PART 3

Consumers and Producers

Consumers and producers are the main actors in the economy. Consumers earn, save, and make purchases. Producers make, invent, design, and bring goods to markets. In this section we analyze how individual consumers behave and optimize in their consumptiion and investment decisions, and how producers operate in various time frames when their objective is to maximize profit. The organization we call the firm plays a key role in the lives of each set of actors. Firms form the operating shell for producers, and also serve as an investment vehicle for consumers.

Chapter 6 develops the theory of consumer optimization in two frameworks: utility maximization and indifference analysis. Chapter 7 describes the purpose and operation and nature of the firm: how it serves the producer's needs and how it provides individuals with a vehicle for investing in a risk-filled world. Chapter 8 analyzes how producers achieve their goal of supplying the market with a product while minimizing the associated cost. Shot- and long-run time frames are distinguished.

CHAPTER 6

Consumer Choice and Demand Decisions

LEARNING OUTCOMES

By the end of this chapter you should understand:

- Consumer choice with measurable utility
- Utility and demand
- Indifference analysis: the budget constraint
- Indifference analysis: tastes
- Consumer optimization
- Applications of indifference analysis to demand
- Policy application: subsidy and income transfer policies

Understanding every detail of individual decision-making may involve a lifetime of enquiry. As social scientists, we require only a *reliable model* of behaviour, that is, *a way of describing the essentials of choice that is consistent with our everyday observations on individual behaviour patterns*. In this chapter, our aim is to understand more fully the behavioural forces that drive the demand side of the economy.

We will develop two different, yet complementary, approaches to decision making —utility and indifference. We begin by portraying individuals as maximizing their *measurable utility* (sometimes called *cardinal utility*). When we progress to indifference analysis, we invoke a weaker assumption about the ability of individuals to measure their satisfaction. In this instance we do not assume that individuals can measure their utility, only that they can say if one collection of goods and services yields them greater satisfaction than another group. This ranking of choices corresponds to what is sometimes called *ordinal utility*. But in each perspective individuals are described as maximizers or optimizers: They allocate their income so as to choose the outcome that will make them as well off as possible.

6.1 Consumer Choice with Measurable Utility

Neal loves to pump his way through the high-altitude moguls at the Whistler ski and snowboard resort. His student-rate lift-ticket cost is $30 per visit. He also loves to frequent the jazz bars in downtown Vancouver, and each such visit costs him $20. With expensive passions, Neal must allocate his monthly entertainment budget carefully. He has evaluated how much satisfaction, measured in utils, he obtains from each snowboard outing and each jazz club visit. We assume that these utils are measurable, and we use the term **cardinal utility** to denote this. These are listed in columns 2 and 3 of Table 6.1. These numbers measure the **total utility** he gets from the activities.

Neal's total utility from each activity in this example is independent of the amount of the other activity he engages in. These total utilities are also plotted in Figures 6.1 (a) and 6.1 (b). Clearly, more of each activity yields more utility, so the additional or **marginal utility** of each activity is positive. We frequently call this *non-satiation*—more is always better. Note, however, that the decreasing slopes of the total utility curves show that total utility is increasing at a diminishing rate. While more is certainly better, each additional visit to Whistler or a jazz club augments Neal's utility by a diminishing amount; at the margin, his additional utility declines: he has **diminishing marginal utility**.

In Figure 6.2, we have plotted the marginal utility (MU) associated with consuming different amounts of the two goods, using the data from columns 4 and 5 in Table 6.1. These functions are declining, as indicated by their negative slope.

Cardinal utility is a measurable concept of satisfaction.

Total utility is a measure of the total satisfaction derived from consuming a given amount of goods and services.

Marginal utility is the addition to total utility created when one more unit of a good or service is consumed.

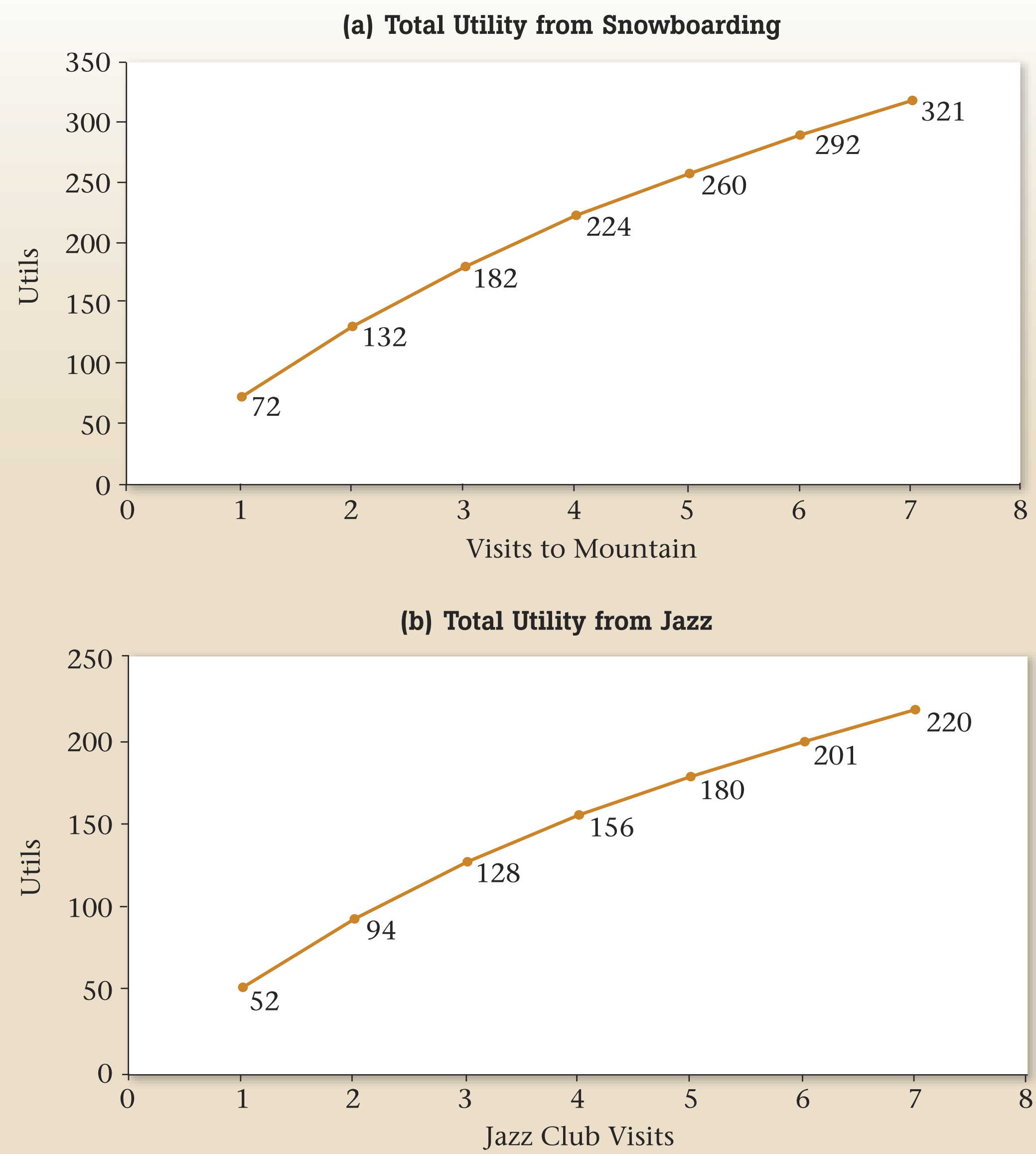
Diminishing marginal utility implies that the addition to total utility from each extra unit of a good or service consumed is declining.

TABLE 6.1 Utils from Snowboarding and Jazz

1	2	3	4	5	6	7
Visit Number	Total Snowboard Utils	Total Jazz Utils	Marginal Snowboard Utils	Marginal Jazz Utils	Marginal Snowboard Utils per $	Marginal Jazz Utils per $
1	72	52	72	52	2.4	2.6
2	132	94	60	42	2.0	2.1
3	182	128	50	34	1.67	1.7
4	224	156	42	28	1.4	1.4
5	260	180	36	24	1.2	1.2
6	292	201	32	21	1.07	1.05
7	321	220	29	19	0.97	0.95

Price of snowboard visit = $30, Price of jazz club visit = $20

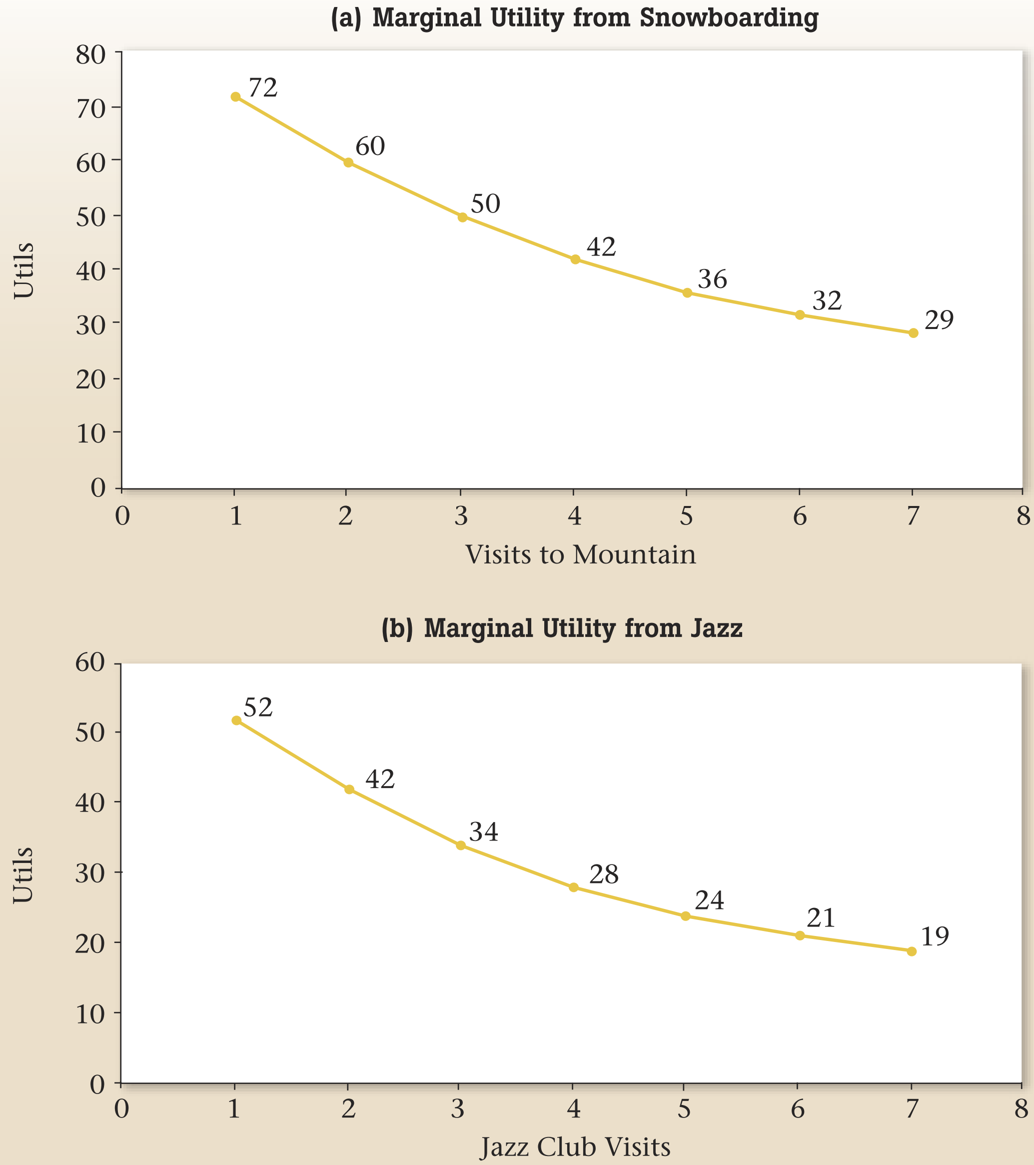
FIGURE 6.1



Now that Neal has defined his utility schedules, he must consider the price of each activity. Ultimately, when deciding how to allocate his monthly entertainment budget, he must consider how much utility he gets from each dollar spent on snowboarding and jazz: What "bang for his buck" does he get? Let us see how he might go about allocating his budget. *When he has fully spent his budget in the manner that will yield him greatest utility, we call that state an equilibrium*, because he will have no incentive to change his expenditure patterns.

If he boards once, at a cost of \$30, he gets 72 utils of satisfaction—2.4 utils per dollar spent (= 72/30). One visit to a jazz club would yield him 2.6 utils per dollar

FIGURE 6.2



(= 52/20). Initially, therefore, his dollars give him more *utility per dollar* when spent on jazz. His MU per dollar spent on each activity is given in the final two columns of the table.

We will assume that Neal has a budget of $200. He realizes that his initial expenditure should be on a jazz club visit, because he gets more utility per dollar spent there. Having made one jazz club visit, he sees that a second such outing would yield him 2.1 utils per dollar expended, while a first visit to Whistler would yield him 2.4 utils per dollar. Accordingly, his second activity is a snowboard outing.

Having made one jazz and one snowboarding visit, he then decides upon a second jazz club visit for the same reason as before—utility value for his money. He continues to allocate his budget in this way until his budget is exhausted. In our example, this occurs when he spends $120 on four snowboarding outings and $80 on four jazz club visits. At this **consumer equilibrium**, he gets the same utility value per dollar for the *last unit of each activity consumed*. This is a necessary condition for him to be maximizing his utility, that is, to be in equilibrium.

A **consumer equilibrium** occurs when marginal utility per dollar spent on the last unit of each good is equal.

To be absolutely convinced of this, imagine that Neal had chosen instead to board twice and to visit the jazz clubs seven times; this combination would also exhaust his $200 budget exactly. With such an allocation, he would get 2.0 utils per dollar spent on his marginal (second) snowboard outing, but just 0.95 utils per dollar spent on his marginal (seventh) jazz club visit.[1] If, instead, he were to reallocate his budget in favour of snowboarding, he would get 1.67 utils per dollar spent on a third visit to the hills. By reducing the number of jazz visits by one, he would loose 0.95 utils per dollar reallocated. Consequently, the utility gain from a reallocation of his budget towards snowboarding would outweigh the utility loss from allocating fewer dollars to jazz. His initial allocation, therefore, was not an optimum, or equilibrium.

Only when the utility per dollar expended on each activity is equal at the margin will Neal be optimizing. When that condition holds, a reallocation would be of no benefit to him, because the gains from one more dollar on boarding would be exactly offset by the loss from less jazz. Therefore, using the notation MU to denote marginal utility and P_i to represent the price of good *i*, we can write the equilibrium condition as

$$MU_s/P_s = MU_j/P_j \qquad (6.1)$$

Review Question 1

This condition must hold for all pairs of goods on which the consumer allocates his or her budget.

6.2 Utility and Demand

THE THEORY

Utility theory is a useful way of analyzing how a consumer makes choices. But in the real world we do not observe a consumer's utility, either total or marginal. Instead, his or her behaviour in the marketplace is observed through the demand curve. How are utility and demand related?

Demand functions relate the quantity of a good consumed to the price of that good. So let us trace out the effects of a price change on demand, with the help of this utility framework. We will introduce a simplification here: that goods are divisible, or that they come in small packages relative to income. Think, for example, of kilometres driven per year, or litres of gasoline purchased. Conceptualizing things in this way enables us to imagine more easily experiments in which small amounts of a budget are allocated one dollar at a time. In contrast, in the snowboard/jazz example, we had to reallocate the budget in lumps of $30 or $20 at a time because we could not "fractionalize" these goods.

[1] Note that, with two snowboard outings and seven jazz club visits, total utility is (132 + 220 =) 352, while the optimal combination of four of each yields a total utility of (224 + 156 =) 380.

APPLICATION BOX 6.1

Health Care

How does the budget allocation rule apply to goods such as health care in Canada that are sometimes supplied at a zero or subsidized price? If health care were privately supplied at a price determined in the marketplace, the consumer would allocate income between it and other goods in accordance with the optimizing rule. But governments attempt to implement a type of "equal health care for all" policy.

The optimizing rule dictates that, if the price of health care is very low, we should demand a great deal of it; a high quantity demanded would drive down its marginal utility. But in reality this does not happen. The health system cannot meet the demand at the prices that are set—frequently the price is zero, as when visiting the family doctor or the local clinic. Patients are therefore faced with waiting lists, which are a means of rationing health care. In fact, Canadians are in this way prevented from consuming as much health care as they wish, and therefore never succeed in driving the MU towards zero.

The effects of a price change on a consumer's demand can be seen through the condition that describes his or her equilibrium. If we have an allocation for three goods {a, b, c}, such that $MU_a/P_a = MU_b/P_b = MU_c/P_c$, and the price of, say, good b falls, the consumer must reallocate the budget so that once again the MUs per dollar spent are all equated. How does he do this? Clearly, if he purchases more or less of any one good, the MU changes. If the price of good b falls, then the consumer initially gets more utility from good b *for the last dollar he spends on it* (the denominator in the expression MU_b/P_b falls, and consequently the value of the ratio rises to a value greater than the values for goods a and c).

The consumer responds to this, in the first instance, by buying more of the cheaper good. He obtains more total utility as a consequence, and in the process will get *less* utility *at the margin* from that good. In essence, the numerator in the expression then falls, in order to realign it with the lower price. This equality also provides an underpinning for what is called the **law of demand**: More of a good is demanded at a lower price. If the price of any good falls, then, in order for the equilibrium condition to be re-established, the MU of that good must be driven down also. Since MU declines when more is purchased, this establishes that demand curves must slope downwards.

The **law of demand** states that, other things being equal, more of a good is demanded the lower is its price.

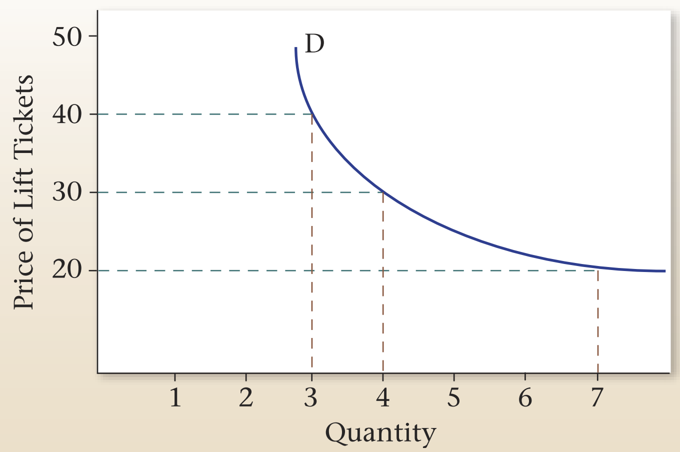
However, the effects of a price decline are normally more widespread than this, because the quantities of other goods consumed will also change. For example, as explained in earlier chapters, the decline in the price of good b will lead the consumer to purchase more units of *complementary goods* and fewer units of goods that are *substitutes*. So the whole budget allocation process must be redetermined in response to any price change. But at the end of the day, a new equilibrium must be one where the marginal utility per dollar spent on each good is equal.

APPLYING THE THEORY

The demand curves developed in Chapter 3 can be related to the foregoing utility analysis. In our example, Neal purchased four lift tickets at Whistler when the price was $30. We can think of this combination as one point on his demand curve, where the "other things kept constant" are the price of jazz, his income, his tastes, etc.

FIGURE 6.3 **Utility to Demand**

When the price of a lift ticket is $30, the consumer finds the quantity at which the MU/P is equal for all purchases. The corresponding quantity purchased is four tickets. At prices of $40 and $20, the equilibrium condition implies quantities of three and seven respectively.



Suppose now that the price of a lift ticket increased to $40. How could we find another point on his demand curve corresponding to this price, using the information in Table 6.1? The marginal utility per dollar associated with each visit to Whistler could be recomputated by dividing the values in column 4 by 40 rather than 30, yielding a new column 6. We would then determine a new allocation of his budget between the two goods that would maximize utility. After such a calculation we would find that he makes three visits to Whistler and four jazz-club visits. Thus, the combination $\{P_S = \$40, Q_s = 3\}$ is another point on his demand curve. Note that this allocation exactly exhausts his $200 budget.

By setting the price equal to $20, this exercise could be performed again, and the outcome will be a quantity demanded of lift tickets equal to seven (plus three jazz club visits). Thus, the combination $\{P_S = \$20, Q_s = 7\}$ is another point on his demand curve. Figure 6.3 plots a demand curve going through these three points.

By repeating this exercise for many different prices, the demand curve is established. We have now linked the demand curve to utility theory.

6.3 Indifference Analysis—The Budget Constraint

In the preceding section, we invoked the concept of measurable utility in order to better understand how consumers allocate their budgets, and how this process is reflected in the market demands that we observe.

Here, we use the less demanding assumption that individuals are able to identify (a) different *combinations* of goods and services that yield equal satisfaction, and (b) combinations of goods and services that yield more satisfaction than other combinations. In contrast to measurable (or cardinal) utility, this concept is called **ordinal utility**, because it assumes only that consumers can *order* utility bundles rather than quantify the utility.

Ordinal utility assumes that individuals can rank commodity bundles in accordance with the level of satisfaction associated with each bundle.

We may ask why it is necessary to develop further analytical tools. The answer is that different approaches provide different and extended insights into behaviour, and therefore increase our understanding of the marketplace.

APPLICATION BOX 6.2

Marginal Utility and the Diamond/Water Paradox

Some objects have tremendous market value but little use value; others have great use value but a low market value. Diamonds and water in Canada are examples. Water can be supplied cheaply, but not diamonds. Adam Smith first stated this "paradox" in 1776. Since the price of water is negligible, we use a lot of it, and thereby drive the *marginal* utility down to an almost zero value. Nevertheless, our water consumption yields enormous *total* value. In contrast, diamonds are rare, and therefore costly. For the MU per dollar spent on each of these two goods to be equal, it must be the case that the *marginal* utility of diamonds is very high. Nonetheless, the *total* utility gained from sporting a diamond will be less than the *total* utility from water consumption: glamour or death?

Neal's monthly expenditure limit, or **budget constraint**, is \$200. In addition, he faces a price of \$30 for lift tickets and \$20 per visit to jazz clubs. Therefore, using S to denote the number of snowboard outings and J the number of jazz club visits, if he spends his entire budget it must be true that the sum of expenditures on each activity exhausts his budget or income (I):

The **budget constraint** defines all bundles of goods that the consumer can afford with a given budget.

$$\$30S + \$20J = \$200$$

or, more generally, that the budget constraint is defined by

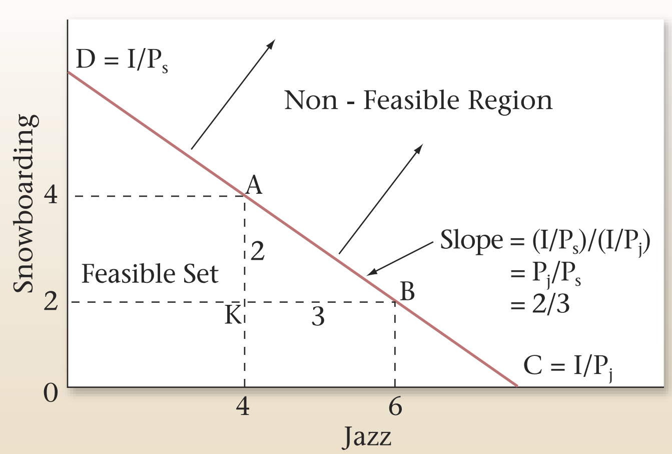
$$P_sS + P_jJ = I \qquad (6.2)$$

whatever the income and prices may be. Since many different combinations of the two goods are affordable, it follows that the budget constraint defines all bundles of goods that the consumer can afford with a given budget.

The budget constraint, then, is just what it claims to be—a limit on behaviour. Neal's budget constraint is illustrated in Figure 6.4, where the amount of each good consumed is given on the axes. If he spends all of his \$200 income on jazz, he can make exactly

FIGURE 6.4 **The Budget Line**

DC is the budget constraint, and defines the set of feasible combinations of jazz and snowboarding. D represents all income being spent on snowboarding, and is therefore $D = I/P_S$. Similarly, $C = I/P_J$. Points above DC are not feasible. The slope is the vertical distance of any segment, divided by the horizontal distance.



ten jazz club visits (\$200/\$20 = 10). We can make the same calculation for visits to Whistler. Thus, the intercept value is obtained by dividing income by the price of the good or activity in question.

The **feasible set** of goods and services for the consumer is bounded by the budget line from above; the **non-feasible set** lies strictly above the budget line.

In addition to these affordable extremes, Neal can also afford many other bundles, e.g., {S = 2, J = 7}, or {S = 4, J = 4}, or (S = 6, J = 1). The complete, or **feasible**, set of combinations is bounded by the budget line, and this is illustrated in Figure 6.4.

Review Question 2

The slope of the budget line is informative. It tells us how many snowboard visits must be sacrificed for one additional jazz visit; it defines the consumer's *trade-offs*. To illustrate: Suppose Neal is initially at point A {J = 4, S = 4}, and moves to point B {J = 7, S = 2}. Clearly, both points are feasible. In making the move, he trades two snowboard outings in order to get three additional jazz club visits, a trade-off of 2/3. This trade-off is the slope of the budget line, which, in Figure 6.4, is AK/KB = –2/3, where the negative sign reflects the slope.

Could it be that this ratio reflects the two prices (\$20/\$30)? The answer is yes: If each unit of the good on the vertical axis is more expensive that the good on the horizontal axis, it makes sense that fewer units of the former must be sacrificed to get one unit of the latter. This result is derived by noting that the slope of the budget line is given by the vertical distance divided by the horizontal distance, OD/OC. The points D and C were obtained by dividing income by the respective price—Remember that the jazz intercept is \$200/\$20 = 10. Formally, that is I/P_j. The intercept on the snowboard axis is likewise I/P_s. It follows that

$$\text{slope of the budget constraint} = \text{vertical distance /horizontal distance}$$
$$= OD/OC = (I/P_s)/(I/P_j)$$
$$= (I/P_s).(P_j/I) = P_j/P_s.$$

Review Questions 3 and 4

Since the budget line has a negative slope, we can write the general result, where good *x* is on the horizontal axis, and *y* on the vertical axis, as

$$\textbf{Slope of the budget constraint} = P_x/P_y \qquad (6.3)$$

6.4 Indifference Analysis—Tastes

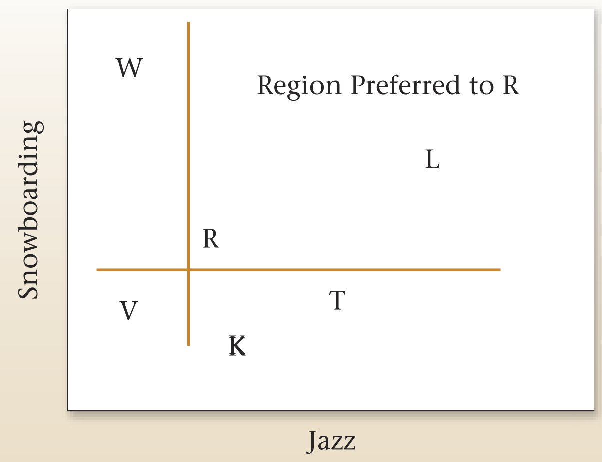
We now consider how to represent a consumer's tastes in two dimensions, given that he can order, or rank, different consumption bundles, and that he can define a series of different bundles that all yield the same satisfaction. We limit ourselves initially to considering just "goods," and not "bads" such as pollution.

Figure 6.5 examines the implications of these assumptions about tastes. Each point shows a consumption bundle of snowboarding and jazz. Let us begin at bundle R. Since more of a good is preferred to less, any point such as L, which lies to the northeast of R, is preferred to R, since L offers more of both goods than R. Conversely, points to the southwest of R offer *less of each good* than R, and therefore R is preferred to a point such as V.

Without knowing the consumer's exact tastes, we cannot be sure at this stage how points in the northwest and southeast regions compare with R. At W or T, the consumer has more of one good and less of the other than at R. Someone who really likes snowboarding might prefer W to R, but a jazz buff would prefer T to R.

FIGURE 6.5 Ranking Consumption Bundles

Points like L are preferred to R, since more of each good is consumed at L. For the same reasoning, points such as V are less preferred than R. Points like W and T contain more of one good and less of the other than R. Consequently, we cannot say if they are preferred to R without knowing how the consumer trades the goods off—that is, his or her preferences.



Let us now ask Neal to enlighten us on his tastes, by asking him to define several combinations of snowboarding and jazz that *yield him exactly the same degree of satisfaction as the combination at R*. His answers define a series of points that lie on a beautifully smooth contour U_R in Figure 6.6. Since he is indifferent between all points on U_R by construction, this contour is an **indifference curve**.

Pursuing this experiment, we could take other points in Figure 6.5, such as L and V, and ask the consumer to define bundles that would yield the same level of satisfaction, or indifference. These combinations would yield additional contours, such as U_L and U_V in Figure 6.6. This process yields a series of indifference curves that together form an **indifference map**.

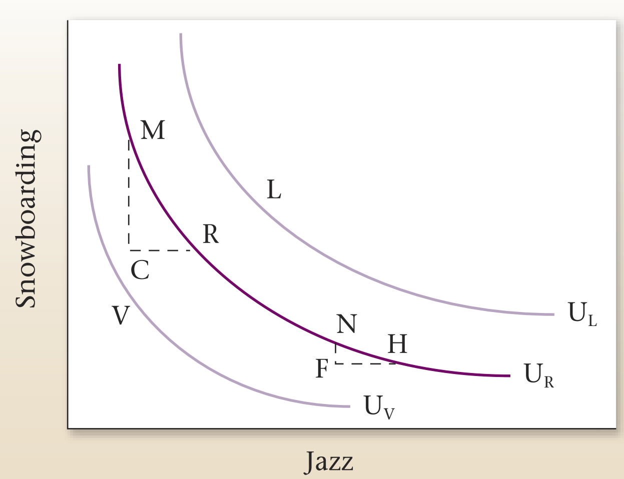
Review Question 5

An **indifference curve** defines combinations of goods and services that yield the same level of satisfaction to the consumer.

An **indifference map** is a set of indifference curves, where curves further from the origin denote a higher level of satisfaction.

FIGURE 6.6 Indifference Curves

An indifference curve defines a series of consumption bundles, all of which yield the same satisfaction. The slope of an indifference curve is called the marginal rate of substitution (MRS), and defines the number of units of the good on the vertical axis that the individual will trade for one unit of the good on the horizontal axis. The MRS declines as we move southeasterly (down to the right), because the consumer values any good more highly when he has less of it.



Let us now explore the properties of this map, and thereby understand why the contours have their smooth convex shape. They have four properties. The first three follow from our preceding discussion, and the fourth requires investigation.

- Indifference curves *further from the origin reflect higher levels of satisfaction*.
- Indifference curves are *negatively sloped*. This reflects the fact that if a consumer gets more of one good she should have less of the other in order to remain indifferent between the two combinations.
- Indifference curves *cannot intersect*. If two curves were to intersect at a given point, then we would have two different levels of satisfaction being associated with the same commodity bundle—an impossibility.
- Indifference curves are convex when viewed from the origin, reflecting a *diminishing marginal rate of substitution*.

The convex shape reflects an important characteristic of preferences: When consumers have a lot of some good, they value a marginal unit of it less than when they have a small amount of that good. More formally, they have a *higher marginal valuation at low consumption levels*—that first cup of coffee in the morning provides greater satisfaction than the second or third cup.

Consider the various points on U_R, starting at M in Figure 6.6. At M Neal snowboards a lot; at N he boards much less. The convex shape of his indifference map shows that he values a marginal snowboard trip more at N than at M. To see this, consider what happens as he moves along his indifference curve, starting at M. We have chosen the co-ordinates on U_R so that, in moving from M to R, and again from N to H, the additional amount of jazz is the same: CR = FH. From M, if Neal moves to R, he consumes an additional amount of jazz, CR. By definition of the indifference curve, he is willing to give up MC snowboard outings. The ratio MC/CR defines his willingness to substitute one good for the other. This ratio is the slope of the indifference curve and is called the **marginal rate of substitution**, MRS.

The **marginal rate of substitution** is the slope of the indifference curve. It defines the amount of one good the consumer is willing to sacrifice in order to obtain a given increment of the other.

Review Question 6

At N, the consumer is willing to sacrifice the amount NF of boarding to get the same additional amount of jazz. Note now that, when he boards *less,* as at N, he is willing to give up less boarding than when he has a lot of it, as at M, in order to get the same additional amount of jazz. His willingness to substitute *diminishes* as he moves from M to N. In order to reflect this taste characteristic, the indifference curve has a **diminishing marginal rate of substitution**, a flatter slope as we move down along its surface.

A **diminishing marginal rate of substitution** reflects a higher marginal value being associated with smaller quantities of any good consumed.

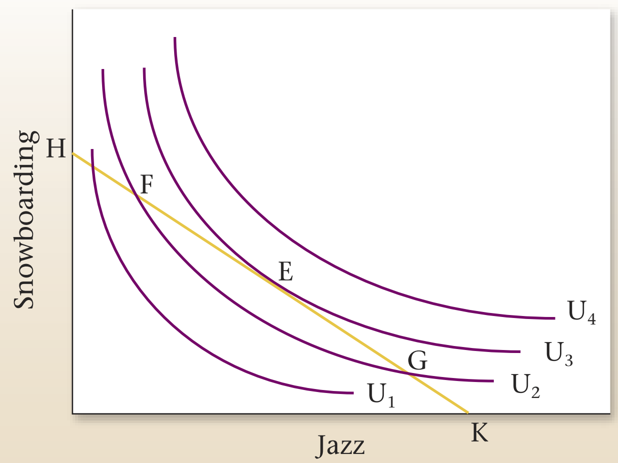
6.5 Optimization

We are now in a position to examine how the consumer optimizes—how he gets to the highest level of satisfaction possible. The constraint on his behaviour is the feasible set defined in Figure 6.4 (page 109), the budget line.

Figure 6.7 displays several of Neal's indifference curves in conjunction with his budget constraint. We propose that he maximizes his utility, or satisfaction, at the point E, on the indifference curve denoted by U_3. While points such as F and G are also on the boundary of the feasible set, they do not yield as much satisfaction as E, because E lies on a higher indifference curve. *The highest possible level of satisfaction is attained, therefore, when the budget line touches an indifference curve at just a single point—that is,*

FIGURE 6.7 **The Consumer Optimum**

The budget constraint constrains the individual to points on or below HK. The highest level of satisfaction attainable is U_3, where the budget constraint just touches, or is just tangent to it. At this optimum, the slope of the budget constraint (P_j/P_s) equals the MRS.



where the constraint is tangent to the indifference curve. E is such a point. This tangency between the budget constraint and an indifference curve requires that the slopes of each be the same at the point of tangency. We have already established that the slope of the budget constraint is the negative of the price ratio ($= -P_x/P_y$). The slope of the indifference curve is the marginal rate of substitution MRS. It follows, therefore, that the **consumer optimizes** where the marginal rate of substitution equals the slope of the price line.

An **optimum for the consumer** occurs where the chosen consumption bundle is a point such that the price ratio equals the marginal rate of substitution.

$$\mathrm{MRS} = P_j/P_s \qquad (6.4)$$

Notice the resemblance between this condition and the one derived in Section 6.1 (page 106). There we argued that an equilibrium requires the marginal utility per dollar expended to be equal for each good:

$$MU_j/P_j = MU_s/P_s, \quad \text{that is,} \quad MU_j/MU_s = P_j/P_s.$$

In fact, with a little mathematics it can be shown that the MRS is indeed the same as the ratio of the marginal utilities, and therefore the two conditions are in essence the same! However, we did not need to assume that an individual can actually measure his utility in obtaining the result that the MRS should equal the price ratio in equilibrium. We relied simply on the concept of ordinal utility.

Review Question 7

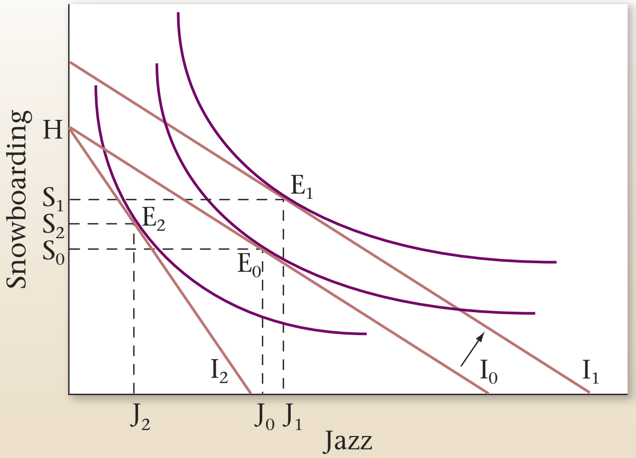
ADJUSTMENT TO INCOME CHANGES

Suppose now that Neal's income changes from $200 to $300. How will this affect his consumption decisions? In Figure 6.8, this change is reflected in a *parallel* outward shift of the budget constraint. Since no price change occurs, the slope remains constant. By recomputing the ratio of income to price for each activity, we find that the new snowboard and jazz intercepts are 10 and 15, respectively. Clearly, the consumer can attain a higher level of satisfaction—at a new tangency to a higher indifference curve—as a result of the size of the feasible set being expanded. In Figure 6.8, the new equilibrium is at E_1.

FIGURE 6.8 **Income and Price Adjustments**

An income increase is represented by an outward shift of the budget constraint from I_0 to I_1. This results in the attainment of a higher level of indifference.

A price rise in jazz tickets rotates the budget line I_0 inwards around the snowboard intercept to I_2. The price rise reflects a lower real value of income, and results in a lower equilibrium level of satisfaction.



ADJUSTMENT TO PRICE CHANGES

Review Question 8

Next, consider the impact of a price change from the initial equilibrium E_0 in Figure 6.8. Suppose that jazz now costs more. This reduces the purchasing power of the given budget of $200. The new jazz intercept is reduced—the number of visits possible if Neal spends all his income on jazz. The budget constraint becomes steeper and rotates around the snowboard intercept H, which is unchanged because its price is constant. The new equilibrium is at E_2, which reflects a lower level of satisfaction because the feasible set has been reduced by the price increase. As explained in section 6.2, E_0 and E_2 are points on the demand curve for jazz. In contrast, the price increase for jazz *shifts* the demand curve for snowboarding.

6.6 Applications of Indifference Analysis

COMPLEMENTS AND SUBSTITUTES

Review Questions 9 and 10

The nature of complements and substitutes, defined in Chapter 4, can be further understood with the help of Figure 6.8. We have drawn the new equilibrium so that the increase in the price of jazz results in more snowboarding—the quantity of S increases to S_2 from S_0. These goods are substitutes in this picture, because snowboarding *increases* in response to an *increase* in the price of jazz. If the new equilibrium E_2 were at a point yielding a lower level of S than S_0, we would conclude that they were complements.

CROSS-PRICE ELASTICITIES

Review Question 11

Continuing with the same price increase in jazz, we could compute the *percentage* change in the quantity of snowboarding demanded as a result of the *percentage* change in the jazz price. In this example, the result would be a positive elasticity value, because the quantity change in snowboarding and the price change in jazz are both in the same direction, each being positive.

APPLICATION BOX 6.3

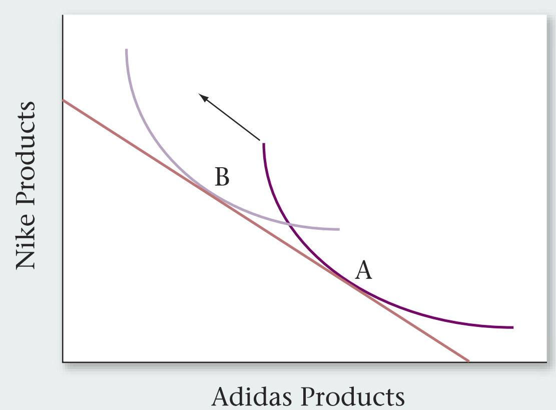
Can Tiger Tweak Your Tastes?

Tiger Woods earns more from his Nike and Buick contracts each year than he does in prize money on the golf course. Michelle Wie and Anna Sharapova do likewise. Each one is trying to tweak our tastes in favour of their sponsor's product. Perhaps we can be as successful if we follow their advice?

Individual tastes are seldom constant for long. Whether it is new fashions or peer influences on teens, sellers are out to influence our preferences. What are they doing to our indifference curves? In fact, they are trying to shift them around—away from their competitor's axis, and towards the axis of their own product. In terms of the equilibrium below, Nike is attempting to get the consumer to move from an equilibrium like A to one such as B, because B involves purchasing more Nike goods.

Marketing and Tastes

A prime objective of marketing is to influence the tastes of individuals. A consumer in equilibrium at point A purchases more Adidas products than Nike products. If Nike wishes to influence the consumer, using sports stars like Tiger Woods, to have a stronger preference for Nike products, it essentially tries to move the consumer's indifference curves with advertising and marketing messages so that an equilibrium such as B becomes an optimum.



NORMAL AND INFERIOR GOODS

We know from Chapter 4 that the quantity demanded of a *normal good* increases in response to an income increase, whereas the quantity demanded of an *inferior good* declines. Clearly, both jazz and boarding are normal goods, as illustrated in Figure 6.8, because more of each one is demanded in response to the income increase from I_0 to I_1. It would challenge the imagination to think that either of these goods might be inferior. But if J were to denote junky (inferior) goods, and S super goods, we could envisage an equilibrium E_1 to the northwest of E_0; less J and more S would be consumed in response to the income increase.

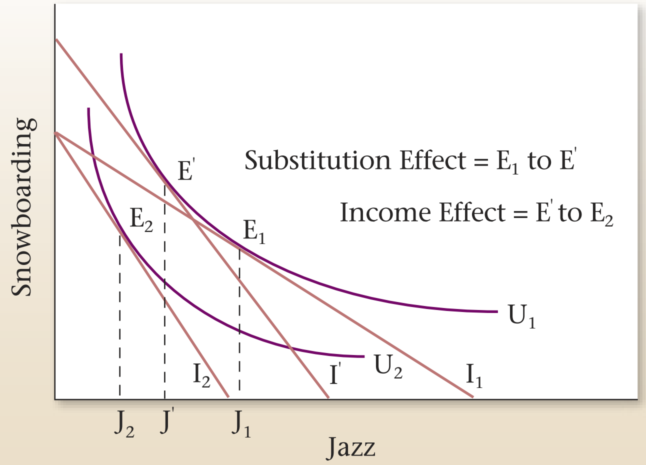
Review Question 12

INCOME AND SUBSTITUTION EFFECTS

It is very useful, as we shall see presently, to decompose a price change, which moves the consumer along his demand curve, into two components—an income effect and a substitution effect. Figure 6.9 illustrates the impact of an increase in the price of jazz: The equilibrium moves from E_1 to E_2 as a result of the budget constraint's changing

FIGURE 6.9 **Income and Substitution Effects**

An initial equilibrium E_1 is disturbed by an increase in P_j that rotates the budget constraint from I_1 to I_2. The new equilibrium is E_2. The substitution component of this is from E_1 to E'—a move to a different point on the initial indifference curve where the slope is the same as the slope of I_2. The remaining component—the move from E' to E_2 is the income effect, because it is equivalent to a parallel shift in the budget constraint I' to I_2.



from I_1 to I_2. This price increase reduces the demand for jazz in two ways. First, jazz becomes *relatively more expensive* compared with other goods, and this is reflected in the steeper price line. Second, the price increase reduces the real purchasing power of the consumer's income.

Imagine an experiment in which we could give the consumer just enough income, at the new price ratio, to attain the same level of utility as was originally attained, U_1. The budget line that permits this is parallel to the constraint I_2—the post price-change line—and tangent to U_1. Call this imaginary budget line I', and let it result in a tangency at E'. The reduction in jazz *that is due solely to the change in the relative prices, and that could keep the consumer at the indifference level U_1*, is called the **substitution effect** of the price change. This is defined in the figure as the distance from J_1 to J'.

The **substitution effect** of a price change is the adjustment of demand to a relative price change alone, and maintains the consumer on the initial indifference curve.

The remaining impact of the price change on the demand for jazz—the move from J' to J_2—is the **income effect**. The reason is that this move is associated with a *parallel* inward shift of the budget constraint. It is therefore an income effect.

The **income effect** of a price change is the adjustment of demand to the change in real income alone.

Income and substitution effects are frequently thought of as being obscure. But this is not so. They are vital to understanding policy issues, such as subsidies and taxation. Let us turn to an application.

6.7 Policy Application: Income Transfers and Price Subsidies

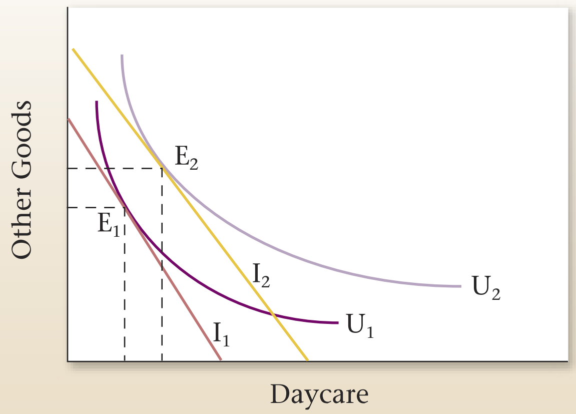
Government policies that improve the purchasing power of low-income households come in two main forms: pure income transfers and price subsidies. *Social Assistance* payments or *Employment Insurance* benefits, for example, provide an increase in income to the needy. Subsidies, on the other hand, enable individuals to purchase particular goods at a lower price—for example, rent or daycare subsidies.

In contrast to taxes, which *reduce* the purchasing power of the consumer, subsidies and income transfers *increase* purchasing power. We can compare the impact of an income transfer with that of a pure price subsidy, using Figure 6.10.

FIGURE 6.10

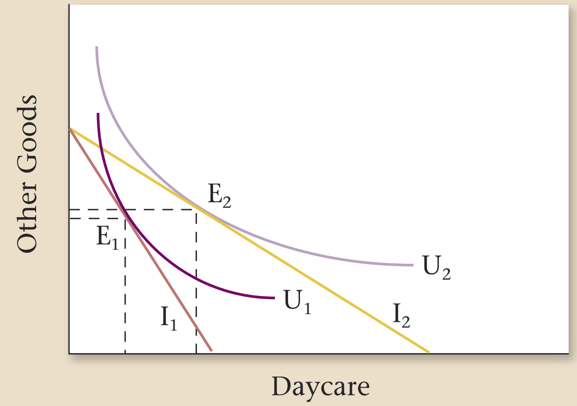
(a) Income Transfer

An increase in income because of a government transfer shifts the budget constraint outwards from I_1 to I_2. This parallel shift increases the quantity consumed of the target good (daycare) and other goods, unless one is inferior.



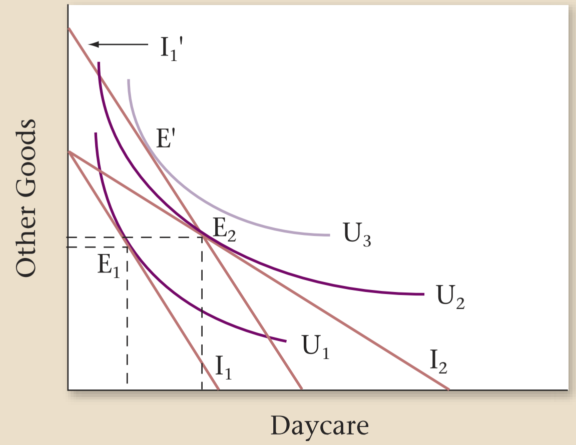
(b) Price Subsidy

A subsidization of the targeted good, by reducing its price, changes the budget constraint from I_1 to I_2. This induces the consumer to direct expenditure more towards daycare and less towards other goods than does an income transfer that does not change the relative prices of the two choices.



(c) Subsidy-Transfer Comparison

A subsidization of the targeted good induces the individual to consume at the equilibrium E_2, facing a budget constraint I_2. An income transfer that permits the individual to consume this same bundle is given by I_1'. However, it permits the individual to attain a higher level of satisfaction, denoted by the point E' on the indifference curve U_3.



In panel (a), an *income transfer* increases income from I_1 to I_2. The new equilibrium at E_2 reflects an increase in utility, and an increase in the consumption of *both* daycare and other goods.

Suppose now that a government program administrator decides that, while helping this individual to purchase more daycare accords with the intent of the transfer, she does not intend that government money should be used to purchase other goods. She therefore decides that a daycare *subsidy* program might better meet this objective than a pure income transfer.

A daycare subsidy reduces the price of daycare and therefore *rotates the budget constraint outwards around the intercept on the vertical axis*. At the equilibrium, we illustrate, in Figure 6.10 (b), that purchases of other goods change very little, and therefore most of the additional purchasing power is allocated to daycare.

Review Question 13

The different program outcomes can be understood in terms of income and substitution effects. The pure income transfer policy described in panel (a) contains only income effects, whereas the policy in panel (b) has a substitution effect in addition. Since the relative prices have been altered, the subsidy policy necessarily induces a substitution towards the good whose price has fallen. In this example, where there is a minimal change in "other good" consumption following the daycare subsidy, the substitution effect towards more daycare almost offsets the income effect that increases these other purchases.

Let us take the example one stage further. Taking the equilibrium E_2 in Figure 6.10 (b) as a starting point, suppose that, instead of a subsidy, we gave an income transfer *that enabled the consumer to purchase the combination E_2*. Such a transfer is represented in Figure 6.10(c) by a parallel outward shift of the budget constraint from I_1 to I_1', going through the point E_2. This budget constraint is very close to the one we used in establishing the substitution effect earlier. We now have a subsidy policy and an alternative income transfer policy, each permitting the same consumption bundle (E_2). The interesting aspect of this pair of possibilities is that the income transfer will enable the consumer to attain a higher level of satisfaction—for example, at point E'—and will also induce her to consume more of the good on the vertical axis.

APPLICATION BOX 6.4

Daycare Subsidies in Quebec

The Quebec provincial government subsidizes daycare very heavily. In 2004, many parents were able to place their children in daycare for $7 per day, thanks to subsidies. This policy of providing daycare at about 15 percent of the actual cost was originally intended to enable parents on lower incomes to work in the marketplace without having to spend too large a share of their earnings on daycare.

The consequences of such a heavy subsidization are predictable. First, there is an extreme excess demand, to such an extent that children are frequently placed on waiting lists for daycare places not long after they are born. This excess demand is exacerbated by the fact that the subsidy is open to parents of all income levels. Annual subsidy costs amount to $1.5 billion per year. The consequence of universality is that many low-income parents are not able to obtain subsidized daycare places for their children, because the limited number of such spaces is partly taken up by children from families with high incomes.

Next

We have now completed our discussion of the consumer and the demand side of the market. Our next task is to deepen our understanding of the supply side. We begin this by discussing the nature of the firm, and then proceed to an analysis of cost and productivity.

SUMMARY

- **Total utility** is the total amount of satisfaction obtained from a particular consumption bundle. **Marginal utility** is the utility obtained from consuming the last unit of a good. **Marginal utility diminishes** as more is consumed.
- **Measurable or cardinal** utility assumes that consumers can measure the number of utils of satisfaction they obtain from consuming different bundles of goods.
- **Ordinal utility** assumes that bundles of goods or services can be ranked according to the amount of satisfaction they yield.
- An **optimizing individual** chooses a consumption bundle so that the **marginal utility per dollar is equal** for the last unit of each good consumed. This is an **equilibrium condition** for utility-maximizing individuals.
- A **change in income or prices** requires an optimizing consumer to reallocate the available budget so that the marginal utilities per dollar are again equalized at the margin.
- Diminishing marginal utility establishes the **law of demand**: Other things being equal, a decline in price increases quantity demanded.
- **Consumer tastes** can be represented by a map of non-intersecting **indifference curves**. Higher curves are preferred to lower curves. Indifference curves must slope downwards: To preserve a given level of satisfaction, increases in the quantity of one good must be offset by reductions in the other.
- **Indifference curves exhibit a diminishing marginal rate of substitution**: To maintain a given level of satisfaction, consumers are willing to sacrifice progressively smaller amounts of a good as they have less of it, for equal increments of the other good.
- The **budget constraint** states that the sum of expenditures on all goods must not be greater than the total income available for consumption. It defines the **feasible** and **non-feasible sets**.
- **Utility-maximizing consumers** choose the highest possible indifference curve permitted by their budget constraint. This occurs when the budget line is tangent to an indifference curve. At this point, the **marginal rate of substitution equals the price ratio**.
- At constant prices, an **increase in income** leads to a parallel outward shift of the budget line. If goods are **normal**, the quantity demanded of each increases; if one is **inferior**, the demand for it declines.
- A **change in the price** of one good rotates the budget line around the intercept on the other axis. A price change contains a **substitution effect and an income effect**. The income effect of a price rise reduces the quantity demanded of normal goods. The substitution effect, induced by relative price movements alone, always leads the consumer to substitute away from the good that has risen in price.
- Government **income support programs** can be in the form of a **lump-sum income transfer** or a **price subsidy**. A subsidy skews expenditures more towards the goods that are subsidized than does a general income transfer.

KEY TERMS

KEY EQUATIONS AND RELATIONS

Equations

Consumer utility maximizing condition: $MU_S/P_S = MU_j/P_j$ **(6.1)** p. 106

Budget constraint: $P_S S + P_j J = I$ **(6.2)** p. 109

Slope of budget constraint = P_j/P_S **(6.3)** p. 110

Consumer optimum (indifference analysis): MRS = P_j/P_S **(6.4)** p. 113

REVIEW QUESTIONS

Answers to odd-numbered Review Questions can be found in Appendix A on the Online Learning Centre.

1. In the example given in Table 6.1 (page 103), suppose Neal experiences a small increase in income. Will he allocate it to snowboarding or jazz? (*Hint*: At the existing equilibrium, which activity will yield the higher MU for an additional dollar spent on it?)

2. Cappuccinos, C, cost $3 each, and compact disks, CDs, of your favourite artist cost $12 each. Income is $48.
   a. Draw the budget line to scale, with cappuccinos on the vertical axis, and compute its slope.
   b. If the price of cappuccinos rises to $6, compute the new slope.
   c. At the *initial* set of prices, are the following combinations of goods in the feasible set: (4C and 3CD), (6C and 2CD), (1C and 4CD)?
   d. Which combination(s) in part (c) lie inside the feasible set, and which lie on the boundary?

3. Henry spends his income on gasoline and "other goods."
   a. First, draw a budget constraint (with gasoline on the horizontal axis). Then, illustrate by how much the intercept on the gasoline axis changes in response to a doubling of the price of gasoline.
   b. Suppose that, in addition to a higher price, the government imposes a *ration* on Henry that limits his purchase of gasoline to less than some amount within his feasible set. Draw the new effective budget constraint.

4. Instead of the ration in the preceding question, suppose that the government increases taxes, in addition to the market price increase. Illustrate this new equilibrium.

5. The price of cappuccinos is \$3, the price of a theatre ticket is \$12, and consumer income is \$72.
   a. In a graph with theatre tickets on the vertical axis and cappuccinos on the horizontal axis, draw the budget constraint to scale, marking the intercepts.
   b. Suppose the consumer chooses the combination of 4 theatre tickets and 8 cappuccinos. Draw such a point on the budget constraint and map out the feasible and non-feasible regions.
   c. Is the combination of 3 tickets and 24 cappuccinos feasible?
   d. Is the combination in part c preferred to, or less preferred than, the chosen point?
   e. If the price of cappuccinos falls to \$2 per cup, is the combination of 24 cappuccinos and 3 tickets feasible?

6. Suppose that you are told that the indifference curves defining the trade-off for two goods took the form of straight lines. Which of the four properties outlined in Section 6.4 (page 112) would such indifference curves violate?

7. A student's income is \$50. Meals at the cafeteria cost \$5 per unit, and movies at the Student Union cost \$2 each.
   a. Draw the budget line to scale, insert some indifference curves, and choose the tangency equilibrium, denoted by E_0.
   b. If the price of meals falls to \$2.50, draw the new budget line. What can be said about the new equilibrium relative to E_0 if both goods are normal?
   c. If the price of movies also falls to \$1, draw the new budget line and illustrate the new equilibrium.
   d. How does the equilibrium in (c) differ from the equilibrium in (b)?

8. François likes to eat a nice piece of Brie cheese while having a glass of wine. He has a weekly gourmet budget of \$120. In a diagram with wine on the vertical axis and cheese on the horizontal axis, suppose that the intercepts are 10 bottles on the wine axis and 4 kilos on the cheese axis. He is observed to purchase 5 bottles of wine and 2 kilos of cheese.
   a. What are the prices of wine and cheese?
   b. Suppose that the price of wine increases to \$20 per bottle, but that François's income simultaneously increases by \$60. Draw the new budget constraint.
   c. Is François better off in the new or old situation?

9. Draw an extended indifference map with several budget constraints corresponding to different possible levels of income. Now find some optimizing—that is, tangency—points. Join all of these points. You have just constructed what is called an *income-consumption curve*.

10. Draw an extended indifference map again, this time considering several different prices for jazz, keeping the price of lift tickets constant. Draw in the resulting equilibria or tangencies and join up all of these points. You have just constructed a *price-consumption curve* for jazz.

11. From the equilibrium based on the data in Table 6.1 (page 103), let us compute some elasticities, using the midpoint formula that we developed in Chapter 4. Suppose that the price of jazz falls to \$16 per outing, from the initial price of \$20. Income remains at \$200.
    a. First compute Neal's new equilibrium, by computing a new MU/P schedule for jazz.
    b. What is his price elasticity of demand for jazz at this set of prices?
    c. What is the cross-price elasticity of demand for snowboarding, with respect to the price of jazz, at this set of prices? (*Hint*: Calculate the percentage change in the number of snowboard visits to Whistler, relative to the percentage change in the price of jazz.)

12. Suppose that movies are a normal good, but public transport is inferior. Draw an indifference map with a budget constraint and initial equilibrium. Now let income increase and draw a plausible new equilibrium.

13. Consider the set of choices facing the consumer in Figure 6.10 (b). The parent chooses between other goods and daycare. In response to a daycare subsidy, draw two possible equilibria, one where "other goods" purchased increase, and the other where they decrease. In which case are the goods on the axes substitutes? In which case are they complements?

14. *Internet* Go to the Web site www.expedia.ca or www.travelocity.com. Compare the prices you can get for different hotels in, and different flights to, a given destination for a particular week this year. If you find prices that are particularly low (high) relative to your expectations, would you consider extending (reducing) your stay? If you did react in this way, you would essentially be changing the marginal utility of the last day of your stay by altering the number of days. You would be adjusting quantity so as to equate the MU/P for this good with all other goods in your consumption bundle.

15. *Internet* Many of the goods we consume are considered worthy of subsidy by the government. Medical services are one; drugs and pharmaceuticals are another. As a student, you will be interested to know that most professors are subsidized by their university for medical costs not covered by the state. Does your provincial government have a drug prescription program that reduces the costs of drugs to citizens? Go to your provincial government's ministry of health to find out. Does your student union provide you with information on medical support available to students in your college or university?