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.

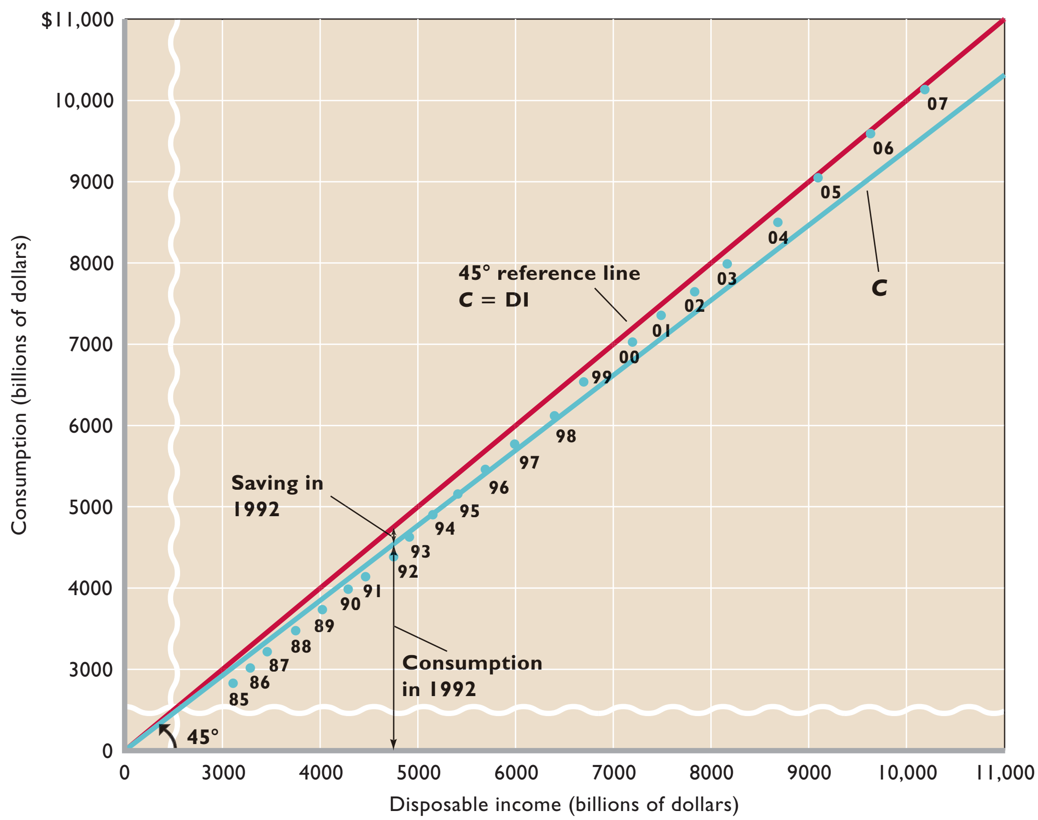
The Income-Consumption and Income-Saving Relationships

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 27.1 each dot represents consumption and disposable income for 1 year since 1985. 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

FIGURE 27.1 Consumption and disposable income, 1985–2007. 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.**

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 1992 disposable income was $4751 billion and consumption was $4385 billion, so saving was $366 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. That historical pattern, however, has temporarily broken down in recent years.

The Consumption Schedule

The dots in Figure 27.1 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 27.1, represented in **Figure 27.2a (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 27.1, 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.

ORIGIN OF THE IDEA

O 27.1

Income-consumption relationship

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 27.1, column 2) from disposable income (column 1) to find the amount saved (column 3) at each DI. Thus, columns 1 and 3 in Table 27.1 are the saving schedule, represented in Figure 27.2b. 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 DIs. For example, at $370 billion (row 1, Table 27.1), 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 27.2a and 27.2b. Both vertical distances measure the $5 billion of dissaving that occurs at $370 billion of income.

In our example, the **break-even income** is $390 billion (row 2, Table 27.1). This is the income level at which

TABLE 27.1 Consumption and Saving Schedules (in Billions) and Propensities to Consume and Save

(1) Level of Output and Income (GDP = DI)	(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), Δ(2)/Δ(1)*	(7) Marginal Propensity to Save (MPS), Δ(3)/Δ(1)*
(1) $370	$375	$−5	1.01	−.01		
(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."

keygraph

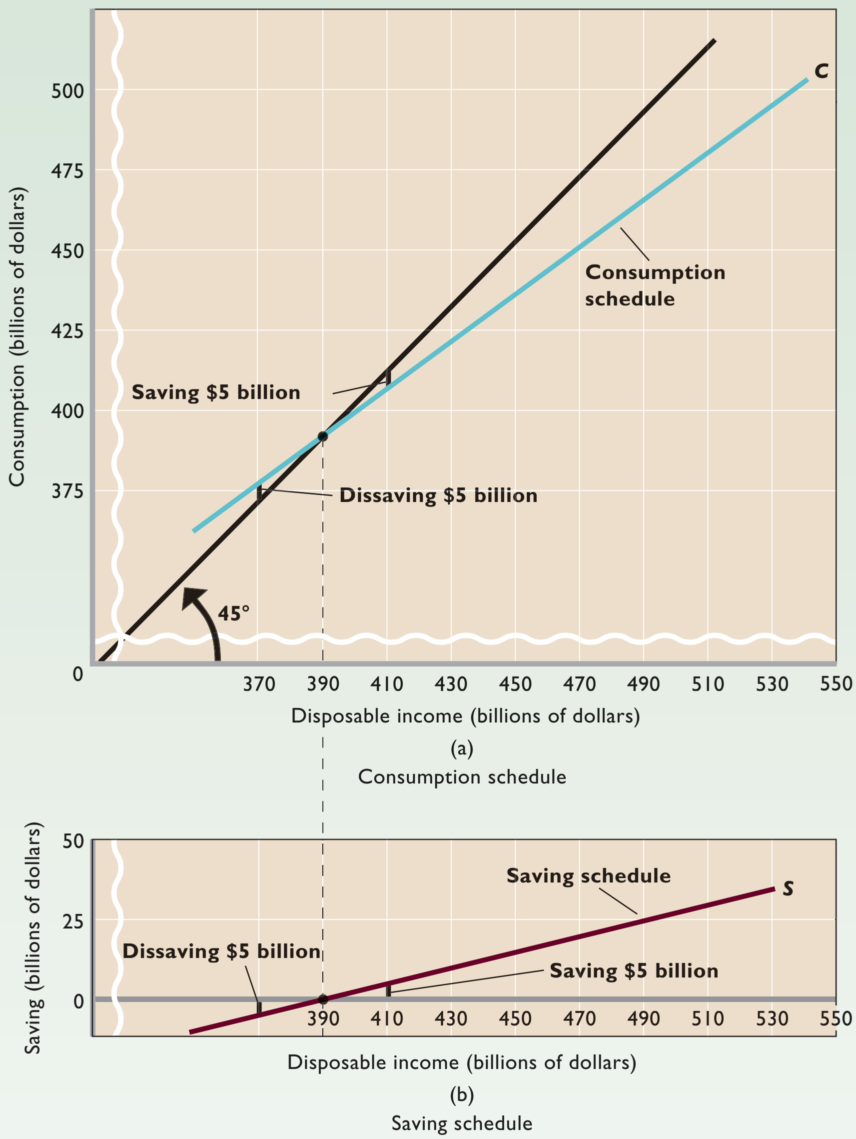


FIGURE 27.2 (a) Consumption and (b) saving schedules. The two parts of this figure show the income-consumption and income-saving relationships in Table 27.1 graphically. The saving schedule in (b) is found by subtracting the consumption schedule in (a) vertically from the 45° line. Consumption equals disposable income (and saving thus equals zero) at $390 billion for these hypothetical data.

QUICK QUIZ FOR FIGURE 27.2

1. The slope of the consumption schedule in this figure is .75. Thus, the:
- **a.** slope of the saving schedule is 1.33.
- **b.** marginal propensity to consume is .75.
- **c.** average propensity to consume is .25.
- **d.** slope of the saving schedule is also .75.

2. In this figure, when consumption is a positive amount, saving:
- **a.** must be a negative amount.
- **b.** must also be a positive amount.
- **c.** can be either a positive or a negative amount.
- **d.** is zero.

3. In this figure:
- **a.** the marginal propensity to consume is constant at all levels of income.
- **b.** 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

households plan to consume their entire incomes (C = DI). 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 27.2a), as does the vertical distance between the saving schedule and the horizontal axis (see Figure 27.2b). For example, at the $410 billion level of income (row 3, Table 27.1), both these distances indicate $5 billion of saving.

Average and Marginal Propensities

Columns 4 to 7 in Table 27.1 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,

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

and

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

For example, at $470 billion of income (row 6 in Table 27.1), the APC is $\frac{450}{470} = \frac{45}{47}$, or about 96 percent, while the APS is $\frac{20}{470} = \frac{2}{47}$, or about 4 percent. Columns 4 and 5 in Table 27.1 show the APC and APS at each of the 10 levels of DI; note in the table that the APC falls and the APS rises as DI increases, as was implied in our previous comments.

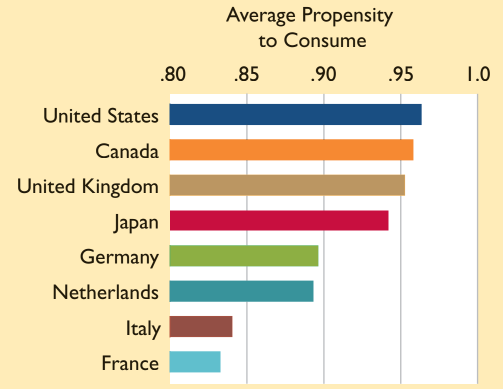
Because disposable income is either consumed or saved, the fraction of any DI consumed plus the fraction saved (not consumed) must exhaust that income. Mathematically, APC + APS = 1 at any level of disposable income, as columns 4 and 5 in Table 27.1 illustrate.

Global Perspective 27.1 shows APCs for several countries.

GLOBAL PERSPECTIVE 27.1

Average Propensities to Consume, Selected Nations

There are surprisingly large differences in average propensities to consume (APCs) among nations. The United States, Canada, and the United Kingdom in particular have substantially higher APCs, and thus lower APSs, than other advanced economies.



Source: Statistical Abstract of the United States 2006, p. 875, and authors' calculations. Latest data.

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:

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

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:

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

If disposable income is $470 billion (row 6 horizontally in Table 27.1) 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 .75, and the MPS is $\frac{1}{4}$ or .25, as shown in columns 6 and 7.

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. Therefore, the fraction consumed (MPC) plus the fraction saved (MPS) must exhaust the whole change in income:

$$\text{MPC} + \text{MPS} = 1$$

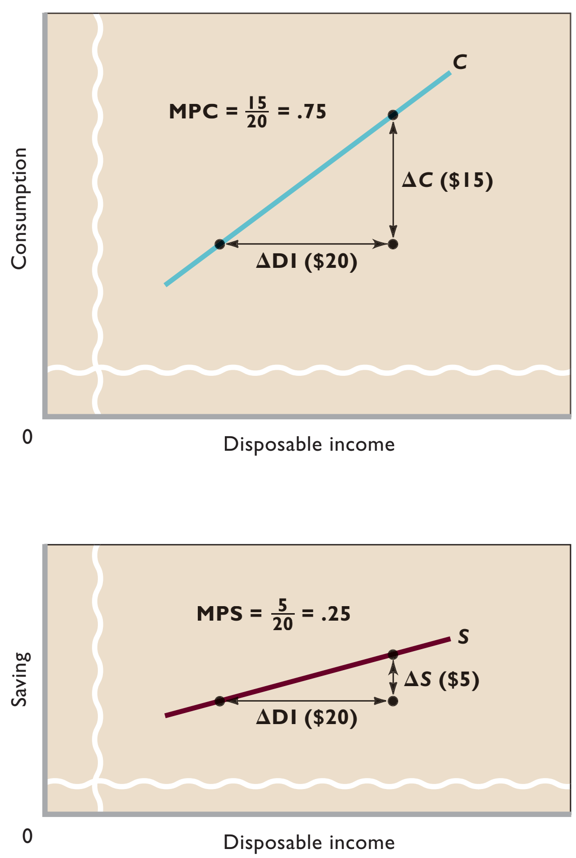
In our example, .75 plus .25 equals 1.

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.

WORKED PROBLEMS
W 27.1
Consumption and saving

Figure 27.3 measures the slopes of the consumption and saving lines, using enlarged portions of Figure 27.2a and 27.2b. 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 .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).

FIGURE 27.3 The marginal propensity to consume and the marginal propensity to save. The MPC is the slope ($\Delta C/\Delta \text{DI}$) of the consumption schedule, and the MPS is the slope ($\Delta S/\Delta \text{DI}$) of the saving schedule. The Greek letter delta (Δ) means "the change in."



The slope of the saving line therefore is .25 (= $5/$20), which is the value of the MPS. **(Key Question 5)**

Nonincome Determinants of Consumption and Saving

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 modest "reverse wealth effect" occurred in 2000 and 2001, when stock prices sharply fell.

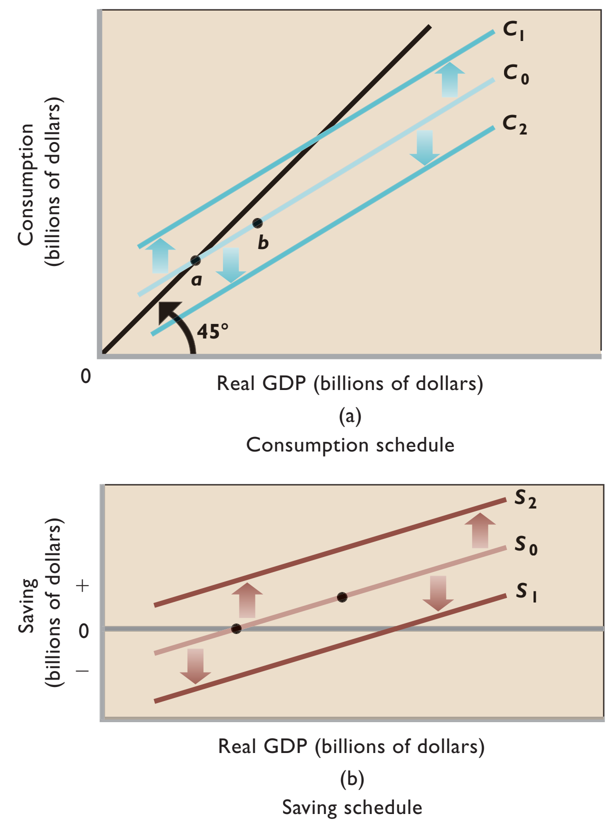
Borrowing Household borrowing also affects consumption. When a household borrows, it can increase current consumption beyond what would be possible if its spending were limited to its disposable income. By allowing households to spend more, borrowing shifts the current consumption schedule upward.

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 in order to increase current consumption.

Expectations Household expectations about future prices and income may affect current spending and saving. For example, expectations of rising prices tomorrow may trigger more spending and less saving today. 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. If so, the consumption schedule 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, 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.

FIGURE 27.4 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.



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 27.4a and 27.4b, where the horizontal axes measure real GDP.
- ***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 27.4a) 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 27.4a, 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 27.4b.
- ***Schedule 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 27.4a, the saving schedule shifts downward, from S_0 to S_1 in Figure 27.4b. 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 27.4a and the saving schedule in Figure 27.4b 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.

INTERACTIVE GRAPHS

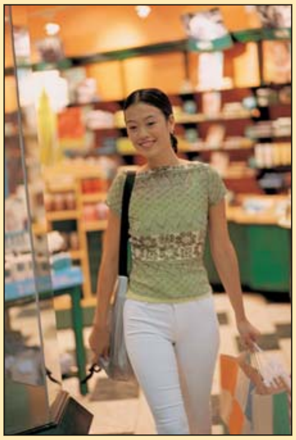
G 27.1

Consumption and saving schedules

QUICK REVIEW 27.1

- 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).

CONSIDER THIS . . .



What Wealth Effect?

The consumption schedule is relatively stable even during rather extraordinary times. Between March 2000 and July 2002, the U.S. stock market lost a staggering $3.7 trillion of value (yes, trillion). Yet consumption spending was greater at the end of that period than at the beginning. How can that be? Why didn't a "reverse wealth effect" reduce consumption?

There are a number of reasons. Of greatest importance, the amount of consumption spending in the economy depends mainly on the *flow* of income, not the *stock* of wealth. Disposable income (DI) in the United States is about $10 trillion annually and consumers spend a large portion of it. Even though there was a mild recession in 2001, DI and consumption spending were both greater in July 2002 than in March 2000. Second, the Federal government cut personal income tax rates during this period and that bolstered consumption spending. Third, household wealth did not fall by the full amount of the $3.7 trillion stock market loss because the market value of houses increased dramatically over this period. Finally, lower interest rates during this period enabled many households to refinance their mortgages, reduce monthly loan payments, and increase their current consumption.

For all these offsetting reasons, the general consumption-income relationship of Figure 27.2 held steady in the face of the extraordinary loss of stock market value.

The Interest-Rate–Investment Relationship

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 $1000 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 34.) 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 $1100. Then, after the $1000 cost of the machine is subtracted from the net expected revenue of $1100, the firm will have an expected profit of $100. Dividing this $100 profit by the $1000 cost of the machine, we find that the **expected rate of return,** r, on the machine is 10 percent (= $100/$1000). 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 $1000 of *money* "capital" to purchase the $1000 of *real* capital (the sanding machine).

The interest cost of the investment is computed by multiplying the interest rate, i, by the $1000 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. That means it should invest up to the point where $r = i$ because then it has undertaken all investment for which r exceeds 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 terms, needs to be weighed against the expected rate of return.

The *real* rate of interest, rather than the *nominal* rate, is crucial in making investment decisions. Recall from Chapter 26 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 $1000 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. **(Key Question 7)**

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.