chapter 11

>>Income and Expenditure

BE A PATRIOT AND SPEND

AFTER THE TERRORIST ATTACKS ON September 11, 2001, many leading figures in American life made speeches urging the shocked nation to show fortitude—and keep buying consumer goods. "Do your business around the country. Fly and enjoy America's great destination spots," urged President Bush. "Go shopping," said former president Clinton.

Such words were a far cry from British prime minister Winston Churchill's famous 1940 declaration, in the face of an imminent Nazi invasion of the United Kingdom, that he had nothing to offer but "blood, toil, tears, and sweat." But there was a reason politicians of both parties called for spending, not sacrifice. The economy was already in recession, mainly because of a 14% drop in real investment spending. A plunge in consumer spending would have greatly deepened the recession. Fortunately, that didn't happen: American consumers bought less of some goods and services, such as air travel, but bought more of others.

As we explained in Chapter 10, the source of most, but not all, recessions since World War II has been negative demand shocks, leftward shifts of the aggregate demand curve. Over the course of this and the next three chapters, we'll continue to focus on the short-run behavior of the economy, looking in detail at the factors that cause such shifts of the aggregate demand curve. In this chapter, we begin by looking at the determinants of consumer

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After 9/11, Americans traveled less but shopped more for goods that they could enjoy at home like barbecue grills and swimming pools.

What you will learn in this chapter:

- About **consumption function,** which shows how disposable income affects consumer spending
- How expected future income and aggregate wealth affect consumer spending
- The determinants of investment spending, and the distinction between **planned investment** and **unplanned inventory investment**
- How the inventory adjustment process moves the economy to a new equilibrium after a demand shock
- Why investment spending is considered a leading indicator of the future state of the economy

spending and investment spending. We'll examine in further detail the multiplier process discussed in Chapter 10, the process by which slumps or booms in consumer spending or investment spending are amplified throughout the economy over a period of time. We'll see how changes in investment spending are crucial to the multistage multiplier process that eventually moves the economy to a new equilibrium. Through this analysis we'll come to understand why investment spending and the levels of inventories are considered to be key indicators 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, individuals and families are constantly confronted with such choices—not just about the consumption mix but 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. So changes in consumer spending can produce significant shifts in the aggregate demand curve. And as we know from Chapter 10, the position of the aggregate demand curve, along with the position of the short-run aggregate supply curve, determines the economy's aggregate output and aggregate price level in the short run.

But what determines how much consumers spend? We'll focus on three significant factors: current disposable income, expected future disposable income, and wealth.

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 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 disposable income.

Figure 11-1 is a scatter diagram illustrating the relationship between household disposable income and household consumer spending for American households by income group in 2003. For example, point *A* shows that among the group with an annual income of $40,000 to $49,999, average household disposable income was $42,842 and average household consumer spending was $39,757 in 2003. It's clear that households with higher 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.

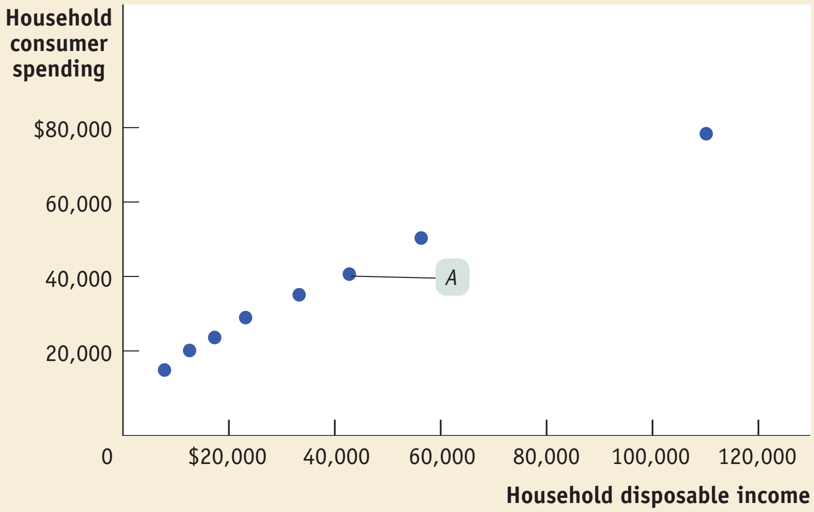
$$\textbf{(11-1)} \quad c = a + MPC \times yd$$

In this equation, c is individual household consumer spending and yd is individual household disposable income. As we learned in Chapter 10, MPC, the marginal propensity to consume, is the amount by which consumer spending rises if current

Figure 11-1

Disposable Income and Consumer Spending for American Households in 2003

For each income group, average disposable income in 2003 is plotted versus average consumer spending in 2003. For example, point *A* shows that among the group with an annual income of $40,000 to $49,999, average disposable income was $42,842 and average consumer spending was $39,757. The data clearly show a positive relationship between disposable income and consumer spending: higher disposable income leads to higher consumer spending.



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.

Recall Equation 10-1, here rewritten as Equation 11-2, which expressed MPC as the ratio of a change in consumer spending to the change in disposable income:

$$\textbf{(11-2)} \quad MPC = \Delta c / \Delta yd$$

Multiplying both sides of Equation 11-2 by Δyd, we get:

$$\textbf{(11-3)} \quad MPC \times \Delta yd = \Delta c$$

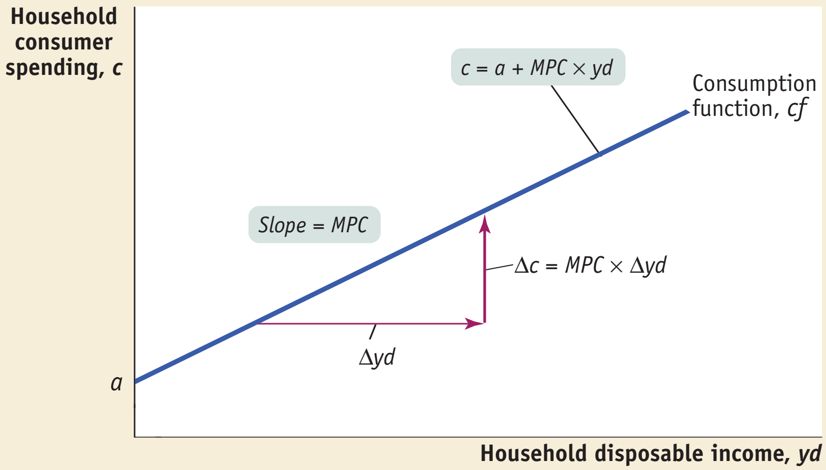
Equation 11-3 tells us that when yd goes up by $1, c goes up by $MPC \times \$1$. Notice, by the way, that we're using y for income. That's standard practice in macroeconomics, even though *income* isn't actually spelled "yncome." The reason, as we'll see shortly, is that I is reserved for investment spending.

Figure 11-2 shows what Equation 11-1 looks like graphically, plotting yd on the horizontal axis and c on the vertical axis. Individual autonomous spending, a, is the

Figure 11-2

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 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, $MPC \times \$1$ of it is spent.



value of c when yd is zero—it is the vertical axis *intercept* of the consumption function, *cf*. *MPC* is the *slope* of the line, measured by rise over run. If disposable income rises by Δyd, household spending, c, rises by $MPC \times \Delta yd$, so that the slope of the consumption function is:

$$\textbf{(11-4)} \quad \text{Slope of consumption function} = \text{Rise over run} = \Delta c/\Delta yd = \frac{MPC \cdot \Delta yd}{\Delta yd} = MPC$$

In reality, actual data never fit Equation 11-1 perfectly, but the fit can be pretty good. Figure 11-3 shows the data from Figure 11-1 again, together with a line drawn to fit the data as closely as possible. According to the data on households' spending and current income, the best estimate of a is \$14,184 and of *MPC* is 0.597. So the consumption function fitted to the data is:

$$c = \$14{,}184 + 0.597 \times yd$$

That is, the data suggest a marginal propensity to consume of approximately 0.6. This implies that the marginal propensity to save (*MPS*)—the amount of an additional \$1 of disposable income that is saved—is approximately 0.4.

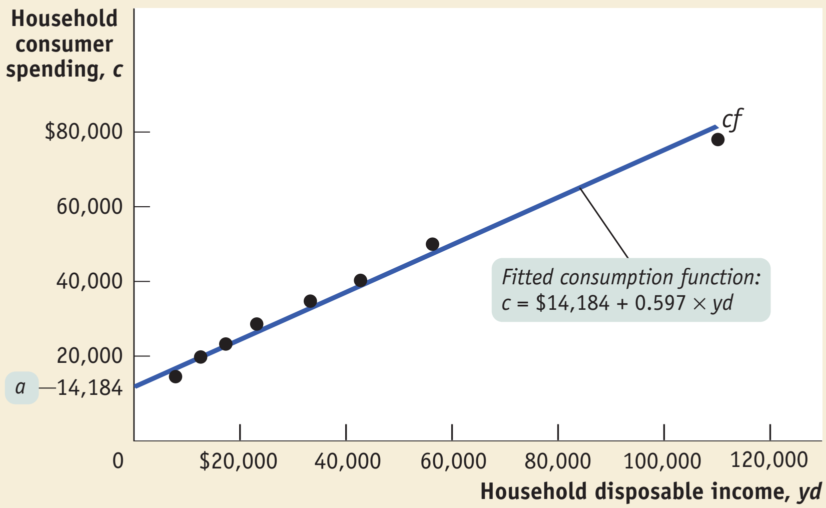
It's important to realize that Figure 11-1 shows a microeconomic relationship: between the current disposable income of individual families and their spending on goods and services. However, macroeconomists assume that a similar relationship holds *for the economy as a whole*: that there is a relationship, called the **aggregate consumption function,** between aggregate disposable income and aggregate consumer spending. So we'll assume that it has the same form as the household-level consumption function—$C = A + MPC \times YD$. Here C is aggregate consumer spending (what we have called just "consumer spending"); YD is aggregate disposable income (what we have called just "disposable income"); and A is aggregate autonomous consumer spending, the amount of consumer spending when YD equals zero. This is the relationship represented by *CF*, analogous to *cf* in Figure 11-3.

The **aggregate consumption function** is the relationship between disposable income and aggregate consumer spending.

Figure 11-3

A Consumption Function Fitted to Data

The data from Figure 11-1 are reproduced here, along with a line drawn to fit the data as closely as possible. For American households in 2003, the best estimate of a is \$14,184 and the best estimate of *MPC* is 0.597, or approximately 0.6.



Shifts in the Aggregate Consumption Function

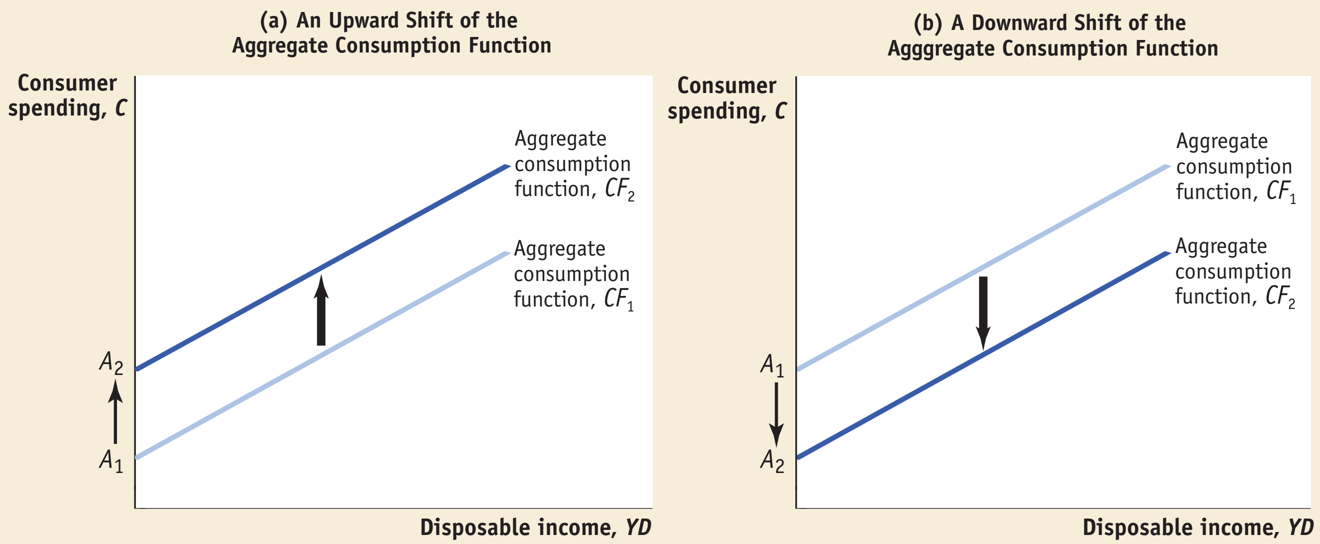
The aggregate consumption function shows the relationship between disposable income and consumer spending for the economy as a whole, other things equal. When other things change, the aggregate consumption function shifts. There are two principal causes of shifts in the aggregate consumption function: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

Changes in Expected Future Disposable Income Suppose you land a really good, well-paying job on graduating from college—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 the 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 these examples show how expectations about future disposable income can affect consumer spending. The two panels of Figure 11-4, on page 274 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

Figure 11-4 Shifts of the Aggregate Consumption Function



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

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 As we discussed in Chapter 10, a household's wealth influences how much of its disposable income it spends. This observation is part of an 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 live off the wealth they have accumulated while working during their retirement. We won't go into the details of this 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 income but still need to save for their retirement.

Because wealth affects consumer spending, changes in wealth across the economy can shift the aggregate consumption function. A rise in aggregate wealth—say, because of rising housing prices, which make homeowners wealthier—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 stock market crash—reduces *A* and shifts the aggregate consumption function down.

economics in action

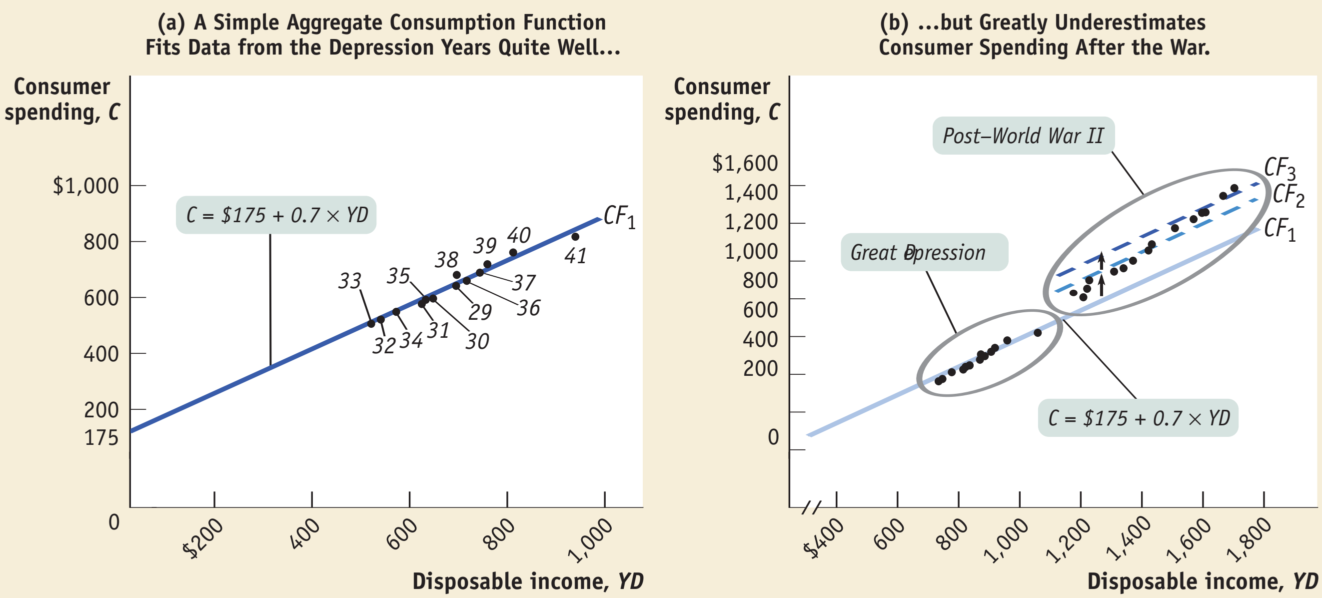
Famous First Forecasting Failures

The Great Depression created modern macroeconomics. It also gave birth to the modern field of econometrics—the use of statistical techniques to fit economic models to empirical data. The consumption function was one of the first things econometricians studied. And, sure enough, they quickly experienced one of the first major failures of economic forecasting: consumer spending after World War II was much higher than estimates of the aggregate consumption function based on prewar data would have predicted.

Figure 11-5 tells the story. Panel (a) shows aggregate data on disposable income and consumer spending from 1929 to 1941. A simple linear consumption function, CF_1, seems to fit the data very well. And many economists thought this relationship would continue to hold in the future. But panel (b) shows what actually happened in later years. The points in the circle at the left are the data from the Great Depression shown in panel (a). The points in the circle at the right are data from 1946 to 1960. (Data from1942 to 1945 aren't included because rationing during World War II prevented consumers from spending normally.) The line in the figure is the consumption function fitted to 1929–1941 data. As you can see, post–World War II consumer spending was much higher than the relationship from the Depression years would have predicted. For example, in 1960 consumer spending was 13.5% higher than the level predicted by CF_1.

Why was extrapolating from the earlier relationship so misleading? The answer is that from 1946 on both expected future disposable income and aggregate wealth

Figure 11-5 Disposable Income and Consumption Spending During and After the Great Depression



Panel (a) is a scatter diagram of observations of American households' annual disposable income measured in 2000 dollars versus annual consumption spending, also in 2000 dollars, during the period 1929–1941. A simple consumption function line, CF_1 of the form $C = \$175 + 0.7 \times YD$ fits the data quite well and suggests that during the Great Depression the marginal propensity to consume was 0.7. Panel (b) contains the same data as panel (a) and the same consumption function line, as well as observations from the postwar period. CF_1 lies below the postwar observations and does not fit the data from those years well. In fact, the consumption function line shifted up over time, as shown in the figure by the dashed lines, CF_2 and CF_3.

were steadily rising. Consumers grew increasingly confident that the Great Depression wouldn't reemerge and that the post–World War II economic boom would continue. At the same time, wealth was steadily increasing. As indicated by the dashed lines in panel (b), CF_2 and CF_3, the increases in expected future disposable income and in aggregate wealth shifted the aggregate consumption function up a number of times.

In macroeconomics, failure—whether of economic policy or of economic prediction—often leads to intellectual progress. The embarrassing failure of early estimates of the aggregate consumption function to predict post–World War II consumer spending led to important progress in our understanding of consumer behavior. ■

>> QUICK REVIEW

- The *consumption function* shows the relationship between an individual household's current disposable income and its individual consumer spending.
- The *aggregate consumption function* shows the relationship between disposable income and consumer spending across the economy. It can shift due to changes in expected future disposable income and changes in aggregate wealth.

>> CHECK YOUR UNDERSTANDING 11-1

1. Suppose the economy consists of three people: Angelina, Felicia, and Marina. The table shows how their spending varies as their disposable income rises by $10,000.
   a. Derive each individual consumption function, where *MPC* is calculated for a $10,000 change in disposable income.
   b. Derive the aggregate consumption function.

Disposable income	Angelina	Felicia	Marina
$ 0	$ 8,000	$ 6,500	$ 7,250
10,000	12,000	14,500	14,250

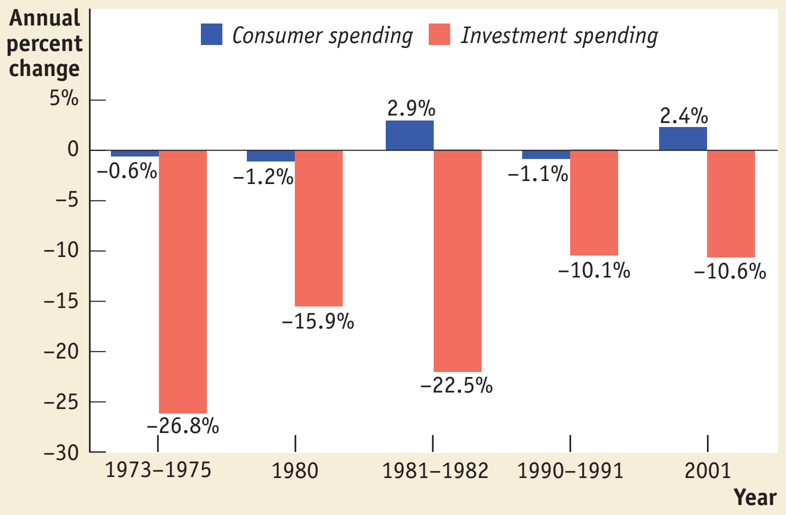
2. Suppose that problems in the capital markets make consumers unable to borrow or save. What implication does this have for the effects of expected future disposable income on consumer spending?

Solutions appear at back of book.

Figure 11-6

Fluctuations in Investment Spending and Consumer Spending

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



Investment Spending

A major reason economists were so concerned about a possible fall in consumer spending after 9/11 was that there was no clear alternative source of aggregate demand that would offset a fall in consumer spending and keep the economy from plunging. At the time of the attacks, investment spending was in the midst of an 18-month slump and showed few signs of bouncing back. An increase in government spending would take too long to legislate and implement. And there was no feasible way to stimulate foreigners' demand for American goods and services.

Most economists viewed the ongoing slump in investment spending as the cause of the recession that had begun six months earlier in March 2001. As we know from the *AS–AD* model in Chapter 10, a fall in investment spending shifts the aggregate demand curve leftward, leading to a recessionary gap. In fact, most recessions originate as a fall in investment spending. Figure 11-6 illustrates this point; it shows the annual percentage change of investment spending and consumer spending in the United States, both measured in 2000 dollars, during the last five recessions. From it we can see that the swings in investment spending are much more dramatic than those in consumer spending. In addition, economists believe that declines in consumer spending are usually the result of a process that begins with a slump in investment spending. We'll learn very soon how a slump in investment spending generates a fall in consumer spending through the multiplier process. Before we do that, however, let's analyze the factors that determine investment spending, which are different from those that determine consumer spending. The most important ones are the interest rate and expected future real GDP. We'll also revisit a fact that we noted in For Inquiring Minds on page 000 in Chapter 9: that the level of investment spending businesses *actually* carry out is sometimes not the same as the level they had *planned* to undertake.

The Interest Rate and Investment Spending

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

Planned investment spending is the investment spending that firms plan to undertake during a given period, in contrast to investment spending that occurs but is *unplanned*. 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.

Let's begin by recalling the loanable funds model of Chapter 9, which showed how those with funds to lend are matched with those who wish to borrow. Potential lenders are households that are deciding whether to save some of their disposable income and lend it out to earn interest, or to spend it on consumption. The supply of loanable funds is upward-sloping: as the interest rate rises, households are more willing to forgo consumption and lend their funds out. On the other side are potential borrowers, firms with investment spending projects. They will choose to borrow in order to fund a project only if the rate of return on the project equals or exceeds the interest rate charged on the loan. Otherwise, the firm would incur a loss. The demand for loanable funds is downward-sloping: as the interest rate rises, the number of projects with a rate of return that equals or exceeds the interest rate falls. Equilibrium in the loanable funds market is determined by the intersection of the demand and supply curves for loanable funds: at the equilibrium interest rate, the quantity of loanable funds demanded is equal to the quantity supplied. Investment projects with a rate of return equal to or exceeding the equilibrium interest rate are funded; projects with a rate of return less than the equilibrium interest rate are not.

You might think that the trade-off a firm faces changes 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. So 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.

The upshot is 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. (And if it had been unprofitable before, it is even more unprofitable after a rise in the interest rate.) For example, consider a rise in the interest rate caused by a leftward shift in the supply of loanable funds—say, due to fear of a banking crisis that leads households to refuse to deposit their savings in banks that then lend the funds to businesses. Some projects that would have been funded under the initial, lower interest rate will not be funded now; their rates of return fall below the now-higher interest rate. Conversely, a fall in the interest rate makes any given investment project more profitable (or less unprofitable if it was and remains unprofitable at the now-lower interest rate). Some projects will receive funding at the new, lower interest rate that would not have under the original, higher interest rate.

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 equipment and structures that are worn out or have been 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 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 their sales are growing very rapidly. In that case, even excess production capacity will soon be used up, leading firms to resume investment spending. What is an indicator of a high level of sales growth? It's the rate of growth of real GDP. A high rate of growth in real GDP results in a high level of investment spending. This relationship is summarized in a proposition known as the **accelerator principle.** As we explain in the following Economics in Action, the effects of the accelerator principle play an important role in *investment booms,* periods of high investment spending.

According to the **accelerator principle,** a higher rate of growth in real GDP leads to higher planned 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 raw materials and spare parts. In 2004 the overall value of inventories in the U.S. economy was estimated at $1.7 trillion, about 13 % of GDP for that year. In fact, for every $10 of final goods sold in 2004, producers held $4 of inventories of final goods and inputs.

Inventories are stocks of goods held to satisfy future sales.

Tom Boyle/Getty Images

This lot full of cars is inventory awaiting the arrival of eager car buyers.

As we explained in Chapter 6, a firm that increases its inventories is engaging in a form of investment spending because it is increasing the value of its future sales. 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 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.

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

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. And because it is unplanned, there is no direct relationship between this type of investment spending and other factors such as the interest rate or expected future real GDP.

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.

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 between all three can be represented as:

(11-5) $I = I_{Unplanned} + I_{Planned}$

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 to 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 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. In the next section, we will see how production adjustments in response to fluctuations in sales and inventories ensure that the value of final goods and services actually produced is equal to desired purchases of those final goods and services.

economics in action

A Tale of Two Investment Spending Slumps

At the beginning of the 1980s there was a prolonged slump in investment spending, which played a key role in the two recessions—often treated as a single episode—of 1980 and 1981–1982. At the beginning of the twenty-first century there was another prolonged investment spending slump, which played a key role in the 2001 recession and the disappointing "jobless recovery" of the next two years.

But these investment spending slumps were very different. The 1980s slump was mainly in housing; nonresidential investment spending remained fairly strong. The slump that began in 2001 was entirely in nonresidential investment; by 2003 there was actually a boom in housing construction.

Figure 11-7 tells the tale. Panel (a) shows the behavior of the quantity of nonresidential and residential (housing) investment spending, measured in 2000 dollars, during the slump of the early 1980s. The quantities of both types of investment spending are measured in real terms, with 1979 fourth-quarter prices set equal to 100. You can see that the slump was concentrated in housing. Panel (b) shows the

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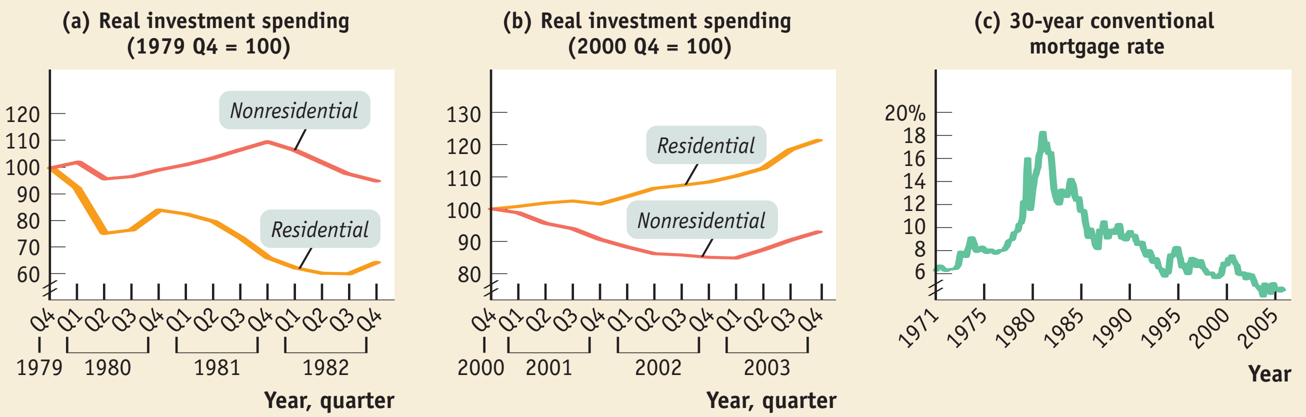
Panel (c) shows the source of the differences in residential investment spending during these two slumps: changes in the interest rate on 30-year mortgages, loans that people use to buy homes. It soared to its highest level ever in the early 1980s and fell to its lowest level in decades after 2000. During the 2001 slump nonresidential investment spending fell 15%: after having undertaken a large amount of investment spending in the late 1990s, firms cut back severely as the economy slowed.

Figure 11-7 Two Investment Spending Slumps and the Mortgage Rate for Housing



Panel (a) shows the quantities of nonresidential and residential (housing) investment spending during the slump of the early 1980s. The quantities of both types of investment spending are expressed as index numbers, where 1979 fourth-quarter prices are equal to 100. As you can see, the primary source of this slump was a slump in residential spending. Panel (b) shows the slump that began in 2001, where 2000 fourth-quarter prices are equal to 100. In contrast, this slump was entirely in nonresidential investment spending; housing spending remained high during the recession and by 2003 there was actually a boom in housing construction.

same comparison starting in the fourth quarter of 2000, measured so that 2000 fourth-quarter prices equal 100. In this case, the investment spending slump was entirely concentrated in nonresidential investment; housing spending remained high through the recession, then went up from there.

This difference in residential investment spending was due to interest rates, which shot up during the early 1980s but fell during the years after 2000. Panel (c) shows the interest rate on 30-year home mortgage loans. The rate soared to its highest level ever in the early 1980s; it fell to its lowest level in decades after 2000.

So why did nonresidential investment spending fall 15%? It was high during the late 1990s in large part because of the accelerator principle: firms believed the economy would grow rapidly, and this encouraged investment spending. When firms became somewhat less optimistic in 2000–2001, this led to a fall in planned investment spending. Also, the high investment spending of the late 1990s left some firms with larger production capacities than they needed. This was especially true in telecommunications, where companies found themselves with lots of "dark fiber": fiber-optic cables (used to transmit phone calls and other data) that turned out not to be needed, at least for the time being. So firms cut back sharply on investment spending, waiting for demand to catch up with capacity. ■

>> QUICK REVIEW

- *Planned investment spending* is negatively related to the interest rate and positively related to expected future GDP. According to the *accelerator principle,* there is a positive relationship between planned investment spending and the expected future growth rate of real GDP.
- Firms hold *inventories* to sell in the future. *Inventory investment,* a form of investment spending, can be positive or negative.
- When actual sales are more or less than expected, *unplanned inventory investment* occurs. *Actual investment spending* is equal to planned investment spending plus unplanned inventory investment.

>> CHECK YOUR UNDERSTANDING 11-2

1. For each event, explain whether planned investment or unplanned 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 long-run growth rate.
   d. An unanticipated fall in sales.
2. Historically, investment spending has experienced more extreme upward and downward swings than consumer spending. Why do you think this is so? (*Hint*: Consider the marginal propensity to consume and the accelerator principle.)
3. Consumer demand was sluggish during 2002 and economists worried that an *inventory overhang*—a high level of unplanned inventory investment throughout the economy—would make it difficult for the economy to recover anytime soon. Explain why an inventory overhang might, like the existence of too much productive capacity, depress economic activity.

Solutions appear at back of book.

Behind Shifts of the Aggregate Demand Curve: The Income-Expenditure Model

We began this chapter by describing the concern voiced by American politicians about a possible slump in consumer spending after 9/11. We can understand that concern in terms of the analysis of short-run economic fluctuations we developed in Chapter 10. There we learned that most, though not all, recessions are caused by negative *demand shocks*—leftward shifts of the aggregate demand curve. What people feared after 9/11, then, was another negative demand shock.

We also learned in Chapter 10 how to use the multiplier to answer the question of how much the demand curve shifts in response to a demand shock. We saw that due to the multistage process of a change in aggregate demand leading to changes in GDP, disposable income, and consumer spending, the magnitude of the shift of the demand curve is several multiples of the size of the original demand shock. In this section, we will examine more closely the adjustment process that occurs behind this multistage process. We'll see that the multiple rounds of changes in GDP are accomplished through changes in inventories held by firms—changes that they make in response to changes in their sales. From it we'll come to understand why inventories play a central role in macroeconomic models of the economy in the short run, and 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. *The aggregate price level is fixed*. In other words, we'll analyze the determination of aggregate output as if the short-run aggregate supply curve, *SRAS*, is horizontal at a given aggregate price level. This is in contrast to the upward-sloping short-run aggregate supply curve of the *AS–AD* model.
2. *The interest rate is fixed.* We'll take the interest rate as predetermined and unaffected by the factors we analyze in the model. As in the case of the aggregate price level, what we're really doing here is leaving the determinants of the interest rate outside the model. As we'll see, the model can still be used to study the effects of a change in the interest rate.
3. *Taxes, transfers, and government purchases are all zero.*
4. *There is no foreign trade.*

The appendix of the next chapter addresses how taxes affect the multiplier process. In all subsequent chapter we will drop the assumption that the aggregate price level is fixed. We'll explain how the interest rate is determined in Chapter 14 and bring foreign trade back into the picture in Chapter xx.

Planned Aggregate Spending and GDP

In an economy with no government and no foreign trade, there are only two sources of aggregate demand: 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: 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:

(11-6) $GDP = C + I$

(11-7) $YD = GDP$

As we learned earlier in this chapter, 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 form:

(11-8) $C = A + MPC \times YD$

In our simplified model, we will also assume planned investment spending, $I_{Planned}$, to be 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. 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 that

(11-9) $AE_{Planned} = C + I_{Planned}$

The level of planned aggregate spending in a given year depends on the level of GDP in that year. To see why, let's look at a specific example, shown in Table 11-1. We assume that the aggregate consumption function is

(11-10) $C = 300 + 0.6 \times YD$

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

TABLE 11-1

GDP ($ billion)	*YD*	*C*	$I_{Planned}$	$AE_{Planned}$
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

C, *YD*, and $I_{Planned}$ are all measured in billions of dollars, and the level of planned investment, $I_{Planned}$, is fixed at 500. The first column shows possible levels of GDP. The second column shows disposable income, *YD*, which in our simplified model is equal to GDP. The third column shows consumer spending, *C*, equal to 300 plus 0.6 times disposable income, *YD*. The fourth column shows planned investment spending, $I_{Planned}$, which we have assumed is 500 regardless of the level of 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 11-1 are measured in billions of dollars.) As you can see, a higher level of GDP leads to a higher level of disposable income: every 500 increase in GDP raises *YD* by 500, which in turn raises *C* by $500 \times 0.6 = 300$ and $AE_{Planned}$ by 300.

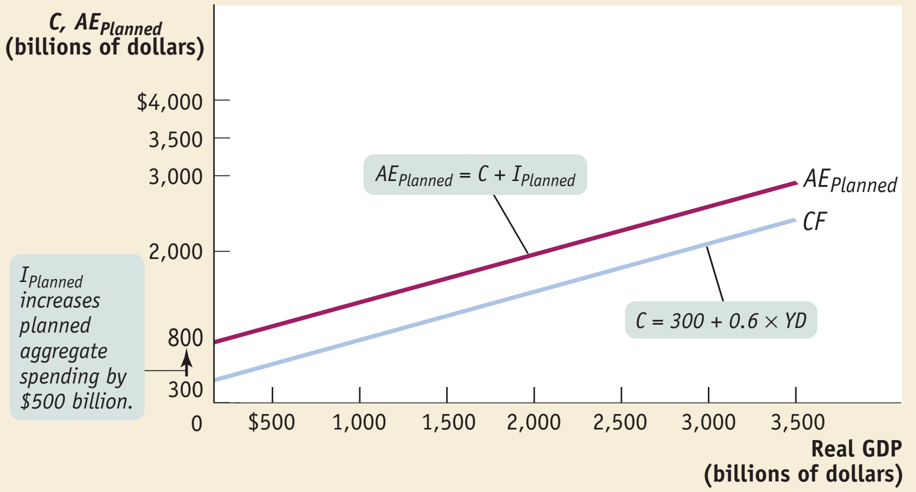
Figure 11-8 illustrates the information in Table 11-1 graphically. GDP is measured on the horizontal axis. *CF* is the aggregate consumption function; it shows how consumer spending depends on GDP. $AE_{Planned}$, the planned aggregate spending line, corresponds to the aggregate consumption function shifted up by 500 (the amount of $I_{Planned}$). It shows how planned aggregate spending depends on 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 11-1 reveals that at all but one level of GDP, when GDP equals 2000, planned aggregate spending, $AE_{Planned}$, doesn't equal the corresponding level of GDP. Is that possible? Didn't we learn in Chapter 7, with the circular-flow diagram, that total spending on final goods and services in the economy 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 GDP because of the role of *unplanned* aggregate spending—$I_{Unplanned}$, unplanned inventory investment. But as we'll see in the next section, the economy moves over time to a situation in which there is no unplanned inventory investment, called *income--expenditure equilibrium.* And when the economy is in income–expenditure equilibrium, the economy as described by the circular-flow diagram holds true: aggregate spending on final goods and services equals aggregate output.

Figure 11-8

The Aggregate Consumption Function and Planned Aggregate Spending

The lower line, *CF*, is the aggregate consumption function constructed from the data in Table 11-1. The upper line, $AE_{Planned}$, is the planned aggregate spending line, also constructed from the data in Table 11-1. It is equivalent to the aggregate consumption function line shifted up by $500 billion, the amount of planned investment spending, $I_{Planned}$.



Income-Expenditure Equilibrium

For all but one value of GDP shown in Table 11-1, GDP is either more or less than $AE_{Planned}$, the sum of consumer spending and *planned* investment spending. For example, when GDP *is* 1,500, consumer spending *c* is 1,200 and planned investment spending is 500, making planned aggregate spending 1,700. This is 200 *more* than the corresponding level of GDP. Now consider what happens when 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 GDP.

As we've just explained, planned aggregate spending can be different from GDP only if there is unplanned inventory investment, $I_{Unplanned}$, in the economy. Let's examine Table 11-2, which includes the numbers for GDP and for planned aggregate spending from Table 11-1. It also includes the levels of unplanned inventory investment, $I_{Unplanned}$, that each combination of GDP and planned aggregate spending implies. For example, if GDP is 2,500, planned aggregate spending is only 2,300. This 200 excess of GDP over $AE_{Planned}$ must consist of 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 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.

TABLE 11-2

GDP ($ billion)	$AE_{Planned}$	$I_{Unplanned}$
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

Conversely, a level of GDP below 2,000 implies that planned aggregate spending is *greater* than GDP. For example, when GDP is 500, planned aggregate spending is much larger, at 1,100. The 600 excess of $AE_{Planned}$ over GDP corresponds to negative unplanned inventory investment of −600. More generally, any level of 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 11-5, 11-6, and 11-9, we can summarize the general relationship among GDP, planned aggregate spending, and unplanned inventory investment:

$$\textbf{(11-11)} \quad \begin{aligned} GDP &= C + I \\ &= C + I_{Planned} + I_{Unplanned} \\ &= AE_{Planned} + I_{Unplanned} \end{aligned}$$

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

But firms will act to correct their mistakes: 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 GDP is equal to planned aggregate spending. Staying with our example, if GDP is 500, negative unplanned inventory investment will lead firms to increase production, leading to a rise in GDP. In fact, this will happen whenever GDP is less than 2,000—that is, whenever GDP is less than planned aggregate spending. Conversely, if GDP is 2,500, positive unplanned inventory investment will lead firms to reduce production, leading to a fall in GDP. This will happen whenever 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 GDP is equal to planned aggregate spending in the current period, an outcome known as **income–expenditure equilibrium.** In Table 11-2, income–expenditure equilibrium is achieved when GDP is 2,000, the only level of GDP at which unplanned inventory investment is zero. From now on, we'll denote the GDP level at which income–expenditure equilibrium occurs as GDP* and call it the **income–expenditure equilibrium GDP.**

The economy is in **income–expenditure equilibrium** when GDP is equal to planned aggregate spending.

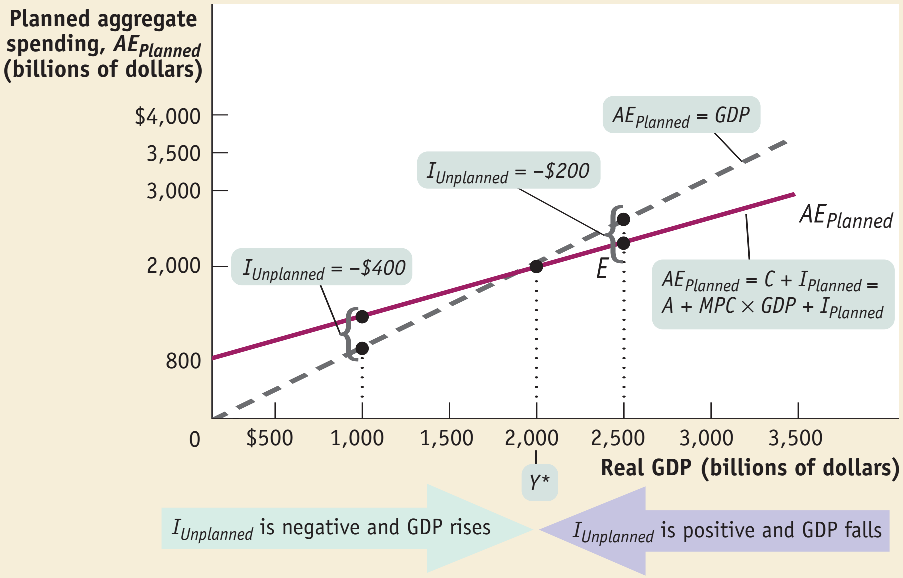
Income–expenditure equilibrium GDP is the level of GDP at which GDP equals planned aggregate spending.

Figure 11-9 on page 284 illustrates the concept of income–expenditure equilibrium graphically. GDP is on the horizontal axis and planned aggregate spending, $AE_{Planned}$, 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 $C + I_{Planned}$,

Figure 11-9

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 GDP* of $2,000 billion, the only point at which GDP equals planned aggregate spending, $AE_{Planned}$, and unplanned inventory investment, $I_{Unplanned}$, is zero. At any level of GDP less than GDP*, $AE_{Planned}$ exceeds GDP. As a result, unplanned inventory spending, $I_{Unplanned}$, is negative and firms respond by increasing reduction. At any level of GDP greater than GDP*, GDP exceeds $AE_{Planned}$. Unplanned inventory investment, $I_{Unplanned}$, is positive and firms respond by reducing production. Through this



PITFALLS

INCOME-EXPENDITURE EQUILIBRIUM VERSUS SHORT-RUN MACROECONOMIC EQUILIBRIUM

In Chapter 10 we developed the concept of short-run macroeconomic equilibrium using the *AS–AD* model. Using it, we determined the equilibrium level of real GDP as the level at which the quantity supplied of aggregate output in the short run is equal to the quantity demanded of aggregate output. Here we've introduced another concept, income–expenditure adjustment process. Using it, we've defined income–expenditure equilibrium to be the level of GDP at which planned aggregate spending equals GDP. So are these concepts of equilibrium in conflict with each other? That is, do they lead to two different and therefore conflicting definitions of what GDP is when the economy is in short-run macroeconomic equilibrium?

Definitely not. Recall that what we're doing in the income–expenditure model is analyzing how GDP would change *holding all prices fixed*. To derive the full short-run macroeconomic equilibrium, we need to bring the flexible aggregate price level back in. So income–expenditure equilibrium is a step on the way to calculating macroeconomic equilibrium—one that allows us to closely examine the inventory adjustment process behind a shift of the aggregate demand curve—not an alternative concept.

depends on 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). 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 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 11-2.

Now consider what happens if the economy isn't in income–expenditure equilibrium. We can see from Figure 11-9 that whenever GDP is smaller than *Y**, the planned aggregate spending line lies above the 45-degree line and $AE_{Planned}$ exceeds GDP. In this situation, $I_{Unplanned}$ is negative: as shown in the figure, at a GDP of 1,000, $I_{Unplanned}$ is –400. As a consequence, GDP will rise. In contrast, whenever GDP is greater than *Y**, the planned expenditure line lies below the 45-degree line. Here, $I_{Unplanned}$ is positive: as shown, at a GDP of 2,500, $I_{Unplanned}$ is 200. The unanticipated accumulation of inventory leads to a fall in GDP.

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

The type of diagram shown in Figure 11-9, which identifies income–expenditure equilibrium as the point at which a 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, there is a self-adjustment process in the economy that moves GDP over time to the point at which GDP and planned aggregate spending are equal. And that self-adjustment mechanism operates through inventories. That's why, as we mentioned earlier, changes in inventories are considered a leading indicator of future economic activity.

Now that we understand how GDP moves to achieve income–expenditure equilibrium for a given level of planned aggregate spending, let's turn now 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?

In our simple model there are only two possible sources of a shift in the planned aggregate spending line: a change in planned investment spending, $I_{Planned}$, or a shift in the consumption function, C. For example, a change in $I_{Planned}$ can occur because of 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 in the 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 housing values. When the planned aggregate spending line shifts—when there is a change in the level of planned aggregate spending at any given level of GDP—this change is an autonomous change in planned aggregate spending. Recall from Chapter 10 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 GDP (although we've assumed away the government for the time being). How does an autonomous change in planned aggregate spending affect GDP in income–expenditure equilibrium?

Table 11-3 and Panel (a) of Figure 11-10 on page 286 start from the same numerical example we used in Table 11-2 and Figure 11-9. They also show the effect of an autonomous increase in planned aggregate spending by 400—what happens when planned aggregate spending is 400 higher at each level of GDP. Look first at Table 11-3. Before the autonomous increase in planned aggregate spending, the level of GDP at which planned aggregate spending is equal to GDP, Y^*, is 2,000. After the autonomous change, Y^* has risen to 3,000. The same result is visible in panel (a) of Figure 11-10. 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.

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 continuing to use panel (a) of Figure 11-10. First, starting from E_1, the increase in planned aggregate spending leads to a gap between planned aggregate spending and 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 inventories: $I_{Unplanned} = -400$. Firms respond by increasing production, leading to a rise in GDP from Y_1^*. The rise in 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

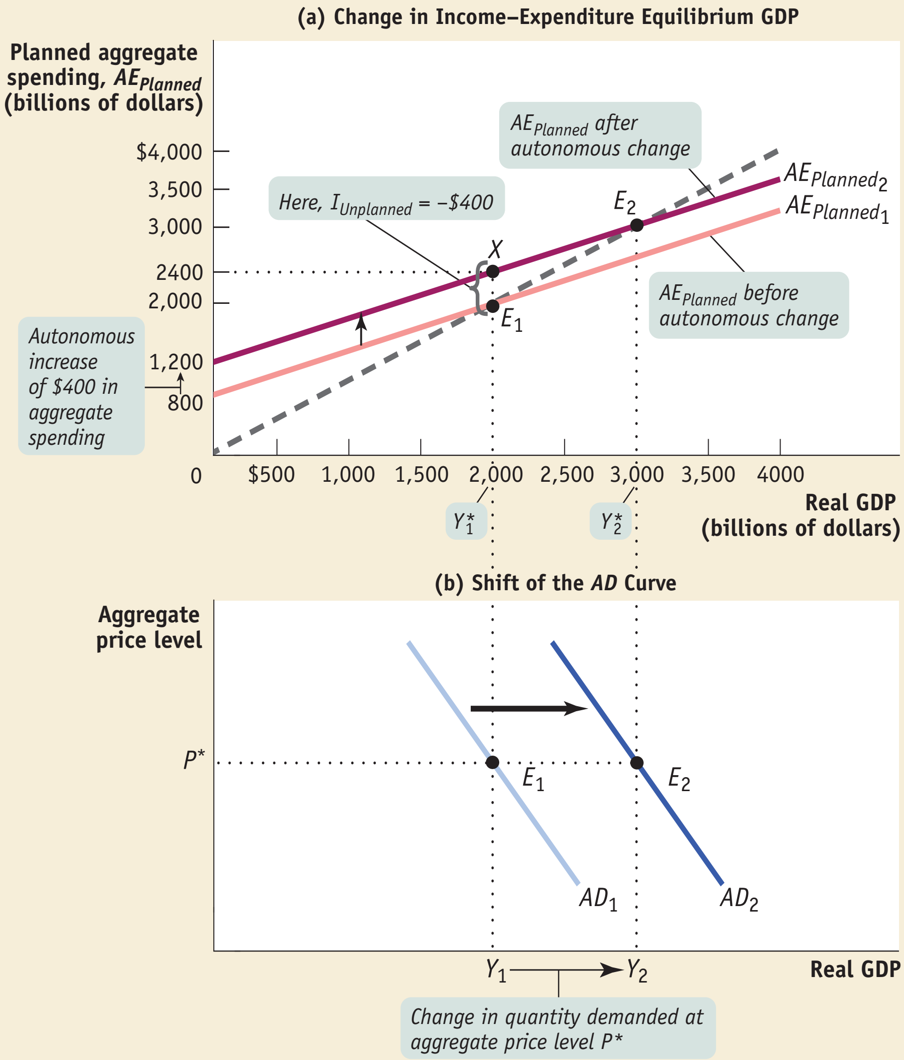
TABLE 11-3

GDP	$AE_{Planned}$ before autonomous change	$AE_{Planned}$ after autonomous change
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 11-10

The Multiplier

Panel (a) illustrates the change in GDP* caused by an autonomous increase in planned spending. The economy is initially at equilibrium point E_1 with an equilibrium GDP_1^* equal to 2,000. $AE_{Planned}$ increases by 400 and shifts the planned aggregate spending line upward by 400. The economy is no longer in income–expenditure equilibrium: 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 equilibrium GDP, GDP_2^*, equal to 3,000. The increase in GDP* is several times larger than the autonomous increased in planned spending, reflecting the effects of the *multiplier* on the economy. Panel (b) shows the corresponding rightward shift of the *AD* curve generated by the increase in $AE_{Planned}$. The change in GDP*, from GDP_1^* to GDP_2^*, corresponds to the increase in quantity demanded of aggregate output at any given aggregate price level.



consumer spending, *C*, which sets off a second-round rise in 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 GDP and consumer spending.

We can summarize these results in an equation:

$$\textbf{(11-12)} \quad \Delta Y^* = \text{Multiplier} \times \Delta AE_{Planned}$$
$$= 1/(1 - MPC) \times \Delta AE_{Planned}$$

Like Equation 10-2, Equation 11-12 tells us that the change in income–expenditure equilibrium GDP, ΔY^*, is several times as large as the autonomous change in planned aggregate spending, $\Delta AE_{Planned}$. Equation 11-12 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 GDP grows at each round, the increase in GDP diminishes from each round to the next. At some point the increase in GDP is negligible, and the economy converges to a new income–expenditure equilibrium at Y_2^*.

Now we're in a position to tie the inventory adjustment that underlies the multiplier process to the question of how much the aggregate demand curve shifts in response to a slump or a boom in consumer spending or investment spending. Panel (b) of Figure 11-10 shows the corresponding shift of the aggregate demand curve generated by the events illustrated in panel (a). At a *fixed aggregate price level*, given here by P^*, the change in the quantity demanded of aggregate output is equal to the change in income–expenditure equilibrium GDP that arises from the multiplier effect. Again, we see the importance of the multiplier: the larger the multiplier, the larger the shift of the *AD* curve at any given aggregate price level.

The Paradox of Thrift You may recall that in Chapter 6(?) we mentioned the Paradox of Thrift to illustrate the fact that, in macroeconomics, the outcome of many individual actions can generate a result that is larger, and much inferior to, the simple sum of those individual actions. In the Paradox of Thrift, households and producers cut their spending in anticipation of future tough economic times. These actions depress the economy, leaving households and producers 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 to provide for your family in hard times) is "bad" (because it can make everyone worse off).

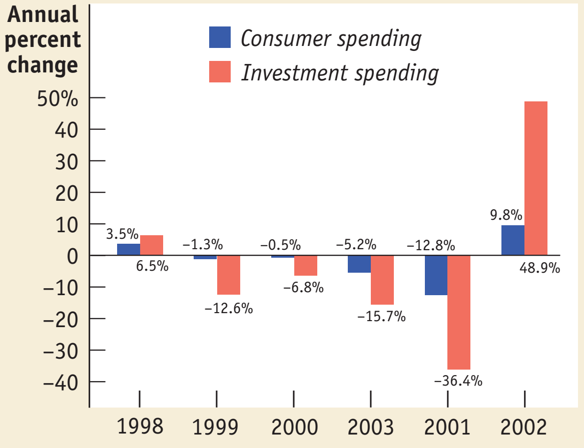
Using the multiplier, we can now see exactly how this scenario unfolds. There is a slump in consumer spending or investment spending, or both, which causes a fall in equilibrium GDP that is several times larger than the original fall in spending. The fall in GDP leaves consumers and producers worse off than they would have been if they hadn't cut their spending. Conversely, prodigal behavior is rewarded: if consumers or producers increase their spending, the resulting multiplier process makes the increase in equilibrium GDP several times larger than the original increase in spending. So prodigal spending makes consumers and producers better off than if they had been cautious spenders.

It's important to realize that setting the multiplier equal to $1/(1 - MPC)$ depends on the simplifying assumption that there are no taxes or transfers, so that disposable income is equal to GDP. In the appendix to the next chapter we'll bring taxes into the picture, which makes the expression for the multiplier more complicated and the multiplier itself smaller. But the general principle we have just learned—an autonomous change in planned aggregate spending leads to a change in GDP*, both directly and through an induced change in consumption—will remain valid.

As we noted earlier in this chapter, declines in planned investment spending are usually the major factor in recessions. So historically they have been the most common source of autonomous reductions in aggregate spending. The tendency of the consumption function to shift upward over time, which we pointed out in Economics in Action on page xx, means that autonomous changes in both planned investment spending and consumer spending play important roles in expansions. But regardless of the source, there are multiplier effects on the economy that magnify the size of the original change in aggregate spending. Recall our opening story about how political leaders urged consumers to open their wallets and spend after 9/11. As we've now learned, the fears of those leaders were understandable: they were concerned that the shock of the terrorist attacks would lead to a reduction in consumer spending that would, through the multiplier effect, greatly worsen the existing recession. Fortunately for the economy, this didn't happen. American consumers were shocked and saddened, but they didn't stop spending. As a result, the economy began to recover only a few months later.

Jim Borgman

Figure 11-11 The Multiplier in Action in Argentina



The most severe recession in recent history was a case of the multiplier at work. The bars show annual rates of change in consumer spending and investment spending in Argentina between 1998 and 2003. A financial crisis led to a plunge in investment spending between 1998 and 2002, leading to a decline in consumer spending. Then an upturn in investment spending led to recovery in consumer spending as well.

economics in action

Bad Times in Buenos Aires

The closest thing the world has seen in recent times to a replay of the Great Depression was the severe recession that hit Argentina from 1998 to 2002. Over that period, Argentina's real GDP fell 18%, and the unemployment rate rose above 20%.

The origins of the Argentine slump lay in a financial crisis: foreign investors lost confidence in the country's ability to repay the debts owed to them. We'll describe in more detail how that crisis played out in Chapter 20. But the channel through which the financial crisis caused a recession was the multiplier. Financial difficulties caused by the loss in confidence led to a plunge in planned investment spending. This, in turn, led to a fall in GDP, both because of the direct effect of the reduction in investment spending and because of the induced fall in consumer spending. Figure 11-11 shows the annual rates of change of real investment spending and real consumption spending in Argentina from 1998 to 2003. As you can see, the slump in investment spending from 1998 to 2002 led to a proportionately smaller decline in consumer spending. Then, when investment spending bounced back in 2003, so did consumer spending. ■

>>QUICK REVIEW

- The economy is in *income–expenditure equilibrium* when *planned aggregate spending* is equal to GDP.
- At any output level greater than *income–expenditure equilibrium GDP*, GDP exceeds planned aggregate spending and inventories are rising. At any lower output level, GDP falls short of planned aggregate spending and inventories are falling
- After an autonomous change in planned aggregate spending, the economy moves to a new income–expenditure equilibrium through the inventory adjustment process, as illustrated by the *Keynesian cross*.

>>CHECK YOUR UNDERSTANDING 11-3

1. Although economists believe that recessions typically begin as slumps in investment spending, they also believe that consumer spending also eventually slumps during a recession. Explain why.
2. Use a diagram like Figure 11-10 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. Suppose GDP* is originally $500 billion, the autonomous reduction in planned aggregate spending is $300 million, and $MPC = 0.5$. Calculate GDP* after such a change.

Solutions appear at back of book.

• A LOOK AHEAD •

In this chapter we studied the inventory adjustment process that underlies the multiplier. But we used a very simplified model of the determination of aggregate output, leaving out a number of important factors in order to focus our attention on a few key relationships. Now we're ready to bring some of the complications back in—starting with the role of government and government policy.

We begin by introducing taxes, transfers, and government purchases into our model. As we'll see, putting the government in leads us immediately to one of the key insights of macroeconomics: sometimes the government can do something about the business cycle. We'll explore the potential and the difficulties of *fiscal policy*—changes in taxes, transfers, and government purchases designed to affect macroeconomic outcomes—in Chapter 12. Then in Chapters 13 and 14 we'll turn to an even more important tool in the government's hands, *monetary policy*.

SUMMARY

1. 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 lifetime. As a result, the aggregate consumption function shifts in response to changes in expected future income and changes in aggregate wealth.
2. **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.
3. 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 and unplanned investment.
4. In **income–expenditure equilibrium, planned aggregate spending,** the sum of consumer spending and planned investment spending, is equal to GDP. 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. The **Keynesian cross** shows how the economy self-adjusts to income–expenditure equilibrium through inventory adjustments.
5. After an autonomous change in planned aggregate spending, the inventory adjustment process moves the economy to a new income–expenditure equilibrium. The change in equilibrium GDP arising from an autonomous change in spending is equal to the multiplier $\times\ \Delta AE_{Planned}$. Correspondingly, the amount of the shift of the *AD* curve at any given aggregate price level arising from a change in investment spending or consumer spending is equal to the multiplier times the change in spending.

KEY TERMS

Consumption function, p. 000
Aggregate consumption function, p. 000
Planned investment spending, p. 000
Accelerator principle, p. 000
Inventories, p. 000
Inventory investment, p. 000
Unplanned inventory investment, p. 000
Actual investment spending, p. 000
Planned aggregate spending, p. 000
Income–expenditure equilibrium, p. 000
Income–expenditure equilibrium GDP, p. 000
Keynesian cross, p. 000

PROBLEMS

1. 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.

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?

2. From 2000 to 2005, Eastlandia experienced large fluctuations in both aggregate consumer spending and disposable income. 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)
2000	$100	$180
2001	350	380
2002	300	340
2003	400	420
2004	375	400
2005	500	500

a. Plot the aggregate consumption function for Eastlandia.

b. What is the aggregate consumption function?

c. What is the marginal propensity to consume? What is the marginal propensity to save?

3. How will each of the following actions affect the aggregate consumption function? Explain whether the event will result in a movement along or a shift of the aggregate consumption function and in which direction.

a. The government grants an unexpected and one-time tax cut for all households.

b. The government announces permanently higher tax rates beginning next year.

c. The Social Security Administration raises the age at which workers who are currently younger than 65 can qualify for Social Security benefits from age 65 to age 75.

4. From the end of 1995 to March 2000, the Standard and Poor's 500 (S&P 500) stock index, a broad measure of stock market prices, rose almost 150%, from 615.93 to a high of 1527.46. From that time to September 10, 2001, the index fell 28.5% to 1092.54. How do you think the movements in the stock index influenced both the growth in real GDP in the late 1990s and the concern about maintaining consumer spending after the terrorist attacks on September 11, 2001?

5. How will the interest rate and planned investment spending change as the following events occur?

a. An increase in the quantity of money by the Federal Reserve increases the amount of money that people wish to lend.

b. The U.S. Environmental Protection Agency decrees that corporations must adopt new technology that reduces their emissions of sulfur dioxide.

c. Baby boomers begin to retire in large numbers and reduce their savings.

6. 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 interest rates.

b. There is a rise in the expected growth rate of real GDP.

c. A sizable inflow of foreign funds into the country lowers interest rates.

7. The accompanying table shows gross domestic product (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 (billions of dollars)	*YD* (billions of dollars)	*C* (billions of dollars)	$I_{Planned}$ (billions of dollars)	$AE_{Planned}$ (billions of dollars)	$I_{Unplanned}$ (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		

a. What is the aggregate consumption function?

b. What is income–expenditure equilibrium GDP, Y^*?

c. What is the value of the multiplier?

d. If planned investment spending falls to $200 billion, what will be the new Y^*?

e. If autonomous consumer spending rises to $200 billion, what will be the new Y^*?

8. 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 consumption function and planned aggregate spending.

b. What is unplanned inventory investment when real GDP equals $600 billion?

c. What is the 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^*?

9. An economy has a marginal propensity to consume of 0.5 and Y^*, income–expenditure equilibrium GDP, equals $500 billion. If planned investment spending increases by $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 raises real GDP and *YD* by $10, leading to an increase in consumer spending of $5 ($MPC \times$ change in disposable income) in row 2.

Rounds	Change in $I_{Planned}$ or C (billions of dollars)	Change in real GDP (billions of dollars)	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 qestions compare?

b. Redo the table, 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?

10. Although the U.S. 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?

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