

The Theory of Consumer Choice

How do prices, incomes, and preferences affect consumers' choices to purchase some goods and not others?



Chapter Outline

3.1 Consumer Preferences

Consumer Preferences Graphed as Indifference Curves Curvature of Indifference Curves Individuals Have Different Preferences Graphing Economic Bads and Economic Neuters Perfect Substitutes and Complements

3.2 The Budget Constraint

Geometry of the Budget Line Shifts in Budget Lines

Application 3.1 BK Versus KFC in the UK in the Wake of BSE

3.3 The Consumer's Choice

A Corner Solution The Composite-Good Convention

Application 3.2 Consumers' Valuation of Air Bags

3.4 Changes in Income and Consumption Choices

Normal Goods Inferior Goods

Application 3.3 The Decline of Public Transit as a Means of Getting to Work
The Food Stamp Program

Application 3.4 Keeping Bugs Bunny and the Back Street Boys at Bay in Canada

Application 3.5 The Allocation of Commencement Tickets

3.5 Are People Selfish?


Application 3.6 The New Philanthropy

3.6 The Utility Approach to Consumer Choice

The Consumer's Optimal Choice Relationship to Indifference Curves

Learning Objectives

- Develop an approach for analyzing consumer preferences.
- Explain how a consumer's income and the prices that must be paid for various goods limit consumption choices.
- Understand how the market basket chosen by a consumer reflects both the consumer's preferences and the budget constraints imposed on the consumer by income and the prices that must be paid for various goods.
- Determine how changes in income affect consumption choices.
- Show how altruism can be explained by the theory of consumer choice.
- Relate the utility approach to the indifference curve method of analyzing consumer choice.

 **C**onsumers spend more than \$4 trillion annually in the United States. These outlays reflect countless decisions by consumers to buy or not to buy various goods. Why do consumers purchase some things and not others? How do incomes, prices, and tastes affect

consumption decisions? In this chapter we develop the fundamentals of the theory economists use to explain how these factors interact to determine consumption choices.

One use of consumer choice theory is to explain why demand curves slope downward. But if the theory of consumer behavior provided nothing more than a justification for drawing demand curves with negative slopes, it would hardly be worth discussing. The basic principles of the theory, however, have far broader applications. For example, in business, the theory yields information for: car companies worried about the extent to which consumers value safety versus fuel mileage; railroad and bus firms facing rising consumer incomes; financial managers concerned about how best to structure clients' portfolios; and suppliers wondering how minutes of phone service sold and profits will be affected by billing customers a constant amount per minute versus offering a flat monthly service fee irrespective of usage. In the public policy arena, consumer choice theory can assist in the design of programs to promote health care and encourage recycling. Furthermore, it can shed light on the school choice debate and whether vouchers that can be used to help underwrite the education of a child at a school of a family's choosing enhance household well-being relative to the historical model of public provision of a particular school in each family's district.

Economists also have extended consumer choice theory to individuals' decisions concerning labor supply, saving and investment, charitable contributions, voting, and even marriage. Indeed, some believe it provides the basis for a general theory of all human choices, not just consumer choices among goods in the marketplace. Several applications will be examined later in Chapter 5, but first we develop the theory fully as it pertains to the simple choices, among goods, made by a consumer.

The basic model focuses on two important factors influencing consumer behavior. First is the consumers' preferences, or tastes, of consumers over various combinations of goods. Second is the ability of consumers to acquire goods as determined by income and the prices of the goods.

3.1

CONSUMER PREFERENCES¹

Everyday observation tells us that consumers differ widely in their preferences: some like liver, others despise it; some smoke cigarettes, others avoid cigarette smoke like the plague; some want a different pair of shoes for every occasion, others wear running shoes everywhere. Given such diversity in preferences about goods, how should we incorporate the influence they have on consumer choices? To deal with this problem, economists base their analysis on some general propositions about consumer behavior that are widely believed to be true. These propositions do not explain why people have the exact tastes they do; they only identify some characteristics shared by the preferences of virtually everyone.

Economists make three assumptions about the typical consumer's preferences. First, we assume that preferences are *complete* in the sense that a consumer can rank (in order of preference) all market baskets. In other words, between a McDonald's Big Mac and a Burger King Whopper hamburger, the consumer prefers the Big Mac to the Whopper, prefers the Whopper to the Big Mac, or is *indifferent* between the two. We say a consumer is indifferent between two options when both are equally satisfactory. Importantly, this preference ranking reflects the relative desirability of the options themselves and ignores their cost. For example, it is not inconsistent for a consumer to prefer a Mercedes to a Saturn automobile but to buy the Saturn. A purchase decision reflects both the preference ranking and the consumer's ability to acquire goods, which is determined by income and the prices of the goods; the consumer purchases the Saturn because its lower purchase price makes it more attractive

¹A mathematical treatment of some of the material in this section is given in the appendix at the back of the book (page xxx).

when both cost and the intrinsic merits of the vehicles are considered. Preferences and budgets both influence consumer choice, but for the moment we will focus only on preferences.

Second, we assume that preferences are *transitive*. Transitivity means that if a consumer prefers market basket A to B, and B to C, then the consumer prefers A to C. For example, if Cindy Crawford likes Pepsi better than Coke, and Coke better than 7-Up, then logically she likes Pepsi better than 7-Up. In a sense this condition simply requires that people have rational or consistent preferences.

Third, a consumer is presumed to prefer more of any good to less. For example, given a choice between one vacation in Tahiti and two vacations in Tahiti, a consumer will prefer the latter provided that the choices are otherwise identical. This characteristic is termed *nonsatiation* and is expressed as “more is preferred to less.”

Are the preceding three assumptions about preferences valid? In general, yes, although there are exceptions. For example, the assumption of transitivity is violated in the case of individuals with a schizophrenic disorder and has been found to be less likely to hold the younger the consumer. Researchers attribute the latter phenomenon either to a willingness to experiment in one’s formative years or to the fact that being able to rank order preferences in a consistent manner is an acquired skill.

The assumption that more is better is also not universally true. Hot dogs might be appealing to most individuals, but more may not always be preferred to less if they have to be consumed all at once. That is, two hot dogs may be preferred to one hot dog, but fifty hot dogs are less appealing than two hot dogs—even to the heartiest eaters—if the hot dogs have to be eaten in one fell swoop.


Moreover, there are other goods such as pollution and liver (for some people), where less is preferred to more over all possible ranges of consumption. We call such commodities **economic “bads”** to distinguish them from the more frequently encountered economic “goods.” An **economic “good”** is one for which more is better than less; in effect it is a desirable commodity in the consumer’s view.

Notwithstanding the exceptions, completeness, transitivity, and nonsatiation appear to be reasonable and robust characteristics of consumer preferences. We start with these assumptions as a basis and show that a versatile theory can be developed without having to resort to more and stronger assumptions. Along the way, we point out how exceptions to the basic assumptions, such as economic “bads,” can be accommodated by the theory.

Consumer Preferences Graphed as Indifference Curves

A consumer’s preferences across various **market baskets** or combinations of goods can be shown in a diagram with indifference curves. An **indifference curve** plots all the market baskets that a consumer views as being equally satisfactory. In other words, it identifies the various combinations of goods among which the consumer is indifferent. Figure 3.1 shows an indifference curve, U_1 , for a student-consumer interested in two goods: movie passes (M) and compact discs (C). The student is equally satisfied with 10M plus 4C (basket A) or 5M plus 12C (basket B)—or any other combination of the two goods along U_1 .

From our basic assumptions we can deduce several characteristics that indifference curves must have. First, an indifference curve must slope downward if the consumer views the goods as desirable. To see this, start with point A on U_1 in Figure 3.1. If we change the composition of the market basket so that it contains more compact discs but the same amount of movie passes (so the new basket is at a point such as D), the student will be better off—more compact discs are preferred to less. Note, though, that the consumer will no longer be on U_1 , the original indifference curve. If we are required to keep the consumer indifferent between alternative combinations of movie passes and compact discs, we must find a market basket that contains *more* compact discs but *fewer* movie passes. Market baskets that are equally satisfactory must contain more of one good and less of the other; in other words, the curve must have a negative slope.



ECONOMIC “BADS”
commodities of which less
is preferred to more over
all possible ranges of
consumption

ECONOMIC “GOODS”
commodities of which
more is better than less

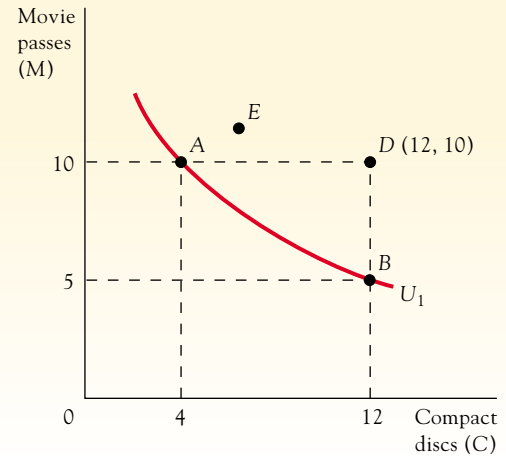


MARKET BASKETS
combinations of goods

**INDIFFERENCE
CURVE**
a plot of all the market
baskets the consumer
views as being equally
satisfactory

FIGURE 3.1**An Indifference Curve**

The indifference curve, U_1 , shows all the combinations of movie passes and compact discs that the consumer considers equally satisfactory. The consumer prefers any market basket lying above U_1 (like point E) to all market baskets on U_1 , and any market basket on U_1 is preferred to any market basket lying below U_1 .



A second characteristic of indifference curves is that a consumer prefers a market basket lying above (to the northeast of) a given indifference curve to every basket on the indifference curve. (Similarly, the consumer regards a basket below the indifference curve as less desirable than any on the indifference curve.) In Figure 3.1, pick any point above U_1 —for instance, E . There must be a point on U_1 that has less of both goods than E —point A , for example. Basket E will clearly be preferred to A because it contains more of both goods, and more is preferred to less. Because A is equally preferred to all points on U_1 , point E must also be preferred to all points on U_1 , from the transitivity assumption. Similar reasoning implies that every basket on U_1 is preferred to any basket lying below the curve.

So far we have examined only one indifference curve. To show a consumer's entire preference ranking, we need a set of indifference curves, or an **indifference map**. Figure 3.2 shows three of the consumer's indifference curves. Because more is preferred to less, the consumer prefers higher indifference curves. Every market basket on U_3 , for example, is preferred to every basket on U_2 . Likewise, every basket on U_2 is preferred to every basket on U_1 .

A set of indifference curves represents an ordinal ranking. An *ordinal ranking* arrays market baskets in a certain order, such as most preferred, second-most preferred, and third-most



INDIFFERENCE MAP
a set of indifference curves that shows the consumer's entire preference ranking

FIGURE 3.2**An Indifference Map**

A set of indifference curves, or an indifference map, indicates how a consumer ranks all possible market baskets. Market baskets lying on indifference curves farther from the origin are preferred to those on curves closer to the origin.

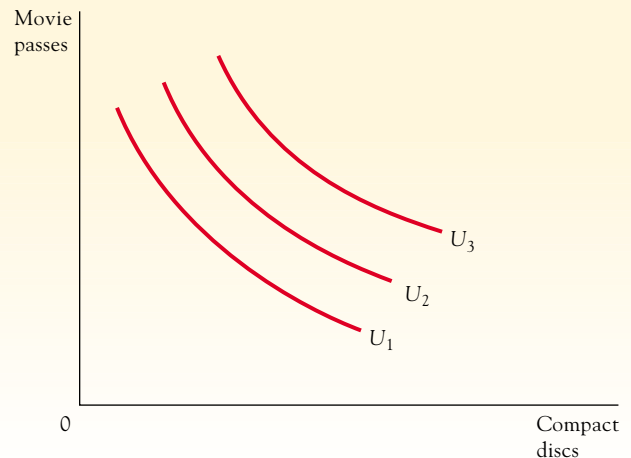
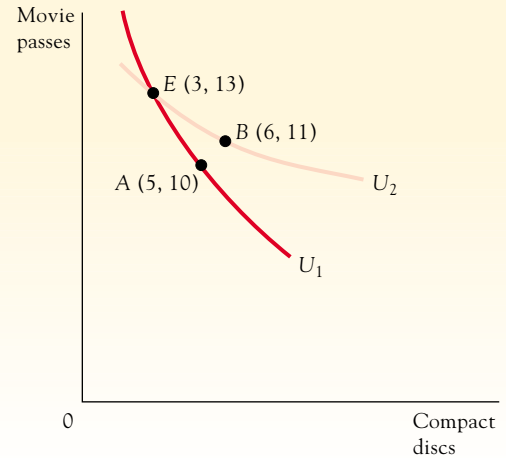


FIGURE 3.3

Why Intersecting Indifference Curves Are Inconsistent

Intersecting indifference curves are inconsistent with rational choice; they violate the assumptions of nonsatiation and transitive preferences.



preferred. It shows order of preference but does not indicate by how much one basket is preferred to another. There is simply no way to measure how much better off the consumer is on U_2 compared with U_1 . Fortunately, we do not need this information to explain consumer choices when using indifference curves: knowing how consumers rank market baskets is sufficient. The numbers used to label the indifference curves measure nothing; they are simply a means of distinguishing more-preferred from less-preferred market baskets.

Now that we have described how preferences can be represented by a set of indifference curves, a third characteristic of these curves can be stated: two indifference curves cannot intersect. We can see this by incorrectly assuming that two curves intersect and then noting that this proposition violates our basic assumptions. In Figure 3.3, two indifference curves have been drawn to intersect. Consider three points: the intersection point E and two other points such that one (B) has more of both goods than the other (A). Now, because B and E lie on U_2 , they are equally preferred. Also, because E and A lie on U_1 , they are equally preferred. Thus, B is equal to E , and E is equal to A , so by transitivity B should equal A . However, because B has more of both goods than A , B must be preferred to A (more is preferred to less). We arrive at a contradiction: B cannot be equal to A and preferred to A simultaneously. Intersecting indifference curves violate our transitivity and nonsatiation assumptions. In short, they don't make sense.

Curvature of Indifference Curves

We have discussed three features of indifference curves: they slope downward, higher curves are preferred to lower ones, and they cannot intersect. These features are implied by the assumptions about consumer preferences made earlier. Convexity is a fourth feature of indifference curves, but because we cannot logically deduce it from the basic assumptions about preferences, further explanation is required.

So far we have seen indifference curves that are convex to the origin; that is, they bow inward toward the origin, so the slope of the curve becomes flatter as you move down the curve. To explain why indifference curves have this shape we introduce the concept of **marginal rate of substitution**, or **MRS**. A student's marginal rate of substitution between, for example, compact discs and movie passes (MRS_{CM}) is *the maximum amount of movie passes the consumer is willing to give up to obtain an additional compact disc*. Because it is a measure of the willingness to trade one good for another, the MRS depends on the initial quantities held: holding the number of movie passes constant, the student's willingness to exchange movie

MARGINAL RATE OF SUBSTITUTION (MRS)

a measure of the consumer's willingness to trade one good for another



passes for compact discs will likely differ if the student has ten compact discs rather than five. Thus, a consumer's MRS is not a fixed number but will vary with the amount of each good the consumer has.

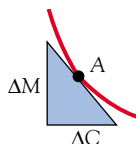
The marginal rate of substitution is related to the slope of the consumer's indifference curves. In fact, the slope of the indifference curve (multiplied by -1) is equal to the MRS. For example, say a market basket contains fifteen movie passes and five compact discs. Let's assume that a student is willing to trade a maximum of four movie passes for one more compact disc. In other words, the MRS at this point is 4M per 1C. What happens to the student's well-being if 4M are lost and 1C is gained, so that the market basket contains 11M and 6C? The student will be no better off and no worse off than before. This is so because we have taken away the maximum amount of movie passes (4) that the student was willing to give up for another compact disc. In other words, if the student's MRS is four movie passes per compact disc, and we take away four movie passes and add one compact disc, the new market basket will be preferred equally to the original one. Both market baskets lie on the same indifference curve.

This relationship is illustrated in Figure 3.4. Market baskets A (15M and 5C) and B (11M and 6C) are both on indifference curve U_1 . Note that the curve's slope between points A and B is $-4\text{M}/1\text{C}$. The slope—or, more precisely, -1 times this slope—measures the consumer's MRS. Purely for ease of communication, we define the MRS as a positive number so that the slope of the indifference curve, which is negative, must be multiplied by -1 . Don't let this definitional complication confuse you: the MRS and the indifference curve slope are identical concepts, both measuring the willingness of a consumer to substitute one good for another. The indifference curve slope shows how many movie passes can be exchanged for a compact disc without changing the consumer's well-being—which is precisely what the MRS measures.² Because an indifference curve's slope and the MRS measure the same thing, drawing an indifference curve as convex (i.e., with a flatter slope as we move down the curve) means that the MRS declines as we move down the curve. In Figure 3.4, the MRS declines from 4M per 1C at basket A to 3M per 1C at B, and so on. To justify drawing indifference curves as convex, we need to explain why the MRS can be expected to decline as we move down the curve.

DIMINISHING MRS

a consumer's willingness to give up less and less of some other good to obtain still more of the first good

A **diminishing MRS** means that as more and more of one good is consumed along an indifference curve, the consumer is willing to give up less and less of some other good to obtain still more of the first good. Look at point F in Figure 3.4. Here the student has a large number of compact discs and very few movie passes; in comparison with points such as A farther up the curve, compact discs are relatively plentiful and movie passes are relatively scarce. Under these circumstances the student will probably be unwilling to exchange many movie passes (already scarce) for more compact discs (already plentiful). Thus, it seems reasonable to suppose that the MRS is lower at F than at A. At A, movie passes are more plentiful and compact discs more scarce, so we might anticipate that the student will place a higher value on compact discs—that is, be willing to sacrifice a larger amount of movie passes to obtain an additional compact disc. In other words, *the assumption of a declining MRS embodies the belief that the relative amounts of goods are related systematically to the consumer's views about their relative importance*. In particular, the more scarce one good is relative to another, the greater its relative value in terms of the other good.

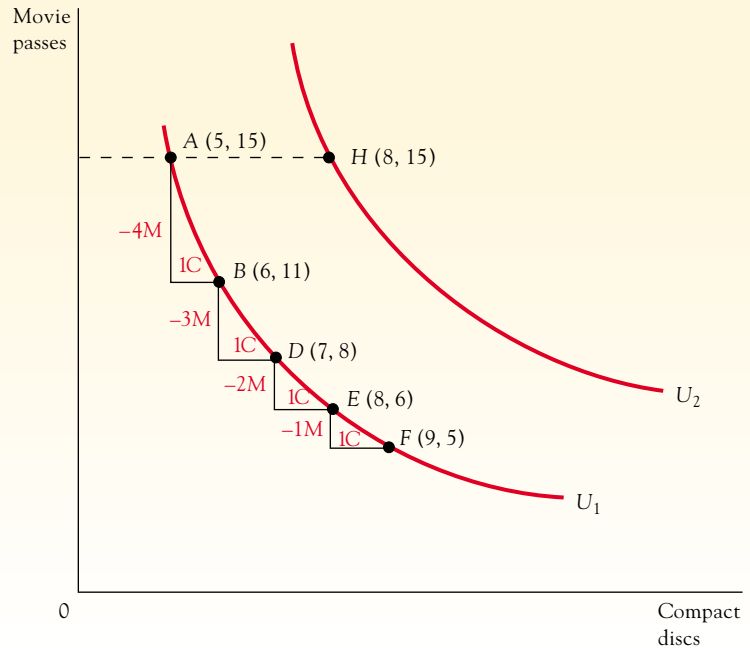


²The slope of the indifference curve at point A is not exactly $-4\text{M}/1\text{C}$. A curved line has a different slope at each point on it; its slope is measured by the slope of a straight line drawn tangent to the curve. As shown in the figure here, the slope at point A is $\Delta\text{M}/\Delta\text{C}$. Identifying the slope as we do in Figure 3.4 is an approximation to the correct measure, but for small movements along the curve the two measures are approximately equal.

FIGURE 3.4

Diminishing *MRS* Along an Indifference Curve

Indifference curves are convex toward the origin, implying that the slope of each curve becomes flatter as we move down the curve. The (absolute value of the) slope of U_1 at A is $4M/1C$; at E it is $1M/1C$. The indifference curve's slope measures the consumer's marginal rate of substitution between goods. The convexity of indifference curves thus embodies the assumption of diminishing *MRS* along an indifference curve.



This discussion is merely an appeal to the intuitive plausibility of convex indifference curves; it is not proof. Thinking along these lines, however, has convinced many people that indifference curves generally reflect a declining *MRS*. We therefore assume that indifference curves are convex to the origin, which implies that the consumer's *MRS* declines as we move down any one of these curves.

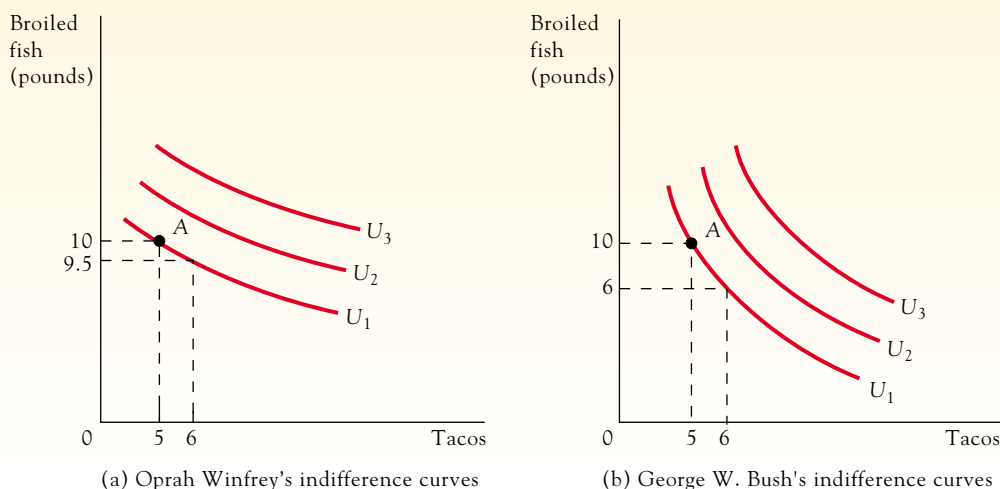
Two final points related to the convexity of indifference curves should also be mentioned. First, we have assumed implicitly that both goods in the student's market basket are economic "goods" (that is, more is preferred to less), which is the general case. In other cases, as with economic "bads," indifference curves need not be convex. Second, a declining *MRS* pertains only to a movement along a given indifference curve, not to a movement from one curve to another. For example, we might be tempted to argue that if the student has more compact discs and the same number of movie passes, the MRS_{CM} will be lower. For Figure 3.4, this argument implies that curve U_2 is flatter at point H than U_1 is at point A . This is not what we are assuming; we are only assuming that the slope of each curve becomes flatter as we move down that curve.

Individuals Have Different Preferences

People have different preferences, and those differences are indicated by the shapes of their indifference curves. Consider the preferences of two consumers, Oprah Winfrey and George W. Bush, for tacos and broiled fish. Figure 3.5a shows Winfrey's preferences with several of her indifference curves relating broiled fish and taco consumption. Figure 3.5b shows Bush's indifference curves. Bush's curves being steeper than Winfrey's indicates that Bush has a stronger preference for tacos than Winfrey does. To understand this idea, suppose they were both consuming the same market basket shown by point A in each graph. Because Bush's indifference curve through this point is steeper than Winfrey's, Bush's *MRS* of fish for tacos is greater than Winfrey's. Bush (who said on Oprah that tacos are his favorite fast food) would be willing to trade four pounds of broiled fish for one more taco, but Winfrey (with her preference for fish over tacos) would give up only half a pound of broiled fish for another taco.

FIGURE 3.5**Indifference Map of Two Consumers**

People have different preferences, and these differences show up in the shapes of their indifference maps. Oprah Winfrey's preferences are graphed in part (a) and George W. Bush's in part (b). The indifference maps show that Bush has a stronger preference for tacos than Winfrey does.



Indifference curves indicate the *relative* desirability of different combinations of goods, so to say that Bush values tacos in terms of broiled fish more than Winfrey does is the same as saying that Winfrey values broiled fish in terms of tacos more than Bush does. They say nothing about how much either of them values roast turkey, for example.

Graphing Economic Bads and Economic Neuters

Although our discussion of indifference curves has been restricted to the most generally encountered case of choices among desirable goods, where more is preferred to less, we may depict *any* type of preferences with a set of indifference curves. Indeed, a good test of your understanding of indifference curves is to analyze some other situations.

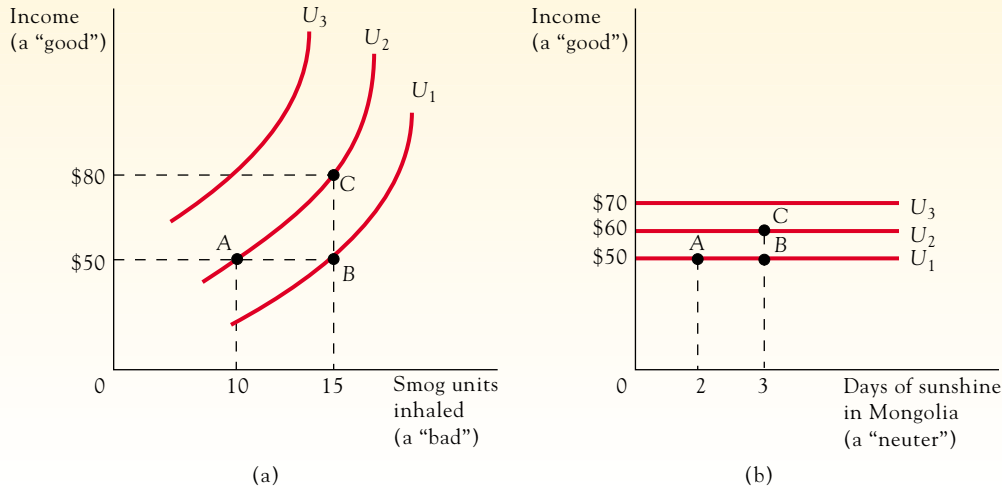
For example, how would you show a person's preferences relating weekly income and pollution with indifference curves? For a typical person, income is a desirable good, but smog is an economic "bad." Figure 3.6a shows income and smog on the axes. To determine the shapes of the indifference curves, we start by picking an arbitrary market basket, point A, for example, composed of 10 units of smog and \$50 in income. If we hold income constant at \$50 but increase units of smog—a move from A to B—the person will be worse off (that is, on a lower indifference curve) because smog is a "bad." If a person inhales more smog and is to remain on the same indifference curve, more of the "good," income, is necessary to compensate for the additional smog, as at point C. Thus, the indifference curve must slope upward. In addition, greater levels of well-being are shown by indifference curves above and to the northwest: U_2 is preferred to U_1 if the "good" is on the vertical axis. This result can be seen by focusing on horizontal movements (more smog with the same income makes the consumer worse off) and vertical movements (more income with the same smog level makes the consumer better off).

Most things are either "goods" or "bads," but an intermediate case is possible where the consumer doesn't care one way or another about something. For example, we suspect most

FIGURE 3.6

Indifference Maps for a “Bad” and a “Neuter”

(a) Indifference curves have the shapes shown here when a “good” is on the vertical axis and a “bad” on the horizontal axis. (b) They have the shapes shown here with a “good” on the vertical axis and a “neuter” on the horizontal axis.



ECONOMIC “NEUTER”

a case in which the consumer doesn’t care one way or another about a particular good

PERFECT SUBSTITUTE

the case where a consumer is willing to substitute one good for another at some constant rate and remain equally well off

PERFECT COMPLEMENTS

goods that must be consumed in a precise combination in order to provide a consumer a given level of satisfaction

people don’t care how many days a week the sun shines in Mongolia (unless they live in Mongolia). Yet we can still draw indifference curves for Mongolian days of sunshine (an economic “neuter”) and a second good such as income. Figure 3.6b shows these indifference curves as horizontal straight lines. Starting at A, we see that a horizontal move to B—more sunshine but the same income—leaves the consumer on the same indifference curve. Thus, the indifference curves are horizontal, implying that the MRS is zero: the consumer is unwilling to give up any income for more days of Mongolian sunshine. Any vertical movement—more income and the same amount of sunshine—will put the consumer on a higher indifference curve.

By thinking of horizontal and vertical movements, you may deduce the shape of indifference curves that relate various goods under different conditions. The most important thing, however, is to understand the general case where desirable goods are on both axes, since this case is the one most frequently encountered.

Perfect Substitutes and Complements

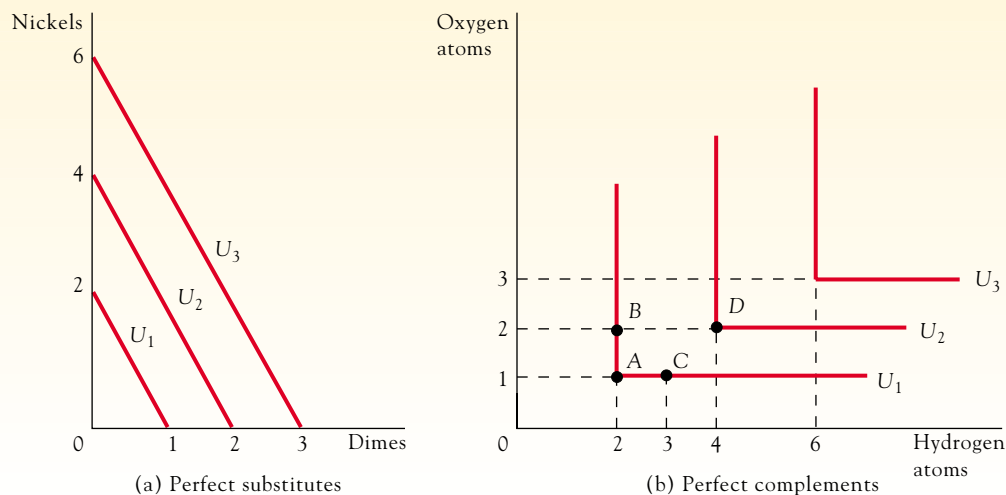
The shapes of indifference curves in general indicate the willingness of consumers to substitute one good for another and remain equally well off. At one extreme, certain goods are **perfect substitutes** in consumption. For example, for most consumers, any dime offers the same satisfaction as any two nickels. As shown in Figure 3.7a, the typical consumer is willing to trade nickels for dimes at a constant two-for-one rate while remaining equally well off. The consumer’s indifference map thus consists of indifference curves all having a constant slope of -2 nickels per dime.

At the other extreme are goods that are **perfect complements** in consumption. To consume a molecule of water, for example, we need an exact match of two atoms of hydrogen for every atom of oxygen. Once we have one atom of oxygen and two atoms of hydrogen, as at point A in Figure 3.7b, additional atoms of either oxygen (as at point B) or hydrogen (as

FIGURE 3.7

Perfect Substitutes and Perfect Complements

(a) Indifference curves are straight lines when goods are perfect substitutes in consumption. (b) With perfect complements, indifference curves are L-shaped.



at point C) keep us on the same indifference curve, U_1 . Only additional atoms of both hydrogen and oxygen, at a two-to-one rate, are sufficient to move us to points such as D and higher indifference curves such as U_2 .

Perfect complements are associated with sharply kinked, L-shaped indifference curves. The indifference curves undergo abrupt changes in slope (from infinity to zero) at their kinks. In our water molecule example, the kink indicates that consumers would be infinitely willing to substitute surplus oxygen for additional hydrogen atoms when they are above point A on indifference curve U_1 . Conversely, consumers would be entirely unwilling to substitute oxygen for hydrogen atoms if they are located to the right of A on indifference curve U_1 and have surplus hydrogen atoms. The reason for the sharp slope change at the kink reflects the desire to consume a precise combination of the goods in question.

The typical goods on which we focus in this book fall somewhere between being perfect substitutes and perfect complements. Namely, the typical indifference curve has a slope that becomes gently flatter as one moves down the curve. The curve is not characterized by a constant slope (as with perfect substitutes). Neither does the typical indifference curve's slope change in an abrupt manner (as with perfect complements).

3.2**THE BUDGET CONSTRAINT³****BUDGET CONSTRAINT**

the way in which a consumer's income and the prices that must be paid for various goods limit choices

The preceding section examined consumer's preferences, or tastes, for various goods. Now, we turn to understanding **budget constraints** or how a consumer's income and the prices that must be paid for various goods limit choices. Let's begin with a simple example. Consider a student who has a weekly discretionary income of \$60 that she uses to purchase only two goods, compact discs and movie passes.⁴ The price of each compact disc (P_C) is \$12, and the price of each

³A mathematical treatment of some of the material in this section is given in the appendix at the back of the book (page xxx).

⁴Note that we are defining income (and, later, consumption) as a "flow" variable—the amount of income the student receives per week—as opposed to a "stock" variable—the wealth at the disposal of the student.

TABLE 3.1

ALTERNATIVE MARKET BASKETS THE CONSUMER MAY PURCHASE

Market Basket	Composition of Market Baskets	
	Movie Passes per Week	Compact Discs per Week
A	10	0
B	8	1
W	6	2
X	4	3
Y	2	4
Z	0	5

Note: Income = \$60; $P_M = \$6/\text{movie pass}$; $P_C = \$12/\text{compact disc}$.

movie pass (P_M) is \$6. What combinations of compact discs and movie passes may be purchased given the student's income and the prices of the two goods? Table 3.1 provides one way of identifying the various market baskets that the consumer can purchase under these conditions.

Market basket A in Table 3.1 shows what can be purchased if all the student's income goes to purchase movie passes. A weekly income of \$60 permits the student to buy 10 movie passes at a price of \$6 each, with nothing left over for compact discs. Basket Z shows the other extreme, when the student spends the entire \$60 on compact discs. Because compact discs cost \$12 each, a maximum of 5 can be purchased per week, with nothing left over for movie passes. All the intermediate baskets, B through Y, indicate the other mixes of compact discs and movie passes that cost a total of \$60. In short, Table 3.1 lists all the alternative combinations of the two goods that the student can purchase with \$60.

Figure 3.8 shows a more convenient way of presenting the same information. In this diagram the amount of movie passes consumed per week is measured on the vertical axis, and the number of compact discs is measured on the horizontal axis. Both axes, therefore, measure *quantities* (in contrast to a supply–demand diagram that has price on one axis). The line AZ plots the various market baskets the student may purchase from the data in Table 3.1. This line is called the **budget line**, and it shows all the combinations of movie passes and

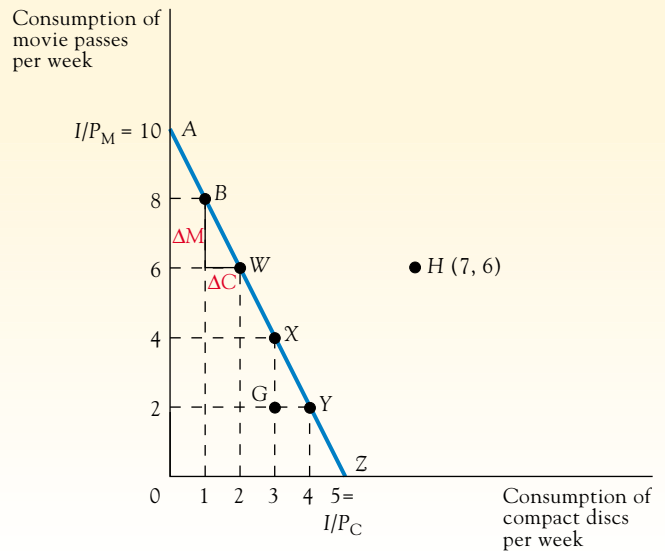
BUDGET LINE
a line that shows the combinations of goods that can be purchased at the specified prices and assuming that all of the consumer's income is expended



FIGURE 3.8

The Budget Line

A consumer's budget line shows the combinations of goods that can be purchased with a given income and prices of goods held constant. Line AZ shows the budget line when income is \$60, $P_M = \$6/\text{movie pass}$, and $P_C = \$12/\text{compact disc}$. The line's slope is $-P_C/P_M$.



compact discs the student can buy at the specified prices assuming that the student spends all of her income.

The budget line is drawn as a continuous line, not a collection of discrete points such as A and B, reflecting an assumption of continuous divisibility; that is, fractional units may be purchased. Although the assumption of continuous divisibility may be questioned—we can buy zero or one haircut in a week, for example, but can we buy half a haircut?—a little reflection shows that we can buy half a haircut per week by buying one every other week. Viewing consumption as the average consumption per week, rather than the precise level of consumption in any specific week, makes the assumption of a continuous budget line acceptable in most cases.

The consumer's budget line identifies the options from which the consumer can choose. In our example, the student can purchase any basket on or inside line AZ. Any basket inside the line, such as G, involves a total outlay that is smaller than the student's weekly income. Any point outside the line, such as H (7 compact discs and 6 movie passes), requires an outlay larger than the student's weekly income and is therefore beyond reach. Consequently, the budget line reinforces the concept of scarcity developed in Chapter 1: the student cannot have unlimited amounts of everything, so choices among possible options, which are shown by the budget line, must be made.

Geometry of the Budget Line

A thorough understanding of the geometry of a budget line will prove helpful later on. Note that the intercepts with the axes show the maximum amount of one good that can be purchased if none of the other is bought. Point A indicates that 10 movie passes can be bought if income is devoted to movie passes alone. The vertical intercept equals the student's weekly income (I) divided by the price of movie passes (I/P_M , or $[\$60/(\$6/\text{movie pass})] = 10$ movie passes), since \$60 permits the purchase of 10 movie passes costing \$6 each. Similarly, point Z equals weekly income divided by the price of compact discs (I/P_C , or $[\$60/(\$12/\text{compact disc})] = 5$ compact discs).

The budget line's slope indicates how many movie passes the student must give up to buy one more compact disc. For example, the slope at point B in Figure 3.8 is $\Delta M/\Delta C$, or -2 movie passes/1 compact disc, indicating that a move from B to W involves sacrificing 2 movie passes to gain an additional compact disc. (Because AZ is a straight line, the slope is constant at -2 movie passes per 1 compact disc at all points along the line.) Note that the slope indicates the relative cost of each good. To get 1 more compact disc, the student must give up 2 movie passes. A budget line's slope is determined by the prices of the two goods. In fact, the slope is equal to (minus) the ratio of prices:

$$\Delta M/\Delta C = -P_C/P_M.$$

In this example we have:

$$\Delta M/\Delta C = (-2 \text{ movie passes})/(1 \text{ compact disc});$$

because:

$$\begin{aligned} -P_C/P_M &= -[(\$12/\text{compact disc})/(\$6/\text{movie pass})]; \\ &= (-2 \text{ movie passes})/(1 \text{ compact disc}). \end{aligned}$$

To understand this important relationship, note that because movie passes cost \$6 each, the student has to purchase two fewer movie passes (ΔM) to have the \$12 required to buy one more compact disc (ΔC). Thus, the slope of the budget line, which equals two movie passes per compact disc, reflects the fact that compact discs are twice as expensive as movie passes. The slope equals the price ratio: \$12 per compact disc divided by \$6 per movie pass equals

two movie passes per compact disc. Put somewhat differently, the slope of the budget line is a measure of relative price—the price of one unit of a good in terms of units of the other.⁵

Shifts in Budget Lines

We have seen how income together with the prices of goods determines a consumer's budget line. Any change in income or prices will cause a shift in the budget line. Let us explore how the budget line shifts in response to a change in these two underlying factors.

Income Changes

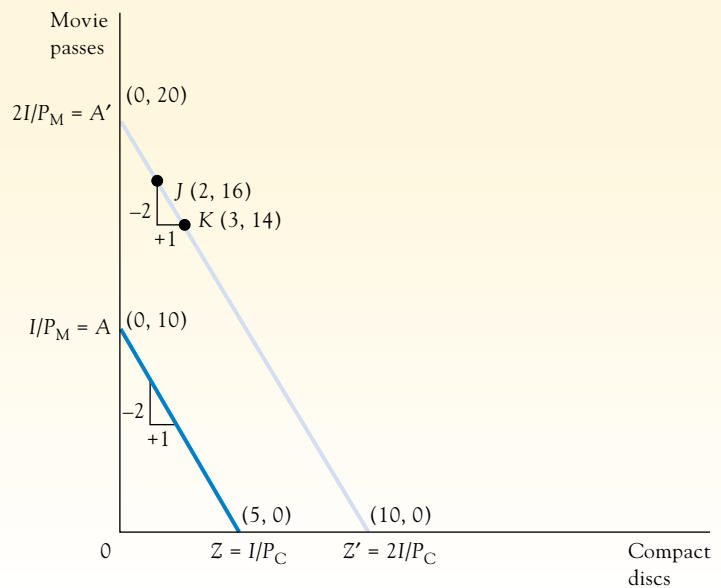
We'll begin with the budget line described before, where the student's weekly income is \$60, the price of each compact disc is \$12, and the price of each movie pass is \$6. We again draw the budget line as AZ in Figure 3.9. (Note that from now on, we will use the shorthand term *compact discs* instead of *weekly consumption of compact discs*. We also will use *income* instead of *weekly income* and *price* instead of *per-unit price*.) Now suppose the student's income rises to \$120, but the prices of compact discs and movie passes do not change. The new budget line is A'Z'. Point A' shows the new maximum number of movie passes that can be bought if all income is allocated to movie passes. Because income is now \$120 ($2I$) and P_M is still \$6, the student can buy 20 movie passes. (Recall that the vertical intercept, A', equals income, now $2I = \$120$, divided by P_M .) Similarly, the student can buy a maximum of 10 compact discs if all income is spent on compact discs.

Note that a change in income with constant prices produces a parallel shift in the budget line. The slope of the budget line has not changed, because prices have remained fixed.

FIGURE 3.9

Effect of an Income Change on the Budget Line

A change in income when product prices remain unchanged results in a parallel shift in the budget line. When income increases from \$60 to \$120, the budget line shifts outward from AZ to A'Z', but its slope does not change.



⁵We summarize this idea with a bit of algebra. The budget line shows market baskets where the sum of expenditures on compact discs and movie passes equals income. Thus, $I = P_C C + P_M M$, where $P_C C$ is the per-unit price times the quantity of compact discs consumed. That is, $P_C C$ is the expenditure on compact discs. Similarly, $P_M M$ is the expenditure on movie passes. Because I , P_C , and P_M are constants, this equation defines a straight line. If we solve for M we have $M = I/P_M - (P_C/P_M)C$. The slope of this line is the coefficient of C , or $-P_C/P_M$.

Even with a higher income, the student must still give up 2 movie passes, at \$6 per pass, to consume 1 more compact disc at \$12 each (as shown by the move from *J* to *K* on the new budget line). The slope of any budget line—regardless of the income level—equals the price ratio; because prices are unchanged, so is the slope. With a higher income the student can purchase more of both goods than before, but the cost of one good in terms of the other remains the same.

Price Changes

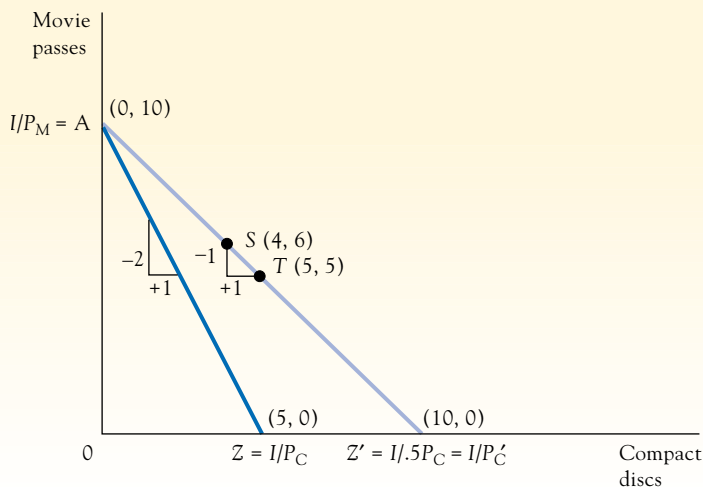
Now consider a change in the price of one good, with income and the price of the other good held constant. Starting again with the same initial budget line *AZ*, reflecting a budget of \$60, Figure 3.10 shows the effect of a reduction in the price of compact discs from \$12 to \$6 (from P_C to P'_C). The price reduction causes the budget line to rotate about point *A* and become flatter, producing the new budget line *AZ'*. The maximum number of movie passes that can be bought is unaffected, because income is still \$60 and P_M is still \$6. However, the maximum number of compact discs that can be bought increases when the price of compact discs falls. At the new price of \$6 ($P'_C = .5P_C$), the student can buy a maximum of 10 compact discs (point *Z'*) if the entire \$60 is spent on compact discs. A price change causes the budget line to rotate, so the slope of the line changes. When the price of compact discs falls, the new budget line becomes flatter because its slope, $-P'_C/P_M$, is now equal to -1 movie pass per 1 compact disc. With the price of both movie passes and compact discs at \$6, the purchase of an additional compact disc now involves a sacrifice of only one movie pass: this tradeoff is illustrated by the move from *S* to *T* on the new budget line. A flatter budget line means that the real or relative price of the good on the horizontal axis is lower.

Now is an appropriate time to emphasize why the slope measures the *real* price. A slope of $-2/1$, like the slope for line *AZ*, means the compact disc price is double the movie pass price. Note, however, that the slope does not tell us what the nominal (absolute) prices are. If both prices change by the same proportion—both double or are cut in half, for instance—the price ratio does not change, so the cost of one good in terms of another is unaffected. For example, see how pure inflation (in which all prices, including wage rates, rise proportionately) affects the budget line. Suppose all prices and income double: the student's income rises to \$120 (or $2I$), and prices increase so that $P'_M = \$12$ (or $2P_M$) and $P'_C = \$24$ (or $2P_C$). Despite the nominal increases in income and prices, the budget line does not change.

FIGURE 3.10

Effect of a Price Change on the Budget Line

A change in the price of one good, with income and the other good's price remaining unchanged, causes the budget line to rotate about one of the intercepts. When the price of compact discs declines from \$12 to \$6, the budget line rotates from *AZ* to *AZ'*.



The budget line intercepts are now $2I/2P_M$ and $2I/2P_C$, and the slope is $-2P_C/2P_M$, which all reduce to the original values. The position and the slope of budget lines always reflect real, not nominal, prices.

We have confined our attention to simple budget lines in which the consumer can buy as much of each good as desired without affecting its price. Since individual consumers usually buy only a tiny portion of the total quantity of any good, their purchases generally have no perceptible effect on price. Thus, the consumer can treat price as constant, and with prices constant the budget line is a simple straight line. As we will see later, there are cases where budget lines are not straight lines, but they are easily dealt with after the standard case has been thoroughly examined.

APPLICATION 3.1

BK VERSUS KFC IN THE UK IN THE WAKE OF BSE

The outbreak of mad cow disease in 1999 in the United Kingdom (UK) provides an example of a relative price change between chicken and beef.⁶ Mad Cow Disease is the more common name for bovine spongiform encephalopathy (BSE), a transmissible and fatal disease affecting the central nervous system of cattle. A variant of BSE is found in humans and had affected over 90 individuals in the UK by 2001. Because of the BSE variant's association with beef products, the outbreak of mad cow disease effectively increased the price of beef in the UK, when price is defined so as to take into account both the cost of purchasing a beef product and the associated risk of infection. Therefore,

if hamburger is placed on the horizontal axis and chicken on the vertical axis, the outbreak of mad cow disease resulted in the budget line confronting the typical UK consumer rotating about its vertical axis intercept and becoming steeper. For reasons that we will fully see in Chapter 4, this change in the budget line ended up having an impact on various fast food chains' market shares: chicken specialist KFC was expected to outdo Burger King (BK) in annual sales in the UK for the first time ever in 2002. The feat capped a strong recovery by KFC, a company hit in the early 1990s by an unfavorable change in the price of chicken (as perceived by consumers) due to then rising fears regarding the health impact of eating fried chicken. Indeed, the company had even changed its name in 1992 to KFC from Kentucky Fried Chicken in an attempt to reduce its association with fried food.

⁶"Chicken Stages Takeaway Comeback," *BBCNews*, December 27, 2001.

3.3

THE CONSUMER'S CHOICE⁷

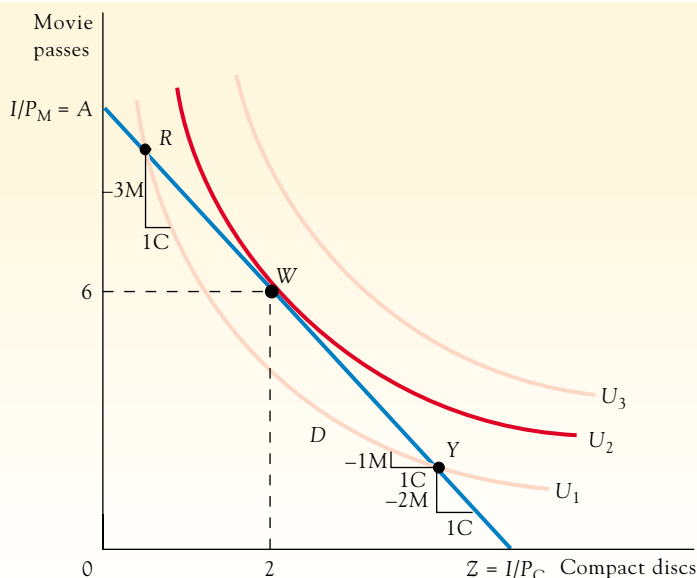
Indifference curves represent the consumer's preferences toward various market baskets; the budget line shows what market baskets the consumer can afford. Putting these two pieces together, we can determine what market basket the consumer will actually choose.

Figure 3.11 shows the student-consumer's budget line AZ along with several indifference curves. Remember from the foregoing section that the budget line AZ is based on income (I) of \$60 and prices (P_C and P_M , respectively) of \$12 per compact disc and \$6 per movie. We assume that the student will purchase the market basket from among those that can be afforded lying on the highest possible (most preferred) indifference curve. In other words, the

⁷A mathematical treatment of some of the material in this section is given in the appendix at the back of the book (pages xxx–xxx).

FIGURE 3.11**The Consumer's Optimal Consumption Choice**

The market basket the consumer will choose is shown by point *W*, where the budget line is tangent to (has the same slope as) indifference curve U_2 . Among market baskets that can be afforded—shown by budget line AZ —basket *W* yields the greatest satisfaction because it is on the highest attainable indifference curve. At point *W*, $MRS_{CM} = P_C/P_M$.



consumer will select the market basket that best satisfies preferences, given a limited income and prevailing prices. Visual inspection of this diagram shows that the student will choose market basket *W* (2 compact discs and 6 movie passes) on indifference curve U_2 . Indifference curve U_2 is the highest level of satisfaction the student can attain, given the limitations implied by the budget line. Although the student would be better off with any market basket on U_3 , none of those baskets is affordable because U_3 lies entirely above the budget line. Any basket other than *W* on the budget line is affordable but yields less satisfaction because it lies on an indifference curve below U_2 . For example, basket *R* can be purchased, but then the student is on U_1 , so basket *R* is clearly inferior to basket *W*.

Note that the highest indifference curve attainable is the one that just touches, or is tangent to, the budget line: U_2 is tangent to AZ at *W*. The consumer's optimal point is *W*. Since U_2 and AZ are tangent at this point, the slopes of the curves are equal. Because the slopes equal the consumer's MRS_{CM} and price ratio, respectively, the consumer's optimal choice is characterized by the following equality:

$$MRS_{CM} = P_C/P_M.$$

This equality indicates that the rate at which the student is willing to substitute compact discs for movie passes (MRS_{CM}) is equal to the rate at which the market allows the student to make the substitution (P_C/P_M). To see why this equality characterizes the student's optimal choice, suppose that the student buys some market basket other than point *W* on the budget line—for example, the basket at point *R*. The indifference curve through any point above *W* on the budget line will intersect the budget line from above, as U_1 does at point *R*.⁸ Thus, at *R* the student's MRS_{CM} (three movie passes per compact disc) is greater than the price ratio (two movie passes per compact disc). At point *R* the student's preferences indicate a willingness to exchange as many as three movie passes for another compact disc, but at the given market prices the student needs to give up only two movie passes per compact disc—a bargain.

⁸If we tried to draw an indifference curve through *R* intersecting from below, we would find that it would intersect U_2 , and intersecting indifference curves are impossible.



MARGINAL BENEFIT
the value the consumer derives from consuming one more unit of a good

MARGINAL COST
the cost of consuming one more unit of a good

In effect, the MRS measures the **marginal benefit** or value the student derives from consuming one more unit of a good. At point R, for example, the marginal benefit of another compact disc is three movie passes, or the number of movie passes the student would give up for another compact disc. On the other hand, the price ratio measures marginal cost: the **marginal cost** of another compact disc is two movie passes. At R, therefore, the marginal benefit of another compact disc in terms of movie passes is greater than the marginal cost, and the student will be better off consuming more compact discs (and fewer movie passes). Thus, by moving along the budget line in the direction of point W, the student will reach a higher indifference curve. In these terms, the optimal point indicates that the student has chosen a market basket so that the marginal benefit of compact discs in terms of movie passes (MRS_{CM}) equals the marginal cost of compact discs in terms of movie passes (P_C/P_M).

At points below W on the budget line, similar reasoning shows that the student would be better off consuming fewer compact discs and more movie passes, so none of these points is optimal. At point Y, the student's MRS is less than the price ratio. The last compact disc consumed is worth 1 movie pass to the student, yet its marginal cost is 2 movie passes, so the student is better off by moving back up toward point W.

A Corner Solution

When a consumer's preferences are such that some of both goods will be consumed, the optimal consumption choice is characterized by an equality between the MRS and the price ratio, as described earlier. In reality, however, there are some goods individual consumers do not consume at all. You may wish you had a Maserati, tickets to the Super Bowl, or a posh condominium in Palm Beach, but in all likelihood your consumption of these, and many other, goods is zero. The reason is that the first unit of consumption of these goods, however desirable, fails to justify the cost involved.

Figure 3.12 shows a situation in which a consumer purchases only one of the two goods available. The optimal consumption point is A, where all the consumer's income goes to purchase clothing. Because the slope of the indifference curve at A is less than the slope of the budget line, the first unit of Dom Perignon champagne (arguably the world's finest) is not worth its cost to the consumer (roughly \$100 per bottle). In this situation, known as a **corner solution**, the consumer's optimal choice is not characterized by an equality between the MRS and the price ratio, because the slopes of the indifference curve and the budget line differ at point A. The equality condition holds only between pairs of goods consumed in positive amounts.

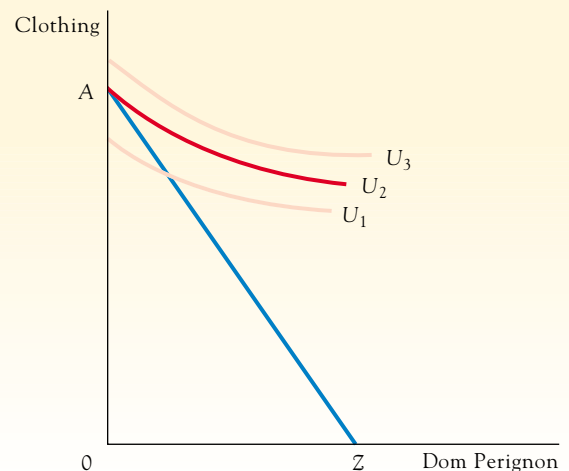
CORNER SOLUTION
a situation in which a particular good is not consumed at all by an individual consumer because the value of the first unit of the good is less than the cost



FIGURE 3.12

A Corner Solution

Possibly, the consumer will not buy any of one good. In this case, the optimal choice lies at one of the intercepts of the budget line, with the consumer's entire income spent on only one good. Here the choice is point A, with only clothing purchased.



The Composite-Good Convention

We developed our analysis for a two-good world, but the general principles apply to a world of many goods. Unfortunately, many goods cannot be shown on a two-dimensional graph. Still, it is possible to deal with a multitude of goods in two dimensions by treating a number of goods as a group. Suppose there are many goods: compact discs, movie passes, pagers, Big Macs, and so on. We can continue to measure compact disc consumption, or whatever good we wish to analyze, on one axis, but then treat all other goods as if they were one good—that is, as a **composite good**. Consumption of the composite good is gauged by total outlays on it—in other words, total outlays on all goods *other than compact discs*.

Figure 3.13 illustrates this approach. The consumer has \$120 in income and the price of compact discs is \$12. The budget line's vertical intercept occurs at \$120, because total outlays on other goods will be \$120 if compact disc consumption is zero. The consumer's income equals A . As noted earlier, the budget line's slope equals the ratio of prices, but because a \$1 outlay on other goods has a price of one, the ratio reduces to the price of compact discs ($P_C/1 = P_C$). Thus, at any point on the budget line, such as Y , consuming one more compact disc (which costs \$12) means that outlays on other goods must be reduced by \$12.

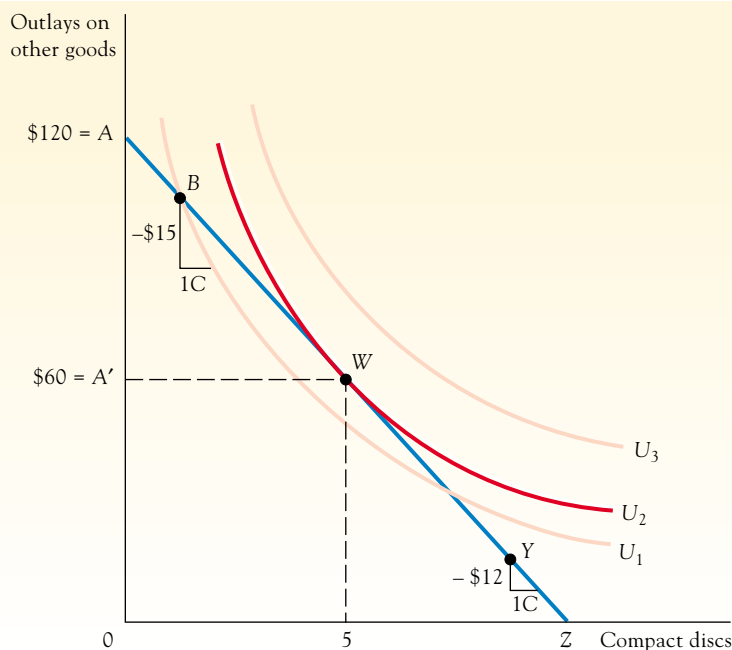
Convex indifference curves can also be drawn to relate outlays on other goods and compact discs, because both are presumed to be desirable goods to the consumer. We must now state an important assumption associated with this approach: we assume that the prices of all the other goods are constant. This assumption allows us to treat them as a single good. We want outlays on other goods to serve as an index of the quantities of other goods consumed, and if prices can vary, it would become a rubbery index. (A larger outlay would not necessarily mean more goods were consumed unless prices were fixed.) When other prices are held constant, the consumer's preferences can be shown as indifference curves that identify a unique level of well-being for each combination of compact discs and outlays on other goods.

COMPOSITE GOOD
a number of goods treated
as a group

FIGURE 3.13

The Composite-Good Convention

To deal graphically with the consumption of many goods, we group together all goods but one and measure total outlays on this composite good on the vertical axis. The slope of the budget line is then the dollar price of the good on the horizontal axis. The consumer's optimal point, W , is once more a tangency between an indifference curve and the budget line.



The slope of an indifference curve, the MRS, now shows how much the consumer is willing to reduce outlays on other goods to obtain one more compact disc. With market basket B, for example, the consumer is willing to give up \$15 worth of other goods in exchange for an additional disc. Note that this MRS is still a measure of the consumer's willingness to substitute among real goods, but now dollar outlays measure the quantity of other goods the consumer is willing to sacrifice in return for compact discs.

Figure 3.13 shows the optimal point for the consumer is W, where the budget line is tangent to an indifference curve. At W, the consumer is just willing to give up \$12 worth of other goods for another compact disc, indicating an MRS of \$12 per compact disc. This figure equals the market price that must be paid for another compact disc (that is, the slope of the budget line, $P_C/1$, equals \$12 per compact disc).

The optimal market basket W consists of five compact discs and \$60 (A') devoted to the purchase of other goods. The total outlay on compact discs can also be shown as the distance AA' . Because the consumer has an income of A (\$120) and, after buying compact discs, has A' (\$60) left to spend on other goods, the difference ($A - A' = AA'$), or \$60, is the total cost of the five compact discs. The difference between the consumer's total income and the amount spent on everything else except compact discs reflects the amount of the consumer's income spent on compact discs.

Thus, we see that using the composite-good convention does not change the substance of our analysis. The consumer's optimal point still involves a balancing of the relative desirability of goods with their relative costs.

APPLICATION 3.2

CONSUMERS' VALUATION OF AIR BAGS

In 1988, only 2 percent of the new cars sold in the United States were equipped with air bags. By 1996, more than 90 percent of all new cars sold came with this safety feature. Why the dramatic increase?

Surprisingly, perhaps, the increase does not reflect a government mandate—a federal law requiring air bags in new vehicles did not take effect until 1998. Rather, an analysis of households purchasing a new car during 1990–1993 reveals that consumers were willing to trade increasingly more of their total outlays on other goods in exchange for an air bag over this time period. Moreover, the increase in the amount of the composite good consumers were willing to exchange for an air bag appears to reflect information about actual experiences with air bags, conveyed through the media and by friends. According to the analysis, the average willingness to pay for a driver-side air bag increased from \$331 in 1990 to \$512 in 1993. The amount a particular consumer was willing to pay for a driver-side air bag was positively related to the consumer's reported number of hours of television

viewing per day and the number of friends owning cars equipped with air bags. According to the study's authors: "Friends provide opportunities for demonstration effects, while television viewing provides opportunities to obtain hard evidence of air bag effectiveness through automakers' advertisements and occasional news stories that feature people who actually survived serious automobile crashes because of air bags."⁹

Although some more recent news has questioned the extent to which air bags promote the safety of vehicular occupants and has negatively affected the extent to which drivers are willing to pay for air bags, it remains clear that consumers' valuation of air bags is a key reason why such a safety feature became commonplace in motor vehicles in the United States.

⁹Fred Mannering and Clifford Winston, "Automobile Air Bags in the 1990s: Market Failure or Market Efficiency?" *Journal of Law and Economics*, 38 No. 2 (October 1995), pp. 265–280.

3.4

CHANGES IN INCOME AND CONSUMPTION CHOICES

A change in income affects consumption choices by altering the set of market baskets a consumer can afford—that is, by shifting the budget line. To examine the impact of a change in income, we assume that the consumer's underlying preferences do not change and the prices of goods remain fixed; only income varies.

In Figure 3.14a, the student's original optimal choice is at point W , where indifference curve U_1 is tangent to budget line AZ . Consumption of compact discs is C_1 and consumption of all other goods is A_1 . Now suppose that income increases such that the budget line parallel shifts out from AZ to $A'Z'$. The budget line's slope (the price ratio) is unchanged since only income is assumed to vary.

The outward shift in the budget line means that the consumer is able to buy market baskets that were previously unaffordable, but which market basket will be chosen? The answer depends on the nature of the consumer's preferences. For the set of indifference curves in Figure 3.14a, the most preferred market basket along the $A'Z'$ budget line is at point W' , where U_2 is tangent to the budget line. The consumer is better off (that is, attains a higher indifference curve) and consumes C_2 compact discs and A_2 of other goods. For the specific indifference curves shown, an increase in income with no change in prices leads to an increase in compact disc consumption, from C_1 to C_2 .

If income increases further such that the budget line shifts to $A''Z''$, the new optimal consumption choice becomes point W'' . Proceeding in the same way, we find that each possible income level has a unique optimal market basket associated with it. Only three optimal consumption points are shown in the diagram, but others can be derived by considering still different levels of income for the student. The line that joins all the optimal consumption points generated by varying income is the **income-consumption curve**. It passes through points W , W' , and W'' in the diagram.

INCOME-CONSUMPTION CURVE

the line that joins all the optimal consumption points generated by varying income

Normal Goods

The relationship in Figure 3.14a is fairly typical of what happens to the consumption of a good (compact discs, in this case) when income increases. As noted in Chapter 2, when more of a good is purchased by an individual as income rises (prices and preferences being unchanged) and less is purchased as income falls, the good is defined to be a normal good. Calling such a good *normal* reflects the judgment that most goods are like this.

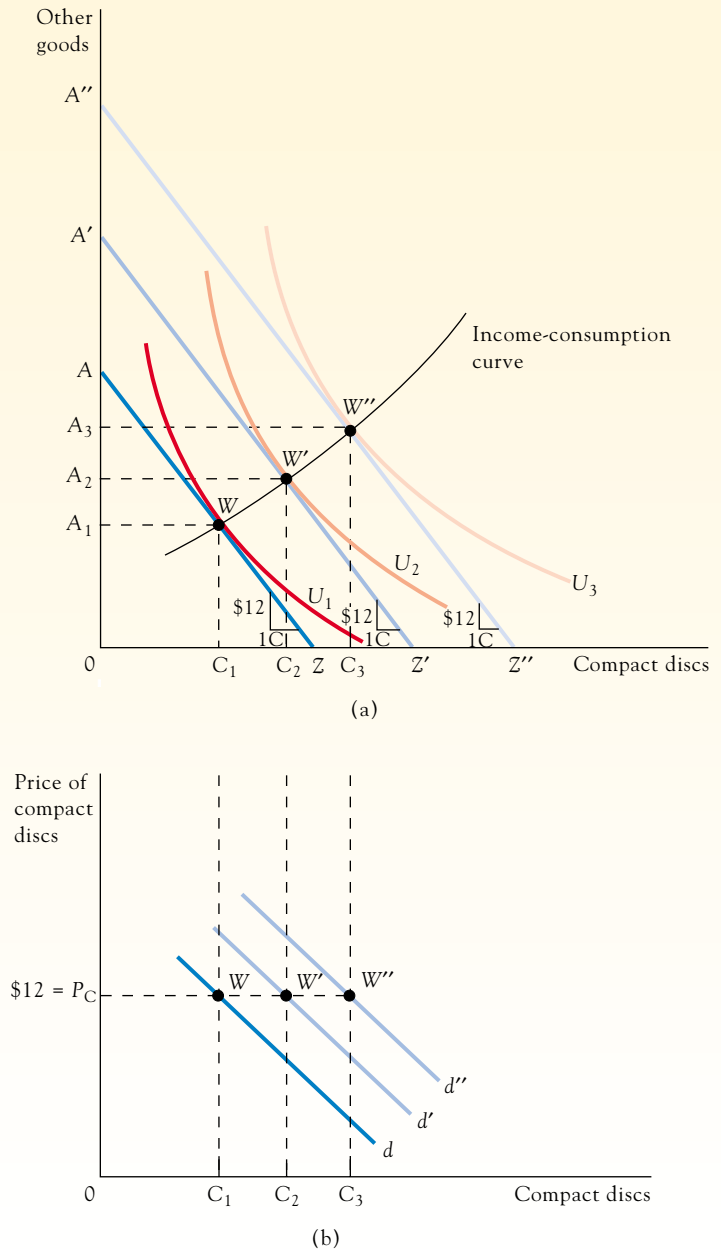
Figure 3.14a indicates that compact disc consumption increases with income even though the price of compact discs (P_C) is unchanged. We can illustrate the same thing by using a different graph that shows the consumer's demand curve, d , for compact discs (we use a lowercase d to indicate that it is the demand curve for an individual consumer). We have not derived an entire demand curve yet, but we can identify one point on the demand curve corresponding to each income level. For example, at the original income level, when the budget constraint is AZ and the price of a compact disc is P_C , the student consumes C_1 compact discs. Therefore, one point on the demand curve d in Figure 3.14b can be identified: point W indicates that compact disc consumption is C_1 when the compact disc price is P_C . (The other points on the curve will be taken for granted at the present.)

When an increase in income combined with no change in prices leads to greater consumption, it is represented by a shift in the demand curve. Thus, when income rises such that the budget line shifts from AZ to $A'Z'$, the entire demand curve shifts to d' , which shows an increased consumption of compact discs, C_2 , at an unchanged compact disc price. Recall that a demand curve shows how price affects consumption when other factors are held constant. One of the more important factors held fixed is the consumer's income, so a change in income can be expected to shift the entire demand curve. Put another way, d is a demand curve that holds income constant (at the level associated with budget line AZ in Figure 3.14a) at all points along it, while d' holds the income constant at a different level (the level associated with budget line $A'Z'$).

FIGURE 3.14

Income Changes and Optimal Consumption Choice

An increase in income parallel-shifts the budget line outward and leads the consumer to select a different market basket. Connecting the optimal consumption points (W , W' , W'') associated with different incomes yields the income-consumption curve in part (a). Part (b) shows how the consumer's demand curve shifts when income changes.



While our emphasis here is on the way budget lines and indifference curves can be used to examine consumer choices, we should not lose sight of the fact that there are alternative ways to approach the same problem. Both parts of Figure 3.14 show the same thing but from different perspectives. Which approach is better depends on the problem being examined.

Inferior Goods

Does an increase in income always lead to increased consumption? As discussed in Chapter 2, not necessarily. The consumption of certain goods, termed inferior goods, is inversely related to income. For example, consumption of Saturn cars may fall (and consumption of Mercedes cars rise) for an individual whose income increases sharply. Rail and bus

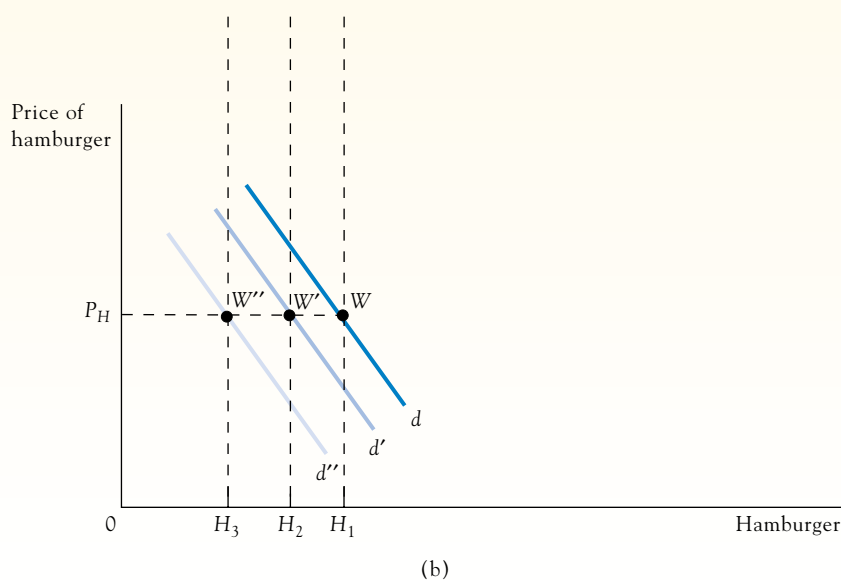
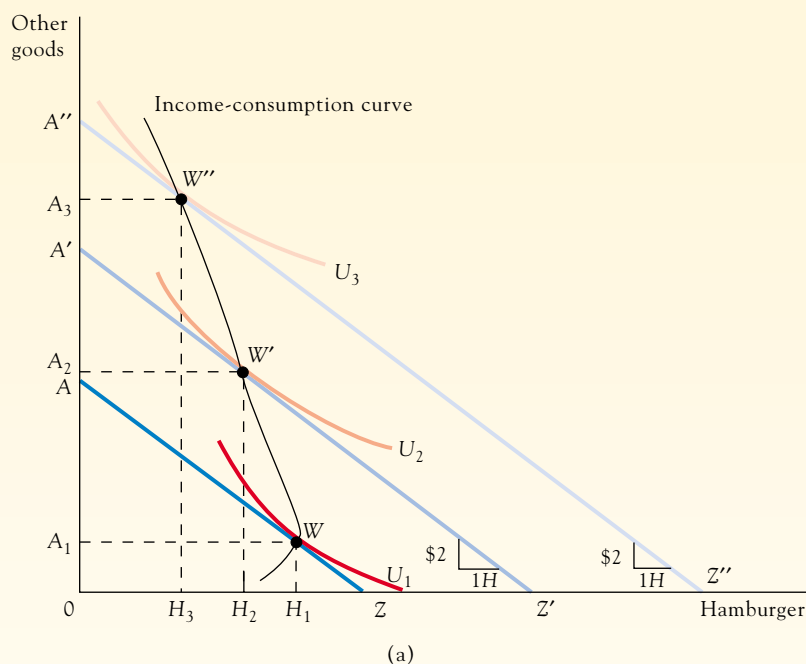
transportation have declined over the past several decades due to rising income levels and consumers traveling by air instead.

For the student whose preferences are shown in Figure 3.15a, hamburger is an inferior good. At the original income level, when the budget line is AZ , the student's optimal consumption point is W . Hamburger consumption is H_1 . When income rises such that the budget line parallel shifts out to $A'Z'$, the optimal point, W' , on the new budget line, shows that hamburger consumption drops to H_2 . When a good is an inferior good, the income-consumption curve connecting the optimal points, W , W' , and so on, is negatively sloped, implying lower consumption at higher income levels. In Figure 3.15b, note that the demand

FIGURE 3.15

Income Changes and Purchases of an Inferior Good

(a) An inferior good is one that the consumer will purchase less of at a higher income and unchanged price, and is characterized by a negatively-sloped income-consumption curve. (b) At a higher income, the demand for an inferior good shifts inward.



curve shifts inward for an inferior good when income increases: lower consumption at an unchanged price of hamburger (P_H) implies a reduction in demand.

Several other subtle points concerning normal and inferior goods should also be kept in mind. First, a good may be inferior for some people and normal for others. Your hamburger consumption may go up if your income rises, but someone else's may go down if their income rises. Goods themselves are not intrinsically normal or inferior: the definitions refer to individuals' responses to income changes, and the responses depend ultimately on the shapes of the individuals' indifference curves.

Second, a good may be a normal good for an individual at some income levels but an inferior good at other income levels. In Figure 3.15a, at a low level of income, the good is normal (as shown by the positively-sloped income-consumption curve when income is low), but it becomes inferior at higher income levels. For example, you might consume more hamburger if your weekly income increases by \$10, but you might consume less if your weekly income increases by \$1,000.

Third, an inferior good should not be confused with an economic "bad." An inferior good is not a "bad" (where less is preferred to more), as shown by the normally shaped indifference curves in Figure 3.15a.

Fourth, inferior goods tend to have certain common characteristics, and understanding these characteristics is helpful in evaluating their significance. For example, most inferior goods are narrowly defined goods in a general category that includes several other higher-quality (and higher-priced) goods. Take hamburger: hamburger is a narrowly-defined good belonging to the general category, meat. In the meat category there are other higher-quality and higher-priced options, such as filet mignon, prime rib, and veal. Understandably, some people would consume less hamburger when their incomes go up, because they could afford the better-quality alternatives that serve the same basic purposes but satisfy them better.

In contrast, intuition and evidence both suggest that broadly defined goods are usually normal. Meat is more likely to be a normal good than hamburger is, and food is more likely to be a normal good than meat. Many applications of economic theory necessarily involve broadly defined goods, which means that the normal-good case is likely to be the most relevant one. For example, the food stamp program subsidizes consumption of all kinds of food, not just hamburger; and food, considered as a composite commodity composed of many specific items, is surely a normal good.

APPLICATION 3.3

THE DECLINE OF PUBLIC TRANSIT AS A MEANS OF GETTING TO WORK

Since 1960, the percentage of metropolitan area dwellers in the United States who rely on public transit (buses, subways, and light rail systems) to get to work has fallen by 59 percent—from a market share of 12.7 to 5.2 percent.¹⁰ Public transit's increasingly diminishing share of the commuting market does not stem from

underfunding. Since 1960, federal, state, and local governments have invested over \$600 billion (in 2002 dollars) in public transit. During the 1980s, the five major metropolitan areas building light rail systems (Atlanta, Baltimore, Buffalo, Portland, and Sacramento) experienced an average loss of public transit's market share of greater than 25 percent. And, nowadays, more people walk or bicycle to work (2.73 percent) than ride the bus or subway (2.66 percent). Given that real incomes have increased over the last half century, public transit thus appears to be an inferior good for the typical urban commuter.

¹⁰Ronald D. Utt and Wendell Cox, "Transit Pork Has Few Passengers," The Heritage Foundation Executive Memorandum Number 518, March 27, 1998; "Transit Work Trip Market Share Trends Downward in All U.S. New Rail Cities," *The Public Purpose*, 1995; and U.S. Bureau of the Census, *American Fact Finder*, Table QT-04, August 2001.

The Food Stamp Program

Under the federal food stamp program, eligible low-income families receive free food stamps, which can be used only to buy food, F . To show how consumer theory can be used to examine this program, we'll use a specific example in which a consumer receives \$50 worth of food stamps each week. We assume that the consumer has a weekly income of \$100 and that the per-unit price of food (P_F) is \$5.

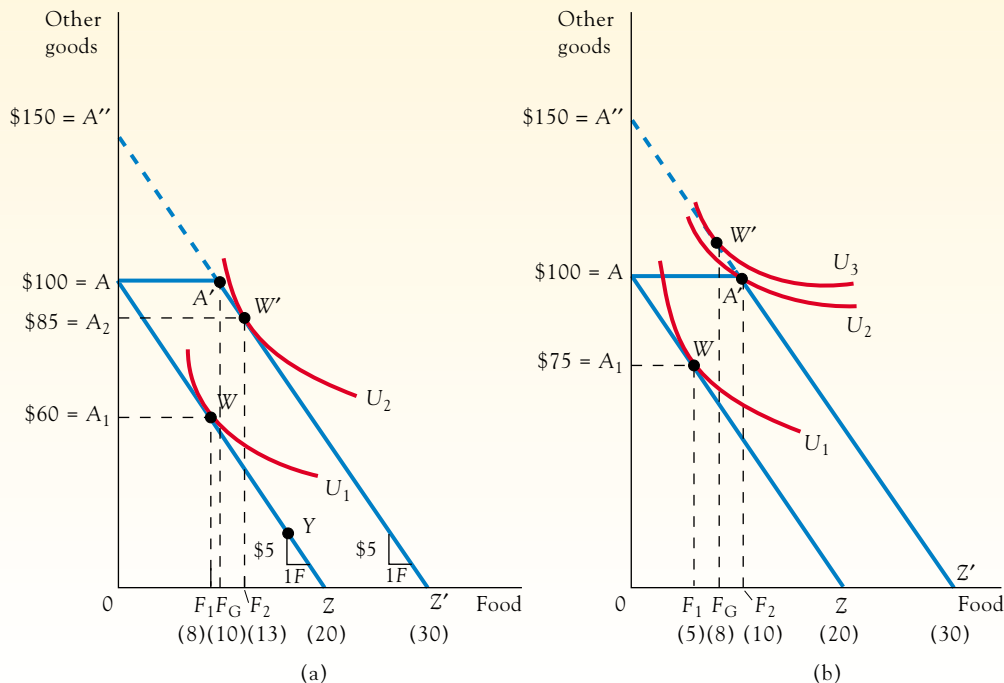
Consider Figure 3.16a. The pre-subsidy budget line is AZ and the consumer purchases 8 food units before receiving food stamps. The food stamp subsidy shifts the budget line to $AA'Z'$. Over the AA' range the budget line is horizontal since the \$50 in free food stamps permits the purchase of up to 10 food units while leaving the consumer's entire income of \$100 to be spent on other goods. If, however, food purchases exceed 10 units, the consumer must buy any additional units at the full market price of \$5. Thus, the $A'Z'$ portion of the budget line has a slope of \$5 per unit of food, indicating the price of food over this range.

In this case, the budget line is not a straight line throughout but is kinked at point A' , since the subsidy terminates at the point where the \$50 in food stamps is used up. Another way of visualizing this is by contrasting it with the budget line associated with an increase in income of \$50, resulting from the government giving the consumer \$50 to spend on any good desired. With a \$50 cash grant the budget line would be $A''Z'$. The only way the food stamp subsidy differs from an outright cash grant is that options indicated on the upper part of the line, $A'A'$, are not available to the recipient, since food stamps cannot be used to purchase nonfood items.

FIGURE 3.16

Effects of the Food Stamp Program on Consumption

If a consumer is given AA' in food stamps, the budget line shifts to $AA'Z'$. The result is identical to giving the consumer cash if preferences are like those in part (a), but the consumer would be better off if given cash for preferences like those in part (b).



The food stamp subsidy will affect the recipient in one of two ways. Figure 3.16a shows one possibility. In this case, the consumer chooses market basket W' when the budget line is $AA'Z'$ under the food stamp program. If the consumer receives instead a cash grant of \$50, the budget line is $A''Z'$, and the same market basket W' would be chosen. Food consumption increases, but only because food is a normal good, and more of a normal good is consumed at a higher income. Note, however, that food consumption rises by less than the amount of the subsidy. For the preferences shown in Figure 3.16a, food consumption increases by 5 units, or \$25. The consumer uses the remainder of the subsidy to increase purchases of other goods, from \$60 to \$85. (Because other goods, taken as a group, are certainly normal goods, too, the purchase of these goods will also increase.)

Figure 3.16b, where the indifference curves differ from those in Figure 3.16a, shows another possible outcome of the food stamp subsidy. In this case, with a direct cash grant of \$50, the consumer prefers to consume at point W'' , where U_3 is tangent to the budget line $A''A'Z'$. The food stamp subsidy prohibits such an outcome, however; the consumer must choose among the options shown by the $AA'Z'$ budget line. Faced with these alternatives, the best the consumer can do is choose point A' , because the highest indifference curve attainable is U_2 , which passes through the market basket at point A' .

When the situation shown in Figure 3.16b occurs, the subsidy increases the consumer's purchases of both food and nonfood items. Indeed, regardless of whether Figure 3.16a or Figure 3.16b is the relevant case, the food stamp subsidy cannot in reality avoid being used in part to finance increased consumption of nonfood items. This result is particularly interesting because many proponents of subsidies of this sort emphasize that the subsidy should not be used to finance consumption of "unnecessary" goods (such as vodka or junk food). In practice, it is difficult to design a subsidy that will increase consumption of only the subsidized good and not affect consumption of other goods at the same time.

Note also that the consumer in Figure 3.16b will be better off if given \$50 to spend as he or she wishes instead of \$50 in food stamps. The budget line will then be $A''A'Z'$, and the consumer will choose the market basket at point W'' , on indifference curve U_3 . This observation illustrates the general proposition that recipients of a subsidy will be better off if the subsidy is given as cash. The situation in Figure 3.16a illustrates why there is a qualification to this proposition: in some cases the consumer is equally well off under either subsidy. There is no case, however, where the consumer is better off with a subsidy to a particular good than with an equivalent cash subsidy.

APPLICATION 3.4

KEEPING BUGS BUNNY AND THE BACK STREET BOYS AT BAY IN CANADA

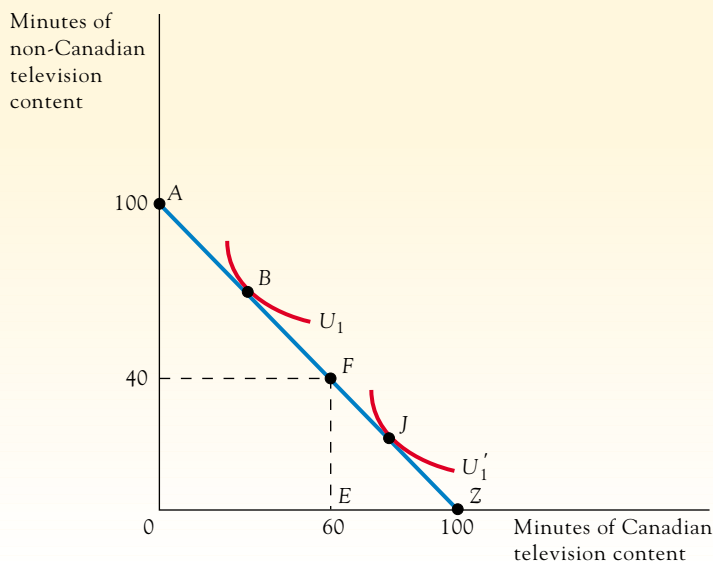
The food stamp program focuses on providing a minimum amount of a particular good, food, to consumers through a subsidy. Government decisionmakers, of course, have other policy instruments at their disposal with which to affect consumption. Among these are taxes, price controls, and quantity controls. An example of a quantity control is the Canadian approach toward limiting the influence of U.S. pop culture. Namely, television stations must offer at least 60 percent Canadian content in their programming. Radio stations must en-

sure that at least 35 percent of the popular songs that they play have a Canadian connection (for example, the music is performed by a Canadian, the lyrics are written by a Canadian, and so on).

Although intended by policymakers to bolster a distinct national culture, the mandates to promote consumption of domestically produced programming have predictable effects on individual consumer welfare. As shown in Figure 3.17, suppose that, based on other demands on his time, a consumer has only 100 minutes to

FIGURE 3.17**A Minimum Purchase Mandate and Consumer Welfare**

A Canadian television viewer is worse off if he would have chosen a point such as *B* on the *AF* portion of the budget line *AZ* prior to the government mandating that at least 60 percent of the programming consumed must have Canadian content.



devote to television viewing and that the only cost associated with viewing either Canadian or non-Canadian programming is the time that must be given up to do so. In the simplified case where the government successfully mandates that at least 60 percent of the consumer's viewing be devoted to Canadian programming, the consumer's budget line is constricted from *AZ* to *EFZ*. Restricted from accessing the *AF* portion of the original

budget line, the viewer is worse off than if less than 60 percent Canadian programming would have been chosen absent government interference (as with an indifference curve such as U_1 and an optimal point of *B*). And the consumer is no better off with the mandate if he would have chosen more than 60 percent Canadian programming on his own (such as with indifference curve U_1' and optimal consumption point *J*).

APPLICATION 3.5**THE ALLOCATION OF COMMENCEMENT TICKETS**

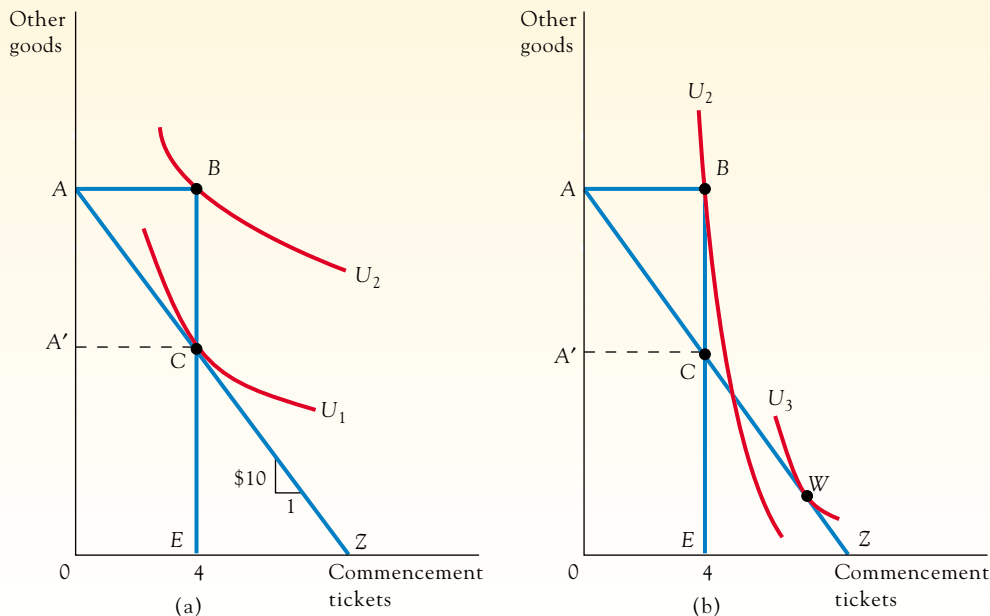
At most colleges, commencement tickets are rationed to seniors at a zero cash price. For example, each senior may be given four tickets for family and friends. We can depict the effects of such an allocation scheme in Figure 3.18a. The typical senior's budget line is *ABCE*: from zero to four tickets the budget line's slope is \$0 since the first four tickets are free; the budget line becomes vertical at four tickets since no more than four tickets can be obtained; and, assuming that the college is the only source of tickets (we rule out, for now, students exchanging tickets between themselves), the price of a ticket becomes infinite beyond four tickets.

Relative to the case where the college sets a positive price for tickets such that the average senior would buy exactly four tickets, the average senior is definitely better off if four tickets are given away instead. Suppose, for example, that, as shown in Figure 3.18a, a \$10 per ticket price would result in the average senior choosing market basket *C* along the budget line *AZ*; the senior would purchase four tickets at \$10 each and spend A' on other goods. Under the \$10-per-ticket pricing scheme, the average senior can attain only indifference curve U_1 . In contrast, when the college provides four free tickets the senior can attain indifference curve U_2 and thus is better off.

FIGURE 3.18

The Allocation of Commencement Tickets

(a) If given 4 free tickets rather than being charged \$10 per ticket, the average senior is better off. (b) However, some students may prefer the \$10-per-ticket pricing scheme to receiving 4 free tickets.



While the average senior depicted in Figure 3.18a may be better off, is every senior better off? The answer is no, and Figure 3.18b shows why. There are some students who may have steeply-sloped indifference curves at point B—four free tickets and an income level of A. Because they come from large families and/or have many friends they may dearly want more than the allocated four tickets. These students will be willing to exchange a considerable amount, in terms of dollars that could be spent on other goods, for additional tickets (the MRS at point B of the student depicted in Figure 3.18b is much greater than for the student shown in Figure 3.18a). Under a \$10-per-ticket pricing scheme, they would select market basket W on indifference curve U_3 and be better off than under the existing system where they get four free tickets and can attain only indifference curve U_2 .

We have so far ruled out seniors exchanging tickets among themselves. At most colleges, however, just such a resale market emerges every spring. The reason is fairly easy to see. Under the allocation scheme employed by most colleges, seniors will select a point such as B on the northeast

corner of their budget line (the northeast corner is the market basket of choice so long as their indifference curves are not either perfectly horizontal or perfectly vertical). Having opted to be on the same northeast corner (a point such as B) of their budget line, however, does not imply that the slopes of the indifference curves of all seniors are identical at their chosen market baskets. As can be seen by comparing Figures 3.18a and 3.18b, some students have flatter indifference curves than others at their optimal consumption points (U_2 is flatter at point B in Figure 3.18a than in Figure 3.18b). Variations in indifference curve slopes imply differences in consumers' willingness to exchange dollars spent on other goods for commencement tickets (that is, differences in their marginal rates of substitution). Such differences create an opportunity for mutually beneficial exchange between the various consumers in a market. In a later chapter we will show something you may be surprised to learn: that although a resale market results in what seems like high prices for otherwise "free" tickets, both individuals buying and selling the tickets gain from the development of such a market.

3.5

ARE PEOPLE SELFISH?

Having set out the basic components of the economic theory of consumer choice, we may now reconsider the general nature of the analysis. In particular, we wish to evaluate a commonly made objection to the way economists characterize individual behavior in economic theory. You may already have heard someone observe: “Economics assumes people are greedy and care only about material possessions;” or “Economics disregards the fact that individuals are benevolent and are concerned with the welfare of other people.”

A review of our basic assumptions about preferences reveals that these criticisms are not valid. Economic analysis does not prejudge what commodities, services, or activities people consider to be economic “goods” or “bads.” In fact, because many things are “goods” for some people and “bads” for others (e.g., liver, liquor, big-time wrestling, ballet, chewing tobacco, video games, cigarettes, reading economic theory), any attempt to specify in advance what all people consider desirable would frequently lead to mistakes.

If we are unable to specify which goods people find desirable, though, how can we apply the theory to concrete situations? The answer is simple: people reveal that some commodities are desirable by the way they allocate their spending. When we observe some consumers giving up money in return for Internet service, the evidence is fairly conclusive that Internet service is a desirable good for them. We would then draw convex indifference curves between Internet service and other goods for such consumers and investigate how their incomes, the price of Internet service, and so on, affect consumption decisions.

People give up time and resources to pursue charitable endeavors, sacrifice material wealth for a quiet life, or campaign for politicians. To show how economic theory can be applied to examine the factors that influence such decisions, consider a hypothetical situation.

Samantha (Sam) and Oscar are friends. Sam earns \$90,000 a year; Oscar earns only \$10,000 a year. Let’s assume that Sam cares about the material well-being of Oscar—or, more precisely, that Oscar’s income (which determines the material comforts he can enjoy) is an economic good for Sam. Does this concern imply that Sam will give some of her income to Oscar?

FIGURE 3.19

Transferring Income to Another Person

Altruistic preferences can also be accommodated in the analysis. In part (a) Sam chooses to give \$5,000 of her income to Oscar. When Sam’s preferences are different, as in part (b)—still altruistic but less so than in part (a)—she will not give any of her income to Oscar.

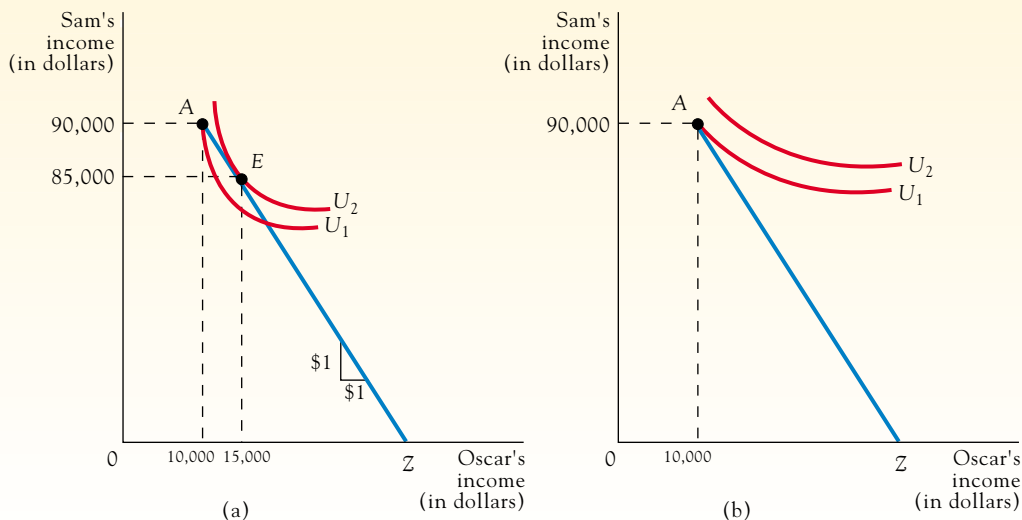


Figure 3.19 illustrates how we can apply indifference curve analysis to this situation. Figure 3.19a shows Sam's budget line AZ, relating her income and Oscar's. Sam's budget line does not intersect the vertical axis because we suppose she can't take income from Oscar. Point A shows their initial incomes. Obviously, Sam can increase Oscar's income by giving Oscar some of her income, but every dollar she gives to Oscar reduces her own income by a dollar, so the slope of the budget line is -1 . Figure 3.19a shows two of Sam's indifference curves, and because both her income and Oscar's are economic goods, they have the usual shapes. Given the preferences indicated by Sam's indifference curves, at point A she would be willing to pay more than \$1 to raise Oscar's income by \$1. Thus, it is in her interest to give some of her income to Oscar, and the best-sized gift from her point of view is \$5,000.

The fact that Sam cares about Oscar's income is not sufficient to imply that she will always donate money to Oscar's cause. Figure 3.19b shows an alternative set of indifference curves that Sam might have. Because these curves slope downward, they imply that Sam still views Oscar's income as an economic good. At point A, however, the slope of U_1 is less than the slope of the budget line. Thus, Sam might be willing to give up, for example, \$0.25 in return for Oscar having \$1 more in income; unfortunately, however, it would cost her \$1 to increase Oscar's income by \$1 (the slope of the budget line), so she decides not to contribute anything to the Oscar fund. A corner equilibrium results.

Both parts of Figure 3.19 show preferences implying that Sam views Oscar's income as an economic good, but the intensity of preferences differs. The differing intensity is shown by the different slopes of the indifference curves (the MRSs) at point A in the two diagrams. Thus, the fact that Sam cares about Oscar's income does not allow us to conclude that she will necessarily transfer any of her income to Oscar: the intensity of her preferences and the cost of giving play critical roles.

APPLICATION 3.6

THE NEW PHILANTHROPY

The increase in wealth created by the technology boom of the 1990s affected charitable giving in the United States.¹¹ Charitable gifts by U.S. citizens totaled \$190 billion in 1999—2 percent of national income and equal to one third of the domestic federal budget. That giving rate represented the highest level in nearly three decades and was led by some notable gifts from prominent business leaders. For example, as of 1999, Microsoft co-founder Bill Gates and his wife Melinda had given \$22 billion to their foundation. In real terms Bill and Melinda Gates have given money away faster and in greater amounts than anyone else in history. By comparison, the charitable contributions of early twentieth century oil tycoon and noted benefactor John D. Rockefeller total \$5.8 billion in 1999 dollars. Steel magnate

and philanthropist Andrew Carnegie's giving amounts to \$4.8 billion in 1999 dollars.

Although significant, modern-day altruism is similar in three ways to the philanthropy of previous generations. First, U.S. citizens have consistently distinguished themselves by their willingness to give of their time and money. This was a cultural trait noted by Frenchman Alexis de Tocqueville in his classic *Democracy in America* after visiting the United States in the early 1800s. A recent Johns Hopkins survey indicates that 49 percent of U.S. respondents volunteered their time for civic activities in the previous year, versus 13 percent of Germans and 19 percent of French. The survey also indicated that 73 percent gave money to charity over the last year versus 44 percent of Germans and 43 percent of French.

Second, much like the federal food stamp program described in the preceding section, philanthropic gifts

¹¹This application is based on "The New Philanthropy," *Time* (July 24, 2000), pp. 49–59.

typically come with restrictions about who the intended beneficiaries will be, and in what particular dimensions those beneficiaries are meant, by the donor, to be better off. For example, one of the first big commitments made by Bill Gates was in 1997 and involved paying billions to help children specifically through wiring every library in the country to the Internet. Many of the libraries wired through the Gates gift had been started earlier in the century through the munificence of Andrew Carnegie, who similarly wanted to provide opportunity to U.S. youth through a subsidy of a particular good (namely, libraries) rather than an equivalent cash subsidy.

Finally, the intensity of preferences for giving to others differs, as it always has, across individuals. Unlike Gates, for instance, Larry Ellison, the founder of Oracle, is skeptical about the extent to which philanthropy can solve the world's problems. Worth about \$24 billion as of 2002, Ellison does not give as much—about \$100 million per year—because he believes that the profit motive is the best tool for solving the world's problems.

Ellison asks, "Which did more for the world? The Ford Motor Company or the Ford Foundation?"

3.6

THE UTILITY APPROACH TO CONSUMER CHOICE

An alternative way to understand consumer choice theory is through the concepts of total and marginal utility. In this section we explain this alternative approach and relate it to the indifference curve approach emphasized earlier.

Let's assume we can measure the amount of satisfaction a consumer gets from any market basket by its utility. Units in which utility is measured are arbitrary, but they are commonly referred to as *utils*: a util is one unit of utility.

In consumers' minds, consumption of goods provides them with utility. But we must distinguish between the concepts of total utility and marginal utility. Table 3.2 illustrates the difference. Suppose Marilyn, the consumer, purchases only champagne (C), so for the moment consider only the first three columns. **Total utility** from champagne consumption (TU_C) is the total utils Marilyn gets from a given number of glasses of champagne. If two glasses are consumed, total utility is 38 utils. Total utility is obviously greater at higher levels of consumption, because champagne is an economic good. The **marginal utility** of champagne (MU_C) refers to the amount total utility rises when consumption increases by one unit. When champagne consumption increases from three to four glasses, total utility rises from 53 to 65 utils, or by 12 utils. The marginal utility of the fourth glass is thus 12 utils.¹²

Table 3.2 also illustrates the assumption of **diminishing marginal utility**. This assumption holds that as more of a given good is consumed, the marginal utility associated with the consumption of additional units tends to decline, other things being equal. (In particular, the other-things-being-equal condition means that consumption of other goods is held fixed as consumption of the good in question is varied.) In Table 3.2, the marginal utility of the first glass of champagne is 20 utils, but it is 18 utils for the second glass (the increase in TU_C from 20 to 38 utils) and so on. Note that the MU_C of each successive glass is smaller.

Table 3.2 also shows the total and marginal utility associated with different levels of consumption of a second good, perfume (F). The total utility of a market basket containing champagne and perfume is then the sum of TU_C and TU_F . (This statement assumes that the



TOTAL UTILITY

assuming that it is measurable, the total satisfaction a consumer receives from a given level of consumption

MARGINAL UTILITY

the amount by which total utility rises when consumption increases by one unit

DIMINISHING MARGINAL UTILITY

the assumption that as more of a given good is consumed, the marginal utility associated with the consumption of additional units tends to decline, other things equal

¹²In Table 3.2, the marginal utility when consumption is 6 glasses is in the same row as 6 glasses of champagne. Because marginal utility refers to the change in going from 5 to 6 glasses, however, some writers prefer to place marginal utility halfway between the fifth and sixth rows. Either procedure is acceptable as long as the correct meaning is communicated.

TABLE 3.2

TOTAL AND MARGINAL UTILITY					
Champagne (glasses)	TU_C	MU_C	Perfume (ounces)	TU_F	MU_F
1	20	20	1	50	50
2	38	18	2	85	35
3	53	15	3	110	25
4	65	12	4	130	20
5	75	10	5	145	15
6	83	8	6	155	10

utility derived from perfume consumption is independent of champagne consumption, and vice versa. While this assumption will not always be true, its use simplifies the explanation of the theory without materially affecting the results.) With consumption of five glasses of champagne and three ounces of perfume, total utility is 185 utils. Obviously, the consumer will choose the market basket yielding the greatest total utility, subject to the limitation implied by her income and the prices of the two goods.

The Consumer's Optimal Choice

If the consumer's income and the prices of champagne and perfume are specified (P_C and P_F), we could consult Table 3.2 and by trial and error eventually find the market basket of champagne and perfume that produces the greatest total utility. With an income of \$65 and the prices of champagne and perfume at \$5 and \$10, we would eventually find that the market basket composed of five glasses of champagne and four ounces of perfume produces more total utility (205 utils) than any other market basket costing \$65.

There is a simpler way to proceed. As it turns out, the utility-maximizing market basket is one for which the consumer allocates income so that the marginal utility divided by the good's price is equal for every good purchased:

$$MU_C/P_C = MU_F/P_F.$$

A market basket of 5C and 4F satisfies this equality: MU_C/P_C is equal to ten utils per glass/\$5 per glass, or two utils per dollar, and MU_F/P_F is equal to twenty utils per ounce/\$10 per ounce, or two utils per dollar. These ratios measure how much additional utility is generated by spending \$1 extra on each good. With MU_C/P_C equal to two utils per dollar, \$1 more spent on champagne (purchasing one-fifth of a glass) will generate two utils in additional utility (one-fifth of the MU associated with the fifth champagne glass). Put slightly differently, MU/P is the marginal rate of return, in terms of utility, earned by the consumer if she invests \$1 extra in a good. The rule for maximizing utility thus can equivalently be stated as allocating income among goods so that the marginal rates of return, measured in terms of utils per dollar "invested," are equalized across all the goods in which the consumer invests.

If this equality is not satisfied, total utility can be increased by a rearrangement in the consumer's purchases. Suppose that Marilyn buys 3C and 5F. This market basket also costs \$65, but total utility is now 198 utils, according to Table 3.2. With this market basket we have $MU_C/P_C > MU_F/P_F$ or 15 utils/\$5 > 15 utils/\$10. This inequality shows that the marginal dollar devoted to champagne yields 3 utils, while the marginal dollar devoted to perfume yields only 1.5 utils. Since \$1 spent on champagne generates a higher return in terms of utility, shifting \$1 from perfume to champagne consumption will increase total utility. Spending \$1 less on perfume reduces utility by 1.5 utils, but spending \$1

more on champagne increases it by 3 utils, a net gain of 1.5 utils. As long as an inequality persists, the consumer should reallocate purchases from the good with a lower marginal utility per dollar of expenditure to the good with a higher marginal utility per dollar of expenditure. Shifting dollar outlays from perfume to champagne will eventually reestablish the equality condition. As champagne consumption increases, its MU falls (reducing MU_C/P_C) because of the assumption of diminishing marginal utility; as perfume consumption falls, its MU rises (increasing MU_F/P_F). When the equality condition is reestablished, at 5C and 4F in this example, the consumer is maximizing utility with the given income and prices.

An analogy from the finance world may help cement your understanding of the foregoing rule for maximizing consumer utility. Suppose that you have a portfolio of \$1 million invested partly at Bank A and partly at Bank B. Your Bank A investment earns a 3 percent annual rate of return while dollars saved at Bank B earn 1.5 percent per year. What would be wrong with such a financial strategy provided that investing at either bank is riskless? The answer is probably clear. You would be better off by shifting money from Bank B to Bank A so long as the rate of return at A is higher. The same principle applies if you are trying to maximize utility by purchasing various goods (investing in various “banks”) with a limited budget.

Relationship to Indifference Curves

As noted earlier in this chapter, an indifference curve shows alternative market baskets yielding the same total utility to the consumer. Figure 3.20 shows two indifference curves. The consumer's MRS_{FC} between points R and T along indifference curve U_2 is $\Delta C/\Delta F$. This slope, however, can also be explained in terms of the marginal utilities of the two goods.

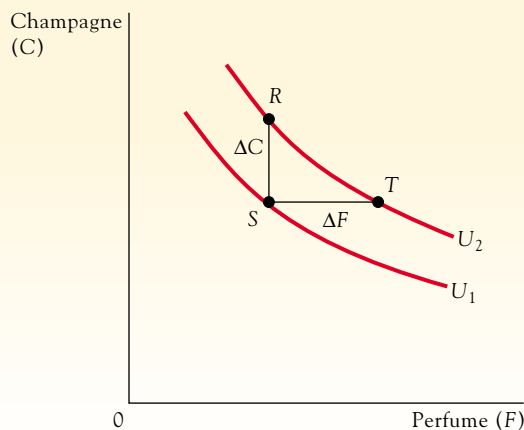
Along an indifference curve, the slope $\Delta C/\Delta F$ equals the ratio of the marginal utilities of the two goods. Suppose $\Delta C/\Delta F = 2C/1F$. That is, one ounce of perfume will replace two glasses of champagne without affecting total utility. If 1F will replace 2C, then the marginal utility of one ounce of perfume must be twice as great as the marginal utility of one glass of champagne. Thus, the slope $\Delta C/\Delta F$ equals MU_F/MU_C . The indifference curve slope measures the relative importance of the two goods to the consumer, which in turn is equal to their relative marginal utilities.

We can demonstrate this conclusion more formally. In Figure 3.20, the movement from R to S, ΔC , reduces total utility by an amount equal to $\Delta C \times MU_C$. (If ΔC is two glasses and the MU per glass of C is 5 utils, then total utility falls by 10 utils.) Similarly, the movement

FIGURE 3.20

MRS and Marginal Utilities

The slope of an indifference curve is related to the marginal utilities of the two goods. At point R the slope is $\Delta C/\Delta F$, and this ratio equals MU_F/MU_C .



from S to T , ΔF , increases total utility by an amount equal to $\Delta F \times MU_F$. Because R and T lie on the same indifference curve, the loss in utility associated with a move from R to S must be exactly offset by the gain in utility in going from S to T . Therefore, we have:

$$\Delta C \times MU_C = \Delta F \times MU_F.$$

Rearranging these terms, we find:

$$\Delta C / \Delta F = MU_F / MU_C.$$

Because $\Delta C / \Delta F$ equals MRS_{FC} , we can substitute terms and obtain:

$$MRS_{FC} = MU_F / MU_C.$$

Earlier in this chapter, we noted that, so long as there is not a corner solution, the consumer's optimal choice is where the indifference curve slope equals the slope of the budget constraint:

$$MRS_{FC} = P_F / P_C.$$

Since MRS_{FC} equals MU_F / MU_C , we can substitute terms and rewrite the optimality condition as:

$$MU_F / MU_C = P_F / P_C.$$

Then, by rearranging terms, we obtain:

$$MU_F / P_F = MU_C / P_C;$$

which is the condition for the optimal consumption choice when using the utility theory approach.

An equality between the marginal utility per dollar's worth of both goods is the same as an equality between the MRS and the price ratio. The utility theory and the indifference curve approach are thus simply different ways of viewing the same thing.



SUMMARY

- The theory of consumer choice is designed to explain why consumers purchase the goods they do. The theory emphasizes two factors: the consumer's preferences over various market baskets and the consumer's budget line, which shows the market baskets that can be bought.
- An indifference curve graphically depicts all the combinations of goods considered equally desirable by a consumer.
- For economic "goods," indifference curves are assumed to be downward-sloping, convex, and nonintersecting.
- The slope of an indifference curve measures the marginal rate of substitution (MRS), which is the willingness of the consumer to trade one good for another.
- A budget line shows the combinations of goods a consumer can purchase with given prices for the good and assuming all the consumer's income is spent on the good.
- The consumer's income and the market prices of the goods determine the position and slope of the budget line. The slope of the budget line is equal to the ratio of the prices of the goods and measures the relative price of one good compared with another.
- From among the market baskets the consumer can purchase, we assume the consumer will select the one that results in the greatest possible level of satisfaction or well-being. Graphically, this optimal choice is shown by the tangency between the budget line and the indifference curve, where the consumer's MRS equals the price ratio.
- A change in the consumer's budget line leads to a change in the market basket selected.
- An income increase when the prices of goods are held constant parallel shifts out the budget line. Either an increase or a decrease in the consumption of a good may result.
- When the consumption of a good rises with an increase in income, the good is a normal good.
- An inferior good is one for which consumption falls as income increases.
- The utility approach to consumer choice does not differ significantly from the indifference curve approach.



REVIEW QUESTIONS AND PROBLEMS

Questions and problems marked with an asterisk have solutions given in *Answers to Selected Problems at the back of the book (pages xxx–xxx)*.

3.1. Imelda spends her entire income on shoes and hats. Draw the budget line for each of the following situations, identifying the intercepts and the slope in each case.

- Monthly income is \$1,000, the price of a pair of shoes is \$8, and the price of a hat is \$10.
- Same conditions as in part a, except that income is \$500.
- Same conditions as in part a, except that income is \$2,000 and the price of a pair of shoes is \$16.
- Same conditions as in part a, except that hats cost \$5 each.

***3.2.** In most cases, a consumer can purchase any number of units of a good at a fixed price. Suppose, however, that a consumer must pay \$10 per visit to an amusement park for the first five visits but only \$5 per visit beyond five visits. What does the budget line relating amusement park visits and other goods look like?

***3.3.** Bill's budget line relating hamburgers and french fries has intercepts of 20 hamburgers and 30 orders of french fries. If the price of a hamburger is \$3, what is Bill's income? What is the per-order price of french fries? What is the slope of the budget line?

3.4. Under what conditions, if any, would a consumer's budget line be convex toward the origin? If a consumer has a convex budget line, is it possible for an indifference curve to be tangent to it at two different points? Which point would the consumer select?

3.5. Elton says, "To me, Coke and Pepsi are both the same." Draw several of Elton's indifference curves relating Coke and Pepsi.

3.6. People's rankings of activities are sometimes described in terms of their "priorities." For example, some students claim that getting good grades takes priority over watching television or dating. Does this ranking mean they never engage in the latter activities and spend all their time studying? If people do consume both high-priority and low-priority goods, what do we mean when we say that some goods have higher priorities than others?

3.7. Draw a set of indifference curves relating two "bads" such as smog and garbage. What characteristics do these curves have?

3.8. With the per-unit prices of broccoli (B) and pork rinds (R) equal to \$2 and \$1, a consumer, George, with an income of \$1,000 purchases 400R and 300B. At that point, the consumer's $MRS_{BR} = 2R/1B$. Does this mean that George would be just as well off consuming 200R and 400B? Explain with a diagram.

***3.9.** Marilyn spends her entire monthly income of \$600 on champagne (C) and perfume (F). The price of a bottle of champagne is \$30 and the price of an ounce of perfume is \$10. If she consumes 12 bottles of champagne and 24 ounces of perfume, her $MRS = 1C/1F$. Is her choice optimal? Explain your answer with a diagram.

***3.10.** Seat belts in cars were available as options before they were required by law. Most motorists, however, did not buy them. Assuming that motorists were aware that seat belts reduced injuries from accidents, were motorists irrational in not purchasing them?

3.11. Is it inconsistent to claim that (a) people's preferences differ and (b) at their current consumption levels, their marginal rates of substitution are equal?

3.12. In a recent study of charitable giving in the United States it was found that households with annual incomes under \$10,000 gave 5.2 percent of their income to charity. Households with incomes between \$10,000 and \$49,999 gave an average of 2.5 percent and households with at least \$50,000 in income gave 2.1 percent. Does this evidence indicate that charitable giving is an inferior good?

***3.13.** Is it possible for all goods a consumer buys to be normal? Is it possible for all goods a consumer buys to be inferior?

***3.14.** Consider two market baskets, A (\$100 worth of other goods, O, and 10 video rentals, V) and B (\$150 worth of other goods and 10 video rentals). If video rentals are a normal good, will the consumer's MRS_{VO} be greater when basket A or basket B is consumed? What if video rentals are an inferior good? Depict in a diagram.

3.15. Explain why the food stamp program can have the same effect on the consumption pattern and well-being of recipients as an outright cash transfer of the same cost. Why do you think it is not converted into an explicit cash transfer program, thereby saving the cost of printing and redeeming food stamps?

3.16. Prior to 1979, the food stamp program required families to pay a certain amount for food stamps. Suppose a family can receive \$150 in food stamps for a payment of \$50; no other options are offered. How would this policy affect the budget line? Compared with an outright gift of \$100 in food stamps, which is the way the program now works, would this policy lead to more, less, or the same food consumption?

3.17. Suppose that Thurston, a color-blind consumer, has \$80 to spend on either pink or lime-green sweaters. Thurston does not care what color sweater he wears but deems it very important to buy as many sweaters as possible with the \$80. Pink sweaters cost \$40 each and lime-green ones cost \$20 each.

- Draw Thurston's budget line and indifference map. What is Thurston's optimal consumption choice?
- A sale on pink sweaters begins: if a consumer buys two pink sweaters at the regular price, he or she can get two additional pink sweaters for free. Two pink sweaters must be purchased to get the deal. Otherwise prices are unchanged. With the sale, depict Thurston's new budget line and preferred consumption point.

3.18. Explain why the fact that most parents would prefer having one boy and one girl rather than two boys or two girls is consistent with diminishing MRS.

3.19. An Engel curve is a relationship between the consumer's income and the quantity of some good consumed (the price of the good fixed). Income is measured on the vertical axis, and the quantity of the good consumed is measured on the horizontal axis. Draw the Engel curves for compact discs and hamburger from Figures 3.14 and 3.15. How does the slope of an Engel curve identify whether the good is normal or inferior?

3.20. Measure the income of Samantha on the vertical axis and the income of Oscar on the horizontal axis, as we did in Figure 3.19. Draw several of Sam's indifference curves under the following circumstances.

- Sam doesn't care about Oscar's income, but the higher her own income is, the better off she is.
- Sam considers both her own income and Oscar's income to be economic "goods," but only as long as her income exceeds Oscar's. When Oscar's income exceeds hers, Sam considers Oscar's income to be an economic "bad."

3.21. If Sam's preferences relating her own income and Oscar's income conform to the Golden Rule ("Love thy neighbor as thyself"), what would her indifference curves in a diagram like Figure 3.19 look like?

3.22. Sam is subject to a 40 percent tax on income, and her after-tax income is \$90,000, as in Figure 3.19. Now suppose the government permits her to deduct her contributions (to Oscar) from her income before the 40 percent tax rate is applied. How will this deduction affect her budget line?

3.23. When we use the composite-good convention, what do we mean by a *composite good* and how do we measure it? What is the slope of the budget line? What is the slope of an indifference curve? Does the consumer equilibrium involve an equality between MRS and a price ratio?

3.24. The text argues that the preferences of an individual can be represented with indifference curves. Can the preferences of a group of people, such as a family or an entire society, be represented by a set of indifference curves? Why or why not?

3.25. Suppose that you have only 9 hours left to cram for final exams and you want to get as high an average numerical grade as possible in three courses: marketing, accounting, and microeconomics. Your grade in each course depends on the time devoted to studying the subjects in the following manner:

Marketing		Accounting		Microeconomics	
Hours of Study	Grade	Hours of Study	Grade	Hours of Study	Grade
0	90	0	80	0	0
1	97	1	90	1	40
2	98	2	97	2	60
3	99	3	98	3	70
4	100	4	99	4	79
5	100	5	100	5	87
6	100	6	100	6	94
7	100	7	100	7	100

How many hours should you devote to studying each subject?

3.26. Relying on the concept of diminishing marginal utility, explain why coin-operated newspaper racks differ from vending machines for candy bars and sodas (the latter dispense one item at a time while the former consist of a stack of newspapers inside with no limit on how many a consumer can take once the first paper has been paid for).

3.27. Depict the effects of mad cow disease (Application 3.1) on the typical British consumer's budget line and indifference map, relating units of fast-food chicken on the vertical axis and units of fast-food beef on the horizontal axis.

3.28. During the economic downturn of the late 1980s and early 1990s, Taco Bell increased sales per outlet and gained overall market share in the fast-food market. By contrast, competitors such as McDonald's and Burger King saw their sales and market share decline over the same time period. Assuming that the relative price of the items sold by the various fast-food chains as well as other factors remained unchanged, does this evidence indicate that the products sold by Taco Bell are normal or inferior goods for the typical consumer? Explain. What about the products sold by McDonald's and Burger King?