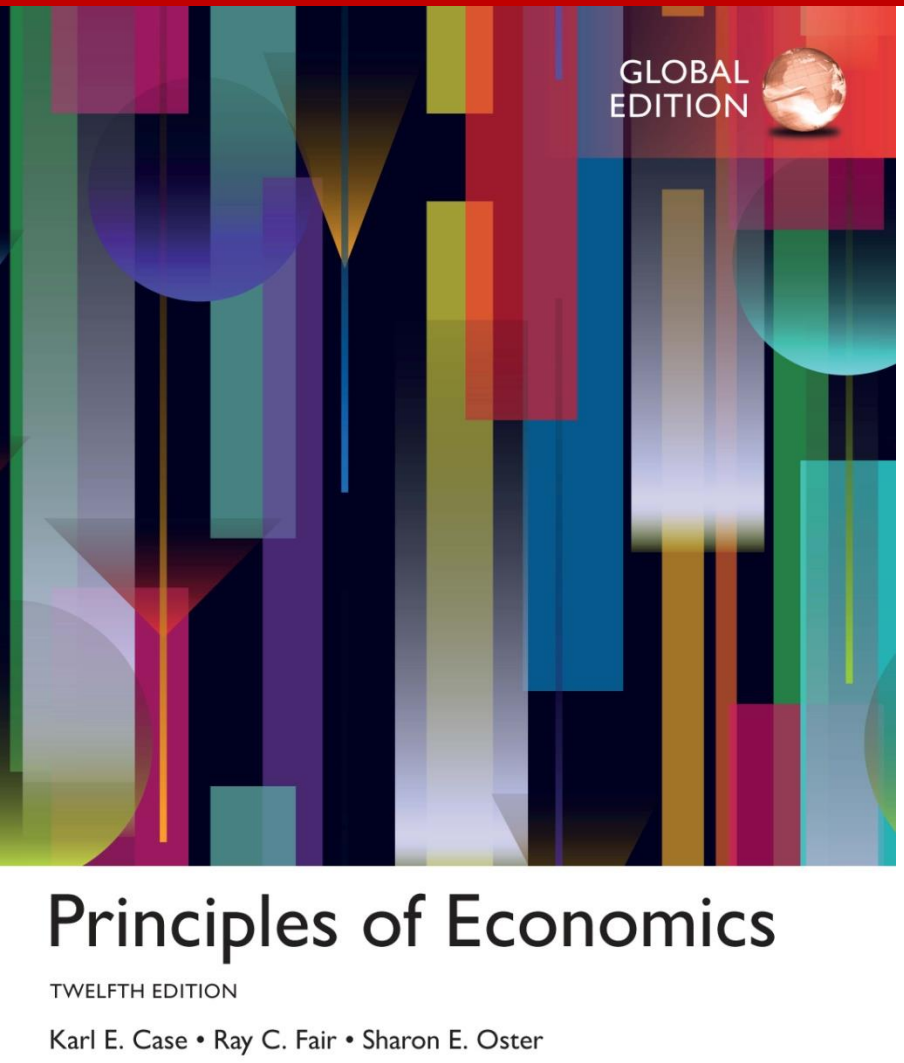
Principles of Economics

Twelfth Edition



Chapter 5

Elasticity

Chapter Outline and Learning Objectives
(1 of 2)

5.1 Price Elasticity of Demand

- Understand why elasticity is preferable as a measure of responsiveness to slope and how to measure it.

5.2 Calculating Elasticities

- Calculate elasticities using several different methods and understand the economic relationship between revenues and elasticity.

5.3 The Determinants of Demand Elasticity

- Identify the determinants of demand elasticity.

Chapter Outline and Learning Objectives
(2 of 2)

5.4 Other Important Elasticities

- Define and give examples of income elasticity, cross-price elasticity, and supply elasticity.

5.5 What Happens When We Raise Taxes: Using Elasticity

- Understand the way excise taxes can be shifted to consumers.

Looking Ahead

Chapter 5 Elasticity *(1 of 2)*

- The model of supply and demand tells us a good deal about how a change in the price of a good affects behavior.
- But knowing the direction of a change is not enough.
- Economists measure market responsiveness using the concept of elasticity.

Chapter 5 Elasticity *(2 of 2)*

- **elasticity** A general concept used to quantify the response in one variable when another variable changes.

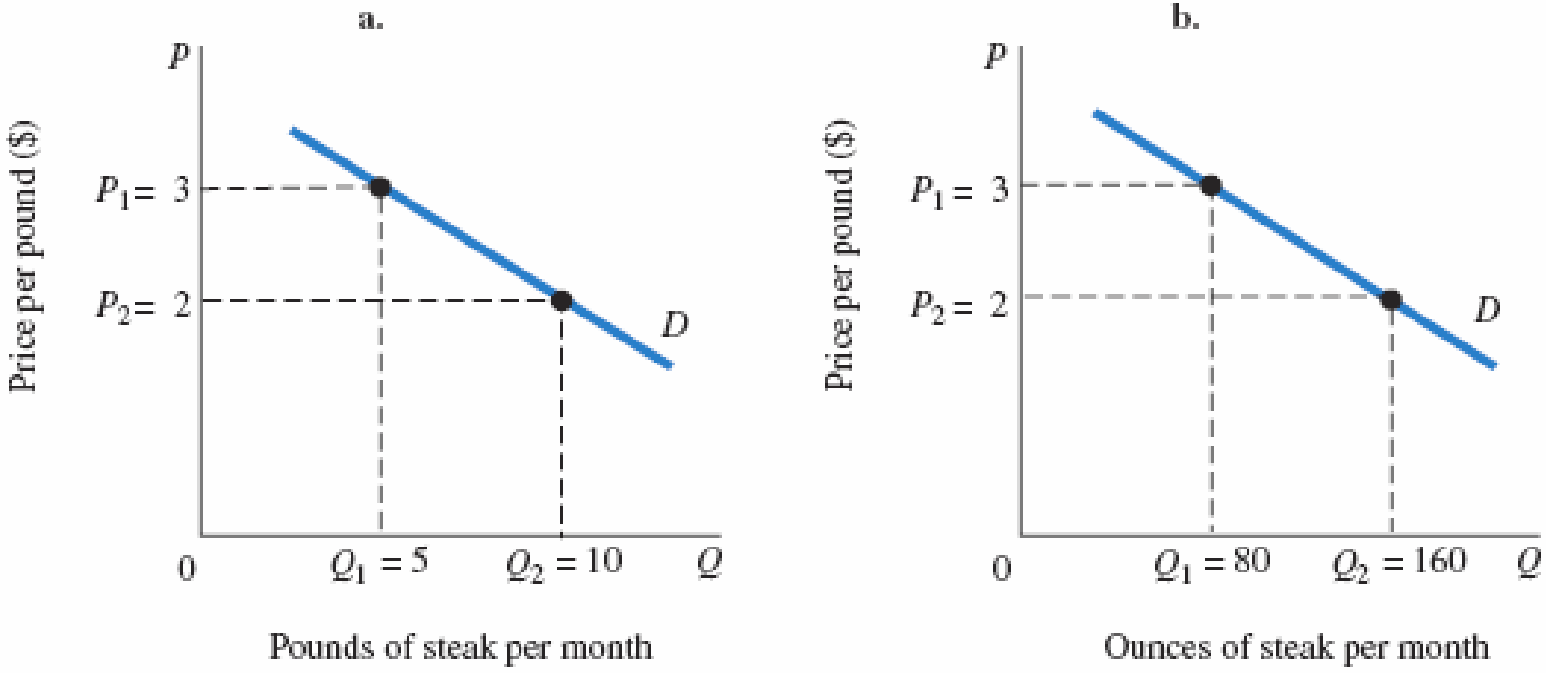
$$\text{elasticity of A with respect to B} = \frac{\%\Delta A}{\%\Delta \text{B}}$$

Price Elasticity of Demand

price elasticity of demand The ratio of the percentage change in quantity demanded to the percentage change in price; measures the responsiveness of quantity demanded to changes in price.

$$\text{price elasticity of demand} = \frac{\%Change\ in\ Quanity\ demanded}{\%change\ in\ price}$$

FIGURE 5.1 Slope Is Not a Useful Measure of Responsiveness



$$\text{Slope: } \frac{\Delta Y}{\Delta X} = \frac{P_2 - P_1}{Q_2 - Q_1} = \frac{2 - 3}{10 - 5} = -\frac{1}{5}$$

$$\text{Slope: } \frac{\Delta Y}{\Delta X} = \frac{P_2 - P_1}{Q_2 - Q_1} = \frac{2 - 3}{160 - 80} = -\frac{1}{80}$$

Changing the unit of measure from pounds to ounces changes the numerical value of the demand slope dramatically, but the behavior of buyers in the two diagrams is identical.

Types of Elasticity *(1 of 4)*

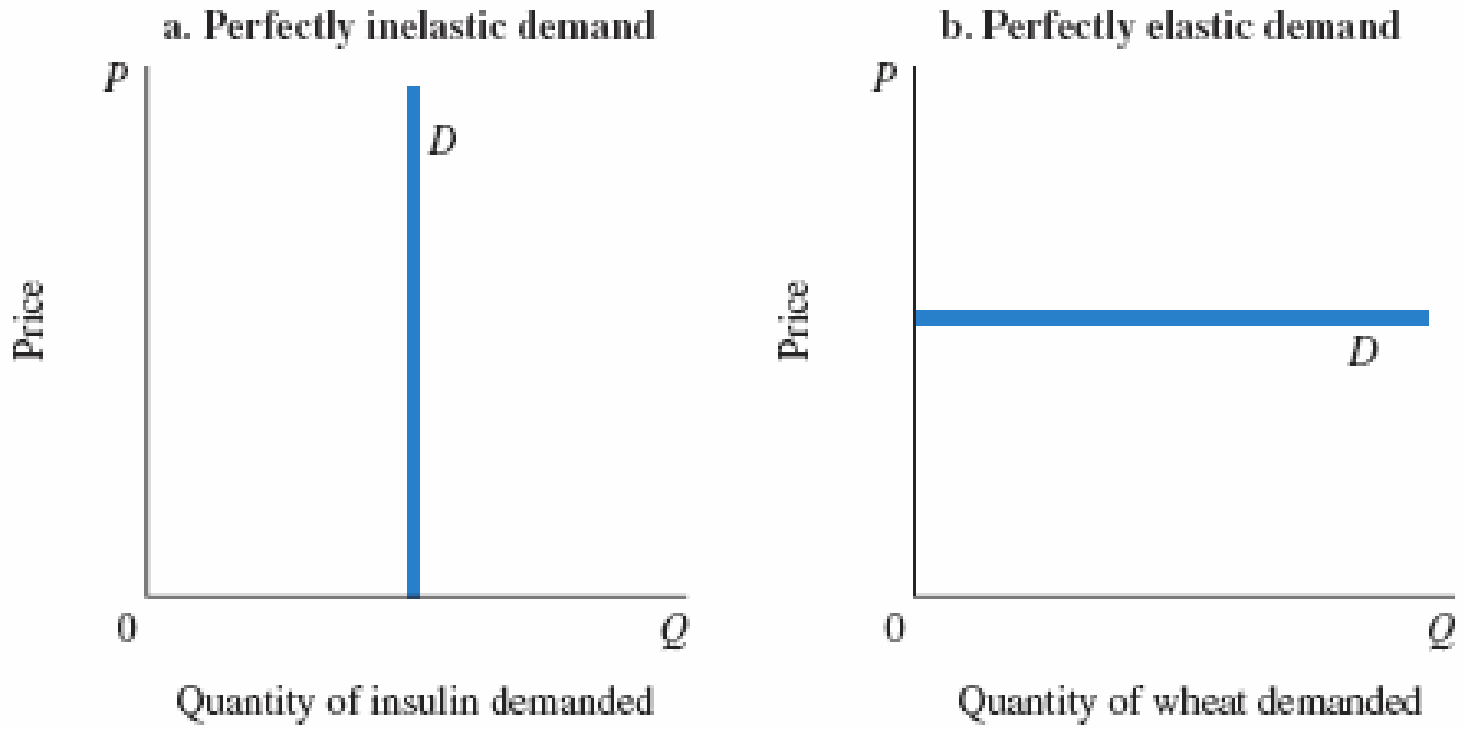
- **perfectly inelastic demand** Demand in which quantity demanded does not respond at all to a change in price.
- **perfectly elastic demand** Demand in which quantity drops to zero at the slightest increase in price.

Types of Elasticity *(2 of 4)*

- A good way to remember the difference between the two perfect elasticities is:

Perfectly Elastic
and Perfectly Inelastic

FIGURE 5.2 Perfectly Inelastic and Perfectly Elastic Demand Curves



Panel (a) shows a perfectly inelastic demand curve for insulin. Price elasticity of demand is zero. Quantity demanded is fixed; it does not change at all when price changes.
Panel (b) shows a perfectly elastic demand curve facing a wheat farmer. A tiny price increase drives the quantity demanded to zero. In essence, perfectly elastic demand implies that individual producers can sell all they want at the going market price but cannot charge a higher price.

Types of Elasticity *(3 of 4)*

- **elastic demand** A demand relationship in which the percentage change in quantity demanded is larger than the percentage change in price in absolute value (a demand elasticity with an absolute value greater than 1).
- **inelastic demand** Demand that responds somewhat, but not a great deal, to changes in price. Inelastic demand always has a numerical value between 0 and 1.

Types of Elasticity *(4 of 4)*

- **unitary elasticity** A demand relationship in which the percentage change in quantity of a product demanded is the same as the percentage change in price in absolute value (a demand elasticity with an absolute value of 1).
- Because it is generally understood that demand elasticities are negative (demand curves have a negative slope), they are often reported and discussed without the negative sign.

Calculating Elasticities *(1 of 2)*

Calculating Percentage Changes

- Here is how we calculate percentage change in quantity demanded using the initial value as the base:

$$\%\text{change in quantity demanded} = \frac{\text{change in quantity demanded}}{Q_1} \times 100\%$$

$$= \frac{Q_2 - Q_1}{Q_1} \times 100\%$$

Calculating Elasticities *(2 of 2)*

- We can calculate the percentage change in price in a similar way.
- By using P_1 as the base, the percentage of change in P is:

$$\%\text{change in price} = \frac{\text{change in price}}{P_1} \times 100\%$$

$$= \frac{P_2 - P_1}{P_1} \times 100\%$$

Elasticity Is a Ratio of Percentages

- Recall the formal definition of elasticity:

$$\text{price elasticity of demand} = \frac{\%\text{ change in quantity demanded}}{\%\text{change in price}} \times 100\%$$

The Midpoint Formula

- **midpoint formula** A more precise way of calculating percentages using the value halfway between P_1 and P_2 for the base in calculating the percentage change in price and the value halfway between Q_1 and Q_2 as the base for calculating the percentage change in quantity demanded.

$$\%\ \text{change in quantity demanded} = \frac{\text{change in quantity demanded}}{(Q_1 + Q_2)/2} \times 100\%$$

$$= \frac{Q_2 - Q_1}{(Q_1 + Q_2)/2} \times 100\%$$

$$\%\ \text{change in price} = \frac{\text{change in price}}{(P_1 + P_2)/2} \times 100\%$$

$$= \frac{P_2 - P_1}{(P_1 + P_2)/2} \times 100\%$$

Elasticity is derived by dividing % change in quantity demanded by % change in price

Point Elasticity *(1 of 3)*

- **point elasticity** A measure of elasticity that uses the slope measurement.

Point Elasticity *(2 of 3)*

- Elasticity is the percentage change in quantity demanded divided by the percentage change in price, i.e.,

$$\frac{\frac{\Delta Q}{Q_1}}{\frac{\Delta P}{P_1}}$$

where Δ denotes a small change and Q1 and P1 refer to the original price and quantity demanded.

Point Elasticity *(3 of 3)*

- The formula can be rearranged and written as:

$$\frac{\Delta Q}{\Delta P} \cdot \frac{P_1}{Q_1}$$

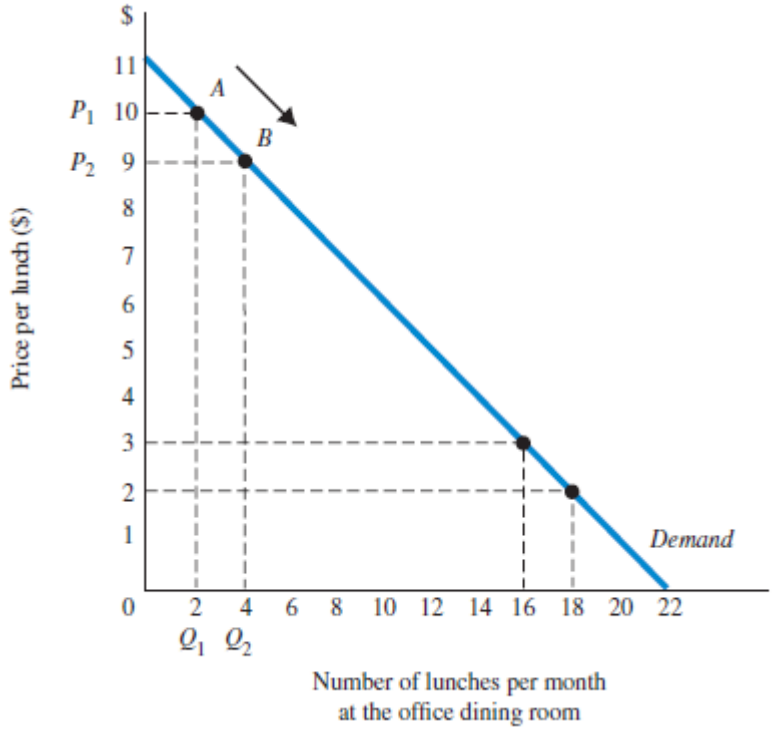
- Notice that $\Delta Q/\Delta P$ is the reciprocal of the slope.
- Using the point method avoids the problem of calculating elasticity over a segment of the curve.

Elasticity Changes along a Straight-Line Demand Curve

TABLE 5.1 Demand Schedule for Office Dining Room Lunches

Price (per Lunch)	Quantity Demanded (Lunches per Month)
$11	0
10	2
9	4
8	6
7	8
6	10
5	12
4	14
3	16
2	18
1	20
0	22

FIGURE 5.3 Demand Curve for Lunch at the Office Dining Room



To calculate price elasticity of demand between points *A* and *B* on the demand curve, first calculate the percentage change in quantity demanded:

$$\%\text{ change in quantity demanded} = \frac{4-2}{(2+4)/2} \times 100\% = \frac{2}{3} \times 100\% = 66.7\%$$

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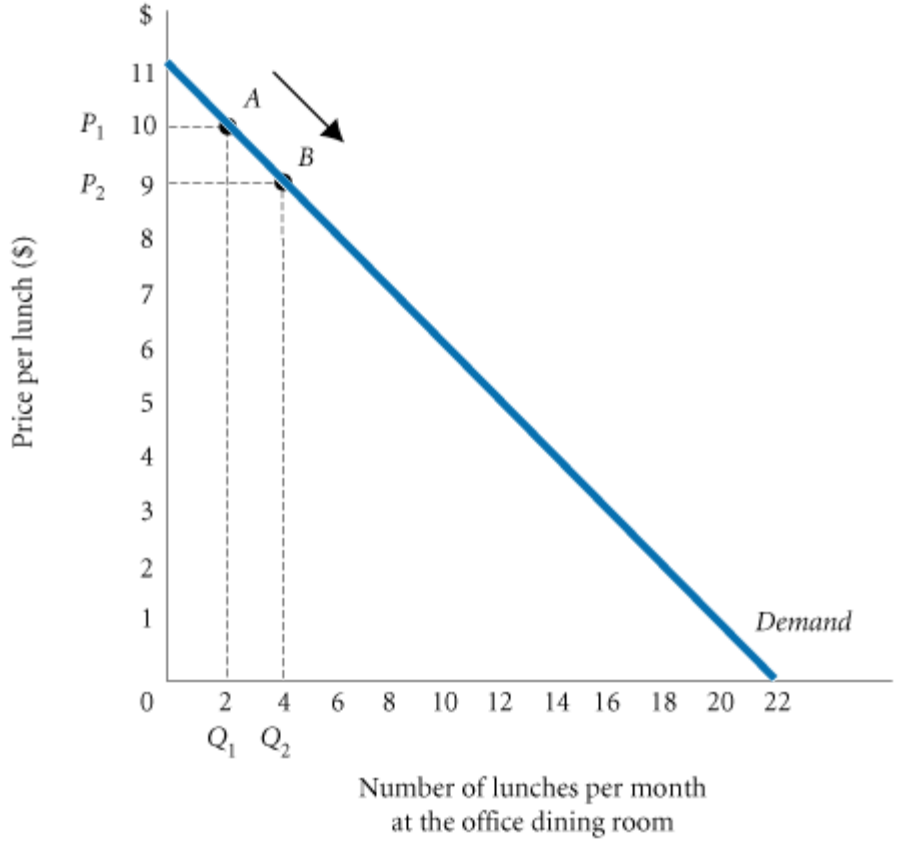

Next, calculate the percentage change in price:

$$\%\text{ change in price} = \frac{9-10}{(10+9)/2} \times 100\% = \frac{-1}{9.5} \times 100\% = -10.5\%$$

Elasticity Changes along a Straight-Line Demand Curve

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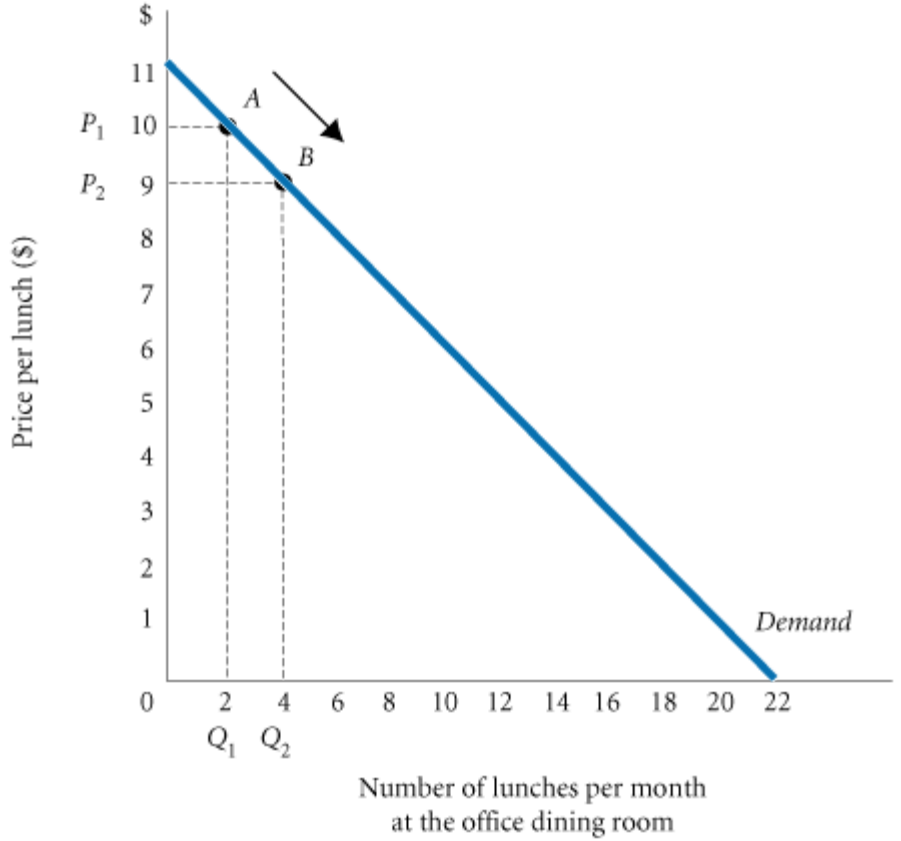

Finally, calculate elasticity:

$$\text{elasticity of demand} = \frac{66.7\%}{-10.5\%} = -6.33$$

Elasticity Changes along a Straight-Line Demand Curve

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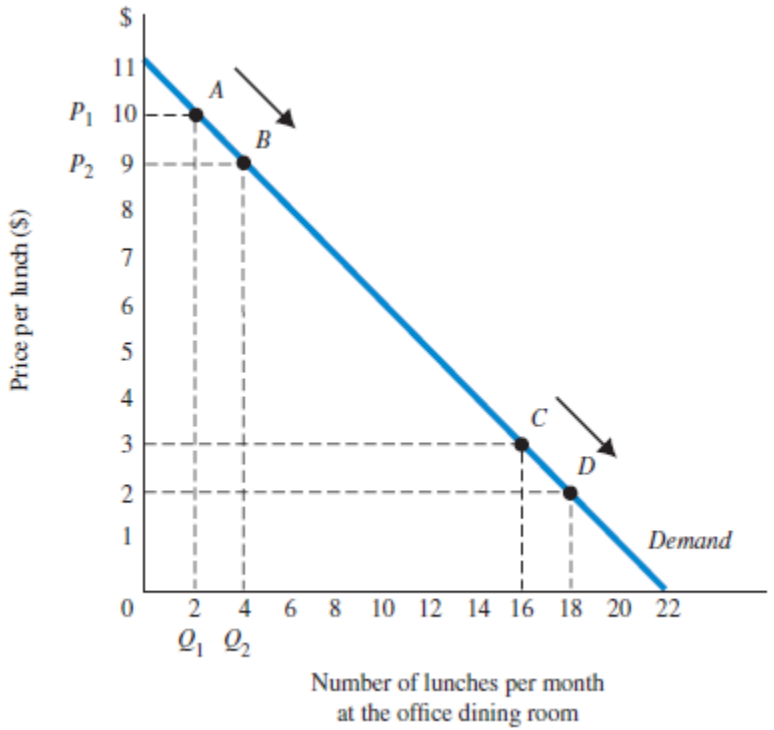
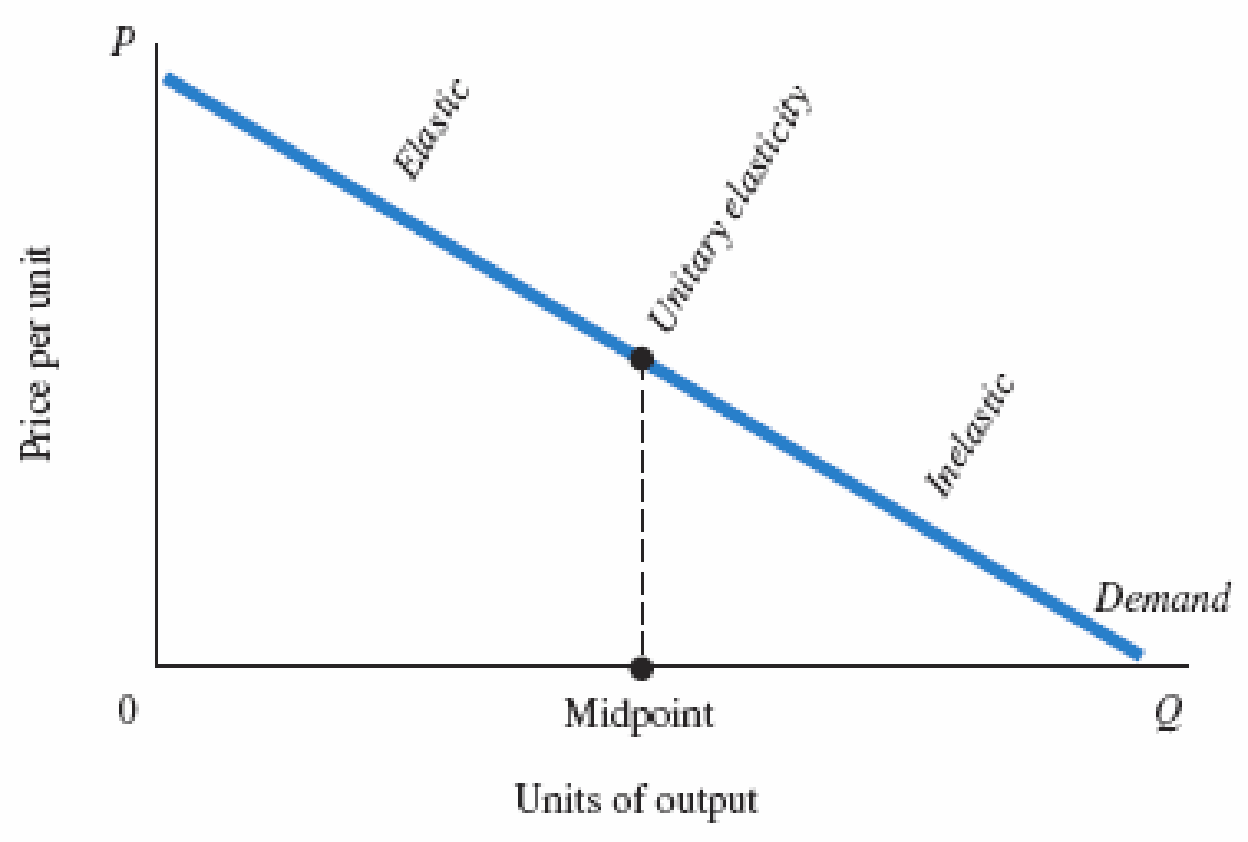


Between points A and B, demand is quite elastic, at −6.33.
Between points C and D, demand is quite inelastic, at −.294.

FIGURE 5.4 Point Elasticity Changes along a Demand Curve



Elasticity and Total Revenue *(1 of 4)*

- In any market, $P \times Q$ is total revenue (TR) received by producers:

$$TR = P \times Q$$

total revenue = price × quantity

Effects of price changes on quantity demanded:

$$P \uparrow \rightarrow Q_D \downarrow$$

and

$$P \downarrow \rightarrow Q_D \uparrow$$

When price (P) declines, quantity demanded (Q_D) increases. The two factors, P and Q_D, move in opposite directions.

Elasticity and Total Revenue *(2 of 4)*

- Because total revenue is the product of *P* and *Q*, whether *TR* rises or falls in response to a price increase depends on which is bigger: the percentage increase in price or the percentage decrease in quantity demanded.

Effect of price increase on a product with inelastic demand: $\uparrow P \times Q_D \downarrow = TR \uparrow$

Elasticity and Total Revenue *(3 of 4)*

- If the percentage decline in quantity demanded following a price increase is larger than the percentage increase in price, total revenue will fall.

Effect of price increase on

a product with elastic demand: $\uparrow P \times Q_D \downarrow = TR \downarrow$

Elasticity and Total Revenue *(4 of 4)*

- The opposite is true for a price cut. When demand is elastic, a cut in price increases total revenue.

Effect of price cut on a product with elastic demand:

$$\downarrow P \times Q_D \uparrow = TR \uparrow$$

- When demand is inelastic, a cut in price reduces total revenue.

Effect of price cut on a product with inelastic demand:

$$\downarrow P \times Q_D \uparrow = TR \downarrow$$

The Determinants of Demand Elasticity
(1 of 2)

Availability of Substitutes

- Perhaps the most obvious factor affecting demand elasticity is the availability of substitutes.

The Importance of Being Unimportant

- When an item represents a relatively small part of our total budget, we tend to pay little attention to its price.

The Determinants of Demand Elasticity
(2 of 2)

Luxuries versus Necessities

- Luxury goods (e.g., yachts) tend to have relatively elastic demand, and necessities (e.g., food) have inelastic demand.

The Time Dimension

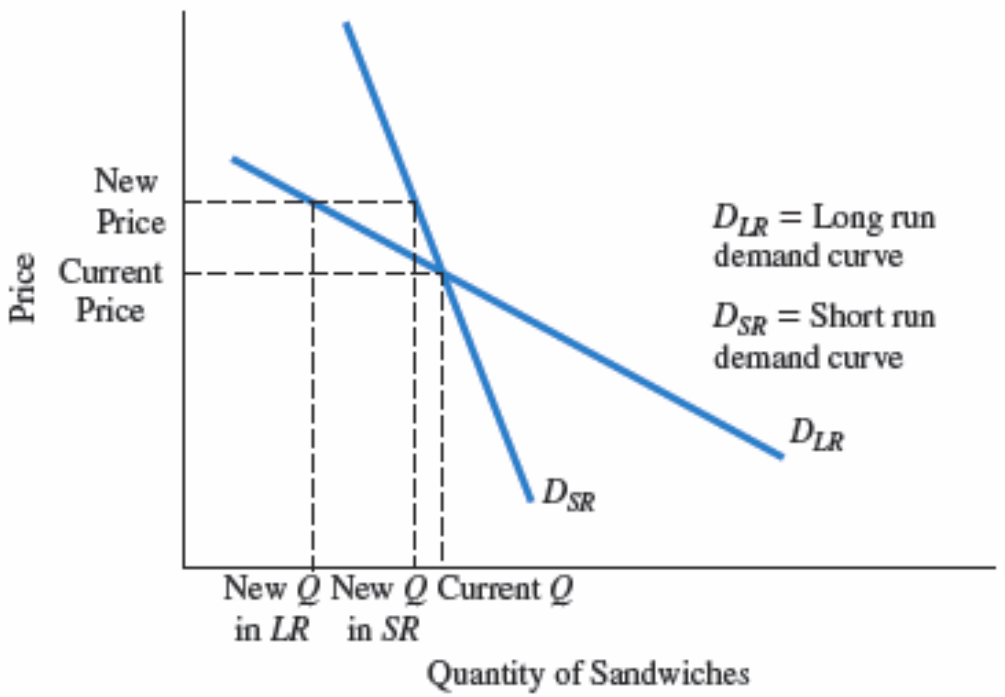
- In the longer run, demand is likely to become more elastic because households make adjustments over time, and producers develop substitute goods.

ECONOMICS IN PRACTICE

Elasticities at a Delicatessen in the Short Run and Long Run

The graph shows the expected relationship between long-run and short-run demand for Frank's sandwiches.

Notice that if you raise prices above the current level, the expected quantity change read from the short-run curve is less than that from the long-run curve.



THINKING PRACTICALLY

1. Provide an example of a purchasing situation in which you think your own short- and long-run elasticities differ a lot and a second in which they are similar. What drives those differences?

Other Important Elasticities *(1 of 2)*

Income Elasticity of Demand

- **income elasticity of demand** A measure of the responsiveness of demand to changes in income.

$$\text{income elasticity of demand} = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in income}}$$

Other Important Elasticities *(2 of 2)*

Cross-Price Elasticity of Demand

- **cross-price elasticity of demand** A measure of the response of the quantity of one good demanded to a change in the price of another good.

$$\text{cross} - \text{price elasticity of demand} = \frac{\%\text{change in quantity of } Y \text{ demanded}}{\%\text{change in price of } X}$$

Elasticity of Supply

- **elasticity of supply** A measure of the response of quantity of a good supplied to a change in price of that good. Likely to be positive in output markets.

$$\text{elasticity of supply} = \frac{\%\text{change in quantity supplied}}{\%\text{ change in price}}$$

- **elasticity of labor supply** A measure of the response of labor supplied to a change in the price of labor.

$$\text{elasticity of labour supply} = \frac{\%\text{change in quantity of labour supplied}}{\%\text{change in the wage rate}}$$

ECONOMICS IN PRACTICE

Tax Rates and Migration in Europe

Denmark is part of the European Union (EU).
In 2009, Denmark enacted a tax relief law aimed at luring highly skilled immigrants.
Researchers found an elasticity of almost 2 for the increase in migration to the reduction in the tax rate.

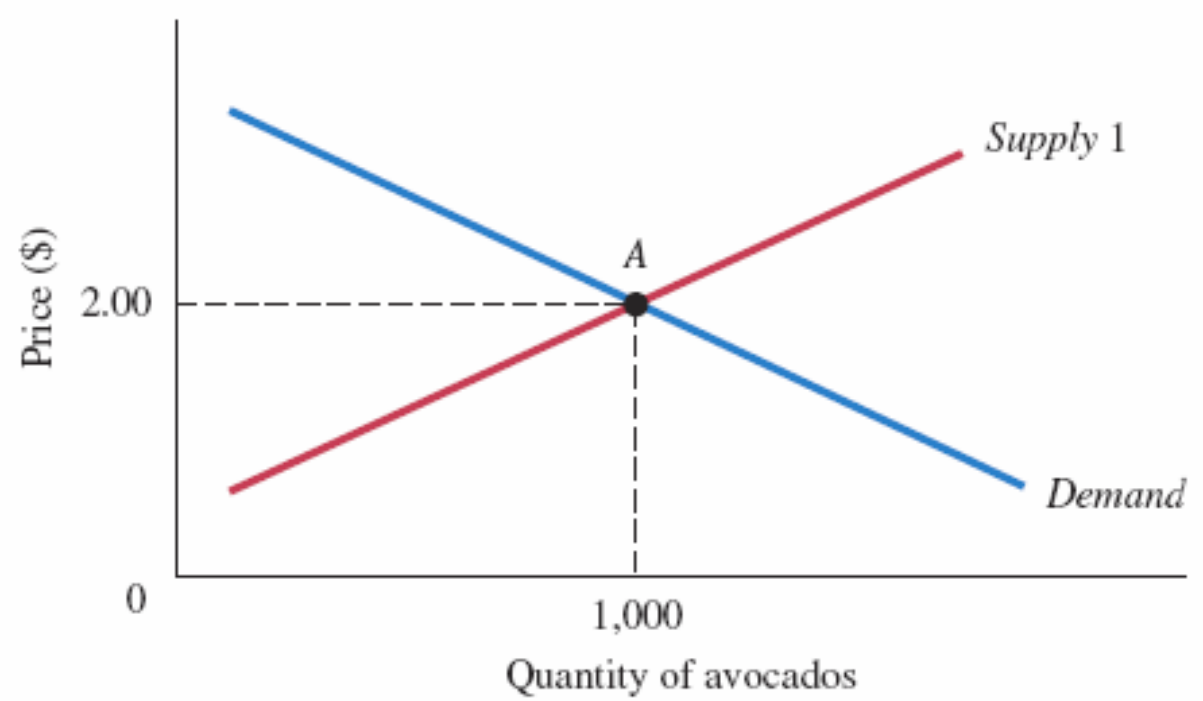
THINKING PRACTICALLY

1. What features of the EU do you think increase the labor elasticity?

What Happens When We Raise Taxes: Using Elasticity

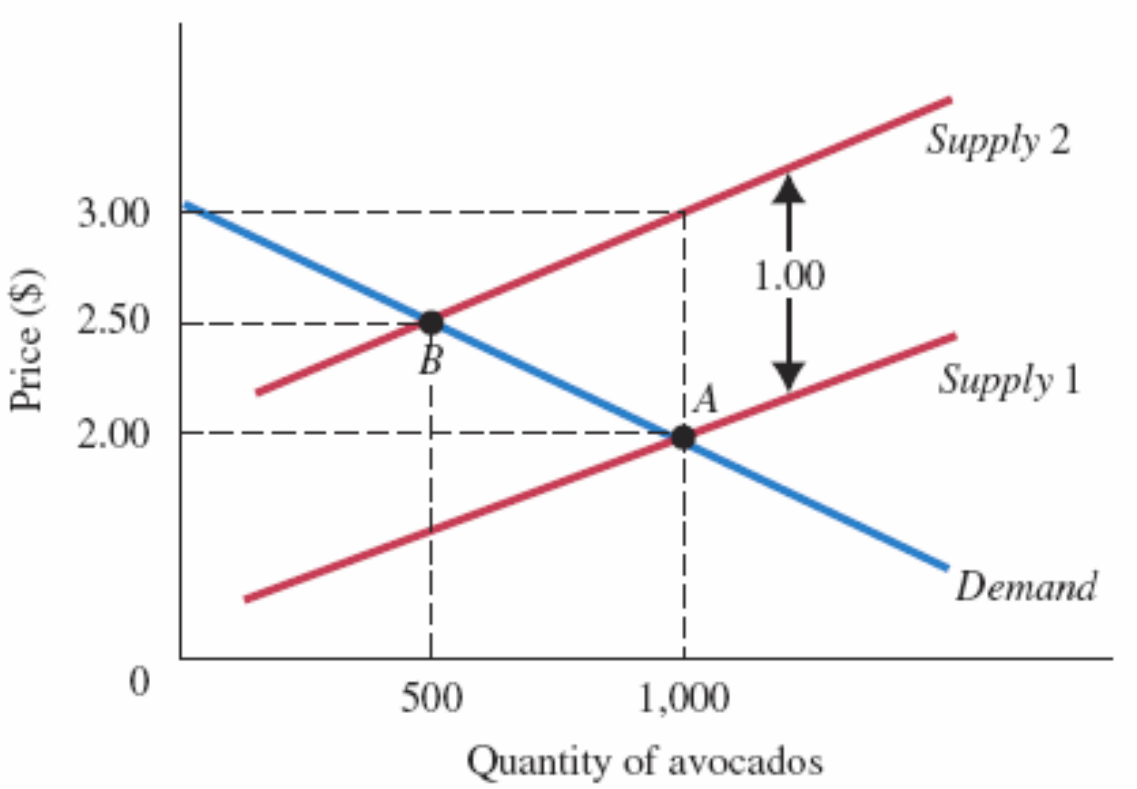
- **excise tax** A per-unit tax on a specific good.
- In the United States, we have excise taxes on gasoline and cigarettes.
- Example: A mayor of a city imposes a tax of $1.00 per avocado in a city where 1,000 avocados are sold per day. Will the city add $365,000 per year in taxes?

FIGURE 5.5 Original Equilibrium in the Avocado Market



Store owners in the city sells 1,000 avocados per day at the market price of $2.00.

FIGURE 5.6 Equilibrium in the Avocado Market after the $1.00 Tax



After the mayor imposes a tax of $1.00 per avocado, the supply curve shifts up by $1.00, and there is a new equilibrium where supply equals demand at point *B*.

At the new equilibrium, 500 avocados are sold; the equilibrium price rises to $2.50, and storeowners receive $1.50 per avocado.

REVIEW TERMS AND CONCEPTS

- cross-price elasticity of demand
- elastic demand
- elasticity
- elasticity of labor supply
- elasticity of supply
- excise tax
- income elasticity of demand
- inelastic demand
- midpoint formula
- perfectly elastic demand
- perfectly inelastic demand
- point elasticity
- price elasticity of demand
- unitary elasticity