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CHAPTER 10

Basic Macroeconomic Relationships*

Learning Objectives

- LO10.1** Describe how changes in income affect consumption (and saving).
- LO10.2** List and explain factors other than income that can affect consumption.
- LO10.3** Explain how changes in real interest rates affect investment.
- LO10.4** Identify and explain factors other than the real interest rate that can affect investment.
- LO10.5**

Illustrate how changes in investment (or one of the other components of total spending) can increase or decrease real GDP by a multiple amount.

In Chapter 9 we discussed the business cycle, unemployment, and inflation. Our eventual goal is to build economic models that can explain these phenomena. This chapter begins that process by examining the basic relationships that exist between three different pairs of economic aggregates. (Recall that to economists “aggregate” means “total” or “combined.”) Specifically, this chapter looks at the relationships between:

- income and consumption (and income and saving).
- the interest rate and investment.
- changes in spending and changes in output.

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What explains the trends in consumption (consumer spending) and saving reported in the news? How do changes in interest rates affect investment? How can initial changes in spending ultimately produce multiplied changes in GDP? The basic macroeconomic relationships discussed in this chapter answer these questions.

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The Income-Consumption and Income-Saving Relationships

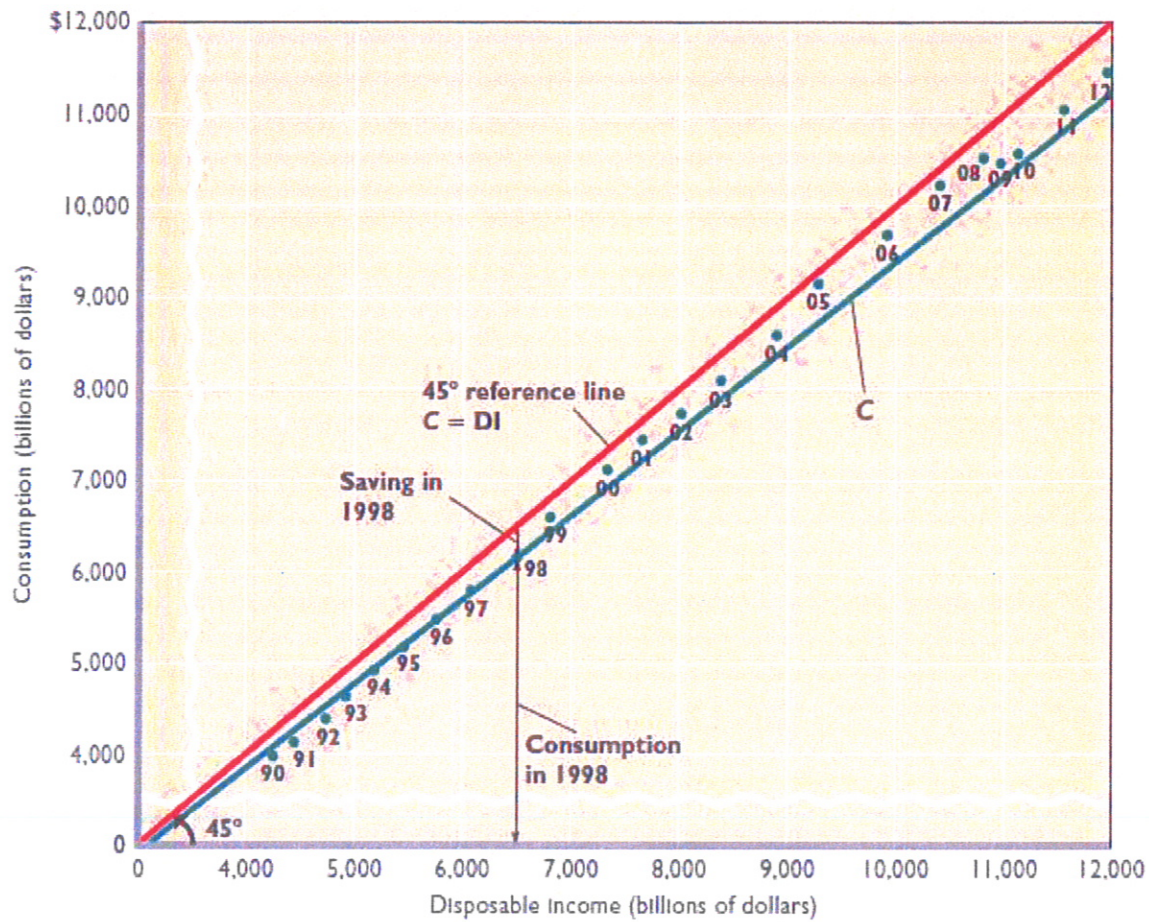
LO10.1 Describe how changes in income affect consumption and saving.

The other-things-equal relationship between income and consumption is one of the best-established relationships in macroeconomics. In examining that relationship, we are also exploring the relationship between income and saving. Recall that economists define *personal saving* as “not spending” or as “that part of disposable (after-tax) income not consumed.” Saving (S) equals disposable income (DI) *minus* consumption (C).

Many factors determine a nation's levels of consumption and saving, but the most significant is disposable income. Consider some recent historical data for the United States. In Figure 10.1 each dot represents consumption and disposable income for 1 year since 1987. The line C that is loosely fitted to these points shows that consumption is directly (positively) related to disposable income; moreover, households spend most of their income.

But we can say more. The **45°(degree) line** is a reference line. Because it bisects the 90° angle formed by the two axes of the graph, each point on it is equidistant from the two axes. At each point on the 45° line, consumption would equal disposable income, or $C = DI$. Therefore, the vertical distance between the 45° line and any point on the horizontal axis measures either consumption *or* disposable income. If we let it measure disposable income, the vertical distance between it and the consumption line labeled C represents the amount of saving (S) in that year. Saving is the amount by which actual consumption in any year falls short of the 45° line—($S = DI - C$). For example, in 1998 disposable income was \$6,498.9 billion and consumption was \$6,157.5 billion, so saving was \$341.4 billion. Observe that the vertical distance between the 45° line and line C increases as we move rightward along the horizontal axis and decreases as we move leftward. Like consumption, saving typically varies directly with the level of disposable income. However, that historical pattern broke down somewhat in several years preceding the recession of 2007–2009.

FIGURE 10.1 Consumption and disposable income, 1990–2012. Each dot in this figure shows consumption and disposable income in a specific year. The line C , which generalizes the relationship between consumption and disposable income, indicates a direct relationship and shows that households consume most of their after-tax incomes.



Source: Bureau of Economic Analysis, www.bea.gov.

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The Consumption Schedule



The dots in Figure 10.1 represent historical data—the actual amounts of DI, C , and S in the United States over a period of years. But, because we want to understand how the economy would behave under different possible scenarios, we need a schedule showing the various amounts that households would *plan* to consume at each of the various levels of disposable income that might prevail at some specific time. Columns 1 and 2 of Table 10.1, represented in **Figure 10.2a (Key Graph)**, show the hypothetical consumption schedule that we require. This **consumption schedule** (or “consumption function”) reflects the direct consumption–disposable income relationship suggested by the data in Figure 10.1, and it is consistent with many household budget studies. In the aggregate, households increase their spending as their disposable income rises and spend a larger proportion of a small disposable income than of a large disposable income.

The Saving Schedule

It is relatively easy to derive a **saving schedule** (or “saving function”). Because saving equals disposable income less consumption ($S = DI - C$), we need only subtract consumption (Table 10.1, column 2) from disposable income (column 1) to find the amount saved (column 3) at each DI. Thus, columns 1 and 3 in Table 10.1 are the saving schedule, represented in Figure 10.2b. The graph shows that there is a direct relationship between saving and DI but that saving is a smaller proportion of a small DI than of a large DI. If households consume a smaller and smaller proportion of DI as DI increases, then they must be saving a larger and larger proportion.

Remembering that at each point on the 45° line consumption equals DI, we see that *dissaving* (consuming in excess of after-tax income) will occur at relatively low DI. For example, at \$370 billion (row 1, Table 10.1), consumption is \$375 billion. Households can consume more than their current incomes by liquidating (selling for cash) accumulated wealth or by borrowing. Graphically, dissaving is shown as the vertical distance of the consumption schedule above the 45° line or as the vertical distance of the saving schedule below the horizontal axis. We have marked the dissaving at the \$370 billion level of income in Figure 10.2a and 10.2b. Both vertical distances measure the \$5 billion of dissaving that occurs at \$370 billion of income.

TABLE 10.1 Consumption and Saving Schedules (in Billions) and Propensities to Consume and Save

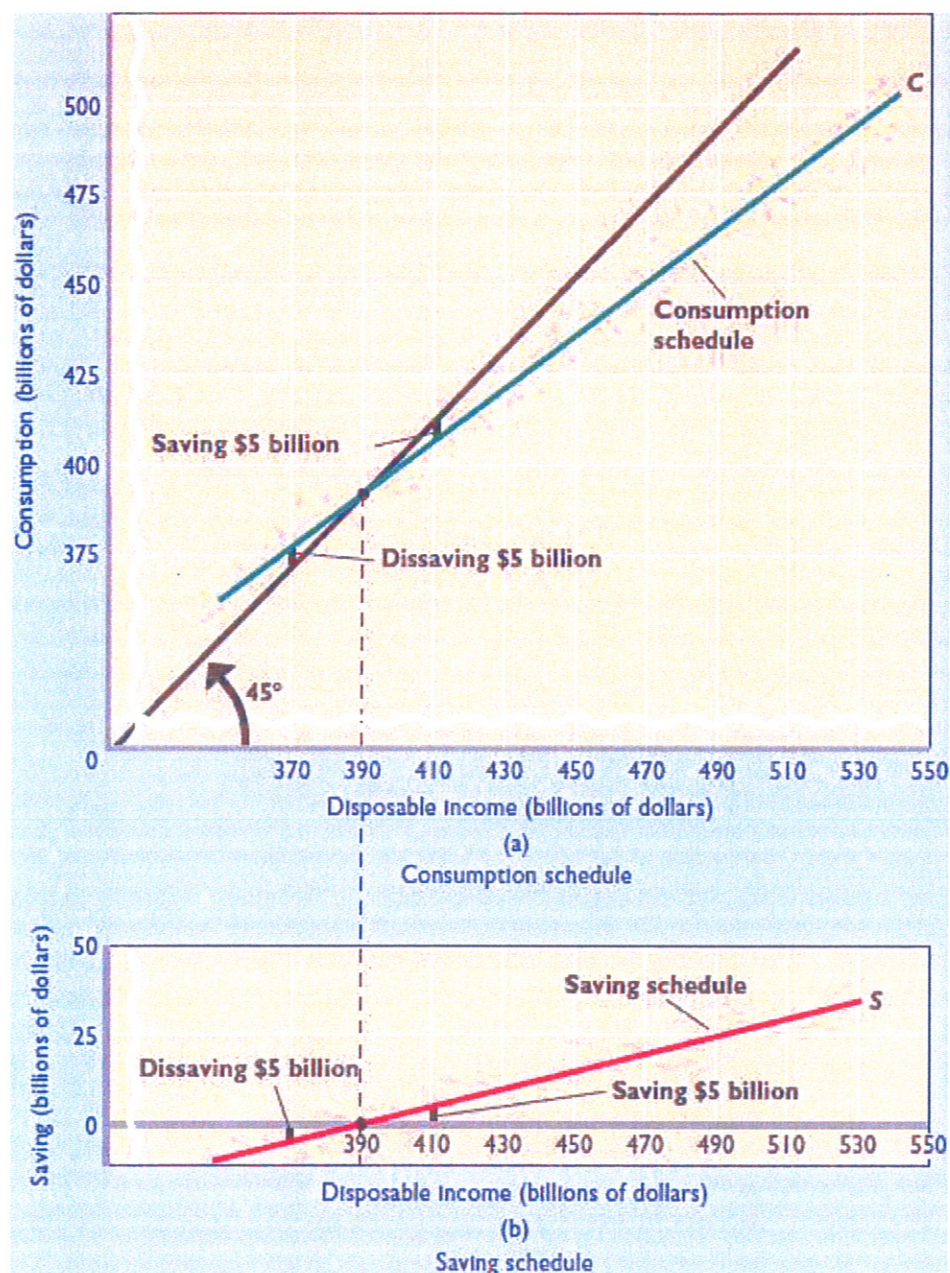
(1) Level of Output and Income (GDP = D1)	(2) Consumption (C)	(3) Saving (S), (1) – (2)	(4) Average Propensity to Consume (APC), (2)/(1)	(5) Average Propensity to Save (APS), (3)/(1)	(6) Marginal Propensity to Consume (MPC), $\Delta(2)/\Delta(1)^*$	(7) Marginal Propensity to Save (MPS), $\Delta(3)/\Delta(1)^*$
(1) \$370	\$375	\$-5	1.01	-.01	.75	.25
(2) 390	390	0	1.00	.00	.75	.25
(3) 410	405	5	.99	.01	.75	.25
(4) 430	420	10	.98	.02	.75	.25
(5) 450	435	15	.97	.03	.75	.25
(6) 470	450	20	.96	.04	.75	.25
(7) 490	465	25	.95	.05	.75	.25
(8) 510	480	30	.94	.06	.75	.25
(9) 530	495	35	.93	.07	.75	.25
(10) 550	510	40	.93	.07	.75	.25

*The Greek letter Δ , delta, means "the change in."

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KEY GRAPH

FIGURE 10.2 · Consumption and saving schedules. The two parts of this figure show the income-consumption and income-saving relationships in Table 10.1 graphically. (a) Consumption rises as income increases. Saving is negative (dissaving occurs) when the consumption schedule is above the 45° line, and saving is positive when the consumption schedule is below the 45° line. (b) Like consumption, saving increases as income goes up. The saving schedule is found by subtracting the consumption schedule in the top graph vertically from the 45° line. For these hypothetical data, saving is $-\$5$ billion at $\$370$ billion of income, zero at $\$390$ billion of income, and $\$5$ billion at $\$410$ billion of income. Saving is zero where consumption equals disposable income.



QUICK QUIZ FOR FIGURE 10.2

- The slope of the consumption schedule in this figure is 0.75. Thus, the:
 - slope of the saving schedule is 1.33.
 - marginal propensity to consume is 0.75.
 - average propensity to consume is 0.25.
 - slope of the saving schedule is also 0.75.
- In this figure, when consumption is a positive amount, saving:
 - must be a negative amount.
 - must also be a positive amount.
 - can be either a positive or a negative amount.
 - is zero.
- In this figure:
 - the marginal propensity to consume is constant at all levels of income.
 - the marginal propensity to save rises as disposable income rises.

- c. consumption is inversely (negatively) related to disposable income.
 - d. saving is inversely (negatively) related to disposable income.
4. When consumption equals disposable income:
- a. the marginal propensity to consume is zero.
 - b. the average propensity to consume is zero.
 - c. consumption and saving must be equal.
 - d. saving must be zero.

Answers: 1. b; 2. c; 3. a; 4. d

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In our example, the **break-even income** is \$390 billion (row 2, Table 10.1). This is the income level at which households plan to consume their entire incomes ($C = DI$).

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Graphically, the consumption schedule cuts the 45° line, and the saving schedule cuts the horizontal axis (saving is zero) at the break-even income level.

At all higher incomes, households plan to save part of their incomes. Graphically, the vertical distance between the consumption schedule and the 45° line measures this saving (see Figure 10.2a), as does the vertical distance between the saving schedule and the horizontal axis (see Figure 10.2b). For example, at the \$410 billion level of income (row 3, Table 10.1), both these distances indicate \$5 billion of saving.

Average and Marginal Propensities

Columns 4 to 7 in Table 10.1 show additional characteristics of the consumption and saving schedules.

APC and APS The fraction, or percentage, of total income that is consumed is the **average propensity to consume (APC)**. The fraction of total income that is saved is the **average propensity to save (APS)**. That is,

$$APC = \frac{\text{consumption}}{\text{income}}$$

and

$$APS = \frac{\text{saving}}{\text{income}}$$

For example, at \$470 billion of income (row 6, Table 10.1), the APC is $\frac{450}{470} = \frac{45}{47}$, or about 0.96 (= 96 percent), while the APS is $\frac{20}{470} = \frac{2}{47}$, or about 0.04 (= 4 percent). Columns 4 and 5 in Table 10.1 show the APC and APS at each of the 10 levels of DI. As implied by our previous discussion, the APC falls as DI increases, while the APS rises as DI goes up.

Because disposable income is either consumed or saved, the fraction of any DI consumed plus the fraction saved (not consumed) must exhaust that income. Mathematically, $APC + APS = 1$ at any level of disposable income, as columns 4 and 5 in Table 10.1 illustrate. So if 0.96 of the \$470 billion of income in row 6 is consumed, 0.04 must be saved. That is why $APC + APS = 1$.

Global Perspective 10.1 shows APCs for several countries.

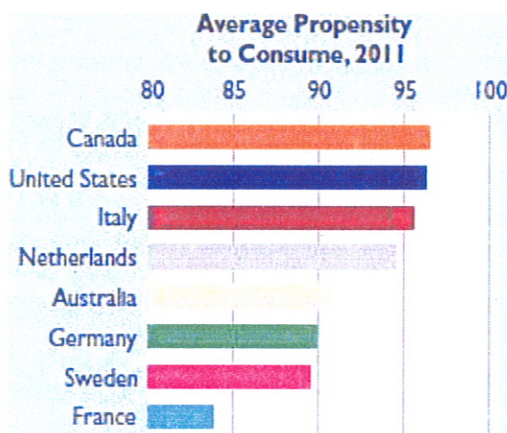
MPC and MPS The fact that households consume a certain proportion of a particular total income, for example, $\frac{45}{47}$ of a \$470 billion disposable income, does not guarantee they will consume the same proportion of any *change* in income they might receive. The proportion, or fraction, of any change in income consumed is called the **marginal propensity to consume (MPC)**, “marginal” meaning “extra” or “a change in.” Equivalently, the MPC is the ratio of a change in consumption to a change in the income that caused the consumption change:



GLOBAL PERSPECTIVE 10.1

Average Propensities to Consume, Selected Nations

There are surprisingly large differences in average propensities to consume (APCs) among nations. In 2011, Italy, the United States, Canada, and the Netherlands in particular had substantially higher APCs, and thus lower APSs, than several other advanced economies.



Source: Organization for Economic Cooperation and Development, OECD, www.oecd.org. Derived from OECD household saving rates as percentages of disposable income. Econ Outlook 86, Annex Table 23, extracted March 2013.

$$MPC = \frac{\text{change in consumption}}{\text{change in income}}$$

Similarly, the fraction of any change in income saved is the **marginal propensity to save (MPS)**. The MPS is the ratio of a change in saving to the change in income that brought it about:

$$MPS = \frac{\text{change in saving}}{\text{change in income}}$$

If disposable income is \$470 billion (row 6 horizontally in Table 10.1) and household income rises by \$20 billion to \$490 billion (row 7), households will consume $\frac{15}{20}$, or $\frac{3}{4}$, and save $\frac{5}{20}$, or $\frac{1}{4}$, of that increase in income. In other words, the MPC is $\frac{3}{4}$ or 0.75, and the MPS is $\frac{1}{4}$ or 0.25, as shown in columns 6 and 7.

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The sum of the MPC and the MPS for any change in disposable income must always be 1. Consuming or saving out of extra income is an either-or proposition; the fraction of any change in income not consumed is, by definition, saved. If 0.75 of extra disposable income is consumed, 0.25 must be saved. The fraction consumed (MPC) plus the fraction saved (MPS) must exhaust the whole change in income:

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$$MPC + MPS = 1$$

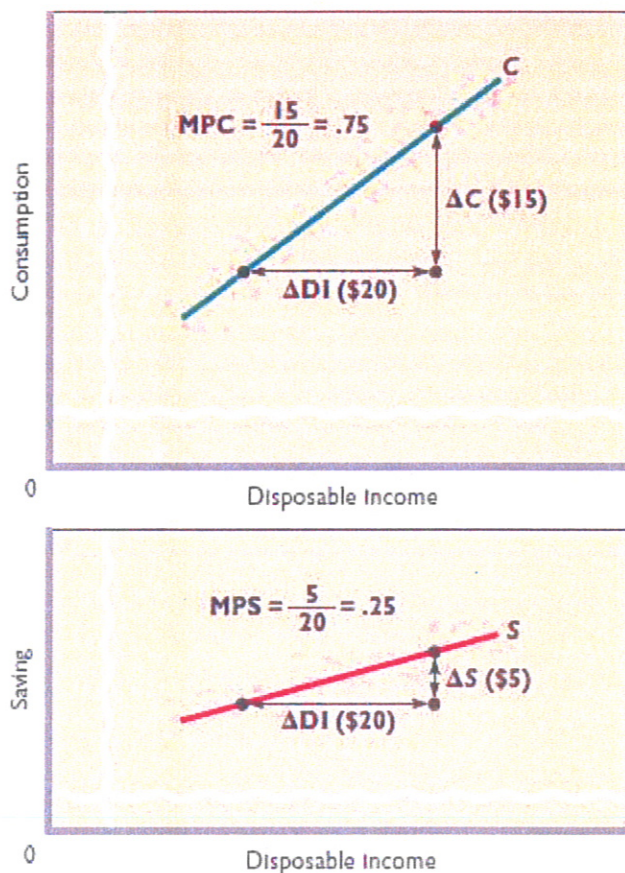
In our example, 0.75 plus 0.25 equals 1.



MPC and MPS as Slopes The MPC is the numerical value of the slope of the consumption schedule, and the MPS is the numerical value of the slope of the saving schedule. We know from the appendix to Chapter 1 that the slope of any line is the ratio of the vertical change to the horizontal change occasioned in moving from one point to another on that line.

Figure 10.3 measures the slopes of the consumption and saving lines, using enlarged portions of Figure 10.2a and 10.2b. Observe that consumption changes by \$15 billion (the vertical change) for each \$20 billion change in disposable income (the horizontal change). The slope of the consumption line is thus 0.75 ($= \$15/\20), which is the value of the MPC. Saving changes by \$5 billion (shown as the vertical change) for every \$20 billion change in disposable income (shown as the horizontal change). The slope of the saving line therefore is 0.25 ($= \$5/\20), which is the value of the MPS.

FIGURE 10.3 The marginal propensity to consume and the marginal propensity to save. In the two parts of this figure, the Greek letter delta (Δ) means “the change in.” (a) The MPC is the slope ($\Delta C/\Delta DI$) of the consumption schedule. (b) The MPS is the slope ($\Delta S/\Delta DI$) of the saving schedule.



Nonincome Determinants of Consumption and Saving

LO40.1 List and explain factors other than income that can affect consumption.

The amount of disposable income is the basic determinant of the amounts households will consume and save. But certain determinants other than income might prompt households to consume more or less at each possible level of income and thereby change the locations of the consumption and saving schedules. Those other determinants are wealth, borrowing, expectations, and interest rates.

- **Wealth** A household's wealth is the dollar amount of all the assets that it owns minus the dollar amount of its liabilities (all the debt that it owes). Households build wealth by saving money out of current income. The point of building wealth is to increase consumption possibilities. The larger the stock of wealth that a household can build up, the larger will be its present and future consumption possibilities.

Events sometimes suddenly boost the value of existing wealth. When this happens, households tend to increase their spending and reduce their saving. This so-called **wealth effect** shifts the consumption schedule upward and the saving schedule downward. They move in response to households taking advantage of the increased consumption possibilities afforded by the sudden increase in wealth. Examples: In the late 1990s, skyrocketing U.S. stock values expanded the value of household wealth by increasing the value of household assets. Predictably, households spent more and saved less. In contrast, a strong "reverse wealth effect" occurred in 2008. Plunging real estate and stock market prices joined together to erase \$11.2 trillion (yes, trillion) of household wealth. Consumers quickly reacted by reducing their consumption spending. The consumption schedule shifted downward.

- **Borrowing** Household borrowing also affects consumption. When a household borrows, it can

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increase current consumption beyond what would be possible if its spending were limited to its disposable income. By allowing households to spend more, borrowing shifts the current consumption schedule upward.

But note that there is no “free lunch.” While borrowing in the present allows for higher consumption in the present, it necessitates lower consumption in the future when the debts that are incurred due to the borrowing must be repaid. Stated a bit differently, increased borrowing increases debt (liabilities), which in turn reduces household wealth (since $wealth = assets - liabilities$). This reduction in wealth reduces future consumption possibilities in much the same way that a decline in asset values would. But note that the term “reverse wealth effect” is reserved for situations in which wealth unexpectedly changes because asset values unexpectedly change. It is not used to refer to situations such as the one being discussed here where wealth is intentionally reduced by households through borrowing and piling up debt to increase current consumption.

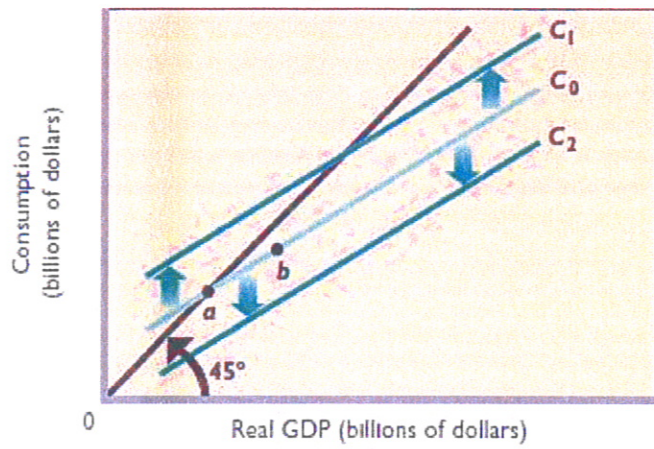
- **Expectations** Household expectations about future prices and income may affect current spending and saving. For example, the expectation of higher prices tomorrow may cause households to buy more today while prices are still low. Thus, the current consumption schedule shifts up and the current saving schedule shifts down. Or expectations of a recession and thus lower income in the future may lead households to reduce consumption and save more today. Their greater present saving will help build wealth that will help them ride out the expected bad times. The consumption schedule therefore will shift down and the saving schedule will shift up.
- **Real interest rates** When real interest rates (those adjusted for inflation) fall, households tend to borrow more, consume more, and save less. A lower interest rate, for example, decreases monthly loan payments and induces consumers to purchase automobiles and other goods bought on credit. A lower interest rate also diminishes the incentive to save because of the reduced interest “payment” to the saver. These effects on consumption and saving, however, are very modest. They mainly shift consumption toward some products (those bought on credit) and away from others. At best, lower interest rates shift the consumption schedule slightly upward and the saving schedule slightly downward. Higher interest rates do the opposite.

Other Important Considerations

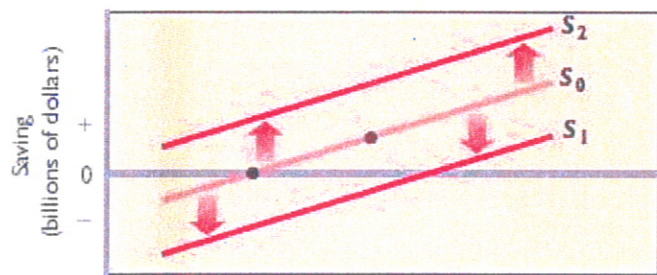
There are several additional important points regarding the consumption and saving schedules:

- **Switching to real GDP** When developing macroeconomic models, economists change their focus from the relationship between consumption (and saving) and *disposable income* to the relationship between consumption (and saving) and *real domestic output (real GDP)*. This modification is reflected in Figure 10.4a and 10.4b, where the horizontal axes measure real GDP.

FIGURE 10.4 Shifts of the (a) consumption and (b) saving schedules. Normally, if households consume more at each level of real GDP, they are necessarily saving less. Graphically this means that an upward shift of the consumption schedule (C_0 to C_1) entails a downward shift of the saving schedule (S_0 to S_1). If households consume less at each level of real GDP, they are saving more. A downward shift of the consumption schedule (C_0 to C_2) is reflected in an upward shift of the saving schedule (S_0 to S_2). This pattern breaks down, however, when taxes change; then the consumption and saving schedules move in the *same* direction—opposite to the direction of the tax change.



(a)
Consumption schedule



(b)
Saving schedule

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CONSIDER THIS ...

The Great Recession and the Paradox of Thrift



The Great Recession of 2007–2009 altered the prior consumption and saving behavior in the economy. Concerned about reduced wealth, high debt, and potential job losses, households increased their saving and reduced their consumption at each level of aftertax income (or each level of GDP). In Figure 10.4, this outcome is illustrated as the downward *shift* of the consumption schedule in the top graph and the upward *shift* of the saving schedule in the lower graph.

This change of behavior illustrates the so-called **paradox of thrift**, which refers to the possibility that a recession can be made worse when households become more thrifty and save in response to the downturn. The paradox of thrift rests on two major ironies. One irony is that saving more is *good* for the economy in the long run, as noted in Chapter 1 and Chapter 6. It finances investment and therefore fuels subsequent economic growth. But saving more can be *bad* for the economy during a recession. Because firms are pessimistic about future sales, the increased saving is not likely to be matched by an equal amount of added investment. The extra saving simply reduces spending on currently

produced goods and services. That means that even more businesses suffer, more layoffs occur, and people's incomes decline even more.

The paradox of thrift has a second irony related to the *fallacy of composition* (Chapter 1, Last Word): Households as a group may inadvertently end up saving less when each individual household tries to save more during a recession. This is because each household's attempt to save more implies that it is also attempting to spend less. Across all households, that collective reduction in total spending in the economy creates additional job losses and further drives down total income. The decline in total income reduces the ability of households as a group to save as much as they did before their spending reduction and subsequent income decline.

- **Changes along schedules** The movement from one point to another on a consumption schedule (for example, from a to b on C_0 in Figure 10.4a) is a *change in the amount consumed* and is solely caused by a change in real GDP. On the other hand, an upward or downward shift of the entire schedule, for example, a shift from C_0 to C_1 or C_2 in Figure 10.4a, is a *shift of the consumption schedule* and is caused by changes in any one or more of the *nonincome* determinants of consumption just discussed.

A similar distinction in terminology applies to the saving schedule in Figure 10.4b.

- **Simultaneous shifts** Changes in wealth, expectations, interest rates, and household debt will shift the consumption schedule in one direction and the saving schedule in the opposite direction. If households decide to consume more at each possible level of real GDP, they must save less, and vice versa. (Even when they spend more by borrowing, they are, in effect, reducing their current saving by the amount borrowed since borrowing is, effectively, “negative saving.”) Graphically, if the consumption schedule shifts upward from C_0 to C_1 in Figure 10.4a, the saving schedule shifts downward, from S_0 to S_1 in Figure 10.4b. Similarly, a downward shift of the consumption schedule from C_0 to C_2 means an upward shift of the saving schedule from S_0 to S_2 .
- **Taxation** In contrast, a change in taxes shifts the consumption and saving schedules in the same direction. Taxes are paid partly at the expense of consumption and partly at the expense of saving. So an increase in taxes will reduce both consumption and saving, shifting the consumption schedule in Figure 10.4a and the saving schedule in Figure 10.4b downward. Conversely, households will partly consume and partly save any decrease in taxes. Both the consumption schedule and saving schedule will shift upward.
- **Stability** The consumption and saving schedules usually are relatively stable unless altered by major tax increases or decreases. Their stability may be because consumption-saving decisions are strongly influenced by long-term considerations such as saving to meet emergencies or saving for retirement. It may also be because changes in the nonincome determinants frequently work in opposite directions and therefore may be self-canceling.

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QUICK REVIEW 10.1

- Both consumption spending and saving rise when disposable income increases; both fall when disposable income decreases.
- The average propensity to consume (APC) is the fraction of any specific level of disposable income that is spent on consumer goods; the average propensity to save (APS) is the fraction of any specific level of disposable income that is saved. The APC falls and the APS rises as disposable income increases.
- The marginal propensity to consume (MPC) is the fraction of a change in disposable income that is consumed and it is the slope of the consumption schedule; the marginal propensity to save (MPS) is the fraction of a change in disposable income that is saved and it is the slope of the saving schedule.
- Changes in consumer wealth, consumer expectations, interest rates, household debt, and taxes can shift the consumption and saving schedules (as they relate to real GDP).

The Interest-Rate–Investment Relationship

LO10.3 Explain how changes in real interest rates affect investment

In our consideration of major macro relationships, we next turn to the relationship between the real interest rate and investment. Recall that investment consists of expenditures on new plants, capital equipment, machinery, inventories, and so on. The investment decision is a marginal-benefit–marginal-cost decision: The marginal benefit from investment is the expected rate of return businesses hope to realize. The marginal cost is the interest rate that must be paid for borrowed funds. Businesses will invest in all projects for which the expected rate of return exceeds the interest rate. Expected returns (profits) and the interest rate therefore are the two basic determinants of investment spending.

Expected Rate of Return

Investment spending is guided by the profit motive; businesses buy capital goods only when they think such purchases will be profitable. Suppose the owner of a small cabinetmaking shop is considering whether to invest in a new sanding machine that costs \$1,000 and has a useful life of only 1 year. (Extending the life of the machine beyond 1 year complicates the economic decision but does not change the fundamental analysis. We discuss the valuation of returns beyond 1 year in Chapter 17.) The new machine will increase the firm's output and sales revenue. Suppose the net expected

revenue from the machine (that is, after such operating costs as power, lumber, labor, and certain taxes have been subtracted) is \$1,100. Then, after the \$1,000 cost of the machine is subtracted from the net expected revenue of \$1,100, the firm will have an expected profit of \$100. Dividing this \$100 profit by the \$1,000 cost of the machine, we find that the **expected rate of return**, r , on the machine is 10 percent ($= \$100/\$1,000$). It is important to note that this is an *expected* rate of return, not a *guaranteed* rate of return. The investment may or may not generate as much revenue or as much profit as anticipated. Investment involves risk.

The Real Interest Rate

One important cost associated with investing that our example has ignored is interest, which is the financial cost of borrowing the \$1,000 of *money* “capital” to purchase the \$1,000 of *real* capital (the sanding machine).

The interest cost of the investment is computed by multiplying the interest rate, i , by the \$1,000 borrowed to buy the machine. If the interest rate is, say, 7 percent, the total interest cost will be \$70. This compares favorably with the net expected return of \$100, which produced the 10 percent expected rate of return. If the investment works out as expected, it will add \$30 to the firm's profit.

We can generalize as follows: If the expected rate of return (10 percent) exceeds the interest rate (here, 7 percent), the investment should be undertaken. The firm expects the investment to be profitable. But if the interest rate (say, 12 percent) exceeds the expected rate of return (10 percent), the investment should not be undertaken. The firm expects the investment to be unprofitable. The firm should undertake all investment projects it thinks will be profitable. This means that the firm should array its prospective investment projects from the highest expected rate of return, r , downward and then invest in all projects for which r exceeds i . The firm therefore should invest to the point where $r = i$ because then it will have undertaken all investments for which r is greater than i .

This guideline applies even if a firm finances the investment internally out of funds saved from past profit rather than borrowing the funds. The role of the interest rate in the investment decision does not change. When the firm uses money from savings to invest in the sander, it incurs an opportunity cost because it forgoes the interest income it could have earned by lending the funds to someone else. That interest cost, converted to percentage

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terms, needs to be weighed against the expected rate of return.

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The *real* rate of interest, rather than the *nominal* rate, is crucial in making investment decisions. Recall from Chapter 9 that the nominal interest rate is expressed in dollars of current value, while the real interest rate is stated in dollars of constant or inflation-adjusted value. Recall that the real interest rate is the nominal rate less the rate of inflation. In our sanding machine illustration, our implicit assumption of a constant price level ensures that all our data, including the interest rate, are in real terms.

But what if inflation *is* occurring? Suppose a \$1,000 investment is expected to yield a real (inflation-adjusted) rate of return of 10 percent and the nominal interest rate is 15 percent. At first, we would say the investment would be unprofitable. But assume there is ongoing inflation of 10 percent per year. This means the investing firm will pay back dollars with approximately 10 percent less in purchasing power. While the nominal interest rate is 15 percent, the real rate is only 5 percent (= 15 percent – 10 percent). By comparing this 5 percent real interest rate with the 10 percent expected real rate of return, we find that the investment is potentially profitable and should be undertaken.

Investment Demand Curve

We now move from a single firm's investment decision to total demand for investment goods by the entire business sector. Assume that every firm has estimated the expected rates of return from all investment projects and has recorded those data. We can cumulate (successively sum) these data by asking: How many dollars' worth of investment projects have an expected rate of return of, say, 16 percent or more? How many have 14 percent or more? How many have 12 percent or more? And so on.

Suppose no prospective investments yield an expected return of 16 percent or more. But suppose there are \$5 billion of investment opportunities with expected rates of return between 14 and 16 percent; an additional \$5 billion yielding between 12 and 14 percent; still an additional \$5 billion yielding between 10 and 12 percent; and an additional \$5 billion in each successive 2 percent range of yield down to and including the 0 to 2 percent range.

To cumulate these figures for each rate of return, r , we add the amounts of investment that will yield each particular rate of return r or higher. This provides the data in the table in Figure 10.5. The data are shown graphically in **Figure 10.5 (Key Graph)**. In the table, the number opposite 12 percent, for example, means there are \$10 billion of investment opportunities that will yield an expected rate of return of 12 percent or more. The \$10 billion includes the \$5 billion of investment expected to yield a return of 14 percent or more plus the \$5 billion expected to yield between 12 and 14 percent.

We know from our example of the sanding machine that an investment project will be undertaken if its expected rate of return, r , exceeds the real interest rate, i . Let's first suppose i is 12 percent. Businesses will undertake all investments for which r exceeds 12 percent. That is, they will invest until the 12 percent rate of return equals the 12 percent interest rate. Figure 10.5 reveals that \$10 billion of investment spending will be undertaken at a 12 percent interest rate; that means \$10 billion of investment projects have an expected rate of return of 12 percent or more.

Put another way: At a financial "price" of 12 percent, \$10 billion of investment goods will be demanded. If the interest rate is lower, say, 8 percent, the amount of investment for which r equals or

exceeds i is \$20 billion. Thus, firms will demand \$20 billion of investment goods at an 8 percent real interest rate. At 6 percent, they will demand \$25 billion of investment goods.



By applying the marginal-benefit–marginal-cost rule that investment projects should be undertaken up to the point where $r = i$, we see that we can add the real interest rate to the vertical axis in Figure 10.5. The curve in Figure 10.5 not only shows rates of return; it shows the quantity of investment demanded at each “price” i (interest rate) of investment. The vertical axis in Figure 10.5 shows the various possible real interest rates, and the horizontal axis shows the corresponding quantities of investment demanded. The inverse (downsloping) relationship between the interest rate (price) and dollar quantity of investment demanded conforms to the law of demand discussed in Chapter 3. The curve ID in Figure 10.5 is the economy's **investment demand curve**. It shows the amount of investment forthcoming at each real interest rate. The level of investment depends on the expected rate of return and the real interest rate.

Shifts of the Investment Demand Curve

LO10.4 Identify and explain factors that determine the real interest rate and affect investment.

Figure 10.5 shows the relationship between the interest rate and the amount of investment demanded, other things equal. When other things change, the investment demand curve shifts. In general, any factor that leads businesses collectively to expect greater rates of return on their investments increases investment demand. That factor shifts the investment demand curve to the right, as from ID_0 to ID_1 in Figure 10.6. Any factor that leads businesses collectively to expect lower rates of return on their investments shifts the curve to the left, as from ID_0 to ID_2 . What are those non-interest-rate determinants of investment demand?

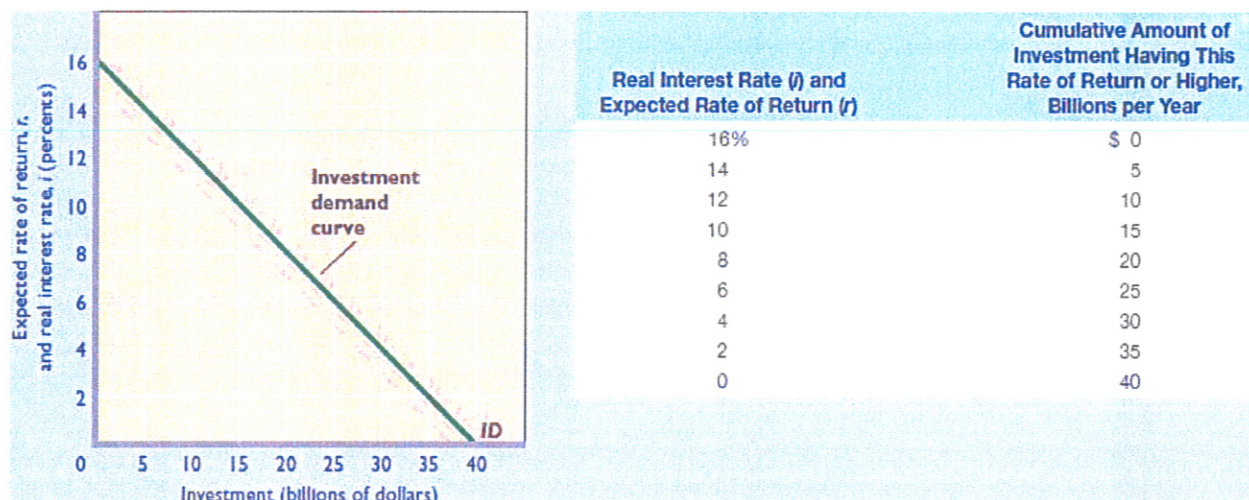
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KEY GRAPH

FIGURE 10.5 The investment demand curve. The investment demand curve is constructed by arraying all potential investment projects in descending order of their expected rates of return. The curve slopes downward, reflecting an inverse relationship between the real interest rate (the financial “price” of each dollar of investing) and the quantity of investment demanded.



QUICK QUIZ FOR FIGURE 10.5

- The investment demand curve:
 - reflects a direct (positive) relationship between the real interest rate and investment.
 - reflects an inverse (negative) relationship between the real interest rate and investment.
 - shifts to the right when the real interest rate rises.
 - shifts to the left when the real interest rate rises.
- In this figure:
 - greater cumulative amounts of investment are associated with lower real interest rates.
 - lesser cumulative amounts of investment are associated with lower expected rates of return on investment.
 - higher interest rates are associated with higher expected rates of return on investment, and therefore greater amounts of investment.
 - interest rates and investment move in the same direction.
- In this figure, if the real interest rate falls from 6 to 4 percent:
 - investment will increase from 0 to \$30 billion.
 - investment will decrease by \$5 billion.
 - the expected rate of return will rise by \$5 billion.

- d. investment will increase from \$25 billion to \$30 billion.
4. In this figure, investment will be:
- zero if the real interest rate is zero.
 - \$40 billion if the real interest rate is 16 percent.
 - \$30 billion if the real interest rate is 4 percent.
 - \$20 billion if the real interest rate is 12 percent.

Answers: 1. b; 2. a; 3. d; 4. c

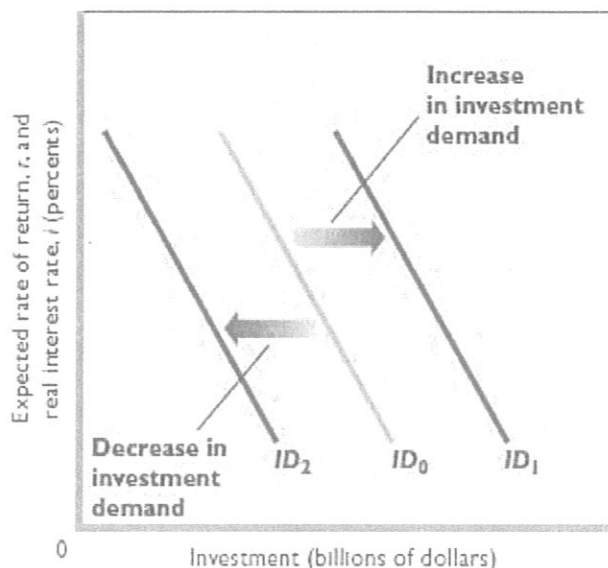
- ***Acquisition, maintenance, and operating costs*** The initial costs of capital goods, and the estimated costs of operating and maintaining those goods, affect the expected rate of return on investment. When these costs rise, the expected rate of return from prospective investment projects falls and the investment demand curve shifts to the left. Example: Higher electricity costs associated with operating tools and machinery shifts the investment demand curve to the left. Lower costs, in contrast, shift it to the right.

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FIGURE 10.6 Shifts of the investment demand curve. Increases in investment demand are shown as rightward shifts of the investment demand curve; decreases in investment demand are shown as leftward shifts of the investment demand curve.



- **Business taxes** When government is considered, firms look to expected returns *after taxes* in making their investment decisions. An increase in business taxes lowers the expected profitability of investments and shifts the investment demand curve to the left; a reduction of business taxes shifts it to the right.
- **Technological change** Technological progress—the development of new products, improvements in existing products, and the creation of new machinery and production processes—stimulates investment. The development of a more efficient machine, for example, lowers production costs or improves product quality and increases the expected rate of return from investing in the machine. Profitable new products (cholesterol medications, Internet services, highdefinition televisions, cellular phones, and so on) induce a flurry of investment as businesses tool up for expanded production. A rapid rate of technological progress shifts the investment demand curve to the right.
- **Stock of capital goods on hand** The stock of capital goods on hand, relative to output and sales, influences investment decisions by firms. When the economy is overstocked with production facilities and when firms have excessive inventories of finished goods, the expected rate of return on new investment declines. Firms with excess production capacity have little incentive to invest in new capital. Therefore, less investment is forthcoming at each real interest rate; the investment demand curve shifts leftward.

When the economy is understocked with production facilities and when firms are selling their output as fast as they can produce it, the expected rate of return on new investment increases and the investment demand curve shifts rightward.

- **Planned inventory changes** Recall from Chapter 7 that the definition of investment includes changes in inventories of unsold goods. An increase in inventories is counted as positive investment while a decrease in inventories is counted as negative investment. It is important to

remember that some inventory changes are planned, while others are unplanned. Since the investment demand curve deals only with *planned* investment, it is only affected by *planned* changes that firms desire to make to their inventory levels. If firms are planning to increase their inventories, the investment demand curve shifts to the right. If firms are planning on decreasing their inventories, the investment demand curve shifts to the left.

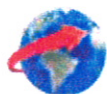
Firms make planned changes to their inventory levels mostly because they are expecting either faster or slower sales. A firm that expects its sales to double in the next year will want to keep more inventory in stock, thereby increasing its investment demand. By contrast, a firm that is expecting slower sales will plan on reducing its inventory, thereby reducing its overall investment demand. But because life often does not turn out as expected, firms often find that the actual amount of inventory investment that they end up making is either more or less than what they had planned. The size of the gap is, naturally, the dollar amount of their *unplanned* inventory changes. These unplanned inventory adjustments will play a large role in the aggregate expenditures model studied in Chapter 11.

- **Expectations** We noted that business investment is based on expected returns (expected additions to profit). Most capital goods are durable, with a life expectancy of 10 or 20 years. Thus, the expected rate of return on capital investment depends on the firm's expectations of future sales, future operating costs, and future profitability of the product that the capital helps produce. These expectations are based on forecasts of future business conditions as well as on such elusive and difficult-to-predict factors as changes in the domestic political climate, international relations, population growth, and consumer tastes. If executives become more optimistic about future sales, costs, and profits, the investment demand curve will shift to the right; a pessimistic outlook will shift the curve to the left.

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GLOBAL PERSPECTIVE 10.2

Gross Investment Expenditures as a Percentage of GDP, Selected Nations

As a percentage of GDP, investment varies widely by nation. These differences, of course, can change from year to year.



Source: Gross fixed capital formation data from International Financial Statistics, International Monetary Fund, www.imf.org.

Global Perspective 10.2 compares investment spending relative to GDP for several nations in a recent year. Domestic real interest rates and investment demand determine the levels of investment relative to GDP.

Instability of Investment

In contrast to consumption, investment is unstable; it rises and falls quite often. Investment, in fact, is the most volatile component of total spending—so much so that most of the fluctuations in output and employment that happen over the course of the business cycle can be attributed to demand shocks relating to unexpected increases and decreases in investment. Figure 10.7 shows just how volatile investment in the United States has been. Notice that the percentage swings in investment in real terms are greater than the percentage swings in real GDP. Several interrelated factors drawn from our previous discussion explain the variability of investment.

- **Variability of expectations** Business expectations can change quickly when some event suggests a significant possible change in future business conditions. Changes in exchange rates, trade barriers, legislative actions, stock market prices, government economic policies, the outlook for war or peace, court decisions in key labor or antitrust cases, and a host of similar considerations may cause substantial shifts in business expectations.

- **Durability** Because of their durability, capital goods have indefinite useful lifespans. Within limits, purchases of capital goods are discretionary and therefore can be postponed. Firms can scrap or replace older equipment and buildings, or they can patch them up and use them for a few more years. Optimism about the future may prompt firms to replace their older facilities and such modernizing will call for a high level of investment. A less optimistic view, however, may lead to smaller amounts of investment as firms repair older facilities and keep them in use.

CONSIDER THIS ...

The Great Recession and the Investment Riddle



During the severe recession of 2007–2009, real interest rates essentially declined to zero. Figure 10.5 suggests that this drop in interest rates should have boosted investment spending. But investment declined substantially during this period. On an annual basis, it declined by 9 percent in 2008 and 26 percent in 2009. Does this combination of lower real interest rates and reduced investment make Figure 10.5 irrelevant?

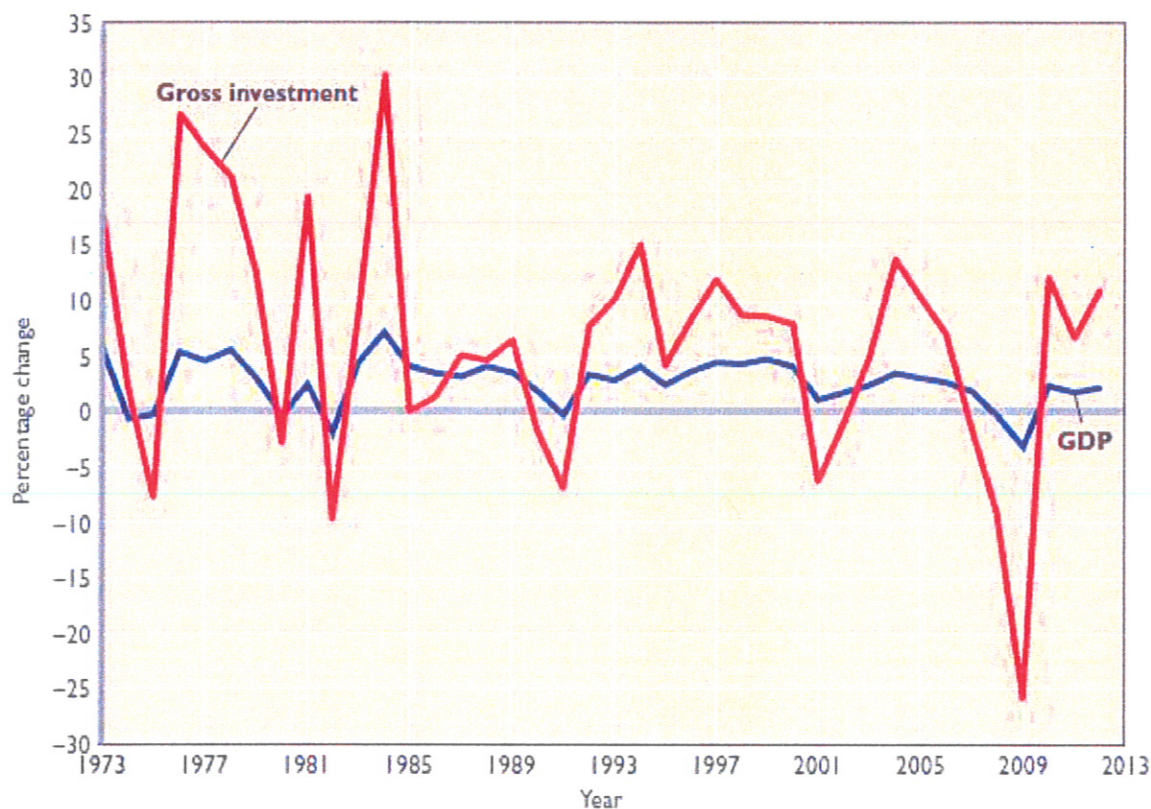
Definitely not! The key to the investment riddle is that during the recession, the investment demand curve shifted inward, as from ID_0 to ID_2 in Figure 10.6. This inward shift overwhelmed any investment-increasing effects of the decline of real interest rates. The net result turned out to be less investment, not more.

The leftward shift of the investment demand reflected a decline in the expected returns from investment. Firms envisioned zero or negative returns on investment in new capital because they were facing an overstock of existing capital relative to their current sales. Understandably, they therefore were not inclined to invest. Also, firms were extremely pessimistic about when the economy would regain its strength. This pessimism also contributed to low expected rates of return on investment and thus to exceptionally weak investment demand. Further, even though the interest rate was so low, firms that wanted to borrow and invest found that lenders were reluctant to lend

them money for fear that they would not be able to pay back the loans.

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FIGURE 10.7 The volatility of investment, 1973–2012. Annual percentage changes in investment spending are often several times greater than the percentage changes in GDP. (Data are in real terms. Investment is gross private domestic investment).



Source: Bureau of Economic Analysis. www.bea.gov.

- **Irregularity of innovation** New products and processes stimulate investment. Major innovations such as railroads, electricity, airplanes, automobiles, computers, the Internet, and cell phones induce vast upsurges or “waves” of investment spending that in time recede. But such innovations occur quite irregularly, adding to the volatility of investment.
- **Variability of profits** High current profits often generate optimism about the future profitability of new investments, whereas low current profits or losses spawn considerable doubt about the wisdom of new investments. Additionally, firms often save a portion of current profits as retained earnings and use these funds (as well as borrowed funds) to finance new investments. So current profits affect both the incentive and ability to invest. But profits themselves are highly variable from year to year, contributing to the volatility of investment.

In terms of our previous analysis, we would represent volatility of investment as occasional and substantial unexpected shifts of the investment demand curve (as in Figure 10.6), which cause significant changes in investment spending (as in Figure 10.7). These demand shocks can contribute to cyclical instability.

QUICK REVIEW 10.2

- A specific investment will be undertaken if the expected rate of return, r , equals or exceeds the real interest rate, i .
- The investment demand curve shows the total monetary amounts that will be invested by an economy at various possible real interest rates.
- The investment demand curve shifts when changes occur in (a) the costs of acquiring, operating, and maintaining capital goods, (b) business taxes, (c) technology, (d) the stock of capital goods on hand, and (e) business expectations.

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The Multiplier Effect*

GDPS rise (or fall) by a larger change in the initial change in spending. A change in spending leads to a larger change in GDP by a multiple amount.

A final basic relationship that requires discussion is the relationship between changes in spending and changes in real GDP. Assuming that the economy has room to expand—so that increases in spending do not lead to increases in prices—there is a direct relationship between these two aggregates. More spending results in a higher GDP; less spending results in a lower GDP. But there is much more to this relationship. A change in spending, say, investment, ultimately changes output and income by more than the initial change in investment spending. That surprising result is called the *multiplier effect*: a change in a component of total spending leads to a larger change in GDP. The **multiplier** determines how much larger that change will be; it is the ratio of a change in GDP to the initial change in spending (in this case, investment). Stated generally,

$$\text{Multiplier} = \frac{\text{change in real GDP}}{\text{initial change in spending}}$$

By rearranging this equation, we can also say that

$$\text{Change in GDP} = \text{multiplier} \times \text{initial change in spending}$$

So if investment in an economy rises by \$30 billion and GDP increases by \$90 billion as a result, we then know from our first equation that the multiplier is 3 (= \$90/\$30).

Note these three points about the multiplier:

- The “initial change in spending” is usually associated with investment spending because of investment's volatility. But changes in consumption (unrelated to changes in income), net exports, and government purchases also lead to the multiplier effect.
- The “initial change in spending” associated with investment spending results from a change in the real interest rate and/or a shift of the investment demand curve.
- Implicit in the preceding point is that the multiplier works in both directions. An increase in initial spending will create a multiple increase in GDP, while a decrease in spending will create a multiple decrease in GDP.

Rationale

The multiplier effect follows from two facts. First, the economy supports repetitive, continuous flows of expenditures and income through which dollars spent by Smith are received as income by Chin and then spent by Chin and received as income by Gonzales, and so on. (This chapter's Last Word presents this idea in a humorous way.) Second, any change in income will change both consumption and saving in the same direction as, and by a fraction of, the change in income.

It follows that an initial change in spending will set off a spending chain throughout the economy. That chain of spending, although of diminishing importance at each successive step, will cumulate to

a multiple change in GDP. Initial changes in spending produce magnified changes in output and income.

The table in Figure 10.8 illustrates the rationale underlying the multiplier effect. Suppose that a \$5 billion increase in investment spending occurs. We assume that the MPC is 0.75, the MPS is 0.25, and prices remain constant. That is, neither the initial increase in spending nor any of the subsequent increases in spending will cause prices to rise.

The initial \$5 billion increase in investment generates an equal amount of wage, rent, interest, and profit income because spending and receiving income are two sides of the same transaction. How much consumption will be induced by this \$5 billion increase in the incomes of households? We find the answer by applying the marginal propensity to consume of 0.75 to this change in income. Thus, the \$5 billion increase in income initially raises consumption by \$3.75 ($= 0.75 \times \5) billion and saving by \$1.25 ($= 0.25 \times \5) billion, as shown in columns 2 and 3 in the table.

Other households receive as income (second round) the \$3.75 billion of consumption spending. Those households consume 0.75 of this \$3.75 billion, or \$2.81 billion, and save 0.25 of it, or \$0.94 billion. The \$2.81 billion that is consumed flows to still other households as income to be spent or saved (third round). And the process continues, with the added consumption and income becoming less in each round. The process ends when there is no more additional income to spend.

The bar chart in Figure 10.8 shows several rounds of the multiplier process of the table graphically. As shown by rounds 1 to 5, each round adds a smaller and smaller blue block to national income and GDP. The process, of course, continues beyond the five rounds shown (for convenience we have simply cumulated the subsequent declining blocks into a single block labeled “All other”). The accumulation of the additional income in each round—the sum of the blue blocks—is the total change in income or GDP resulting from the initial \$5 billion change in spending. Because the spending and respending effects of the increase in investment diminish with each successive round of spending, the cumulative increase in output and income eventually ends. In this case, the ending occurs when \$20 billion of additional income accumulates. Thus, the multiplier is 4 ($= \$20 \text{ billion} / \5 billion).

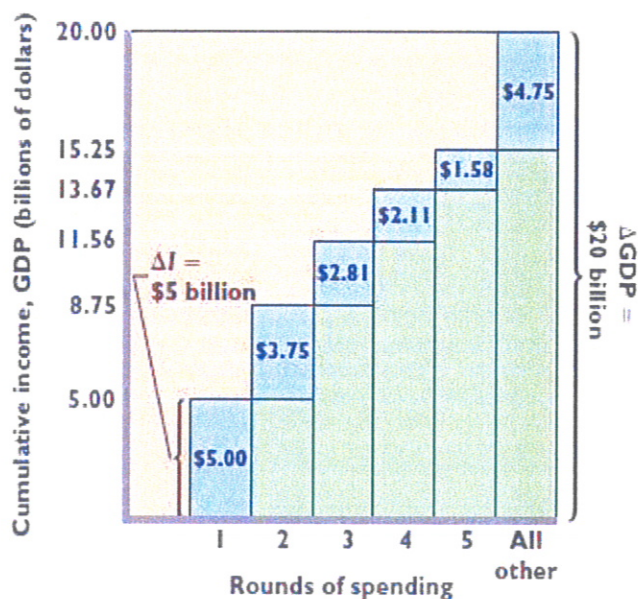
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FIGURE 10.8 The multiplier process ($MPC = 0.75$). An initial change in investment spending of \$5 billion creates an equal \$5 billion of new income in round 1. Households spend \$3.75 ($= 0.75 \times \5) billion of this new income, creating \$3.75 billion of added income in round 2. Of this \$3.75 billion of new income, households spend \$2.81 ($= 0.75 \times \3.75) billion, and income rises by that amount in round 3. Such income increments over the entire process get successively smaller but eventually produce a total change of income and GDP of \$20 billion. The multiplier therefore is 4 ($= \$20 \text{ billion} / \5 billion).

	(1) Change in Income	(2) Change in Consumption ($MPC = 0.75$)	(3) Change in Saving ($MPS = 0.25$)
Increase in investment of \$5.00	\$5.00	\$ 3.75	\$1.25
Second round	3.75	2.81	0.94
Third round	2.81	2.11	0.70
Fourth round	2.11	1.58	0.53
Fifth round	1.58	1.19	0.39
All other rounds	4.75	3.56	1.19
Total	\$20.00	\$15.00	\$5.00



The Multiplier and the Marginal Propensities

You may have sensed from the table in Figure 10.8 that the fractions of an increase in income consumed (MPC) and saved (MPS) determine the cumulative responding effects of any initial change in spending and therefore determine the size of the multiplier. The MPC and the multiplier are directly related and the MPS and the multiplier are inversely related. The precise formulas are as shown in the next two equations:

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

Recall, too, that $\text{MPC} + \text{MPS} = 1$. Therefore $\text{MPS} = 1 - \text{MPC}$, which means we can also write the multiplier formula as

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

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LAST WORD

Squaring the Economic Circle

Humorist Art Buchwald Examines the Multiplier

WASHINGTON—The recession hit so fast that nobody knows exactly how it happened. One day we were the land of milk and honey and the next day we were the land of sour cream and food stamps.

This is one explanation.



Hofberger, the Ford salesman in Tomcat, Va., a suburb of Washington, called up Littleton, of Littleton Menswear & Haberdashery, and said, "Good news, the new Fords have just come in and I've put one aside for you and your wife."

Littleton said, "I can't, Hofberger, my wife and I are getting a divorce."

"I'm sorry," Littleton said, "but I can't afford a new car this year. After I settle with my wife, I'll be lucky to buy a bicycle."

Hofberger hung up. His phone rang a few minutes later.

"This is Bedcheck the painter," the voice on the other end said. "When do you want us to start painting your house?"

"I changed my mind," said Hofberger, "I'm not going to paint the house."

"But I ordered the paint," Bedcheck said. "Why did you change your mind?"

"Because Littleton is getting a divorce and he can't afford a new car."

That evening when Bedcheck came home his wife said, "The new color television set arrived from Gladstone's TV Shop."

"Take it back," Bedcheck told his wife.

"Why?" she demanded.

"Because Hofberger isn't going to have his house painted now that the Littletons are getting a divorce."

The next day Mrs. Bedcheck dragged the TV set in its carton back to Gladstone. "We don't want it."

Gladstone's face dropped. He immediately called his travel agent, Sandstorm. "You know that trip you had scheduled for me to the Virgin Islands?"

"Right, the tickets are all written up."

"Cancel it. I can't go. Bedcheck just sent back the color TV set because Hofberger didn't sell a car to Littleton because they're going to get a divorce and she wants all his money."

Sandstorm tore up the airline tickets and went over to see his banker, Gripsholm. "I can't pay back the loan this month because Gladstone isn't going to the Virgin Islands."

Gripsholm was furious. When Rudemaker came in to borrow money for a new kitchen he needed for his restaurant, Gripsholm turned him down cold. "How can I loan you money when Sandstorm hasn't repaid the money he borrowed?"

Rudemaker called up the contractor, Eagleton, and said he couldn't put in a new kitchen. Eagleton laid off eight men.

Meanwhile, Ford announced it was giving a rebate on its new models. Hofberger called up Littleton immediately. "Good news," he said, "even if you are getting a divorce, you can afford a new car."

"I'm not getting a divorce," Littleton said. "It was all a misunderstanding and we've made up."

"That's great," Hofberger said. "Now you can buy the Ford."

"No way," said Littleton. "My business has been so lousy I don't know why I keep the doors open."

"I didn't realize that," Hofberger said.

"Do you realize I haven't seen Bedcheck, Gladstone, Sandstorm, Gripsholm, Rudemaker or Eagleton for more than a month? How can I stay in business if they don't patronize my store?"

Source: Art Buchwald, "Squaring the Economic Circle," *Cleveland Plain Dealer*, Feb. 22, 1975. Reprinted by permission.

SUMMARY

LO10.1 Describe how changes in income affect consumption (and saving).

Other things equal, a direct (positive) relationship exists between income and consumption and income and saving. The consumption and saving schedules show the various amounts that households intend to consume and save at the various income and output levels, assuming a fixed price level.

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The *average* propensities to consume and save show the fractions of any total income that are consumed and saved; $APC + APS = 1$. The *marginal* propensities to consume and save show the fractions of any change in total income that are consumed and saved; $MPC + MPS = 1$.

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LO10.2 List and explain factors other than income that can affect consumption.

The locations of the consumption and saving schedules (as they relate to real GDP) are determined by (a) the amount of wealth owned by households, (b) expectations of future prices and incomes, (c) real interest rates, (d) household debt, and (e) tax levels. The consumption and saving schedules are relatively stable.

LO10.3 Explain how changes in real interest rates affect investment.

The immediate determinants of investment are (a) the expected rate of return and (b) the real rate of interest. The economy's investment demand curve is found by cumulating investment projects, arraying them in descending order according to their expected rates of return, graphing the result, and applying the rule that investment should be undertaken up to the point at which the real interest rate, i , equals the expected rate of return, r . The investment demand curve reveals an inverse (negative) relationship between the interest rate and the level of aggregate investment.

Shifts of the investment demand curve can occur as the result of changes in (a) the acquisition, maintenance, and operating costs of capital goods; (b) business taxes; (c) technology; (d) the stocks of capital goods on hand; and (e) expectations.

Either changes in interest rates or shifts of the investment demand curve can change the level of investment.

LO10.4 Identify and explain factors other than the real interest rate that can affect investment.

The durability of capital goods, the irregular occurrence of major innovations, profit volatility, and the variability of expectations all contribute to the instability of investment spending.

LO10.5 Illustrate how changes in investment (or one of the other components of total spending) can increase or decrease real GDP by a multiple amount.

Through the multiplier effect, an increase in investment spending (or consumption spending, government purchases, or net export spending) ripples through the economy, ultimately creating a magnified increase in real GDP. The multiplier is the ultimate change in GDP divided by the initiating change in investment or some other component of spending.

The multiplier is equal to the reciprocal of the marginal propensity to save: The greater is the marginal propensity to save, the smaller is the multiplier. Also, the greater is the marginal propensity to consume, the larger is the multiplier.

Economists disagree on the size of the actual multiplier in the United States, with estimates ranging all the way from 2.5 to 0. But all estimates of actual-economy multipliers are less than the multiplier in our purposefully simple text illustrations.

TERMS AND CONCEPTS

45° (degree) line

consumption schedule

saving schedule

break-even income
 average propensity to consume (APC)
 average propensity to save (APS)
 marginal propensity to consume (MPC)
 marginal propensity to save (MPS)
 wealth effect
 paradox of thrift
 expected rate of return
 investment demand curve
 multiplier

The following and additional problems can be found in 

DISCUSSION QUESTIONS

1. Precisely how do the MPC and the APC differ? How does the MPC differ from the MPS? Why must the sum of the MPC and the MPS equal 1? **LO10.1**
2. Why does a downshift of the consumption schedule typically involve an equal upshift of the saving schedule? What is the exception to this relationship? **LO10.2**
3. Why will a reduction in the real interest rate increase investment spending, other things equal? **LO10.3**
4. In what direction will each of the following occurrences shift the investment demand curve, other things equal? **LO10.4**
 - a. An increase in unused production capacity occurs.
 - b. Business taxes decline.
 - c. The costs of acquiring equipment fall.
 - d. Widespread pessimism arises about future business conditions and sales revenues.
 - e. A major new technological breakthrough creates prospects for a wide range of profitable new products.
5. How is it possible for investment spending to increase even in a period in which the real interest rate rises? **LO10.4**
6. Why is investment spending unstable? **LO10.4**
7. Is the relationship between changes in spending and changes in real GDP in the multiplier effect a direct