Chapter 7

UTILITY AND DEMAND

Key Concepts

Household Consumption Choices
Consumption choices are determined by the interaction of the household’s consumption possibilities and its preferences.

♦ Consumption possibilities — the household’s purchases are limited by its income and by the prices of the goods and services. A budget line, as illustrated in Figure 7.1, shows the limits to what the household can purchase.

♦ Preferences — an individual’s likes and dislikes. Preferences are measured by utility. Utility is the benefit or satisfaction from consumption of a good or service.

♦ Total utility is the total benefit from consumption of goods and services.

♦ Marginal utility (MU) is the change in total utility from a one-unit increase in the quantity of a good consumed. MU is positive, but because of diminishing marginal utility, falls as the consumption of the good increases.

Maximizing Utility
Consumers strive to obtain the most total utility possible; they maximize their total utility. A consumer equilibrium occurs when all the consumer’s income is allocated among different products so that the combination of products maximizes the consumer’s total utility.

Total utility is maximized when:

♦ all the consumer’s income is spent; and

♦ the marginal utility per dollar spent, which is the marginal utility from a good divided by its price, is equal for all goods.

In terms of a formula, for the choice between two goods, sodas and movies, the second requirement for maximizing utility is:

$$\frac{MU_m}{P_m} = \frac{MU_s}{P_s}$$

with $MU_m$ the marginal utility from an additional movie, $P_m$ the price of a movie, and $MU_s$ and $P_s$ the analogous variables for soda.

Equating the marginal utilities per dollar is an example of marginal analysis. Marginal analysis says that if the marginal gain from an action exceeds the marginal loss, take the action.
Predictions of Marginal Utility Theory

A fall in the price of a movie raises the marginal utility per dollar spent on movies. Consumers increase the quantity of movies viewed as they substitute movies for sodas. There is a movement along the downward sloping demand curve for movies. The demand curve for soda, a substitute for movies, shifts leftward.

A rise in the price of soda results in a decrease in the quantity of sodas consumed. There is an upward movement along the negatively sloped demand curve for soda. The demand curve for movies, a substitute for soda, shifts rightward.

Movies and soda are normal goods, so an increase in income increases the consumption of both products and thereby increases the demand for both products.

The individual demand is the relationship between the price of an item and the quantity demanded by an individual. The market demand is the relationship between the price of an item and the total quantity demanded. The market demand curve is the horizontal sum of the individual demand curves.

If the marginal utility of a product diminishes only a little as the quantity consumed increases, the demand for the product is elastic; if it diminishes rapidly as the quantity consumed increases, the demand is inelastic.

Efficiency, Price, and Value

A consumer is using resources efficiently by buying the goods and services that maximizes his or her utility.

The marginal benefit from a good is the maximum price a consumer is willing to pay for another unit of the good when the consumer is maximizing his or her utility.

The distinction between total utility and marginal utility solves the paradox of value. Diamonds are less useful than water (that is, they have lower total utility), but diamonds have a higher price since they have higher marginal utility because most people have only a few diamonds. Water is more useful (it has higher total utility), but has a lower price since it has a lower marginal utility because the quantity of water consumed is large.

Helpful Hints

1. The Meaning of Consumer Equilibrium:
   This chapter introduces another equilibrium, namely, the consumer equilibrium. What does consumer equilibrium mean? Recall that the general definition of equilibrium is a situation “where opposing forces balance.” When that occurs, there is no incentive for any changes. In the supply and demand model, equilibrium is attained at the price at which the quantity supplied equals the quantity demanded. At that price neither demanders nor suppliers have an incentive to change their behavior. Consumer equilibrium is similar. When the equilibrium conditions are satisfied, the consumer has the most total utility that can be attained. The consumer therefore has no incentive to change the combination of goods consumed.

2. The Marginal Utility per Dollar Formula:
   One condition for consumer equilibrium is that the marginal utility per dollar spent on a good must equal the marginal utility per dollar of the other goods. In terms of a formula, for two goods, X and Y, the requirement is that the consumer allocate his or her income so that

   $\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$

   Why is this condition necessary for consumer equilibrium? Recall that the term $MU_X/P_X$ is the marginal utility per dollar spent on good X so it is the utility gained if spending on X is increased a dollar or the utility lost if spending on X is decreased by a dollar. $MU_Y/P_Y$ tells us similar information about Y. Anytime there is an inequality between the marginal utility per dollar spent on different goods, the consumer can increase his or her total utility by buying less of the product with the low $MU/P$ and by buying more of the good with the high $MU/P$. Only when the marginal utilities per dollar are equal does the consumer not gain by rearranging the consumption bundle. As a result, only when this equality holds (and the consumer spends all his or her income) is the consumer in equilibrium by obtaining the maximum possible total utility.
Questions

True/False and Explain

Household Consumption Choices
1. A budget line shows the different combinations of goods and services a consumer can afford to buy.
2. Utility measures a consumer’s level of satisfaction.
3. Marginal utility measures the additional utility from consuming an additional unit of a good.
4. As more of a good is consumed, diminishing marginal utility means that the total utility from the good diminishes.

Maximizing Utility
5. Economists assume that households choose their consumption to maximize their marginal utility per dollar spent.
6. The marginal utility per dollar spent on a soda is $MU_s/P_s$, where $MU_s$ is the marginal utility from a soda and $P_s$ is the price of a soda.
7. If the marginal utilities from consuming two goods are equal and the consumer is spending all of his or her income, the consumer is in equilibrium.
8. A household is maximizing its utility if the marginal utility per dollar spent is equal for all goods and the household spends all its income.
9. If the marginal utility per dollar spent on pizza exceeds the marginal utility per dollar spent on tacos, total utility rises by increasing consumption of pizza and decreasing consumption of tacos.

Predictions of Marginal Utility Theory
10. Marginal utility theory predicts that when the price of a product rises, a consumer buys more because the marginal utility from the product is larger.
11. An individual demand curve shows the total market demand for an individual product.
12. The market demand curve is the horizontal sum of all individual demand curves.
13. If the marginal utility from a good diminishes rapidly as more is consumed, demand for the good is inelastic.

Efficiency, Price, and Value
14. Marginal utility theory shows that goods with high prices (such as diamonds) have high total utilities.
15. By maximizing his or her utility, a consumer uses his or resources efficiently.

Multiple Choice

Household Consumption Choices
1. A household’s consumption choices are determined by
   a. prices of goods and services.
   b. its income.
   c. its preferences.
   d. all of the above.
2. A household’s consumption is limited by
   a. its preferences.
   b. only its income.
   c. only the prices it pays for what it buys.
   d. both its income and the prices it pays for what it buys.
3. Which of the following is NOT an assumption of marginal utility theory?
   a. People derive utility from their consumption.
   b. More consumption yields more total utility.
   c. Marginal utility diminishes with more consumption.
   d. Utility can be measured and the units of utility are precisely defined.
4. As more of a good is consumed,
   a. both the marginal utility and total utility from the good rise.
   b. the marginal utility from the good rises and the total utility falls.
   c. the marginal utility from the good falls and the total utility rises.
   d. both the marginal utility and total utility from the good fall.

Maximizing Utility
5. Economists assume that consumers’ objective is to
   a. maximize their total utility.
   b. maximize their marginal utility.
   c. maximize their income.
   d. none of the above.
6. Andrew finds that the marginal utility from a BMW exceeds that from a slice of pizza. Andrew is spending all of his income. These conditions mean that Andrew
   a. is not maximizing his utility.
   b. is maximizing his utility.
   c. must increase his income in order to maximize his utility.
   d. might be maximizing his utility, but we cannot tell without more information.

7. When Kelly maximizes her utility, she spends all of her income and makes sure that the
   a. marginal utility of each good she buys is as high as possible.
   b. marginal utility of each good she buys is equal.
   c. amount of each good she buys is the same.
   d. marginal utility of a good divided by its price is equal for each good she buys.

Use the following table for the next four questions.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Law books</th>
<th>Paper pads</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

8. Amy spends her entire income of $10 on law books and yellow paper pads. Law books cost $2 and paper pads cost $4. The marginal utility of each good is given in Table 7.1. If Amy is maximizing her utility, how many yellow paper pads does she buy?
   a. 0
   b. 1
   c. 2
   d. 3

9. Amy’s total utility at her consumer equilibrium is
   a. 82
   b. 48
   c. 46
   d. 40

10. Amy’s income rises to $16. She continues to buy only law books and yellow paper pads and she continues to maximize her utility. How many yellow paper pads does she buy after her income increases?
   a. 0
   b. 1
   c. 2
   d. 3

11. After Amy’s income rises to $16, what is her total utility?
   a. 82
   b. 64
   c. 40
   d. 36

12. Bobby buys only soda and pizza and is buying the amounts that maximize his utility. The marginal utility from a soda is 10, and the price of the soda is $1. The marginal utility from a slice of pizza is 20. The price of a slice of pizza must be
   a. $20.
   b. $2.
   c. $1.
   d. some amount that cannot be calculated without more information.

13. Meg buys only soda and pizza and is buying the amounts that maximize her utility. The marginal utility from a soda is 30 and the price of the soda is $1. The marginal utility from a slice of pizza is 60. The price of a slice of pizza must be
   a. $20.
   b. $2.
   c. $1.
   d. some amount that cannot be calculated without more information.

14. If Soula is maximizing her utility, when two goods have the same price she will
   a. buy only one.
   b. buy equal quantities of both.
   c. get the same marginal utility from each.
   d. get the same total utility from each.
Predictions of Marginal Utility Theory

15. Marginal utility theory predicts that a rise in the price of a banana leads to
   a. the demand curve for bananas shifting rightward.
   b. the demand curve for bananas shifting leftward.
   c. a movement upward along the demand curve for bananas.
   d. a movement downward along the demand curve for bananas.

16. Lisa buys only compact discs and tapes and spends all her income. The marginal utility from a compact disc is 30 and the marginal utility from a tape is 20. The price of a compact disc is $15 and the price of a tape is $10. To maximize her utility, Lisa should
   a. increase her consumption of compact discs.
   b. increase her consumption of tapes.
   c. not change her consumption of compact discs and tapes.
   d. lower the price of a tape.

17. Michael consumes only steak and lobster. Suppose that the price of a steak rises but Michael’s income does not change. After he is back at a consumer equilibrium, compared to the situation when steak was cheaper, the marginal utility from the last steak will
   a. have increased.
   b. have not changed.
   c. have decreased.
   d. not be comparable with the marginal utility from before the price hike.

18. Michael consumes only steak and lobster. Both are normal goods. Michael’s income increases but the prices of neither steak nor lobster change. After he is back at equilibrium, compared to the situation when Michael’s income was less, the marginal utility from the last steak will
   a. have increased.
   b. have not changed.
   c. have decreased.
   d. not be comparable with the marginal utility from before the increase in income.

19. Which of the following statements is true?
   a. Marginal utility theory predicts that an increase in a consumer’s income increases consumption of all goods.
   b. It is possible to derive the law of demand — that a higher price decreases the quantity demanded — using marginal utility theory.
   c. Marginal utility theory makes no prediction about a consumer’s responses to hikes in the prices of the goods and services he or she consumes.
   d. Marginal utility theory predicts that all goods are normal goods and that all goods are substitutes for each other.

20. The marginal utility from gasoline diminishes very rapidly. As a result, the
   a. demand curve for gasoline is upward sloping and very steep.
   b. demand for gasoline is price inelastic.
   c. demand for gasoline is price elastic.
   d. consumer surplus from gasoline is likely to be nonexistent.

Efficiency, Price, and Value

21. The fact that rubies are more expensive than milk reflects the fact that for most consumers
   a. the total utility from rubies exceeds that from milk.
   b. the marginal utility from rubies equals that from milk.
   c. more milk is consumed than rubies.
   d. a quart of rubies is prettier than a quart of milk.

22. The principle of diminishing marginal utility means that the consumer surplus from the second slice of pizza is
   a. greater than that from the first.
   b. equal to that from the first.
   c. less than that from the first.
   d. not comparable to that from the first.
23. In Figure 7.2 the consumer is buying 4 units at a price of $2 each. Consumer surplus is the area marked
   a. A
   b. B
   c. C
   d. None of the above.

**Short Answer Problems**

1. Explain how the consumer equilibrium condition and the principle of diminishing marginal utility can be used to derive the law of demand.

2. Jake consumes only fish sticks and broccoli. He is initially maximizing his utility, so he spends all of his income on fish sticks and broccoli and sets
   \[
   \frac{MU_{FS}}{P_{FS}} = \frac{MU_B}{P_B}
   \]
   with \(MU_{FS}\) the marginal utility from fish sticks; \(P_{FS}\) the price of fish sticks; \(MU_B\) the marginal utility from broccoli; and \(P_B\) the price of broccoli. The price of fish sticks rises (from 70 cents a pound to 80 cents) as a result of the shift in the supply curve shown in Figure 7.3. Use the condition for utility maximization to explain how Jake will move to a new utility-maximizing consumer equilibrium. Also show the connection between your explanation and the change in the figure from 11,000 pounds of fish sticks being consumed to 10,000 pounds.

3. Loren is in equilibrium, spending her income of $200 buying 2 video games at a price of $40 each and 8 compact discs at a price of $15 each. Then, inflation causes the price of a compact disc and a video game to double (to $80 and $30, respectively) while Loren’s income also doubles (to $400). What happens to Loren’s purchases of video games and compact discs: Do both increase, decrease, not change, or change in some direction that cannot be determined?

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Bats</th>
<th>Lizards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
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</tr>
<tr>
<td>3</td>
<td>14</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>26</td>
</tr>
</tbody>
</table>

4. Igor maximizes his utility by spending his entire income of $16 on bats and lizards. Table 7.2 has Igor’s marginal utility from each good. The price of a bat is $2, and he buys 2 bats. The marginal utility from the last lizard he buys is 36.
   a. Calculate the price of a lizard two ways.
   b. What is Igor’s total utility?
   c. Igor could buy 4 lizards. If he did so and also purchased the maximum number of bats possi-
ble given his income, what would be his total utility then?

d. The marginal utility of even the fourth lizard exceeds the marginal utility from the first bat; yet when maximizing his utility, Igor nonetheless buys some bats. Explain why Igor buys some bats. (Hint: Igor is not batty.)

### Table 7.3

<table>
<thead>
<tr>
<th>Bags of popcorn</th>
<th>Total utility</th>
<th>Marginal utility from last bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>XX</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
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<td>2</td>
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<td>72</td>
<td>XXX</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>XXX</td>
</tr>
</tbody>
</table>

### Table 7.4

<table>
<thead>
<tr>
<th>Candy bars</th>
<th>Total utility</th>
<th>Marginal utility from last bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>XX</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>14</td>
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<tr>
<td>2</td>
<td>26</td>
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<td>51</td>
<td>XXX</td>
</tr>
<tr>
<td>6</td>
<td>57</td>
<td>XXX</td>
</tr>
</tbody>
</table>

5. Tables 7.3 and 7.4 give Liz’s utility from her consumption of popcorn and candy.
   a. Complete Tables 7.3 and 7.4.
   b. Suppose that the price of a bag of popcorn is $1 and that the price of a candy bar is $0.50. Use the information in Tables 7.3 and 7.4 to complete Table 7.5. There $MU/P$ means marginal utility divided by price, which is equivalent to marginal utility per dollar spent.
   c. Liz’s weekly allowance is $4. If she spends her entire allowance on popcorn and candy, how much popcorn and how many candy bars will Liz consume each week?

### Table 7.5 Liz’s Marginal Utilities per Dollar

<table>
<thead>
<tr>
<th>Bags of popcorn</th>
<th>$MU/P$</th>
<th>Candy bars</th>
<th>$MU/P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
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<td>2</td>
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<tr>
<td>6</td>
<td></td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

d. In part (c), what is Liz’s total utility?

e. Now suppose that Liz consumes 3 bags of popcorn and 2 candy bars. Explain why she is not maximizing her utility. Be sure to compare her total utilities for the two consumption bundles — your answer to part (c) and the 3 bags of popcorn, 2 candy bars used in this question. Also use the $MU/P$ terms to explain why consuming 3 bags of popcorn and 2 candy bars is not optimal.

6. Suppose that Liz’s utility remains as it is in Problem 5 but the price of a candy bar doubles to $1. The price of a bag of popcorn, however, does not change — it remains equal to $1 per bag.
   a. Construct a new table (similar to Table 7.5) of the marginal utility per dollar for popcorn and candy bars.
   b. Liz’s allowance continues to be $4. After the price change, how much popcorn and how many candy bars will she consume each week?
   c. Are popcorn and candy bars substitutes or complements for Liz? Why?
   d. Based on the information you have obtained, draw Liz’s demand curve for candy bars.

7. Lori has $40 a week that she spends on playing tennis and buying comic books. A set of tennis costs $1 and a comic book costs $2. One week when Lori spent all her income, she found that the marginal utility from the last set of tennis was 16 and that the marginal utility from the last comic book was 20.
   a. Show that Lori’s choice of tennis sets and comic books was not optimal.
   b. To increase her utility, which good should Lori consume more of and which less?
8. Table 7.6 shows Alice’s, Bob’s, and Carol’s demand schedules for rutabagas (a turnip-like vegetable that is one of Canada’s main exports).

a. Assume that Alice, Bob, and Carol comprise the entire market and complete the table by calculating the market demand schedule.

b. On a single diagram, draw the individual demand curves for Alice, Bob, and Carol, as well as the market demand curve.

9. What is the relationship between price elasticity and how rapidly marginal utility diminishes as more of a good is consumed? Why does this relationship exist?

10. How does marginal utility theory resolve the diamond/water paradox of value?

You’re the Teacher

1. “This whole idea of marginal utility is stupid. I mean, after all, who goes into a store and calculates the marginal utility from something before deciding to buy it? I just look at something, look at the price, think about how much money I’ve got in my pocket, and then decide whether or not to buy the thing. No one I know calculates marginal utilities when they go shopping, so why do I have to learn this stuff?” What response do you make to your classmate? (Don’t agree!)

2. “One thing I don’t understand about all this material dealing with consumers and their choices is how I am supposed to think about products like apartments. Suppose that the rent in my apartment goes up. Marginal utility theory says that I will consume fewer apartments. But what does this mean? I’ll still rent one apartment. And, if rent goes down, I sure won’t go out and rent two! How does marginal utility theory account for this fact?” Your friend has come up with a good question; provide an equally good explanation to help your friend understand this point.
**Answers**

**True/False Answers**

**Household Consumption Choices**

1. T The budget line shows the limits to what a consumer can afford to purchase.

2. T Utility measures an individual’s satisfaction without any regard to the prices of the items or the person’s income.

3. T As this definition stresses, marginal utility is the extra utility from an extra unit of a good.

4. F The principle of diminishing marginal utility implies that the marginal utility from additional units declines.

**Maximizing Utility**

5. F Economists assume that households maximize their total utility.

6. T The question presents the definition of marginal utility per dollar.

7. F To be in equilibrium, the marginal utilities divided by the prices, $MU/P$, must be equal.

8. T These are the two conditions necessary for a household to maximize its utility.

9. T In this case, the gain in utility from consuming one dollar more of pizza exceeds the loss in utility from consuming one dollar less of tacos.

**Predictions of Marginal Utility Theory**

10. F Marginal utility theory predicts that the quantity demanded of a product decreases when its price rises.

11. F An individual demand curve shows one individual’s demand for a product.

12. T The market demand shows the demand from all individuals.

13. T If the marginal utility declines rapidly, then when the price of the good changes it requires only a small change in consumption of the good to restore its marginal utility per dollar back to equality with the marginal utility per dollar for other goods.

**Efficiency, Price, and Value**

14. F Products with high prices must have high marginal utilities, not necessarily high total utilities.

15. T By maximizing his or her utility, the person is consuming the combination of goods and services that gives him or her the highest value, which means no resources are wasted.

**Multiple Choice Answers**

**Household Consumption Choices**

1. d A household’s consumption is determined by its preferences, its income, and prices of goods.

2. d A household’s consumption purchases are limited by its budget, which depends on the household’s income and the prices of the goods and services it buys.

3. d Utility cannot be measured, so its units cannot be precisely defined.

4. c The marginal utility diminishes and, as a result, total utility increases but by less as each additional unit of the good is consumed.

**Maximizing Utility**

5. a By maximizing their total utilities, people make themselves as well off as possible.

6. d If Andrew is maximizing his utility, we know that $MU_{pizza}/P_{pizza} = MU_{BMW}/P_{BMW}$ but without information about the price of a BMW and a pizza, we cannot determine whether this condition is satisfied.

7. d To maximize her utility, Kelly consumes the amounts of the different goods that equalize the marginal utility per dollar of each good.

8. b When Amy buys 1 yellow paper pad, she can buy 3 books. With this consumption bundle, $MU_{pad}/P_{pad} = 4$ and $MU_{book}/P_{book} = 4$.

9. c Amy receives utility of 16 from yellow paper pads and 30 (12 + 10 + 8) from law books, for total utility of 46.

10. c Amy now buys 2 paper pads and 4 law books because this combination of pads and books uses all her income and sets $MU_{pad}/P_{pad} = MU_{book}/P_{book} = 3$.

11. b Amy has utility of 28 (16 + 12) from yellow paper pads and 36 (12 + 10 + 8 + 6) from law books for total utility of 64.

12. b To maximize his utility, Bobby must set $MU_{soda}/P_{soda} = MU_{pizza}/P_{pizza}$. Because
Because more milk is consumed, the \(MU_{\text{soda}} / P_{\text{soda}}\) in order for \(MU_{\text{pizza}} / P_{\text{pizza}}\) also to equal 10, with \(MU_{\text{pizza}} = 20, \ P_{\text{pizza}} = \$2\).

13. **b** The same reasoning outlined in the answer to Question 12 applies and \(P_{\text{pizza}} = \$2\). Even though Bobby’s and Meg’s marginal utilities are not the same, nonetheless to maximize their utility, both set \(MU_{\text{soda}} / P_{\text{soda}}\) equal to \(MU_{\text{pizza}} / P_{\text{pizza}}\).

14. **c** Because \(MU/P\) is equal for all goods, if two products have the same \(P\), they must have the same \(MU\).

**Predictions of Marginal Utility Theory**

15. **c** With a higher price for a banana, consumers decrease the quantity they consume, which raises the marginal utility of bananas.

16. **c** \(MU_{\text{CDs}} / P_{\text{CDs}} = MU_{\text{tape}} / P_{\text{tape}}\). Lisa is already maximizing her utility.

17. **a** Michael consumes fewer steaks, so the marginal utility from the last steak he consumes is higher.

18. **c** Michael consumes more steak because steak is a normal good. Because he consumes more steak, the marginal utility from the last steak he consumes is lower than before.

19. **b** By making assumptions about people’s behavior — that they aim to obtain the maximum total utility and that their marginal utility diminishes as they consume more of a product — it is possible to derive the law of demand.

20. **b** Consider a large fall in the price of gasoline. To bring \(MU_{\text{gas}} / P_{\text{gas}}\) back to equality with \(MU / P\) for other goods, more gasoline will be consumed, which lowers \(MU_{\text{gas}}\). If the marginal utility declines rapidly as more gasoline is consumed, only a little more gasoline is consumed before \(MU_{\text{gas}}\) falls enough so that \(MU_{\text{gas}} / P_{\text{gas}}\) equals \(MU / P\) for everything else. As a result, the large fall in the price of gasoline leads to only a small increase in the quantity demanded.

**Efficiency, Price, and Value**

21. **c** Because more milk is consumed, the \(MU\) from milk is lower than the \(MU\) from rubies.

22. **c** Because the second slice of pizza is valued less than the first because of diminishing marginal utility, consumer surplus from the second slice is less than that from the first.

23. **a** Consumer surplus is the area under the demand curve and above the price paid.

**Answers to Short Answer Problems**

1. Suppose that an individual in consumer equilibrium consumes only two goods, \(X_0\) units of good \(X\) and \(Y_0\) units of good \(Y\). Therefore at consumption levels \(X_0\) and \(Y_0\), the marginal utility per dollar spent on \(X\) equals the marginal utility per dollar spent on \(Y\). If the price of \(X\) rises, how does the consumer respond? The marginal utility per dollar spent on \(X\) declines and becomes less than the marginal utility per dollar spent on \(Y\). To restore equilibrium, the consumer must increase the marginal utility of \(X\) and decrease the marginal utility of \(Y\). From the principle of diminishing marginal utility, the only way to do so is to decrease the consumption of \(X\) and increase the consumption of \(Y\). This action, then, demonstrates the law of demand: A rise in the price of \(X\) results in a decrease in the consumption of \(X\).

2. When the price of a fish stick rises, \(\frac{MU_{\text{FS}}}{P_{\text{FS}}} < \frac{MU_{\text{B}}}{P_{\text{B}}}\).

Jake no longer is in equilibrium because the utility per dollar spent on fish sticks is less than that for broccoli. So Jake increases his total utility by spending fewer dollars on fish sticks and more on broccoli. These changes make \(MU_{\text{FS}}\) rise and \(MU_{\text{B}}\) fall, which will eventually result in equality between the marginal utility per dollar spent on fish sticks and broccoli. Jake’s decreased consumption of fish sticks moves him along his individual demand curve for fish sticks. Indeed, consumers in general decrease the quantity of fish sticks they consume, which accounts for the movement along the market demand curve in the figure from the initial equilibrium (with 11,000 pounds of fish sticks produced and consumed) to the new equilibrium (with only 10,000 pounds of fish sticks produced and consumed).

3. After the inflation Loren still purchases 2 video games and 8 compact discs. Loren buys the combi-
nation of games and CDs that maximizes her utility, setting \( MU_{\text{games}}/P_{\text{games}} = MU_{\text{CDs}}/P_{\text{CDs}} \) and spending all her income. For the first requirement, before the inflation the combination of 2 games and 8 CDs maximized Loren’s utility so that it was the case that \( MU_{\text{games}}/P_{\text{games}} = MU_{\text{CDs}}/P_{\text{CDs}} \). After the inflation, the marginal utilities do not change, but the prices double. So, \( MU/P \) for games equals \( MU_{\text{games}}/(2 \times P_{\text{games}}) \) and \( MU/P \) for CDs equals \( MU_{\text{CDs}}/(2 \times P_{\text{CDs}}) \). The \( MU/P \) for video games is half what it was before, as is the \( MU/P \) for compact discs. Because they were equal before the inflation, dividing each by 2 does not change their equality; that is, after the inflation the equality of the marginal utilities per dollar condition for utility maximization is still met. For the second condition, that all income is spent, after the inflation, buying 2 video games and 8 compact discs uses up all of Loren’s income, so the second criteria is met. The combination of 2 games and 8 CDs continues to maximize Loren’s utility, so that is the combination she will purchase.

4. a. One of two methods for calculating the price of a lizard is based on the fact that Igor spends all his income on bats and lizards. This fact means that:

\[
Y = P_b \times Q_b + P_l \times Q_l
\]

where \( Y \) is Igor’s income, \( P_b \) is the price of a bat, \( Q_b \) is the quantity of bats bought, \( P_l \) is the price of a lizard, and \( Q_l \) is the quantity of lizards purchased. We know that \( Y = 16 \), \( P_b = 2 \), \( Q_b = 2 \), and, if the marginal utility of the last lizard is 36, that \( Q_l = 3 \). Substituting these values, we solve for \( P_l \):

\[
\begin{align*}
16 &= 2 \times 2 + P_l \times 3 \\
12 &= P_l \times 3 \\
4 &= P_l
\end{align*}
\]

The second way to determine the price of a lizard uses the condition for utility maximization, that the marginal utility per dollar spent on a lizard equals the marginal utility per dollar spent on a bat. In terms of a formula, we have that:

\[
\frac{MU_l}{P_l} = \frac{MU_{bk}}{P_b}
\]

We know that \( MU_l = 36 \), \( P_b = 2 \), and, if Igor buys 2 bats, that \( MU_{bk} = 18 \). Substituting these values, we solve for \( P_l \):

\[
\begin{align*}
36 &= 18 \times \frac{36}{P_l} \\
36 &= 9 \\
4 &= P_l
\end{align*}
\]

b. Igor receives total utility of 38 from his bats (20 + 18) and total utility of 130 from his lizards (50 + 44 + 36). Igor’s overall total utility from bats and lizards is 168.

c. If Igor buys 4 lizards, because each lizard costs $4, he spends all his income and so can purchase no bats. In this case, Igor’s total utility is 156 (50 + 44 + 36 + 26).

d. Even though each bat returns less marginal utility than a lizard, bats are less expensive than lizards. So when Igor is selecting his utility-maximizing combination of bats and lizards, the cheapness of bats means that he will buy some. For example, compare Igor’s total utility when he buys 2 bats and 3 lizards, given in part (b) as 168, with his total utility when he buys 0 bats and 4 lizards, computed in part (c) as 156. Clearly Igor’s total utility is higher when he buys 2 bats and 3 lizards than when he concentrates solely on lizards by purchasing 4 lizards and 0 bats.

5. a. Tables 7.7 and 7.8 (on the next page) are completed versions of Tables 7.3 and 7.4, respectively.

b. Table 7.9 (on the next page) completes Table 7.5.

<table>
<thead>
<tr>
<th>Bags of popcorn</th>
<th>Total utility</th>
<th>Marginal utility from last bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>XX</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>62</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>72</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>8</td>
</tr>
</tbody>
</table>
TABLE 7.8
Liz’s Utility from Candy Bars

<table>
<thead>
<tr>
<th>Candy bars</th>
<th>Total utility from last bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td>5</td>
<td>51</td>
</tr>
<tr>
<td>6</td>
<td>57</td>
</tr>
</tbody>
</table>

TABLE 7.9
Liz’s Marginal Utilities Per Dollar

<table>
<thead>
<tr>
<th>Bags of popcorn</th>
<th>MU/P</th>
<th>Candy bars</th>
<th>MU/P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

6. a. Table 7.10 shows Liz’s MU/P for popcorn and candy after the price hike for candy. The price rise did not change Liz’s MUs.

b. Liz will consume 3 bags of popcorn and 1 candy bar. This combination of popcorn and candy spends all of Liz’s income ($4), and the marginal utility per dollar spent is the same for popcorn and candy bars (14).

c. Popcorn and candy bars are substitutes for Liz because a rise in the price of a candy bar leads to an increase in the demand for popcorn.

d. Two points on Liz’s demand curve have been identified. When the price of a candy bar is $1, 1 candy bar will be demanded, and when the price is $0.50, 4 candy bars will be demanded. The demand curve is a line through these two points, as illustrated in Figure 7.4.

FIGURE 7.4
Short Answer Problem 6
7. a. Lori is not maximizing her utility because the marginal utility per dollar spent on the set of tennis ($16/2 = 8$) is not the same as the marginal utility per dollar spent on comic books ($20/2 = 10$).

b. To equate the marginal utilities per dollar spent (and by so doing increase her total utility), Lori will increase her consumption of tennis and decrease her consumption of comic books. To show that this change raises her utility, we can use marginal analysis. By cutting back a dollar on comic books, Lori loses 10 units of utility; but by then spending the dollar on tennis, Lori gains 16 units. Therefore, on net, Lori gains 6 units of utility (16 gained from tennis minus 10 lost from comic books) by changing her consumption bundle.

8. a. Table 7.11 gives the market demand. For an example of how to calculate these answers, at the price of $0.50 per pound, the market demand is 24, with 10 demanded by Alice plus 4 demanded by Bob plus 10 demanded by Carol.

b. Figure 7.5 shows the three individual demand curves and the market demand curve, the sum of Alice’s plus Bob’s plus Carol’s demand.

9. The more rapidly the marginal utility from a good diminishes as more of the good is consumed, the less elastic is the demand for the product. Conversely, the less rapidly the marginal utility diminishes, the more elastic is the demand for the product. For example, take the case of sugar. The marginal utility of sugar diminishes rapidly as more units of it are consumed. Initially consumers set the $MU/P$ from sugar equal to the $MU/P$ for all other products. Suppose that the price of sugar falls by a substantial amount. This change causes the marginal utility per dollar spent on sugar, $MU/P$, to rise (a lot) because $P$ falls (a lot). In response to the increase in the marginal utility per dollar spent on sugar, people consume more sugar. This increase in consumption reduces sugar’s marginal utility, and the $MU/P$ from sugar falls. Enough additional sugar will be consumed so that the $MU/P$ from sugar falls back to equality with the $MU/P$ from all other products. How much additional sugar consumption is required? Because the marginal utility from sugar falls rapidly as more sugar is consumed, not very much more sugar must be consumed in order to reduce substantially the $MU/P$ of sugar. So when the marginal utility from a good diminishes rapidly as more is consumed, a large price change brings only a small change in the quantity demanded, which means that the demand for the product is price inelastic.

10. The paradox of value is resolved by recognizing the difference between the total utility from a product and its marginal utility. For instance, the total utility from consumption of water is large but because we consume a lot of water, the marginal utility from the last gallon of water is small. The total utility from the consumption of diamonds is small, but because we consume few diamonds, the marginal utility of the last diamond is large. In consumer equilibrium, because the marginal utility per dollar spent is the same for water and diamonds, the price of water must be low and the price of a diamond must be high. The paradox of value is solved because it is the
marginal utilities — not the total utilities — that are related to the price of diamonds and water.

**You’re the Teacher**

1. “You’re right that no one goes into a store and calculates marginal utility before deciding whether to buy something. But that is missing the point of marginal utility theory. Marginal utility theory is not trying to explain how people make decisions about what to buy. Instead, it is based on the assumption that people make themselves as well off as possible — maximize their utility — to explain how people respond to changes in prices and incomes. It’s not a theory of people’s thoughts. It’s a theory of people’s actions.”

2. “What you are missing is the fact that apartments are not all identical. My apartment is larger than yours. If the price of an apartment rose — rents go up — I’d move to a smaller apartment. Or, if the price went down, I wouldn’t rent two apartments, but I’d move to a still larger one. So think about it this way: If the price of an apartment goes up, we’ll consume ‘fewer’ apartments by renting smaller apartments; and, if the price goes down, we’ll consume ‘more’ apartments by renting larger ones.”
Chapter Quiz

1. As Sam’s consumption of rice decreases, his
   a. average utility from rice falls.
   b. total utility from rice falls.
   c. marginal utility from rice decreases.
   d. elasticity of utility from rise increases.

2. When Romona is in consumer equilibrium,
   a. her marginal utilities from all goods are equal.
   b. her total utilities from all goods are equal.
   c. her total utility per dollar from all goods are equal.
   d. her marginal utility per dollar from all goods are equal.

3. According to marginal utility theory, consumers
   a. maximize their total utility and minimize their marginal utility.
   b. maximize their total utility given the prices of goods and their income.
   c. maximize their income.
   d. spend the most on least expensive goods.

4. The price of a soda is $1 and the price of a movie is $5. Bobby spends all of his income on sodas and movies. If Bobby’s marginal utility from a soda is 10 and his marginal utility from a movie is 20, to maximize his utility Bobby definitely ____ the number of movies he sees and ____ his consumption of sodas.
   a. increases; increases
   b. increases; decreases
   c. decreases; increases
   d. decreases; decreases

5. When economists talk of inferior goods they mean only goods for which
   a. the demand curve slopes downward.
   b. marginal utility falls as more of the good is consumed.
   c. marginal utility is always negative.
   d. demand decreases when income rises.

6. The statement that more consumption yields more utility is
   a. a prediction of marginal utility theory.
   b. an assumption of marginal utility theory.
   c. a fallacy disproven by marginal utility theory.
   d. true of goods but not of services.

7. Marginal utility theory predicts that an increase in the price of a good ____ the quantity demanded.
   a. increases
   b. has no effect on
   c. decreases
   d. perhaps increases, has no effect on, or decreases, depending on whether the good is a normal good or inferior good.

8. The market demand curve for rutabagas is
   a. used to derive the individual demand curves.
   b. the sum of the quantity demanded by each individual at each price.
   c. more elastic than any individual demand curve.
   d. less elastic than any individual demand curve.

9. Kathy is in consumer equilibrium and consumes many goods. For her, purses are a normal good. An increase in her income changes her to a new equilibrium in which her consumer surplus from purses is
   a. zero, as it was in the old equilibrium.
   b. positive and equal to what it was in the old equilibrium.
   c. lower than in the old equilibrium.
   d. higher than in the old equilibrium.

10. Megan buys only soda and pizza and is buying the amounts that maximize her utility. The marginal utility from a soda is 10 and the price of a soda is $1. The marginal utility from a pizza is 80. Hence the price of a pizza must be
    a. $80.
    b. $10.
    c. $8.
    d. $4.

The answers for this Chapter Quiz are on page 367