spending. This relationship is summarized in a proposition known as the **accelerator principle.**

As we explain in the upcoming Economics in Action, when expectations of future real GDP growth turned negative, planned investment spending—and, in particular, residential investment spending—plunged, accelerating the economy's slide into recession. Generally, the effects of the accelerator principle play an important role in *investment spending slumps,* periods of low investment spending.

Inventories and Unplanned Investment Spending

Most firms maintain **inventories,** stocks of goods held to satisfy future sales. Firms hold inventories so they can quickly satisfy buyers—a consumer can purchase an item off the shelf rather than waiting for it to be manufactured. In addition, businesses often hold inventories of their inputs to be sure they have a steady supply of necessary materials and spare parts. At the end of 2012, the overall value of inventories in the U.S. economy was estimated at $1.5 trillion, just over 10% of GDP.

A firm that increases its inventories is engaging in a form of investment spending. Suppose, for example, that the U.S. auto industry produces 800,000 cars per month but sells only 700,000. The remaining 100,000 cars are added to the inventory at auto company warehouses or car dealerships, ready to be sold in the future.

Inventory investment is the value of the change in total inventories held in the economy during a given period. Unlike other forms of investment spending, inventory investment can actually be negative. If, for example, the auto industry reduces its inventory over the course of a month, we say that it has engaged in negative inventory investment.

Johner Images/Alamy

Firms undertake high levels of investment spending when they expect the economy to grow rapidly. If an economic slump is expected, they do the opposite.

To understand inventory investment, think about a manager stocking the canned goods section of a supermarket. The manager tries to keep the store fully stocked so that shoppers can almost always find what they're looking for. But the manager does not want the shelves too heavily stocked because shelf space is limited and products can spoil.

Similar considerations apply to many firms and typically lead them to manage their inventories carefully. However, sales fluctuate. And because firms cannot always accurately predict sales, they often find themselves holding more or less inventories than they had intended. These unintended swings in inventories due to unforeseen changes in sales are called **unplanned inventory investment.** They represent investment spending, positive or negative, that occurred but was unplanned.

So in any given period, **actual investment spending** is equal to planned investment spending plus unplanned inventory investment. If we let $I_{Unplanned}$ represent unplanned inventory investment, $I_{Planned}$ represent

planned investment spending, and I represent actual investment spending, then the relationship among all three can be represented as:

(61-6) $I = I_{Unplanned} + I_{Planned}$

To see how unplanned inventory investment can occur, let's continue to focus on the auto industry and make the following assumptions. First, let's assume that the industry must determine each month's production volume in advance, before it knows the volume of actual sales. Second, let's assume that it anticipates selling 800,000 cars next month and that it plans neither to add to nor subtract from existing inventories. In that case, it will produce 800,000 cars to match anticipated sales.

Now imagine that next month's actual sales are less than expected, only 700,000 cars. As a result, the value of 100,000 cars will be added to investment spending as unplanned inventory investment.

The auto industry will, of course, eventually adjust to this slowdown in sales and the resulting unplanned inventory investment. It is likely that it will cut next month's production volume in order to reduce inventories. In fact, economists who study macroeconomic variables in an attempt to determine the future path of the economy pay careful attention to changes in inventory levels. Rising inventories typically indicate positive unplanned inventory investment and a slowing economy, as sales are less than had been forecast. Falling inventories typically indicate negative unplanned inventory investment and a growing economy, as sales are greater than forecast.

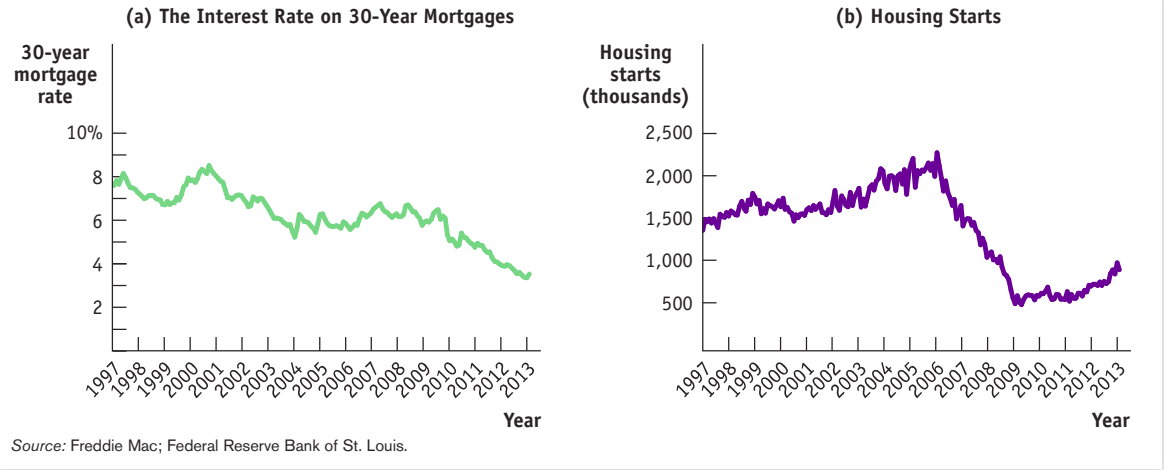
ECONOMICS IN ACTION

INTEREST RATES AND THE U.S. HOUSING BOOM

The housing boom in the Ft. Myers metropolitan area, described at the beginning of this section, was part of a broader housing boom in the country as a whole. There is little question that this housing boom was caused, in the first instance, by low interest rates.

Figure 61-6 shows the interest rate on 30-year home mortgages—the traditional way to borrow money for a home purchase—and the number of housing starts, the number of homes for which construction is started per month, from 1997 to early 2013, in the United States. Panel (a), which shows the mortgage rate, gives you an idea of how much interest rates fell. In the second half of the 1990s, mortgage rates

FIGURE 61-6 Interest Rates and the U.S. Housing Boom



Source: Freddie Mac; Federal Reserve Bank of St. Louis.

generally fluctuated between 7% and 8%; by 2003, they were down to between 5% and 6%. These lower rates were largely the result of Federal Reserve policy: the Fed cut rates in response to the 2001 recession and continued cutting them into 2003 out of concern that the economy's recovery was too weak to generate sustained job growth.

The low interest rates led to a large increase in residential investment spending, reflected in a surge of housing starts, shown in panel (b). This rise in investment spending drove an overall economic expansion, both through its direct effects and through the multiplier process.

Unfortunately, the housing boom eventually turned into too much of a good thing. By 2006, it was clear that the U.S. housing market was experiencing a bubble: people were buying housing based on unrealistic expectations about future price increases. When the bubble burst, housing—and the U.S. economy—took a fall. The fall was so severe that even when the Fed cut rates to near zero, and mortgage rates consequently dropped to below 5% beginning in 2009, housing starts merely stabilized. It wasn't until 2012 that housing starts began to increase again.

MODULE 61

Review

Solutions appear at the back of the book.

Check Your Understanding

1. Suppose the economy consists of three people: Angelina, Felicia, and Marina. The table shows how their consumer spending varies as their current disposable income rises by $10,000.

Current disposable income	Consumer spending		
	Angelina	Felicia	Marina
$0	$8,000	$6,500	$7,250
10,000	12,000	14,500	14,250

   a. Derive each individual's consumption function, where *MPC* is calculated for a $10,000 change in current disposable income.

   b. Derive the aggregate consumption function.

2. Suppose that problems in the capital markets make consumers unable either to borrow or to put money aside for future use. What implication does this have for the effects of expected future disposable income on consumer spending?

3. For each event, explain whether planned investment spending or unplanned inventory investment will change and in what direction.

   a. an unexpected increase in consumer spending

   b. a sharp rise in the cost of business borrowing

   c. a sharp increase in the economy's growth rate of real GDP

   d. an unanticipated fall in sales

4. When consumer spending is sluggish an *inventory overhang*—a high level of unplanned inventory investment throughout the economy—can make it difficult for the economy to recover quickly. Explain why an inventory overhang might, like the existence of too much production capacity, depress current economic activity.

Multiple-Choice Questions

1. Changes in which of the following lead to a shift of the aggregate consumption function?

   I. expected future disposable income
   II. aggregate wealth
   III. current disposable income

   a. I only
   b. II only
   c. III only
   d. I and II only
   e. I, II, and III

2. The slope of a family's consumption function is equal to
   a. the real interest rate.
   b. the inflation rate.
   c. the marginal propensity to consume.
   d. the rate of increase in household current disposable income.
   e. the tax rate.

3. Given the consumption function $c = \$16{,}000 + 0.5\,yd$, if individual household current disposable income is $20,000, individual household consumer spending will equal
   a. $36,000.
   b. $26,000.
   c. $20,000.
   d. $16,000.
   e. $6,000.

4. The level of planned investment spending is negatively related to the
   a. rate of return on investment.
   b. level of consumer spending.
   c. level of actual investment spending.
   d. interest rate.
   e. all of the above.

5. Actual investment spending in any period is equal to
   a. planned investment spending + unplanned inventory investment.
   b. planned investment spending – unplanned inventory investment.
   c. planned investment spending + inventory decreases.
   d. unplanned inventory investment + inventory increases.
   e. unplanned inventory investment – inventory increases.

Critical-Thinking Question

List the three most important factors affecting planned investment spending. Explain how each is related to actual investment spending.

MODULE 62

The Income–Expenditure Model

moodboard/Alamy

WHAT YOU WILL LEARN

1. How planned aggregate spending determines income–expenditure equilibrium
2. How the inventory adjustment process moves the economy to a new equilibrium after a change in planned aggregate spending

Using the Income–Expenditure Model

Earlier in this section, we described how autonomous changes in spending—such as a fall in investment spending when a housing bubble bursts—lead to a multistage process through the actions of the multiplier that magnifies the effect of these changes on real GDP. In this module, we will examine this multistage process more closely. We'll see that the multiple rounds of changes in real GDP are accomplished through changes in the amount of output produced by firms—changes that they make in response to changes in their inventories. We'll come to understand why inventories play a central role in macroeconomic models of the economy in the short run as well as why economists pay particular attention to the behavior of firms' inventories when trying to understand the likely future state of the economy.

Before we begin, let's quickly recap the assumptions underlying the multiplier process.

1. *Changes in overall spending lead to changes in aggregate output.* We assume that producers are willing to supply additional output at a fixed price level. As a result, changes in spending translate into changes in output rather than moves of the overall price level up or down. A fixed aggregate price level also implies that there is no difference between nominal GDP and real GDP. So we can use the two terms interchangeably in this module.
2. *The interest rate is fixed.* As we'll see, the model we examine here can still be used to study the effects of a change in the interest rate.
3. *Taxes, government transfers, and government purchases are all zero.*
4. *Exports and imports are both zero.*

Planned Aggregate Spending and Real GDP

In an economy with no government and no foreign trade, there are only two sources of aggregate spending: consumer spending, C, and investment spending, I. And since we assume that there are no taxes or transfers, aggregate disposable income is equal to GDP (which, since the aggregate price level is fixed, is the same as real GDP): the total value of final sales of goods and services ultimately accrues to households as income. So in this highly simplified economy, there are two basic equations of national income accounting:

(62-1) $GDP = C + I$

(62-2) $YD = GDP$

As we learned in the previous module, the aggregate consumption function shows the relationship between disposable income and consumer spending. Let's continue to assume that the aggregate consumption function is of the same form as in Equation 61-5:

(62-3) $C = A + MPC \times YD$

In our simplified model, we will also assume planned investment spending, $I_{Planned}$, is fixed.

We need one more concept before putting the model together: **planned aggregate spending,** the total amount of planned spending in the economy. Unlike firms, households don't take unintended actions like unplanned inventory investment. So planned aggregate spending is equal to the sum of consumer spending and planned investment spending. We denote planned aggregate spending by $AE_{Planned}$, so:

(62-4) $AE_{Planned} = C + I_{Planned}$

The level of planned aggregate spending in a given year depends on the level of real GDP in that year. To see why, let's look at a specific example, shown in Table 62-1. We assume that the aggregate consumption function is:

(62-5) $C = 300 + 0.6 \times YD$

Real GDP, YD, C, $I_{Planned}$, and $AE_{Planned}$ are all measured in billions of dollars, and we assume that the level of planned investment, $I_{Planned}$, is fixed at $500 billion per year. The first column shows possible levels of real GDP. The second column shows disposable income, YD, which in our simplified model is equal to real GDP. The third column shows consumer spending, C, equal to $300 billion plus 0.6 times disposable income, YD. The fourth column shows planned investment spending, $I_{Planned}$, which we have assumed is $500 billion regardless of the level of real GDP.

Finally, the last column shows planned aggregate spending, $AE_{Planned}$, the sum of aggregate consumer spending, C, and planned investment spending, $I_{Planned}$. (To economize on notation, we'll assume that it is understood from now on that all the variables in Table 62-1 are measured in billions of dollars per year.) As you can see, a higher level of real GDP leads to a higher level of disposable income: every 500 increase in real GDP raises YD by 500, which in turn raises C by $500 \times 0.6 = 300$ and $AE_{Planned}$ by 300.

TABLE 62-1

Real GDP	YD	C	$I_{Planned}$	$AE_{Planned}$
	(billions of dollars)			
$0	$0	$300	$500	$800
500	500	600	500	1,100
1,000	1,000	900	500	1,400
1,500	1,500	1,200	500	1,700
2,000	2,000	1,500	500	2,000
2,500	2,500	1,800	500	2,300
3,000	3,000	2,100	500	2,600
3,500	3,500	2,400	500	2,900

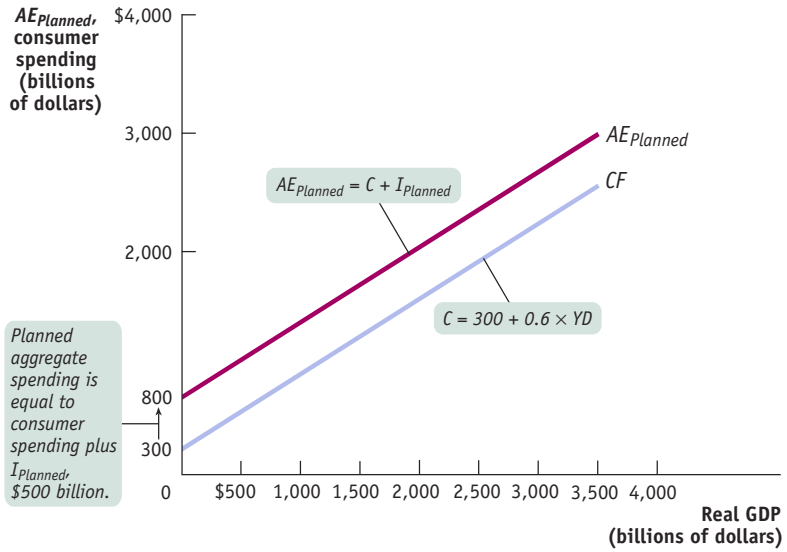
Figure 62-1 illustrates the information in Table 62-1 graphically. Real GDP is measured on the horizontal axis. CF is the aggregate consumption function; it shows how consumer spending depends on real GDP. $AE_{Planned}$, the planned aggregate spending line, corresponds to the aggregate consumption function shifted up by 500 (the amount of $I_{Planned}$). It shows how planned aggregate spending depends on real GDP. Both lines have a slope of 0.6, equal to MPC, the marginal propensity to consume.

But this isn't the end of the story. Table 62-1 reveals that real GDP equals planned aggregate spending, $AE_{Planned}$, only when the level of real GDP is at 2,000. Real GDP does not equal $AE_{Planned}$ at any other level. Is that possible? Didn't we learn from the circular-flow diagram that total spending on final goods and services in the economy

Planned aggregate spending is the total amount of planned spending in the economy.

FIGURE 62-1 The Aggregate Consumption Function and Planned Aggregate Spending

The lower line, *CF*, is the aggregate consumption function constructed from the data in Table 62-1. The upper line, $AE_{Planned}$, is the planned aggregate spending line, also constructed from the data in Table 62-1. It is equivalent to the aggregate consumption function shifted up by $500 billion, the amount of planned investment spending, $I_{Planned}$.



is equal to the total value of output of final goods and services? The answer is that for *brief* periods of time, planned aggregate spending can differ from real GDP because of the role of *unplanned* aggregate spending—$I_{Unplanned}$, unplanned inventory investment. But as we'll see, the economy moves over time to a situation in which there is no unplanned inventory investment, a situation called *income–expenditure equilibrium*. And when the economy is in income–expenditure equilibrium, planned aggregate spending on final goods and services equals aggregate output.

Income–Expenditure Equilibrium

For all but one value of real GDP shown in Table 62-1, real GDP is either more or less than $AE_{Planned}$, the sum of consumer spending and *planned* investment spending. For example, when real GDP is 1,000, consumer spending, *C*, is 900 and planned investment spending is 500, making planned aggregate spending 1,400. This is 400 *more* than the corresponding level of real GDP. Now consider what happens when real GDP is 2,500; consumer spending, *C*, is 1,800 and planned investment spending is 500, making planned aggregate spending only 2,300, 200 *less* than real GDP.

As we've just explained, planned aggregate spending can be different from real GDP only if there is unplanned inventory investment, $I_{Unplanned}$, in the economy. Let's examine Table 62-2, which includes the numbers for real GDP and for planned aggregate spending from Table 62-1. It also includes the levels of unplanned inventory investment, $I_{Unplanned}$, that each combination of real GDP and planned aggregate spending implies. For example, if real GDP is 2,500, planned aggregate spending is only 2,300. This 200 excess of real GDP over $AE_{Planned}$ must consist of positive unplanned inventory investment. This can happen only if firms have overestimated sales and produced too much, leading to unintended additions to inventories. More generally, any level of real GDP in excess of 2,000 corresponds to a situation in which firms are producing more than consumers and other firms want to purchase, creating an unintended increase in inventories.

Conversely, a level of real GDP below 2,000 implies that planned aggregate spending is *greater* than real GDP. For example, when real GDP is 1,000, planned aggregate

TABLE 62-2

Real GDP	$AE_{Planned}$	$I_{Unplanned}$
(billions of dollars)		
$0	$800	–$800
500	1,100	–600
1,000	1,400	–400
1,500	1,700	–200
2,000	2,000	0
2,500	2,300	200
3,000	2,600	400
3,500	2,900	600

spending is much larger, at 1,400. The 400 excess of $AE_{Planned}$ over real GDP corresponds to negative unplanned inventory investment equal to −400. More generally, any level of real GDP below 2,000 implies that firms have underestimated sales, leading to a negative level of unplanned inventory investment in the economy.

By putting together Equations 61-6, 62-1, and 62-4, we can summarize the general relationships among real GDP, planned aggregate spending, and unplanned inventory investment as follows:

$$\textbf{(62-6)}\quad GDP = C + I$$
$$= C + I_{Planned} + I_{Unplanned}$$
$$= AE_{Planned} + I_{Unplanned}$$

So whenever real GDP exceeds $AE_{Planned}$, $I_{Unplanned}$ is positive; whenever real GDP is less than $AE_{Planned}$, $I_{Unplanned}$ is negative.

But firms will act to correct their mistakes. We've assumed that they don't change their prices, but they *can* adjust their output. Specifically, they will reduce production if they have experienced an unintended rise in inventories or increase production if they have experienced an unintended fall in inventories. And these responses will eventually eliminate the unanticipated changes in inventories and move the economy to a point at which real GDP is equal to planned aggregate spending.

Monty Rakusen/Getty Images

Firms can adjust output and inventory to correct for sales projections that were too high or low, helping to move the economy back to equilibrium.

Staying with our example, if real GDP is 1,000, negative unplanned inventory investment will lead firms to increase production, leading to a rise in real GDP. In fact, this will happen whenever real GDP is less than 2,000—that is, whenever real GDP is less than planned aggregate spending. Conversely, if real GDP is 2,500, positive unplanned inventory investment will lead firms to reduce production, leading to a fall in real GDP. This will happen whenever real GDP is greater than planned aggregate spending.

The only situation in which firms won't have an incentive to change output in the next period is when aggregate output, measured by real GDP, is equal to planned aggregate spending in the current period, an outcome known as **income–expenditure equilibrium.** In Table 62-2, income–expenditure equilibrium is achieved when real GDP is 2,000, the only level of real GDP at which unplanned inventory investment is zero. From now on, we'll denote the real GDP level at which income–expenditure equilibrium occurs as Y^* and call it the **income–expenditure equilibrium GDP.**

Figure 62-2 illustrates the concept of income–expenditure equilibrium graphically. Real GDP is on the horizontal axis and planned aggregate spending, $AE_{Planned}$, is on the vertical axis. There are two lines in the figure. The solid line is the planned aggregate spending line. It shows how $AE_{Planned}$, equal to $C + I_{Planned}$, depends on real GDP; it has a slope of 0.6, equal to the marginal propensity to consume, *MPC,* and a vertical intercept equal to $A + I_{Planned}$ (300 + 500 = 800).

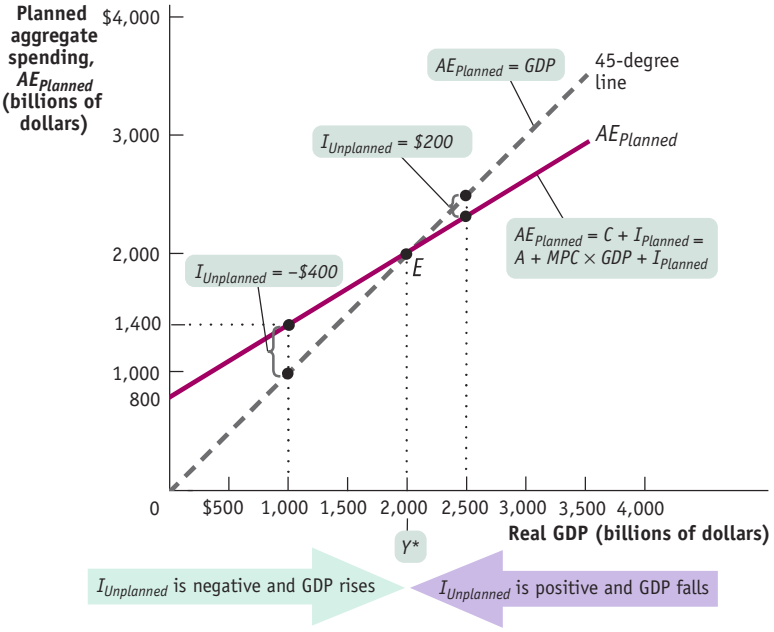
The economy is in **income–expenditure equilibrium** when aggregate output, measured by real GDP, is equal to planned aggregate spending.

Income–expenditure equilibrium GDP is the level of real GDP at which real GDP equals planned aggregate spending.

The dashed line, which goes through the origin with a slope of 1 (often called a 45-degree line), shows all the possible points at which planned aggregate spending is equal to real GDP. This line allows us to easily spot the point of income–expenditure equilibrium, which must lie on both the 45-degree line and the planned aggregate spending line. So the point of income–expenditure equilibrium is at *E,* where the two lines cross. And the income–expenditure equilibrium GDP, Y^*, is 2,000—the same outcome we derived in Table 62-2.

FIGURE 62-2 Income–Expenditure Equilibrium

Income–expenditure equilibrium occurs at *E*, the point where the planned aggregate spending line, $AE_{Planned}$, crosses the 45-degree line. At *E*, the economy produces real GDP of $2,000 billion per year, the only point at which real GDP equals planned aggregate spending, $AE_{Planned}$, and unplanned inventory investment, $I_{Unplanned}$, is zero. This is the level of income–expenditure equilibrium GDP, *Y**. At any level of real GDP less than *Y**, $AE_{Planned}$ exceeds real GDP. As a result, unplanned inventory investment, $I_{Unplanned}$, is negative and firms respond by increasing production. At any level of real GDP greater than *Y**, real GDP exceeds $AE_{Planned}$. Unplanned inventory investment, $I_{Unplanned}$, is positive and firms respond by reducing production.



Now consider what happens if the economy isn't in income–expenditure equilibrium. We can see from Figure 62-2 that whenever real GDP is less than *Y**, the planned aggregate spending line lies above the 45-degree line and $AE_{Planned}$ exceeds real GDP. In this situation, $I_{Unplanned}$ is negative: as shown in the figure, at a real GDP of 1,000, $I_{Unplanned}$ is −400. As a consequence, real GDP will rise. In contrast, whenever real GDP is greater than *Y**, the planned aggregate expenditure line lies below the 45-degree line. Here, $I_{Unplanned}$ is positive: as shown, at a real GDP of 2,500, $I_{Unplanned}$ is 200. The unanticipated accumulation of inventory leads to a fall in real GDP.

The type of diagram shown in Figure 62-2, which identifies income–expenditure equilibrium as the point at which the planned aggregate spending line crosses the 45-degree line, has a special place in the history of economic thought. Known as the **Keynesian cross,** it was developed by Paul Samuelson, one of the greatest economists of the twentieth century (as well as a Nobel Prize winner), to explain the ideas of John Maynard Keynes, the founder of macroeconomics as we know it.

The Multiplier Process and Inventory Adjustment

We've just learned about a very important feature of the macroeconomy: when planned spending by households and firms does not equal the current aggregate output by firms, this difference shows up in changes in inventories. The response of firms to those inventory changes moves real GDP over time to the point at which real GDP and planned aggregate spending are equal. That's why, as we mentioned earlier, changes in inventories are considered a leading indicator of future economic activity.

Now that we understand how real GDP moves to achieve income–expenditure equilibrium for a given level of planned aggregate spending, let's turn to understanding what happens when there is *a shift of the planned aggregate spending line*. How does the economy move from the initial point of income–expenditure equilibrium to a new point of income–expenditure equilibrium? And what are the possible sources of changes in planned aggregate spending?

The **Keynesian cross** diagram identifies income–expenditure equilibrium as the point where the planned aggregate spending line crosses the 45-degree line.

In our simple model there are only two possible sources of a shift of the planned aggregate spending line: a change in planned investment spending, $I_{Planned}$, or a shift of the aggregate consumption function, *CF*. For example, a change in $I_{Planned}$ can occur because of a change in the interest rate. (Remember, we're assuming that the interest rate is fixed by factors that are outside the model. But we can still ask what happens when the interest rate changes.) A shift of the aggregate consumption function (that is, a change in its vertical intercept, *A*) can occur because of a change in aggregate wealth—say, due to a rise in house prices.

When the planned aggregate spending line shifts—when there is a change in the level of planned aggregate spending at any given level of real GDP—there is an autonomous change in planned aggregate spending. Recall that an autonomous change in planned aggregate spending is a change in the desired level of spending by firms, households, and government at any given level of real GDP (although we've assumed away the government for the time being). How does an autonomous change in planned aggregate spending affect real GDP in income–expenditure equilibrium?

Table 62-3 and Figure 62-3 start from the same numerical example we used in Table 62-2 and Figure 62-2. They also show the effect of an autonomous increase in planned aggregate spending of 400—what happens when planned aggregate spending is 400 higher at each level of real GDP. Look first at Table 62-3. Before the autonomous increase in planned aggregate spending, the level of real GDP at which planned aggregate spending is equal to real GDP, Y^*, is 2,000. After the autonomous change, Y^* has risen to 3,000.

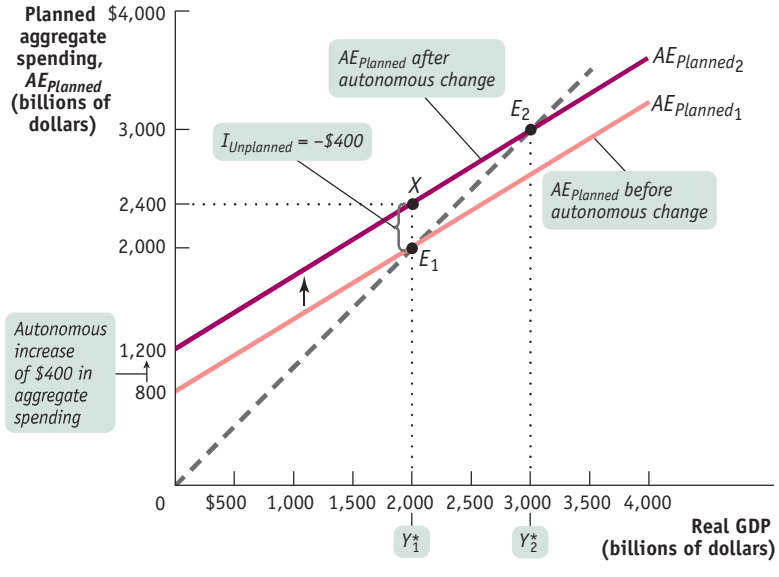
The same result is visible in Figure 62-3. The initial income–expenditure equilibrium is at E_1, where Y_1^* is 2,000. The autonomous rise in planned aggregate spending shifts the planned aggregate spending line up, leading to a new income–expenditure equilibrium at E_2, where Y_2^* is 3,000.

TABLE 62-3

Real GDP	$AE_{Planned}$ before autonomous change	$AE_{Planned}$ after autonomous change
	(billions of dollars)	
$0	$800	$1,200
500	1,100	1,500
1,000	1,400	1,800
1,500	1,700	2,100
2,000	2,000	2,400
2,500	2,300	2,700
3,000	2,600	3,000
3,500	2,900	3,300
4,000	3,200	3,600

FIGURE 62-3 The Multiplier

This figure illustrates the change in Y^* caused by an autonomous increase in planned aggregate spending. The economy is initially at equilibrium point E_1 with an income–expenditure equilibrium GDP, Y_1^*, equal to 2,000. An autonomous increase in $AE_{Planned}$ of 400 shifts the planned aggregate spending line upward by 400. The economy is no longer in income–expenditure equilibrium: real GDP is equal to 2,000 but $AE_{Planned}$ is now 2,400, represented by point *X*. The vertical distance between the two planned aggregate spending lines, equal to 400, represents $I_{Unplanned}$ = –400—the negative inventory investment that the economy now experiences. Firms respond by increasing production, and the economy eventually reaches a new income–expenditure equilibrium at E_2 with a higher level of income–expenditure equilibrium GDP, Y_2^*, equal to 3,000.



The fact that the rise in income–expenditure equilibrium GDP, from 2,000 to 3,000, is much larger than the autonomous increase in aggregate spending, which is only 400, has a familiar explanation: the multiplier process. In the specific example we have just described, an autonomous increase in planned aggregate spending of 400 leads to an increase in Y^* from 2,000 to 3,000, a rise of 1,000. So the multiplier in this example is 1,000/400 = 2.5.

We can examine in detail what underlies the multistage multiplier process by looking more closely at Figure 62-3. First, starting from E_1, the autonomous increase in planned aggregate spending leads to a gap between planned aggregate spending and real GDP. This is represented by the vertical distance between X, at 2,400, and E_1, at 2,000. This gap illustrates an unplanned fall in inventory investment: $I_{Unplanned} = -400$. Firms respond by increasing production, leading to a rise in real GDP from Y_1^*. The rise in real GDP translates into an increase in disposable income, YD.

That's the first stage in the chain reaction. But it doesn't stop there—the increase in YD leads to a rise in consumer spending, C, which sets off a second-round rise in real GDP. This in turn leads to a further rise in disposable income and consumer spending, and so on. And we could play this process in reverse: an autonomous fall in aggregate spending will lead to a chain reaction of reductions in real GDP and consumer spending.

We can summarize these results in an equation, where $\Delta AAE_{Planned}$ represents the autonomous change in $AE_{Planned}$, and $\Delta Y^* = Y_2^* - Y_1^*$, the subsequent change in income–expenditure equilibrium GDP:

$$\textbf{(62-7)}\quad \Delta Y^* = \text{Multiplier} \times \Delta AAE_{Planned} = \frac{1}{1 - MPC} \times \Delta AAE_{Planned}$$

Recalling that the multiplier, $1/(1 - MPC)$, is greater than 1, Equation 62-7 tells us that the change in income–expenditure equilibrium GDP, ΔY^*, is several times as large as the autonomous change in planned aggregate spending, $\Delta AAE_{Planned}$. It also helps us recall an important point: because the marginal propensity to consume is less than 1, each increase in disposable income and each corresponding increase in consumer spending is smaller than in the previous round. That's because at each round some of the increase in disposable income leaks out into savings. As a result, although real GDP grows at each round, the increase in real GDP diminishes from each round to the next. At some point the increase in real GDP is negligible, and the economy converges to a new income–expenditure equilibrium GDP at Y_2^*.

THE PARADOX OF THRIFT Let's now consider what happens when there is a slump in consumer spending or investment spending, or both. This causes a fall in income–expenditure equilibrium GDP that is several times larger than the original fall in spending. The fall in real GDP leaves consumers and producers worse off than they would have been if they hadn't cut their spending. Economists refer to this phenomenon as the *paradox of thrift*.

In the paradox of thrift, households and firms cut their spending in anticipation of future tough economic times. These actions depress the economy, leaving households and firms worse off than if they hadn't acted virtuously to prepare for tough times. It is called a paradox because what's usually "good" (saving for hard times) is "bad" (because it can make everyone worse off).

We've seen that declines in planned investment spending are usually the major factor causing recessions, because historically they have been the most common source of autonomous reductions in aggregate spending. Likewise, we know that consumption spending can change as a result of an increase or decrease in the aggregate wealth or expected future disposable income of individuals. But regardless of the source, there are multiplier effects in the economy that magnify the size of the initial change in aggregate spending.

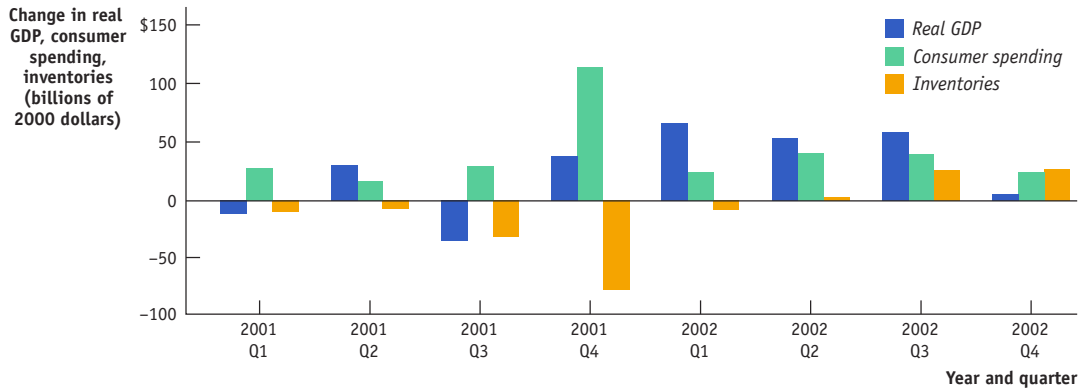
ECONOMICS IN ACTION

INVENTORIES AND THE END OF A RECESSION

A very clear example of the role of inventories in the multiplier process took place in late 2001, as that year's recession came to an end.

The driving force behind the recession was a slump in business investment spending. It took several years before investment spending bounced back in the form of a housing boom. Still, the economy did start to recover in late 2001, largely because of an increase in consumer spending—especially on durable goods such as automobiles.

FIGURE 62-4 Inventories and the End of a Recession



Source: Bureau of Economic Analysis.

Initially, this increase in consumer spending caught manufacturers by surprise. Figure 62-4 shows changes in real GDP, real consumer spending, and real inventories in each quarter of 2001 and 2002. Notice the surge in consumer spending in the fourth quarter of 2001. It didn't lead to a lot of GDP growth because it was offset by a plunge in inventories. But in the first quarter of 2002 producers greatly increased their production, leading to a jump in real GDP.

MODULE 62 Review

Solutions appear at the back of the book.

Check Your Understanding

1. Although economists believe that recessions typically begin as slumps in investment spending, they also believe that consumer spending eventually slumps during a recession. Explain why.

2. a. Use a diagram like Figure 62-3 to show what happens when there is an autonomous fall in planned aggregate spending. Describe how the economy adjusts to a new income–expenditure equilibrium.

   b. Suppose Y^* is originally $500 billion, the autonomous reduction in planned aggregate spending is $300 million ($0.3 billion), and $MPC = 0.5$. Calculate Y^* after such a change.

Multiple-Choice Questions

1. The aggregate consumption function shows the relationship between
   a. disposable income and saving.
   b. saving and consumption spending.
   c. disposable income and consumption spending.
   d. consumption and investment spending.
   e. disposable income and planned aggregate expenditure.

2. In income–expenditure equilibrium
   a. consumption spending equals investment spending.
   b. unplanned inventory investment is zero.
   c. inventory investment is zero.
   d. investment spending is zero.
   e. consumption spending equals real GDP.

3. Planned aggregate spending
   a. always equals real GDP.
   b. never equals real GDP.
   c. equals real GDP if unplanned inventory investment is zero.
   d. equals real GDP if inventory investment is zero.
   e. equals consumption plus investment spending.

4. If real GDP is less than planned aggregate spending then
   a. unplanned inventory investment is positive.
   b. unplanned inventory investment is negative.
   c. unplanned inventory investment is zero.
   d. firms will reduce production.
   e. planned aggregate spending will fall to match real GDP.

5. Suppose there is a $200 million increase in autonomous planned aggregate spending. This will cause the planned aggregate spending line to shift upwards by _____ and real GDP will increase by _____.
   a. $200 million; $200 million
   b. $200 million; less than $200 million
   c. $200 million; more than $200 million
   d. more than $200 million; more than $200 million
   e. more than $200 million; $200 million

Critical-Thinking Question

What is the value of unplanned inventory investment in income–expenditure equilibrium? Why?

BUSINESS CASE • Making It Through in Muskegon

Thinkstock

Muskegon, Michigan, is no Ft. Myers. Unlike the Florida city whose boom and bust we described in this section's opening story, Muskegon didn't have a housing boom in the mid-2000s. And it didn't have that much of a housing bust, either.

Since real estate wasn't a big part of the local economy, the housing bubble burst couldn't do much to drag that economy down. So you might think that Muskegon-area businesses were somewhat insulated from the resulting national downturn.

However, Muskegon businesses were nonetheless hit hard by the recession. For example, Eagle Alloy—a manufacturing company that sells its products to a wide variety of industries, but not especially to the housing or construction sectors—saw its sales drop by 50%. And it wasn't only manufacturers selling to a national market that were hit.

As factories in the Muskegon–Norton Shores metropolitan area laid off workers, and the local unemployment rate increased from around 6% in 2001 to over 15% during 2010, local businesses that depended on these workers' paychecks were hurt as well; employment in retail businesses fell about 8% over the course of the recession.

This story does, however, have a somewhat happy ending.

As the U.S. economy as a whole began to recover, so did Eagle Alloy and other Muskegon-area manufacturing companies. During the recession, Eagle cut its workforce from 430 to 200, but following the recession, the workforce was back to more than 400, and the company was planning to hire another 150 workers. Eagle Alloy's president, Mark Fazakerley, was predicting a 25% increase in sales.

In the broader Muskegon–Norton Shores metropolitan area, by mid-2013, the local unemployment rate had fallen back down to under 9%. And as manufacturing for the national market revived, businesses with local sales also bounced back; the redevelopment of Muskegon's downtown, which stalled during the recession, had resumed.

Questions for Thought

1. Why did a national slump that began with housing affect companies like Eagle Alloy that didn't sell much to the construction industry?
2. Why did the troubles of Muskegon manufacturers spread to other industries, like retailing?
3. How does this story about Muskegon help explain how a slump in housing—a relatively small part of the U.S. economy—could produce such a deep national recession?

SECTION 19 REVIEW

Summary

The Multiplier

1. An **autonomous change in aggregate spending** leads to a chain reaction in which the total change in real GDP is equal to the **multiplier** times the initial change in aggregate spending.
2. The size of the multiplier, $1/(1 - MPC)$, depends on the **marginal propensity to consume, *MPC*,** the fraction of an additional dollar of disposable income spent on consumption.
3. The larger the *MPC*, the larger the multiplier and the larger the change in real GDP for any given autonomous change in aggregate spending. The **marginal propensity to save, *MPS*,** is equal to $1 - MPC$.

Consumption and Investment Spending

4. The **consumption function** shows how an individual household's consumer spending is determined by its current disposable income. The **aggregate consumption function** shows the relationship for the entire economy. According to the life-cycle hypothesis, households try to smooth their consumption over their lifetimes. As a result, the aggregate consumption function shifts in response to changes in expected future disposable income and changes in aggregate wealth.
5. **Planned investment spending** depends negatively on the interest rate and on existing production capacity; it depends positively on expected future real GDP. The **accelerator principle** says that investment spending is greatly influenced by the expected growth rate of real GDP.
6. Firms hold **inventories** of goods so that they can satisfy consumer demand quickly. **Inventory investment** is positive when firms add to their inventories, negative when they reduce them. Often, however, changes in inventories are not a deliberate decision but the result of mistakes in forecasts about sales. The result is **unplanned inventory investment,** which can be either positive or negative. **Actual investment spending** is the sum of planned investment spending and unplanned inventory investment.

The Income–Expenditure Model

7. In **income–expenditure equilibrium, planned aggregate spending,** which in a simplified model with no government and no foreign trade is the sum of consumer spending and planned investment spending, is equal to real GDP.
8. At the **income–expenditure equilibrium GDP,** or Y^*, unplanned inventory investment is zero. When planned aggregate spending is larger than Y^*, unplanned inventory investment is negative; there is an unanticipated reduction in inventories and firms increase production. When planned aggregate spending is less than Y^*, unplanned inventory investment is positive; there is an unanticipated increase in inventories and firms reduce production.
9. The **Keynesian cross** shows how the economy self-adjusts to income–expenditure equilibrium through inventory adjustments.
10. After an autonomous change in planned aggregate spending, the inventory adjustment process moves the economy to a new income–expenditure equilibrium. The change in income–expenditure equilibrium GDP arising from an autonomous change in spending is equal to $(1/(1 - MPC)) \times \Delta AAE_{Planned}$.

Key Terms

Marginal propensity to consume (*MPC*), p. 615
Marginal propensity to save (*MPS*), p. 615
Autonomous change in aggregate spending, p. 616
Multiplier, p. 616
Consumption function, p. 620
Aggregate consumption function, p. 622
Planned investment spending, p. 624
Accelerator principle, p. 626
Inventories, p. 626
Inventory investment, p. 626
Unplanned inventory investment, p. 626
Actual investment spending, p. 626
Planned aggregate spending, p. 631
Income–expenditure equilibrium, p. 633
Income–expenditure equilibrium GDP, p. 633
Keynesian cross, p. 634

Problems

1. Due to an increase in consumer wealth, there is a $40 billion autonomous increase in consumer spending in the economies of Westlandia and Eastlandia. Assuming that the aggregate price level is constant, the interest rate is fixed in both countries, and there are no taxes and no foreign trade, complete the accompanying tables to show the various rounds of increased spending that will occur in both economies if the marginal propensity to consume is 0.5 in Westlandia and 0.75 in Eastlandia. What do your results indicate about the relationship between the size of the marginal propensity to consume and the multiplier?

Westlandia			
Rounds	Incremental change in GDP		Total change in GDP
1	$\Delta C =$	$40 billion	?
2	$MPC \times \Delta C =$	?	?
3	$MPC \times MPC \times \Delta C =$	?	?
4	$MPC \times MPC \times MPC \times \Delta C =$	?	?
. . .		. . .	. . .
Total change in GDP	$(1/(1 - MPC)) \times \Delta C =$		?

Eastlandia			
Rounds	Incremental change in GDP		Total change in GDP
1	$\Delta C =$	$40 billion	?
2	$MPC \times \Delta C =$	?	?
3	$MPC \times MPC \times \Delta C =$	?	?
4	$MPC \times MPC \times MPC \times \Delta C =$	?	?
. . .		. . .	. . .
Total change in GDP	$(1/(1 - MPC)) \times \Delta C =$		?

2. Assuming that the aggregate price level is constant, the interest rate is fixed, and there are no taxes and no foreign trade, what will be the change in GDP if the following events occur?
   a. There is an autonomous increase in consumer spending of $25 billion; the marginal propensity to consume is 2/3.
   b. Firms reduce investment spending by $40 billion; the marginal propensity to consume is 0.8.
   c. The government increases its purchases of military equipment by $60 billion; the marginal propensity to consume is 0.6.

3. Economists observed the only five residents of a very small economy and estimated each one's consumer spending at various levels of current disposable income. The accompanying table shows each resident's consumer spending at three income levels.

Individual consumer spending by	Individual current disposable income		
	$0	$20,000	$40,000
Andre	1,000	$15,000	29,000
Barbara	2,500	12,500	22,500
Casey	2,000	20,000	38,000
Declan	5,000	17,000	29,000
Elena	4,000	19,000	34,000

   a. What is each resident's consumption function? What is the marginal propensity to consume for each resident?
   b. What is the economy's aggregate consumption function? What is the marginal propensity to consume for the economy?

4. From 2008 to 2013, Eastlandia experienced large fluctuations in both aggregate consumer spending and disposable income, but wealth, the interest rate, and expected future disposable income did not change. The accompanying table shows the level of aggregate consumer spending and disposable income in millions of dollars for each of these years. Use this information to answer the following questions.

Year	Disposable income (millions of dollars)	Consumer spending (millions of dollars)
2008	$100	$180
2009	350	380
2010	300	340
2011	400	420
2012	375	400
2013	500	500

   a. Plot the aggregate consumption function for Eastlandia.
   b. What is the marginal propensity to consume? What is the marginal propensity to save?
   c. What is the aggregate consumption function?

5. The Bureau of Economic Analysis reported that, in real terms, overall consumer spending increased by $18.2 billion during January 2013.
   a. If the marginal propensity to consume is 0.52, by how much will real GDP change in response?
   b. If there are no other changes to autonomous spending other than the increase in consumer spending in part a, and unplanned inventory investment, $I_{Unplanned}$, decreased by $10 billion, what is the change in real GDP?
   c. GDP at the end of December 2012 was $15,851 billion. If GDP were to increase by the amount calculated in part b, what would be the percent increase in GDP?

6. During the early 2000s, the Case–Shiller U.S. Home Price Index, a measure of average home prices, rose continuously until it peaked in March 2006. From March 2006 to May 2009, the index lost 32% of its value. Meanwhile, the stock market experienced similar ups and downs. From March 2003 to October 2007, the Standard and Poor's 500 (S&P 500) stock index, a broad measure of stock market prices, almost doubled, from 800.73 to a high of 1,565.15. From that time until March 2009, the index fell by almost 60%, to a low of 676.53. How do you think the movements in home prices both influenced the growth in real GDP during the first half of the decade and added to the concern about maintaining consumer spending after the collapse in the housing market that began in 2006? To what extent did the movements in the stock market hurt or help consumer spending?

7. How will planned investment spending change as the following events occur?
   a. The interest rate falls as a result of Federal Reserve policy.
   b. The U.S. Environmental Protection Agency decrees that corporations must upgrade or replace their machinery in order to reduce their emissions of sulfur dioxide.
   c. Baby boomers begin to retire in large numbers and reduce their savings, resulting in higher interest rates.

8. Explain how each of the following actions will affect the level of planned investment spending and unplanned inventory investment. Assume the economy is initially in income–expenditure equilibrium.
   a. The Federal Reserve raises the interest rate.
   b. There is a rise in the expected growth rate of real GDP.
   c. A sizable inflow of foreign funds into the country lowers the interest rate.

9. a. The accompanying table shows GDP, disposable income (*YD*), consumer spending (*C*), and planned investment spending ($I_{Planned}$) in an economy. Assume there is no government or foreign sector in this economy. Complete the table by calculating planned aggregate spending ($AE_{Planned}$) and unplanned inventory investment ($I_{Unplanned}$).

GDP	*YD*	*C*	$I_{Planned}$	$AE_{Planned}$	$I_{Unplanned}$
(billions of dollars)					
$0	$0	$100	$300	?	?
400	400	400	300	?	?
800	800	700	300	?	?
1,200	1,200	1,000	300	?	?
1,600	1,600	1,300	300	?	?
2,000	2,000	1,600	300	?	?
2,400	2,400	1,900	300	?	?
2,800	2,800	2,200	300	?	?
3,200	3,200	2,500	300	?	?

   b. What is the aggregate consumption function?
   c. What is *Y**, income–expenditure equilibrium GDP?
   d. What is the value of the multiplier?
   e. If planned investment spending falls to $200 billion, what will be the new *Y**?
   f. If autonomous consumer spending rises to $200 billion, what will be the new *Y**?

10. In an economy with no government and no foreign sectors, autonomous consumer spending is $250 billion, planned investment spending is $350 billion, and the marginal propensity to consume is 2/3.
   a. Plot the aggregate consumption function and planned aggregate spending.
   b. What is unplanned inventory investment when real GDP equals $600 billion?
   c. What is *Y**, income–expenditure equilibrium GDP?
   d. What is the value of the multiplier?
   e. If planned investment spending rises to $450 billion, what will be the new *Y**?

11. An economy has a marginal propensity to consume of 0.5, and *Y**, income–expenditure equilibrium GDP, equals $500 billion. Given an autonomous increase in planned investment of $10 billion, show the rounds of increased spending that take place by completing the accompanying table. The first and second rows are filled in for you. In the first row, the increase of planned investment spending of $10 billion raises real GDP and *YD* by $10 billion, leading to an increase in consumer spending of $5 billion (*MPC* × change in disposable income) in row 2, raising real GDP and *YD* by a further $5 billion.

Rounds	Change in $I_{Planned}$ or *C*	Change in real GDP	Change in *YD*
	(billions of dollars)		
1	$\Delta I_{Planned}$ = $10.00	$10.00	$10.00
2	ΔC = $ 5.00	$ 5.00	$ 5.00
3	ΔC = ?	?	?
4	ΔC = ?	?	?
5	ΔC = ?	?	?
6	ΔC = ?	?	?
7	ΔC = ?	?	?
8	ΔC = ?	?	?
9	ΔC = ?	?	?
10	ΔC = ?	?	?

   a. What is the total change in real GDP after the 10 rounds? What is the value of the multiplier? What would you expect the total change in *Y** to be based on the multiplier formula? How do your answers to the first and third questions compare?
   b. Redo the table starting from round 2, assuming the marginal propensity to consume is 0.75. What is the total change in real GDP after 10 rounds? What is the value of the multiplier? As the marginal propensity to consume increases, what happens to the value of the multiplier?

12. Although the United States is one of the richest nations in the world, it is also the world's largest debtor nation. We often hear that the problem is the nation's low savings rate. Suppose policy makers attempt to rectify this by encouraging greater savings in the economy. What effect will their successful attempts have on real GDP?

13. The U.S. economy slowed significantly in early 2008, and policy makers were extremely concerned about growth. To boost the economy, Congress passed several relief packages that combined would deliver about $700 billion in government spending. Assume, for the sake of argument, that this spending was in the form of payments made directly to consumers. The objective was to boost the economy by increasing the disposable income of American consumers.

a. Calculate the initial change in aggregate consumer spending as a consequence of this policy measure if the marginal propensity to consume (*MPC*) in the United States is 0.5. Then calculate the resulting change in real GDP arising from the $700 billion in payments.

b. Illustrate the effect on real GDP with the use of a graph depicting the income–expenditure equilibrium. Label the vertical axis "Planned aggregate spending, $AE_{Planned}$" and the horizontal axis "Real GDP." Draw two planned aggregate expenditure curves ($AE_{Planned1}$ and $AE_{Planned2}$) and a 45-degree line to show the effect of the autonomous policy change on the equilibrium.