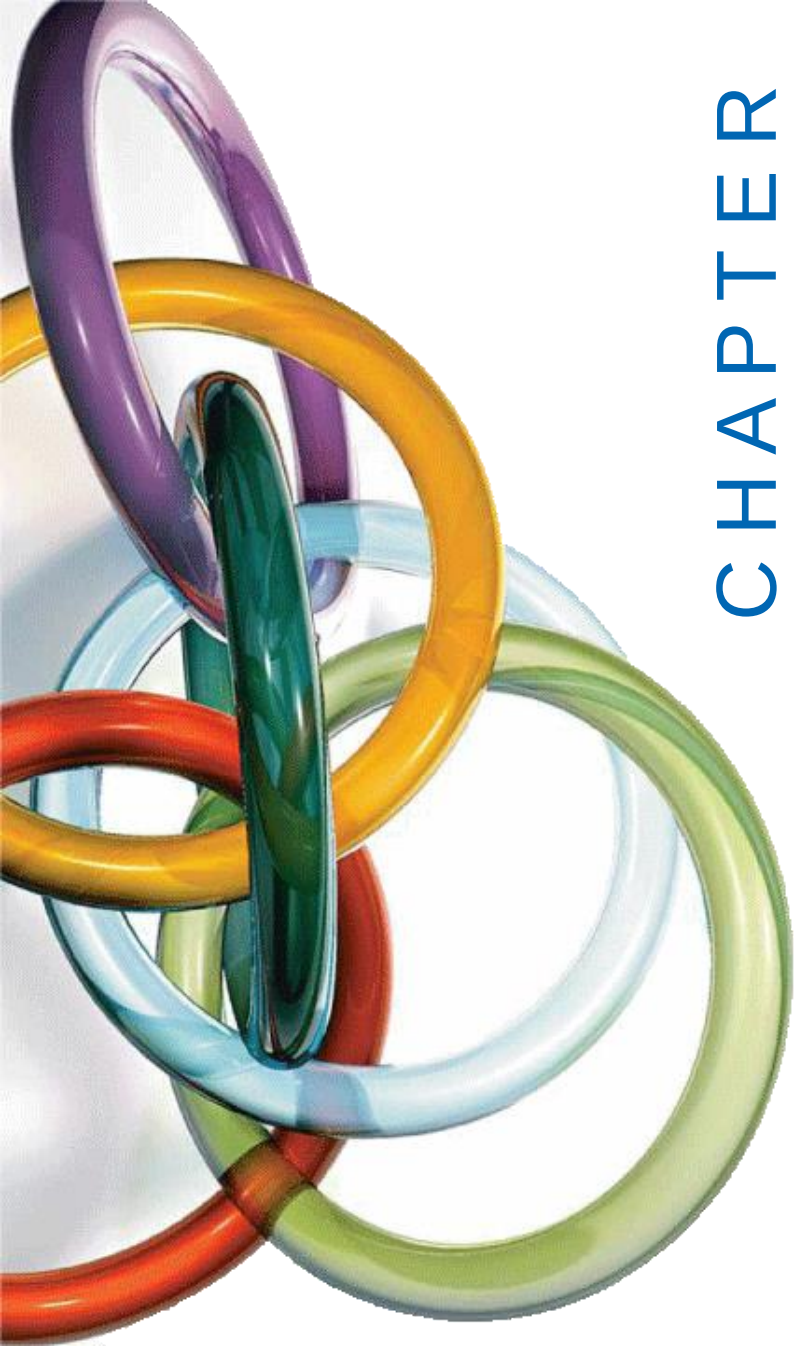

CHAPTER 4

Individual and Market Demand

Prepared by:

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CHAPTER 4 OUTLINE

4.1 Individual Demand

4.2 Income and Substitution Effects

4.3 Market Demand

4.4 Consumer Surplus

4.5 Network Externalities

4.6 Empirical Estimation of Demand

The Individual Demand Curve

Figure 4.1

Effect of Price Changes

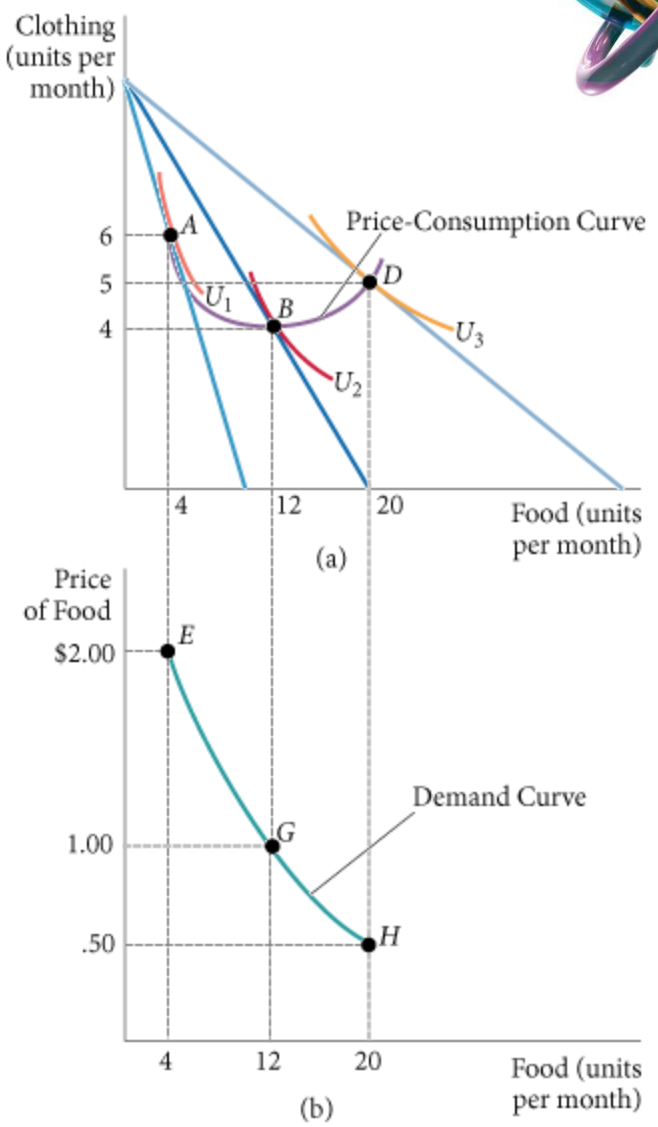
A reduction in the price of food, with income and the price of clothing fixed, causes the consumer to choose a different market basket.

The utility maximizing combination of 6 units of clothing and 4 units of food corresponds to a price of food equal to $2.00.

In panel (a), as the price of food falls, the utility maximizing combination changes.

The baskets that maximize utility for various prices of food trace out the price-consumption curve.

As the price of food changes, the quantity of food demanded changes. The relationship between the price and the quantity of food demanded, shown in panel (b), traces the demand curve for food.



4.1 INDIVIDUAL DEMAND

The Individual Demand Curve

- **price-consumption curve**
  Curve tracing the utility-maximizing combinations of two goods as the price of one changes.

- **individual demand curve**
  Curve relating the quantity of a good that a single consumer will buy to its price.

4.1 INDIVIDUAL DEMAND

Income Changes

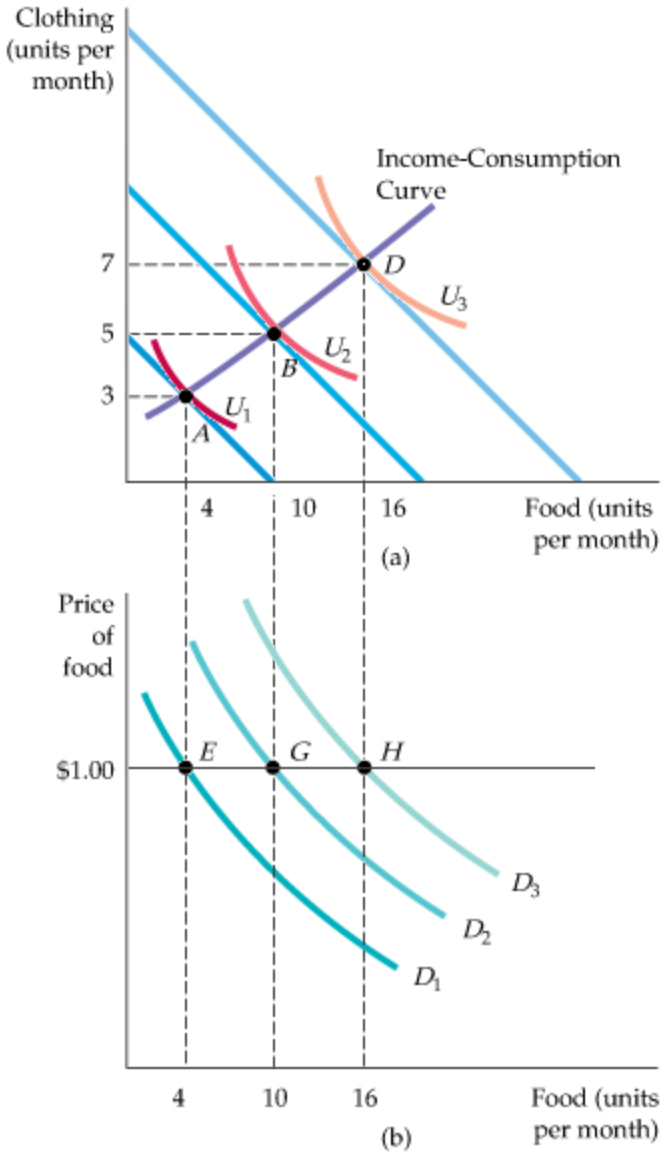
Figure 4.2

Effect of Income Changes

An increase in income, with the prices of all goods fixed, causes consumers to alter their choice of market baskets.

In part (a), the baskets that maximize consumer satisfaction for various incomes (point A, $10; B, $20; D, $30) trace out the income-consumption curve.

The shift to the right of the demand curve in response to the increases in income is shown in part (b). (Points E, G, and H correspond to points A, B, and D, respectively.)



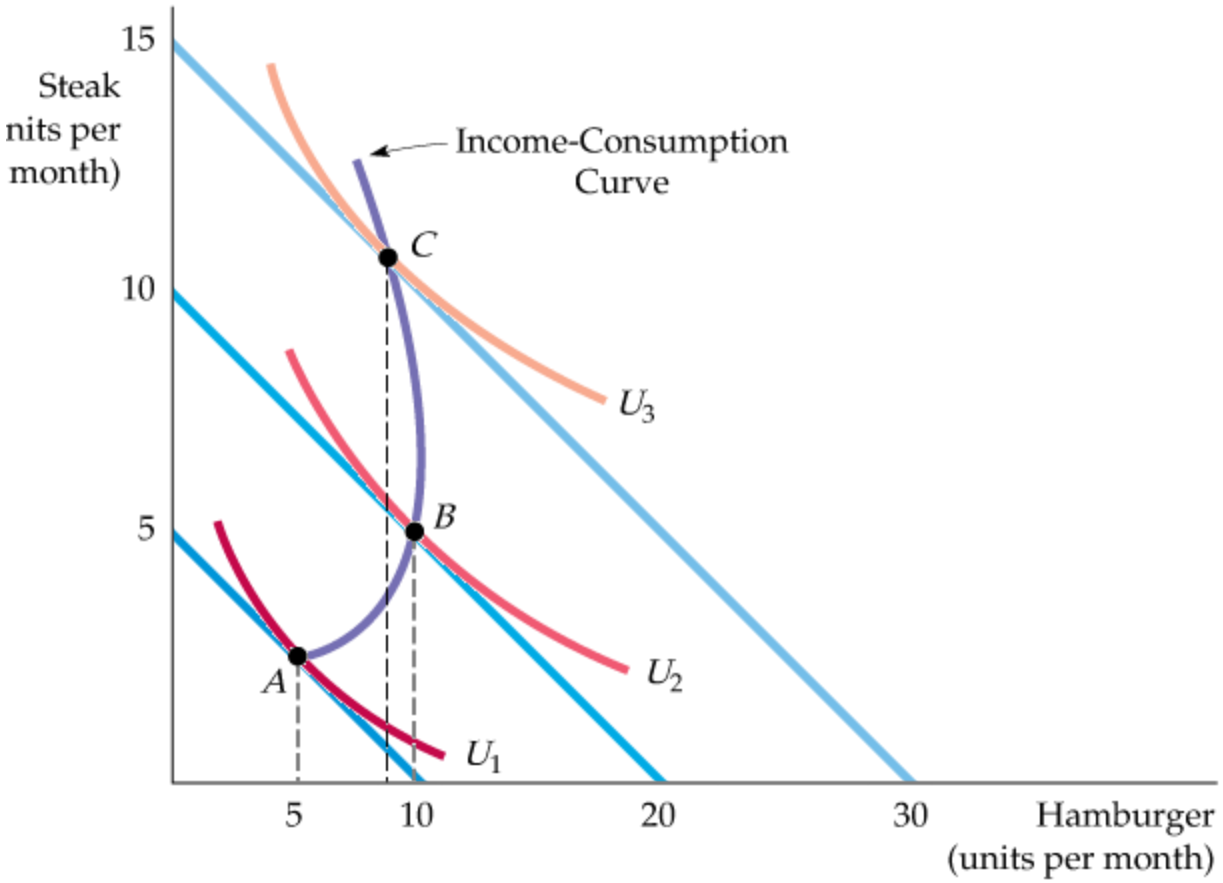
Normal versus Inferior Goods

Figure 4.3

An Inferior Good

An increase in a person's income can lead to less consumption of one of the two goods being purchased.

Here, hamburger, though a normal good between *A* and *B*, becomes an inferior good when the income-consumption curve bends backward between *B* and *C*.



Engel Curves

- **Engel curve** Curve relating the quantity of a good consumed to income.

Figure 4.4

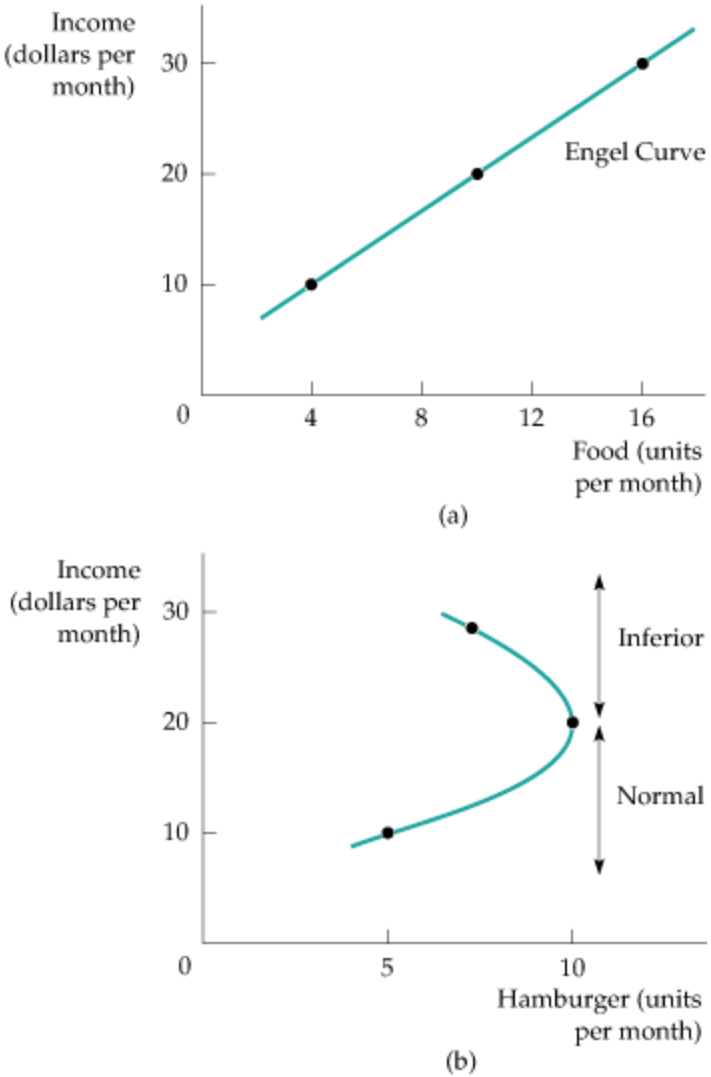
An Inferior Good

Engel curves relate the quantity of a good consumed to income.

In (a), food is a normal good and the Engel curve is upward sloping.

In (b), however, hamburger is a normal good for income less than $20 per month

and an inferior good for income greater than $20 per month.



EXAMPLE 4.1 Consumer Expenditures in the United States

If the market price were held constant, we would expect to see an increase in the quantity demanded as a result of consumers' higher incomes. Because this increase would occur no matter what the market price, the result would be a *shift to the right of the entire demand curve.*

TABLE 4.1 Annual U.S. Household Consumer Expenditures

	INCOME GROUP (2005$)						
Expenditures ($) on:	**Less than $10,000**	**10,000-19,999**	**20,000-29,999**	**30,000-39,999**	**40,000-49,999**	**50,000 69,999**	**70,000 and above**
Entertainment	844	947	1191	1677	1933	2402	4542
Owned Dwelling	4272	4716	5701	6776	7771	8972	14763
Rented Dwelling	2672	2779	2980	2977	2818	2255	1379
Heath Care	1108	1874	2241	2361	2778	2746	3812
Food	2901	3242	3942	4552	5234	6570	9247
Clothing	861	884	1106	1472	1450	1961	3245

Source: U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey, Annual Report 2005."

EXAMPLE 4.1 Consumer Expenditures in the United States (continued)

Figure 4.5

An Inferior Good

Average per-household expenditures on rented dwellings, health care, and entertainment are plotted as functions of annual income.

Health care and entertainment are normal goods, as expenditures increase with income.

Rental housing, however, is an inferior good for incomes above $35,000.

Substitutes and Complements

Recall that:

Two goods are *substitutes* if an increase in the price of one leads to an increase in the quantity demanded of the other.

Two goods are *complements* if an increase in the price of one good leads to a decrease in the quantity demanded of the other.

Two goods are *independent* if a change in the price of one good has no effect on the quantity demanded of the other.

4.2 INCOME AND SUBSTITUTION EFFECTS

A fall in the price of a good has two effects::

1. *Consumers will tend to buy more of the good that has become cheaper and less of those goods that are now relatively more expensive.*

2. *Because one of the goods is now cheaper, consumers enjoy an increase in real purchasing power.*

4.2 INCOME AND SUBSTITUTION EFFECTS

Substitution Effect

- **substitution effect** Change in consumption of a good associated with a change in its price, with the level of utility held constant.

Income Effect

- **income effect** Change in consumption of a good resulting from an increase in purchasing power, with relative prices held constant.

The total effect of a change in price is given theoretically by the sum of the substitution effect and the income effect:

$$\text{Total Effect } (F_1F_2) = \text{Substitution Effect } (F_1E) + \text{Income Effect } (EF_2)$$

4.2 INCOME AND SUBSTITUTION EFFECTS

Figure 4.6

Income and Substitution Effects: Normal Good

A decrease in the price of food has both an income effect and a substitution effect.

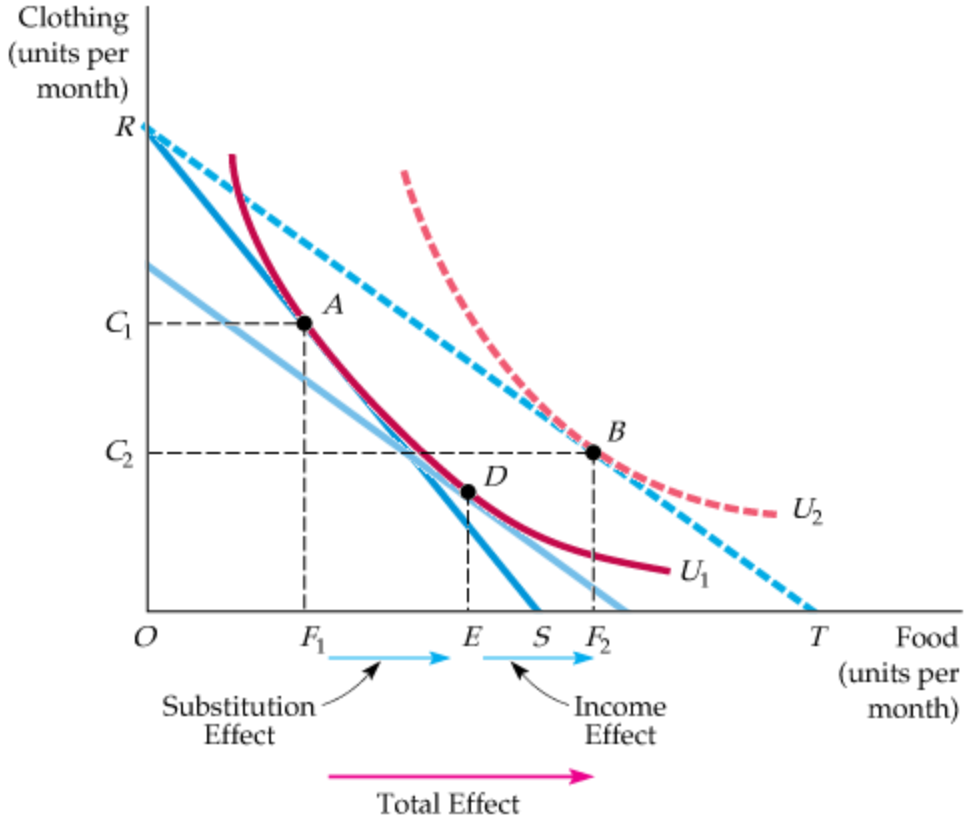
The consumer is initially at *A*, on budget line *RS*.

When the price of food falls, consumption increases by F_1F_2 as the consumer moves to *B*.

The substitution effect F_1E (associated with a move from *A* to *D*) changes the relative prices of food and clothing but keeps real income (satisfaction) constant.

The income effect EF_2 (associated with a move from *D* to *B*) keeps relative prices constant but increases purchasing power.

Food is a normal good because the income effect EF_2 is positive.



Chapter 4: Individual and Market Demand

Income Effect

Figure 4.7

Income and Substitution Effects: Inferior Good

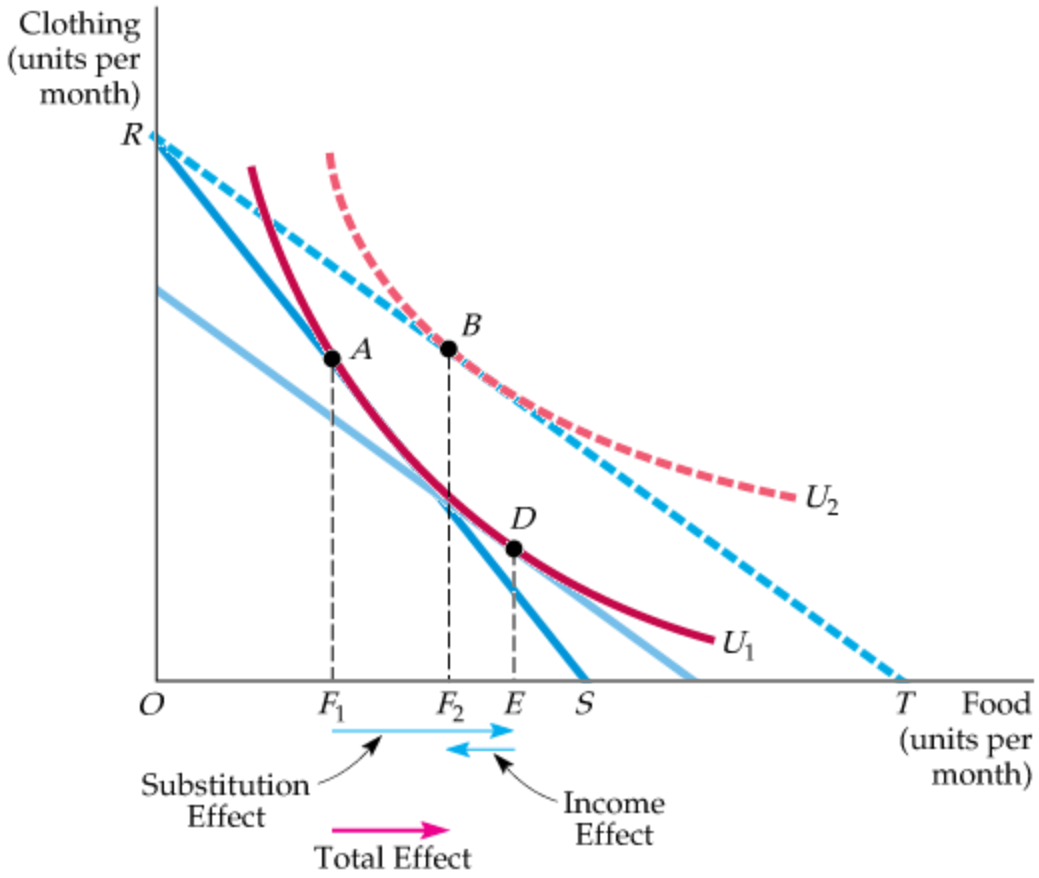
The consumer is initially at *A* on budget line *RS*.

With a decrease in the price of food, the consumer moves to *B*.

The resulting change in food purchased can be broken down into a substitution effect, F_1E (associated with a move from *A* to *D*), and an income effect, EF_2 (associated with a move from *D* to *B*).

In this case, food is an inferior good because the income effect is negative.

However, because the substitution effect exceeds the income effect, the decrease in the price of food leads to an increase in the quantity of food demanded.



4.2 INCOME AND SUBSTITUTION EFFECTS

A Special Case: The Giffen Good

- **Giffen good** Good whose demand curve slopes upward because the (negative) income effect is larger than the substitution effect.

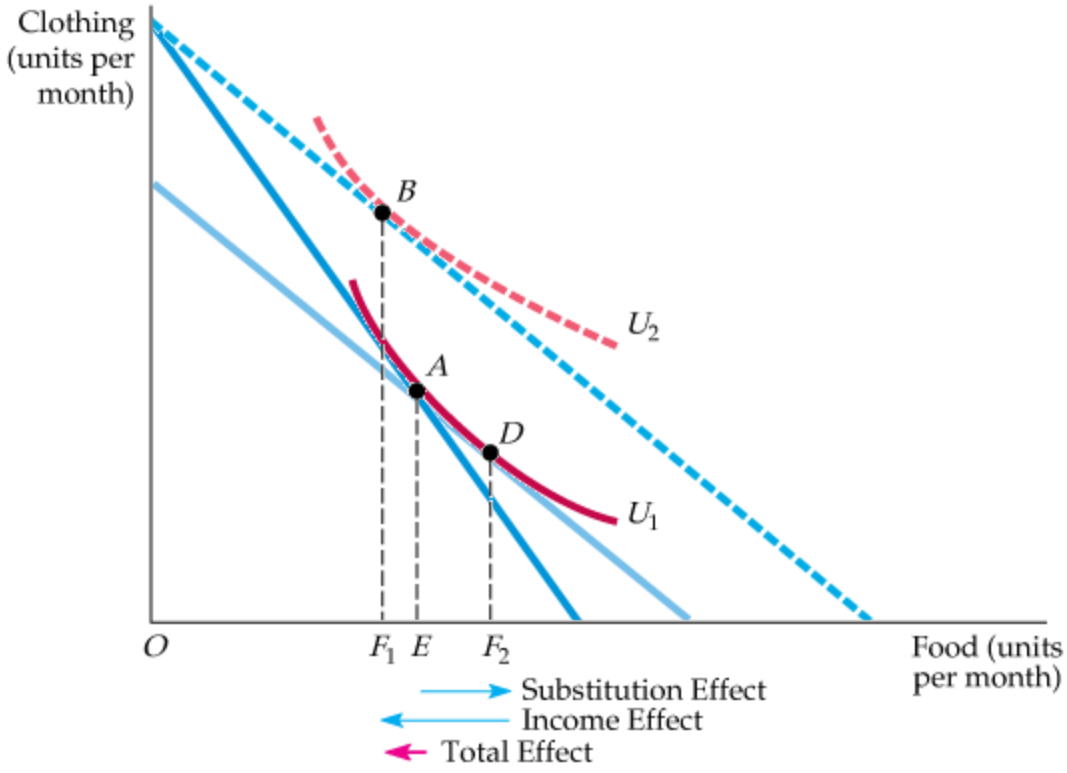
Figure 4.8

Upward-Sloping Demand Curve: The Giffen Good

When food is an inferior good, and when the income effect is large enough to dominate the substitution effect, the demand curve will be upward-sloping.

The consumer is initially at point *A*, but, after the price of food falls, moves to *B* and consumes less food.

Because the income effect F_2F_1 is larger than the substitution effect EF_2, the decrease in the price of food leads to a lower quantity of food demanded.



EXAMPLE 4.1 The Effects of a Gasoline Tax

Figure 4.9

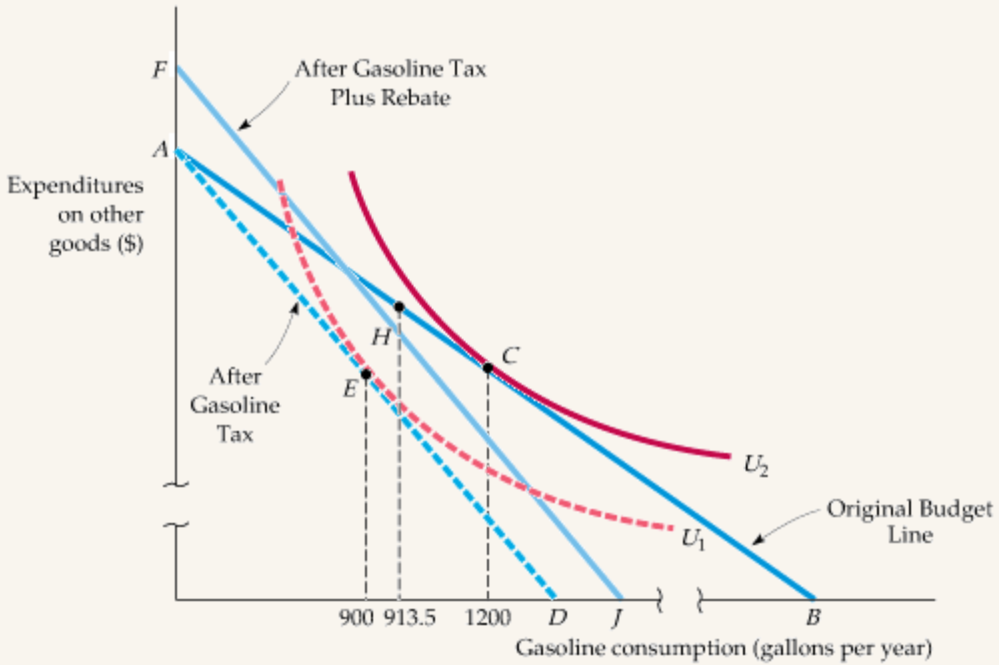
Effect of a Gasoline Tax with a Rebate

A gasoline tax is imposed when the consumer is initially buying 1200 gallons of gasoline at point *C*.

After the tax takes effect, the budget line shifts from *AB* to *AD* and the consumer maximizes his preferences by choosing E, with a gasoline consumption of 900 gallons.

However, when the proceeds of the tax are rebated to the consumer, his consumption increases somewhat, to 913.5 gallons at H.

Despite the rebate program, the consumer's gasoline consumption has fallen, as has his level of satisfaction.



4.3 MARKET DEMAND

- **market demand curve** Curve relating the quantity of a good that all consumers in a market will buy to its price.

Substitution Effect

TABLE 4.2 Determining the Market Demand Curve

(1) Price ($)	(2) Individual A (Units)	(3) Individual B (Units)	(4) Individual C (Units)	(5) Market (Units)
1	6	10	16	32
2	4	8	13	25
3	2	6	10	18
4	0	4	7	11
5	0	2	4	6

Substitution Effect

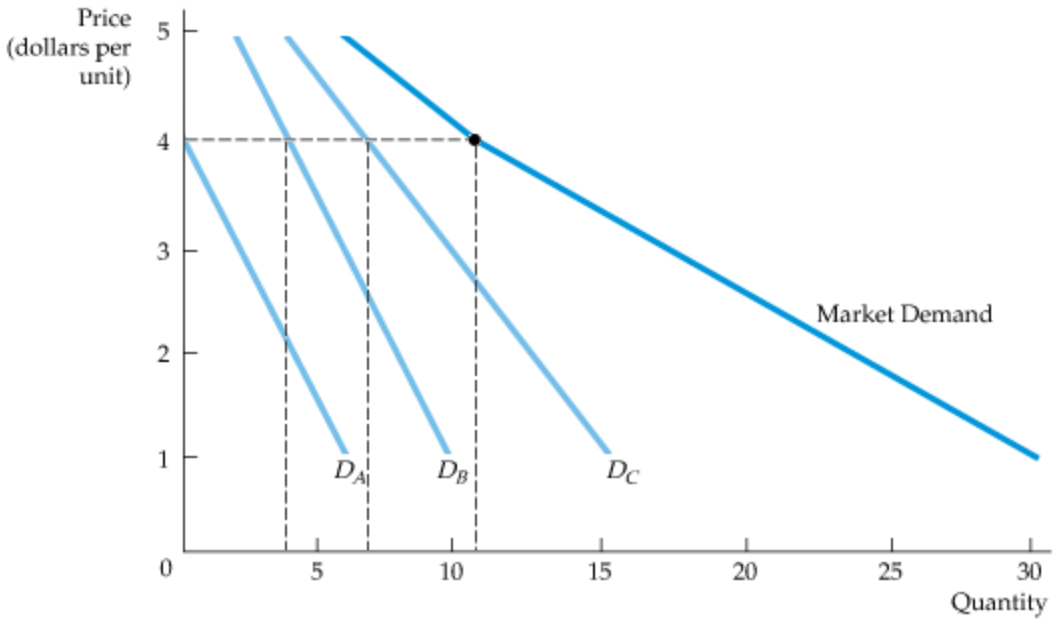
Figure 4.10

Summing to Obtain a Market Demand Curve

The market demand curve is obtained by summing our three consumers' demand curves D_A, D_B, and D_C.

At each price, the quantity of coffee demanded by the market is the sum of the quantities demanded by each consumer.

At a price of $4, for example, the quantity demanded by the market (11 units) is the sum of the quantity demanded by *A* (no units), *B* (4 units), and *C* (7 units).



Substitution Effect

Two points should be noted:

1. *The market demand curve will shift to the right as more consumers enter the market.*
2. *Factors that influence the demands of many consumers will also affect market demand.*

The aggregation of individual demands into market becomes important in practice when market demands are built up from the demands of different demographic groups or from consumers located in different areas.

For example, we might obtain information about the demand for home computers by adding independently obtained information about the demands of the following groups:

- Households with children
- Households without children
- Single individuals

4.3 MARKET DEMAND

Elasticity of Demand

Denoting the quantity of a good by Q and its price by P, the *price elasticity of demand* is

$$E_p = \frac{\Delta Q/Q}{\Delta P/P} = \left(\frac{P}{Q}\right)\left(\frac{\Delta Q}{\Delta P}\right) \qquad (4.1)$$

Inelastic Demand

When demand is inelastic, the quantity demanded is relatively unresponsive to changes in price. As a result, total expenditure on the product increases when the price increases.

Elastic Demand

When demand is elastic, total expenditure on the product decreases as the price goes up.

Elasticity of Demand

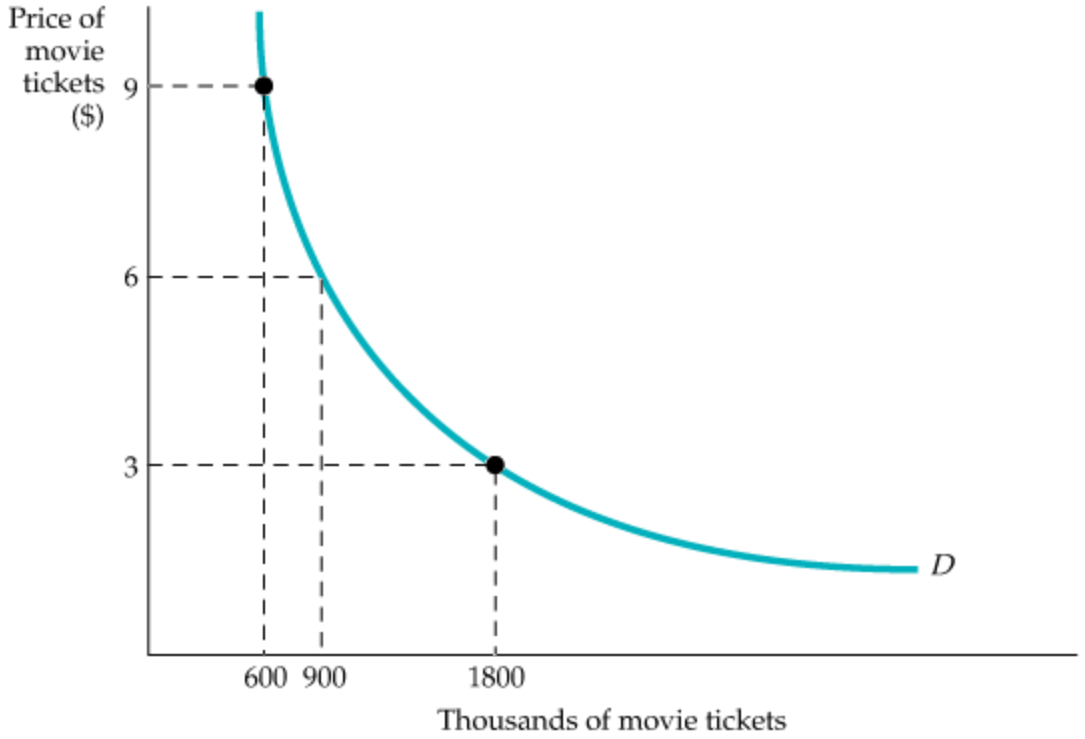
Isoelastic Demand

- **isoelastic demand curve** Demand curve with a constant price elasticity.

Figure 4.11

Unit-Elastic Demand Curve

When the price elasticity of demand is −1.0 at every price, the total expenditure is constant along the demand curve *D*.



Elasticity of Demand

Isoelastic Demand

TABLE 4.3 Price Elasticity and Consumer Expenditures

Demand	If Price Increases, Expenditures	If Price Decreases, Expenditures
Inelastic	Increase	Decrease
Unit elastic	Are unchanged	Are unchanged
Elastic	Decrease	Increase

EXAMPLE 4.3 The Aggregate Demand for Wheat

Domestic demand for wheat is given by the equation

$$Q_{DD} = 1368 - 38P$$

where Q_{DD} is the number of bushels (in millions) demanded domestically, and P is the price in dollars per bushel. Export demand is given by

$$Q_{DE} = 1470 - 70P$$

where Q_{DE} is the number of bushels (in millions) demanded from abroad.

To obtain the world demand for wheat, we set the left side of each demand equation equal to the quantity of wheat. We then add the right side of the equations, obtaining

$$Q_{DD} + Q_{DE} = (1368 - 38P) + (1470 - 70P) = 2838 - 108P$$

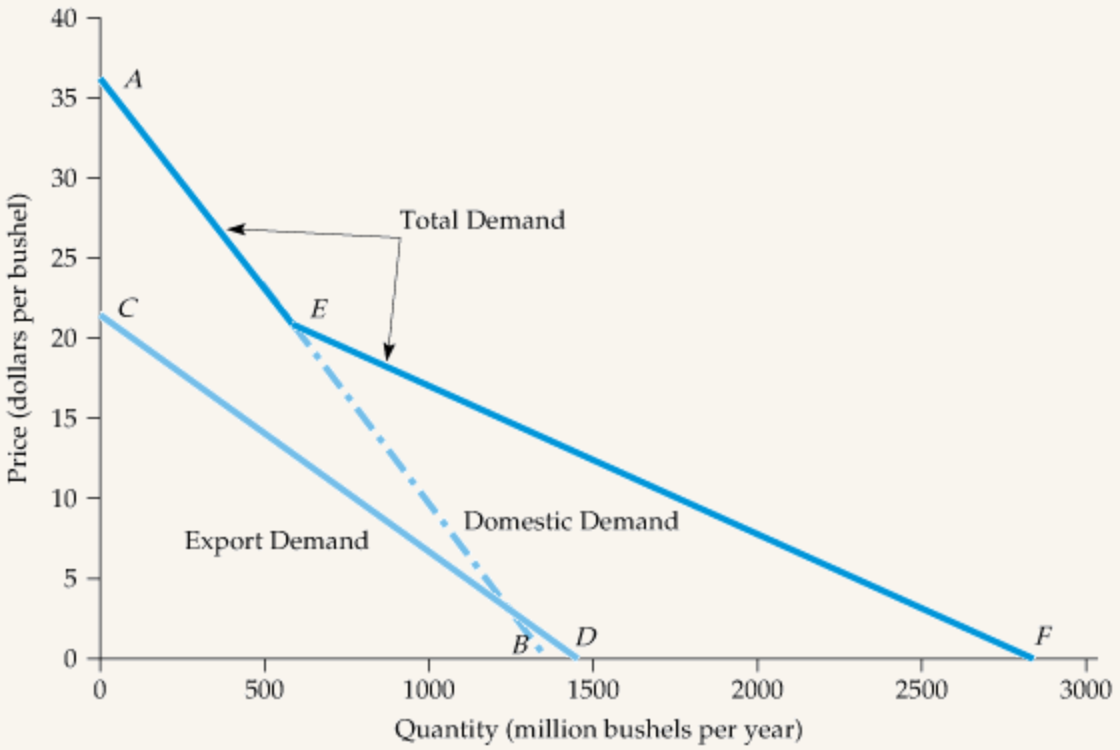
EXAMPLE 4.3 The Aggregate Demand for Wheat (continued)

Figure 4.12

The Aggregate Demand for Wheat

The total world demand for wheat is the horizontal sum of the domestic demand *AB* and the export demand *CD*.

Even though each individual demand curve is linear, the market demand curve is kinked, reflecting the fact that there is no export demand when the price of wheat is greater than about $20 per bushel.



EXAMPLE 4.4 The Demand for Housing

TABLE 4.4 The Demand for Housing

Group	Price Elasticity	Income Elasticity
Single individuals	−0.10	0.21
Married, head of household age less than 30, 1 child	−0.25	0.06
Married, head age 30–39, 2 or more children	−0.15	0.12
Married, head age 50 or older, 1 child	−0.08	0.19

4.4 CONSUMER SURPLUS

- **consumer surplus** Difference between what a consumer is willing to pay for a good and the amount actually paid.

Consumer Surplus and Demand

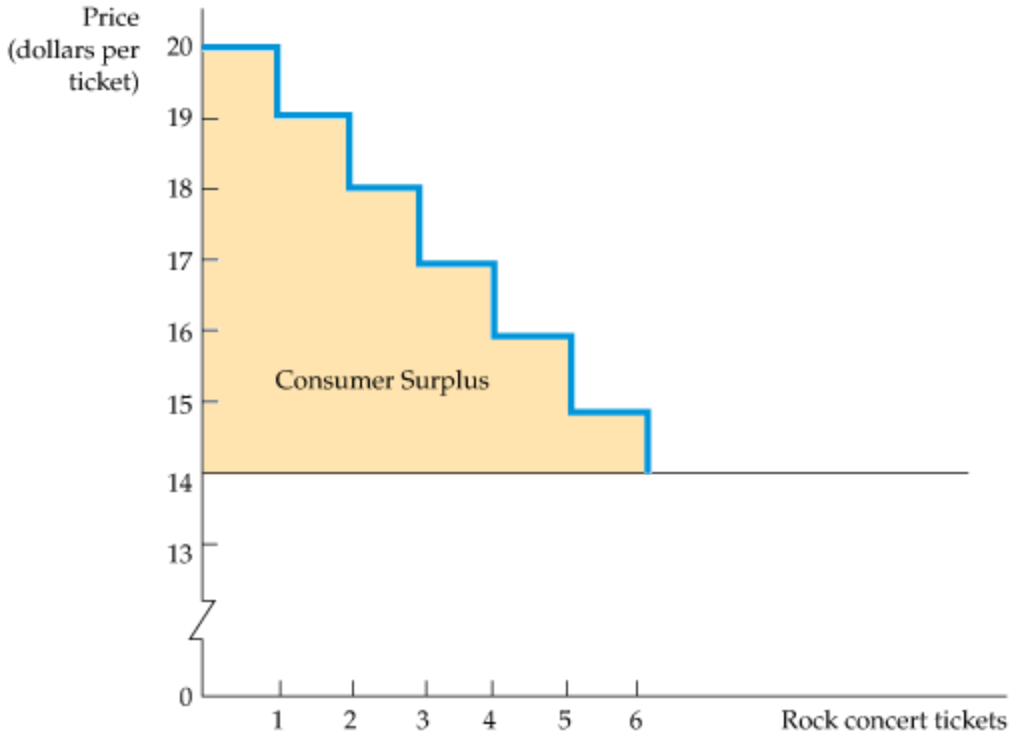
Figure 4.13

Consumer Surplus

Consumer surplus is the total benefit from the consumption of a product, less the total cost of purchasing it.

Here, the consumer surplus associated with six concert tickets (purchased at $14 per ticket) is given by the yellow-shaded area:

$6 + $5 + $4 + $3 + $2 + $1 = $21



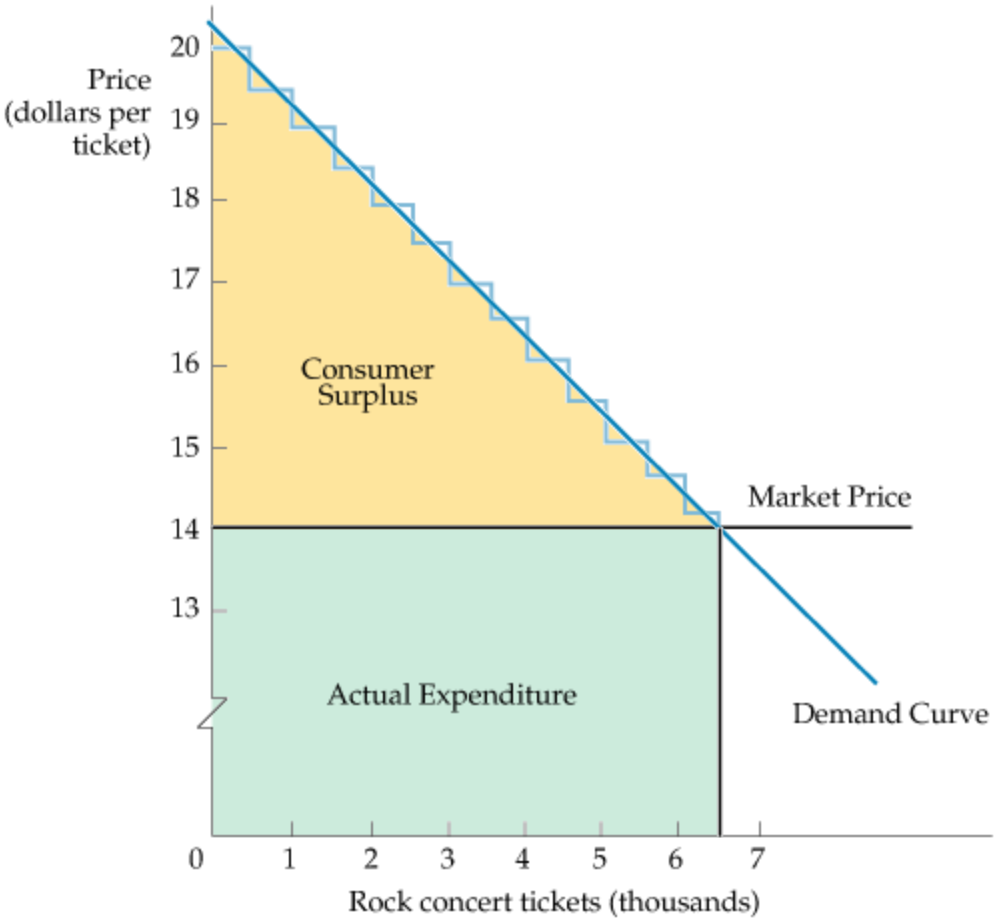
Consumer Surplus and Demand

Figure 4.14

Consumer Surplus Generalized

For the market as a whole, consumer surplus is measured by the area under the demand curve and above the line representing the purchase price of the good.

Here, the consumer surplus is given by the yellow-shaded triangle and is equal to 1/2 × ($20 − $14) × 6500 = $19,500.



EXAMPLE 4.5 The Value of Clean Air

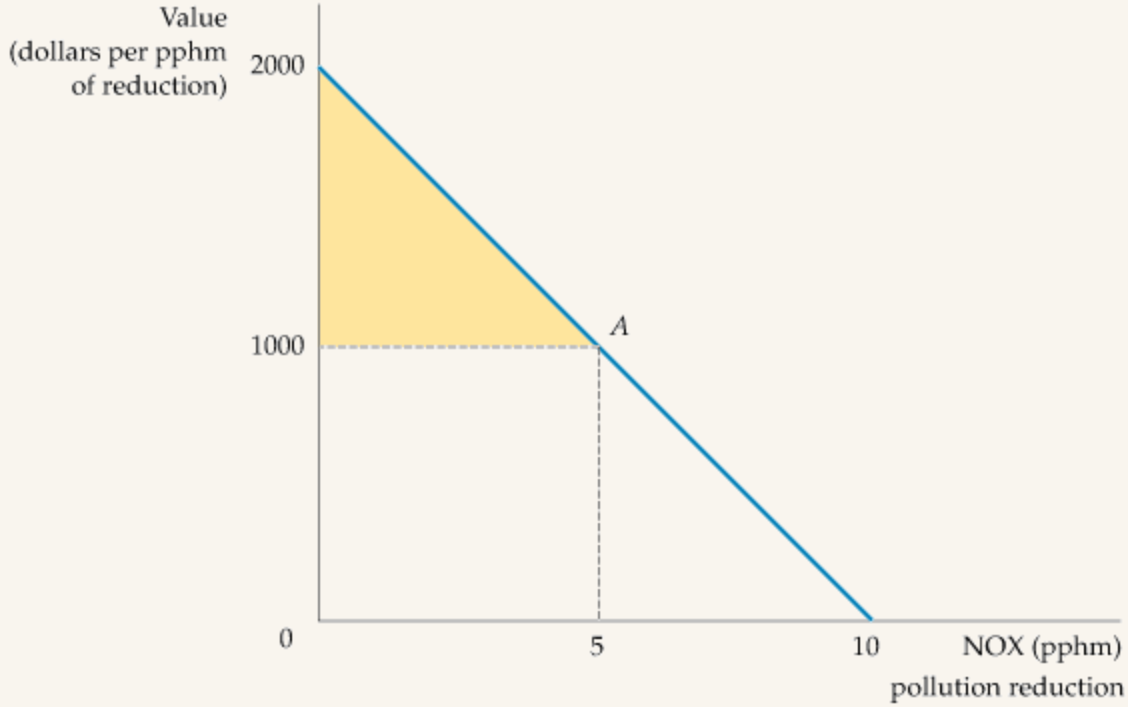
To encourage cleaner air, Congress passed the Clean Air Act in 1977 and has since amended it a number of times.

Figure 4.15

Valuing Cleaner Air

The yellow-shaded triangle gives the consumer surplus generated when air pollution is reduced by 5 parts per 100 million of nitrogen oxide at a cost of $1000 per part reduced.

The surplus is created because most consumers are willing to pay more than $1000 for each unit reduction of nitrogen oxide.



4.5 NETWORK EXTERNALITIES

- **network externality** When each individual's demand depends on the purchases of other individuals.

A *positive* network externality exists *if the quantity of a good demanded by a typical consumer increases in response to the growth in purchases of other consumers*. If the quantity demanded decreases, there is a *negative* network externality.

The Bandwagon Effect

- **bandwagon effect** Positive network externality in which a consumer wishes to possess a good in part because others do.

4.5 NETWORK EXTERNALITIES

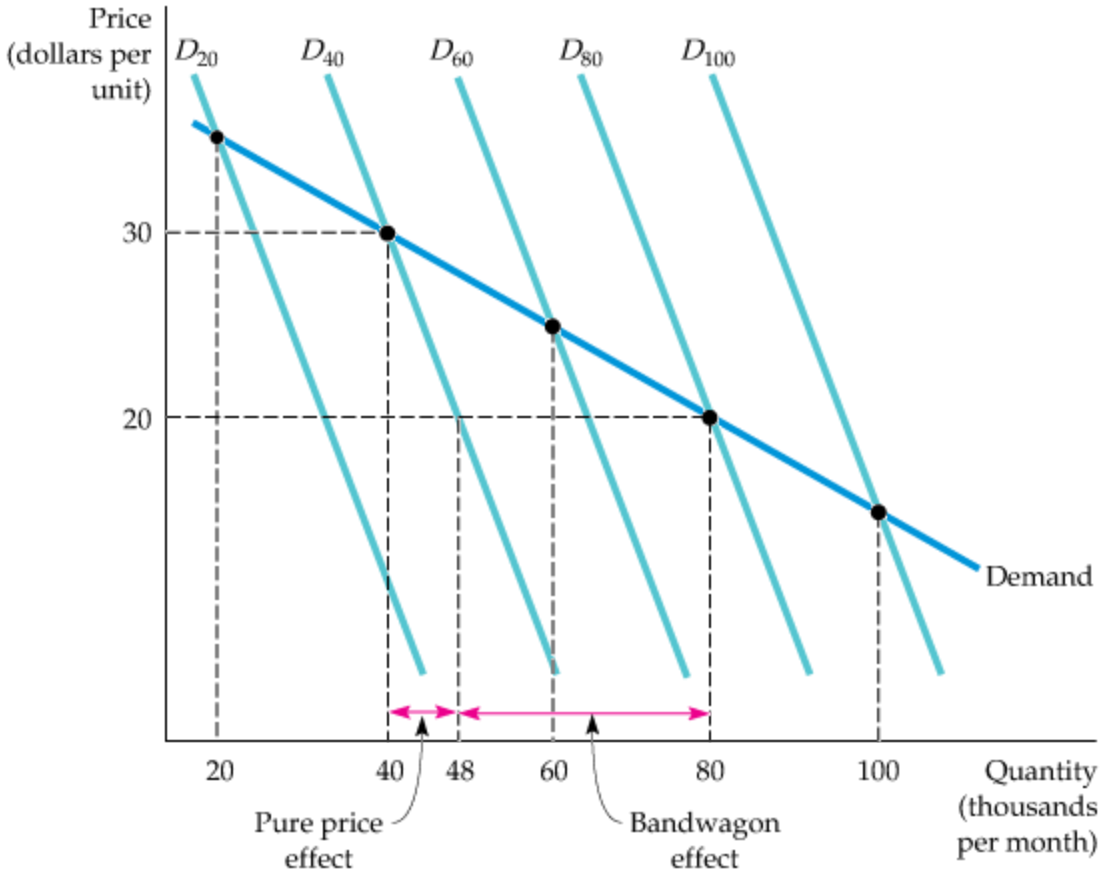
The Bandwagon Effect

Figure 4.16

Positive Network Externality: Bandwagon Effect

A bandwagon effect is a positive network externality in which the quantity of a good that an individual demands grows in response to the growth of purchases by other individuals.

Here, as the price of the product falls from $30 to $20, the bandwagon effect causes the demand for the good to shift to the right, from D_{40} to D_{80}.



4.5 NETWORK EXTERNALITIES

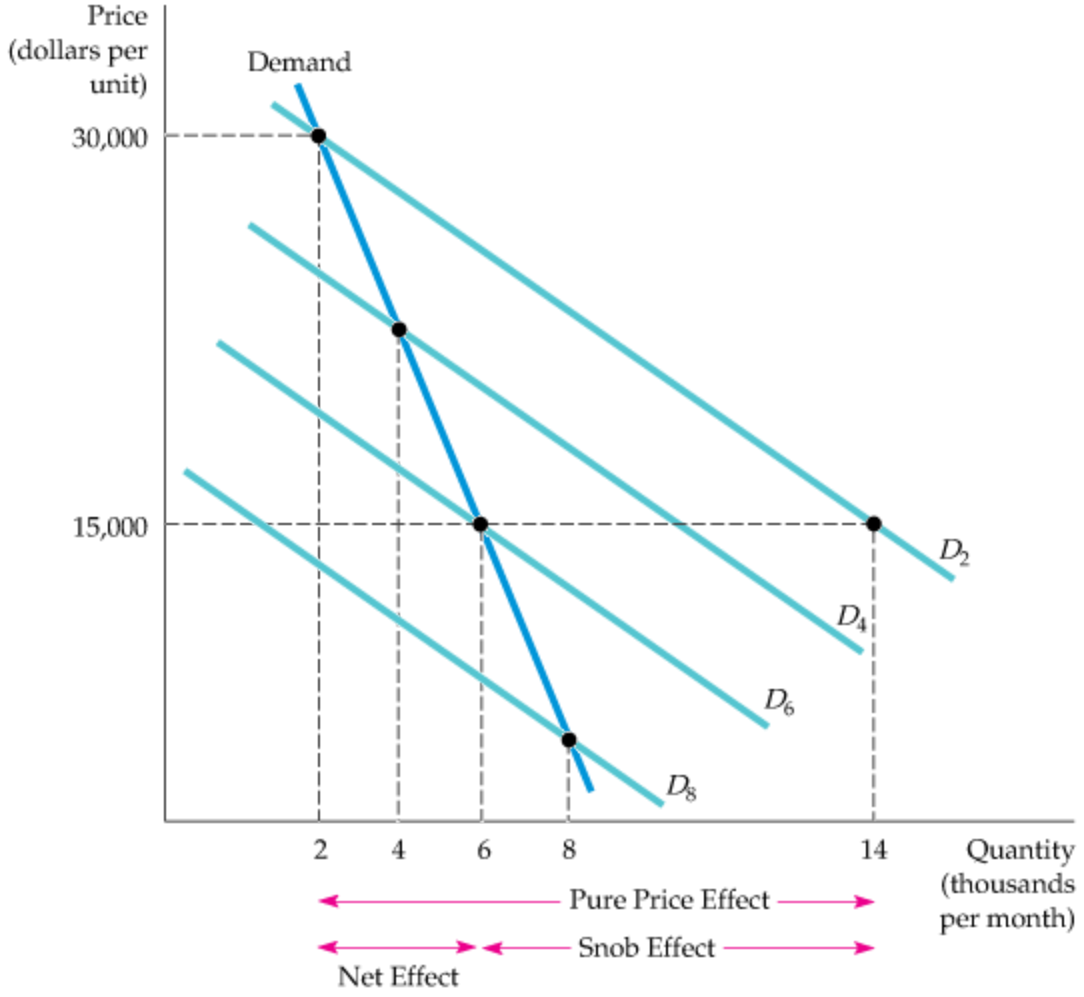
The Snob Effect

Figure 4.17

Negative Network Externality: Snob Effect

The snob effect is a negative network externality in which the quantity of a good that an individual demands falls in response to the growth of purchases by other individuals.

Here, as the price falls from $30,000 to $15,000 and more people buy the good, the snob effect causes the demand for the good to shift to the left, from D_2 to D_6.



4.5 NETWORK EXTERNALITIES

EXAMPLE 4.6 Network Externalities and the Demands for Computers and E-Mail

From 1954 to 1965, annual revenues from the leasing of mainframes increased at the extraordinary rate of 78 percent per year, while prices declined by 20 percent per year.

An econometric study found that the demand for computers follows a "saturation curve"—a dynamic process whereby demand, though small at first, grows slowly. Soon, however, it grows rapidly, until finally nearly everyone likely to buy a product has done so, whereby the market becomes saturated.

This rapid growth occurs because of a positive network externality: As more and more organizations own computers and as more people are trained to use computers, the value of having a computer increases.

Consider the explosive growth in Internet usage, particularly the use of e-mail. Use of the Internet has grown at 20 percent per year since 1998. By 2002, nearly 50 percent of the U.S. population claimed to use e-mail, up from 35 percent in 2000.

4.6* EMPIRICAL ESTIMATION OF DEMAND

The Statistical Approach to Demand Estimation

TABLE 4.5 Demand Data

Year	Quantity (*Q*)	Price (*P*)	Income (*I*)
1995	4	24	0
1996	7	20	10
1997	8	17	10
1998	13	17	17
1999	16	10	17
2000	15	15	17
2001	19	12	20
2002	20	9	20
2003	22	5	20

4.6* EMPIRICAL ESTIMATION OF DEMAND

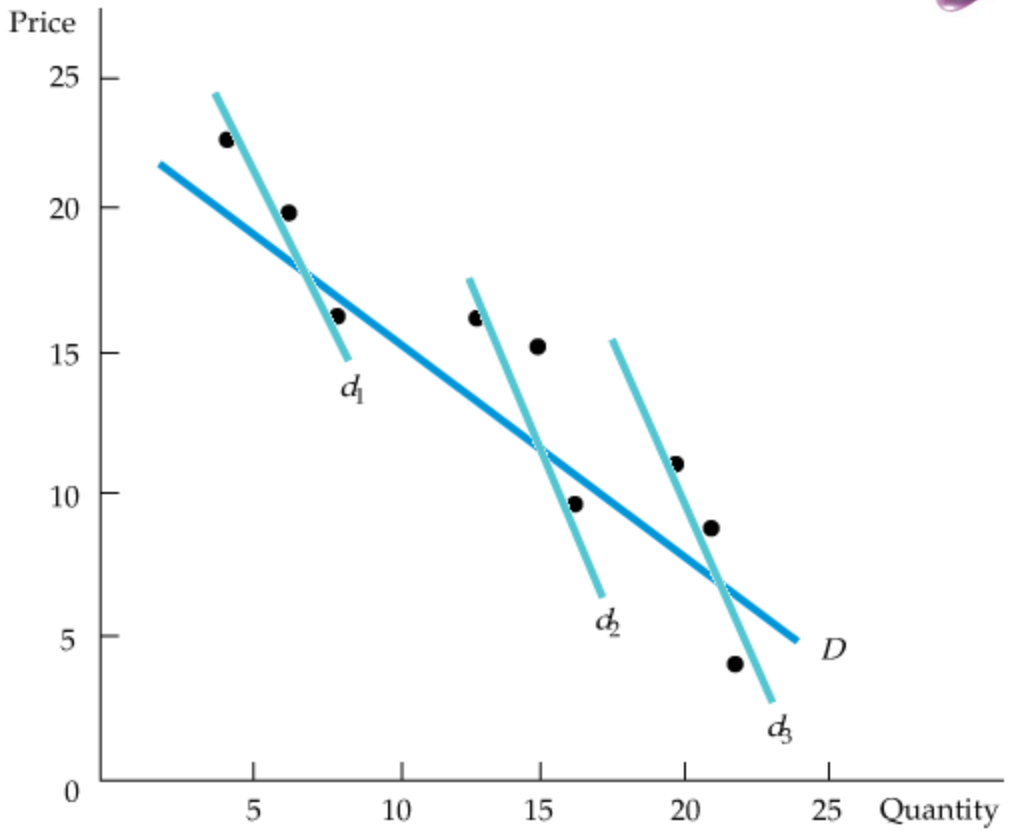
The Statistical Approach to Demand Estimation

Figure 4.18

Estimating Demand

Price and quantity data can be used to determine the form of a demand relationship.

But the same data could describe a single demand curve *D* or three demand curves *d*1, *d*2, and *d*3 that shift over time.



The *linear demand curve* would be described algebraically as

$$Q = a - bP + cI \qquad (4.2)$$

4.6* EMPIRICAL ESTIMATION OF DEMAND

The Form of the Demand Relationship

Because the demand relationships discussed above are straight lines, the effect of a change in price on quantity demanded is constant. However, the price elasticity of demand varies with the price level. For the demand equation $Q = a - bP + cI$, the price elasticity E_P is

$$Ep = (\Delta Q / \Delta P)(P / Q) = -b(P / Q) \qquad (4.3)$$

There is no reason to expect elasticities of demand to be constant. Nevertheless, we often find it useful to work with the isoelastic demand curve, in which the price elasticity and the income elasticity are constant. When written in its log-linear form, the isoelastic demand curve appears as follows:

$$\log(Q) = a - b\log(P) + c\log(I) \qquad (4.4)$$

4.6* EMPIRICAL ESTIMATION OF DEMAND

EXAMPLE 4.7 The Demand for Ready-to-Eat Cereal

The acquisition of Shredded Wheat cereals of Nabisco by Post Cereals raised the question of whether Post would raise the price of Grape Nuts, or the price of Nabisco's Shredded Wheat Spoon Size.

One important issue was whether the two brands were close substitutes for one another. If so, it would be more profitable for Post to increase the price of Grape Nuts *after* rather than *before* the acquisition because the lost sales from consumers who switched away from Grape Nuts would be recovered to the extent that they switched to the substitute product.

The substitutability of Grape Nuts and Shredded Wheat can be measured by the cross-price elasticity of demand for Grape Nuts with respect to the price of Shredded Wheat.

One isoelastic demand equation appeared in the following log-linear form:

$$\log(Q_{GN}) = 1.998 - 2.085\log(P_{GN}) + 0.62\log(I) + 0.14\log(P_{SW})$$

The demand for Grape Nuts is elastic, with a price elasticity of about −2. Income elasticity is 0.62. the cross-price elasticity is 0.14. The two cereals are not very close substitutes.

4.6* EMPIRICAL ESTIMATION OF DEMAND

Interview and Experimental Approaches to Demand Determination

Another way to obtain information about demand is through *interviews* in which consumers are asked how much of a product they might be willing to buy at a given price.

Although indirect approaches to demand estimation can be fruitful, the difficulties of the interview approach have forced economists and marketing specialists to look to alternative methods.

In *direct marketing experiments,* actual sales offers are posed to potential customers. An airline, for example, might offer a reduced price on certain flights for six months, partly to learn how the price change affects demand for flights and partly to learn how competitors will respond.

Even if profits and sales rise, the firm cannot be entirely sure that these increases resulted from the experimental change; other factors probably changed at the same time.