



# WHAT YOU WILL LEARN IN THIS CHAPTER

- Why is elasticity used to measure the response to changes in prices or income?
- What are the different elasticity measures, and what do they mean?
- What factors influence the size of these various elasticities?
- Why is it vitally important to determine the size of the relevant elasticity before setting prices or government fees?

# TAKEN FOR A RIDE

- Charges for an ambulance ride vary wildly across Canada: they range from \$45 to several hundred dollars.
- What accounts for the extreme variation in the cost of ambulance services?
- The answer is responsiveness of consumers to price—the price elasticity of demand.



Scott Kochsiek/Getty Images

# PRICE ELASTICITY OF DEMAND

Price elasticity of demand is the measure of price responsiveness:

- A demand is **elastic** when an increase in price reduces the quantity demanded a lot.
- A demand is **inelastic** when an increase in price reduces quantity demanded just a little.

# CALCULATING THE PRICE ELASTICITY OF DEMAND (1 of 2)

- Price elasticity of demand = the *percentage* change in quantity demanded divided by the *percentage* change in price.

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

# CALCULATING THE PRICE ELASTICITY OF DEMAND (2 of 2)

- Example:
  - If the price of oil increases by 10% and the quantity demanded falls by 5%, then the price elasticity of demand for oil is:

$$\frac{-5\%}{10\%} = -0.5$$

- *Note:* since we know that price and quantity demanded will always move in opposite directions (law of demand), we usually drop the minus sign (for price elasticity of demand *only*).

# THE MIDPOINT METHOD (1 of 3)

- There is a problem: our percent change calculation depends on our choice of starting point.
- Example: Gasoline costs more in Canada than in the United States. What is the percent difference between Canadian and American gas prices? It depends on which way you measure it:
  - Canadian prices are 34% higher.
  - American prices are 25% lower.

# THE MIDPOINT METHOD (2 of 3)

- To solve this problem, we calculate the price elasticity of demand using the **midpoint formula for percentage changes**.
- Instead of dividing by the initial quantity or price, we'll use the average quantity or price.

$$\% \text{ change in } X = \frac{\text{Change in } X}{\text{Average value of } X} \times 100$$

$$\text{Average value of } X = \frac{\text{Starting value of } X + \text{Final value of } X}{2}$$



# THE MIDPOINT METHOD (3 of 3)

- Example: At the initial price of \$10, the quantity demanded is 100. When the price rises to \$20, the quantity demanded is 90.

$$\% \text{ change in price} = \frac{20 - 10}{(10 + 20)/2} \times 100 = 66.6\%$$

$$\% \text{ change in quantity demanded} = \frac{90 - 100}{(100 + 90)/2} \times 100 = -10.5\%$$

$$\text{Price elasticity of demand} = \frac{10.5\%}{66.6\%} = 0.16$$

# LEARN BY DOING: PRACTICE QUESTION 1

- If the price of a sushi roll drops from \$8 to \$4 and sales rise from 20 to 40 units, what is the absolute value of the price elasticity of demand using the midpoint formula?
  - a) 0.5
  - b) 0.66
  - c) 1
  - d) 2

# ESTIMATING ELASTICITIES

- Economists (and many others) are interested in price elasticity of demand.
- Estimating elasticity is crucial to understanding and predicting market outcomes.

**TABLE 6-1 Some Estimated Price Elasticities of Demand**

Good	Price elasticity of demand
<b>Inelastic demand</b>	
Postsecondary education	0.14–0.29
Gasoline (short-run)	0.25
Gasoline (long-run)	0.57–0.74
Airline travel (business, short-haul)	0.70
<b>Elastic demand</b>	
Nonalcoholic beverages	1.14
Housing	1.2
Airline travel (leisure, short-haul)	1.52
Coke/Pepsi	3.3

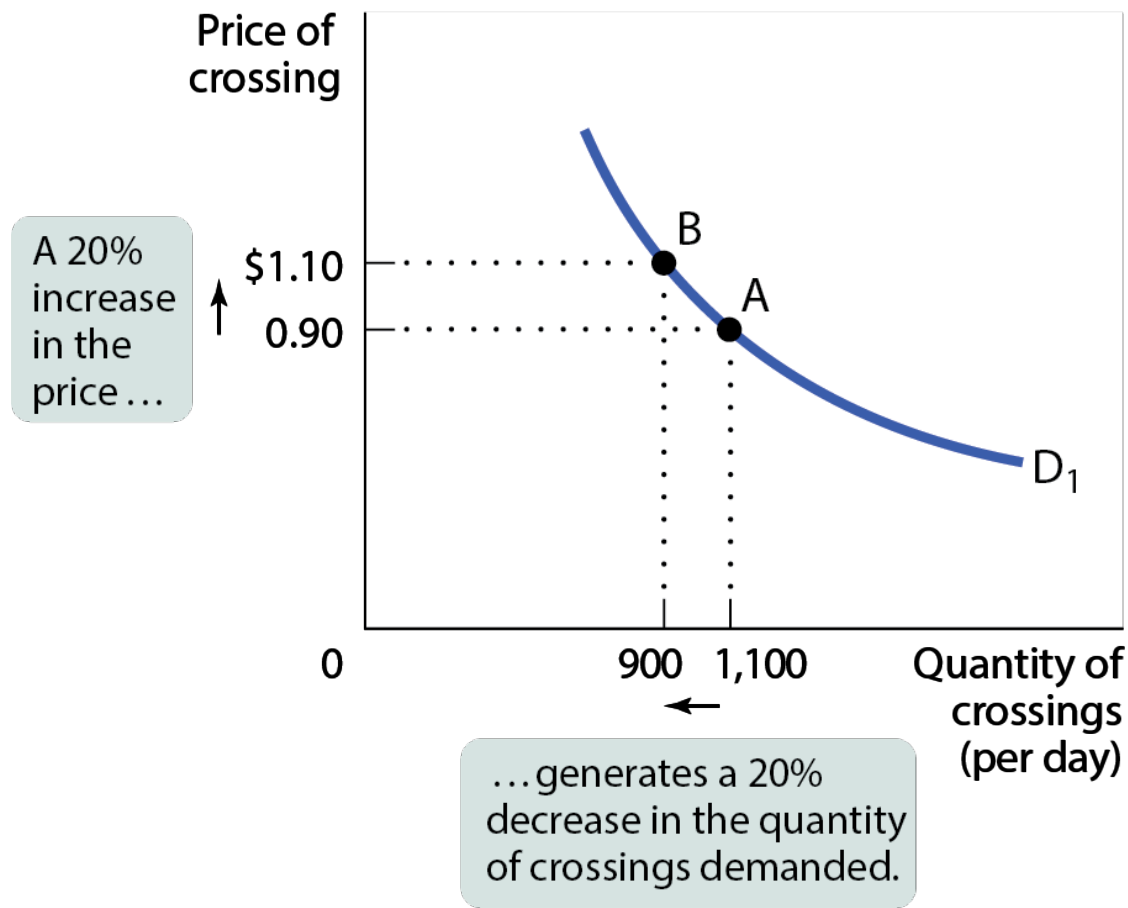
# INTERPRETING THE PRICE ELASTICITY OF DEMAND

- Classification of price elasticity of demand:
  - A good can have a price elasticity as **low as zero** or as **high as infinity**.
  - If a price elasticity  $< 1$ , the demand curve is **inelastic**.
  - If a price elasticity  $> 1$ , the demand curve is **elastic**.
  - If a price elasticity  $= 1$ , the demand curve is **unit-elastic**.
  - If a price elasticity  $= 0$ , the demand curve is **perfectly inelastic**.
  - If a price elasticity  $= \infty$ , the demand curve is **perfectly elastic**.

# UNIT-ELASTIC DEMAND

Figure 6-3(a)

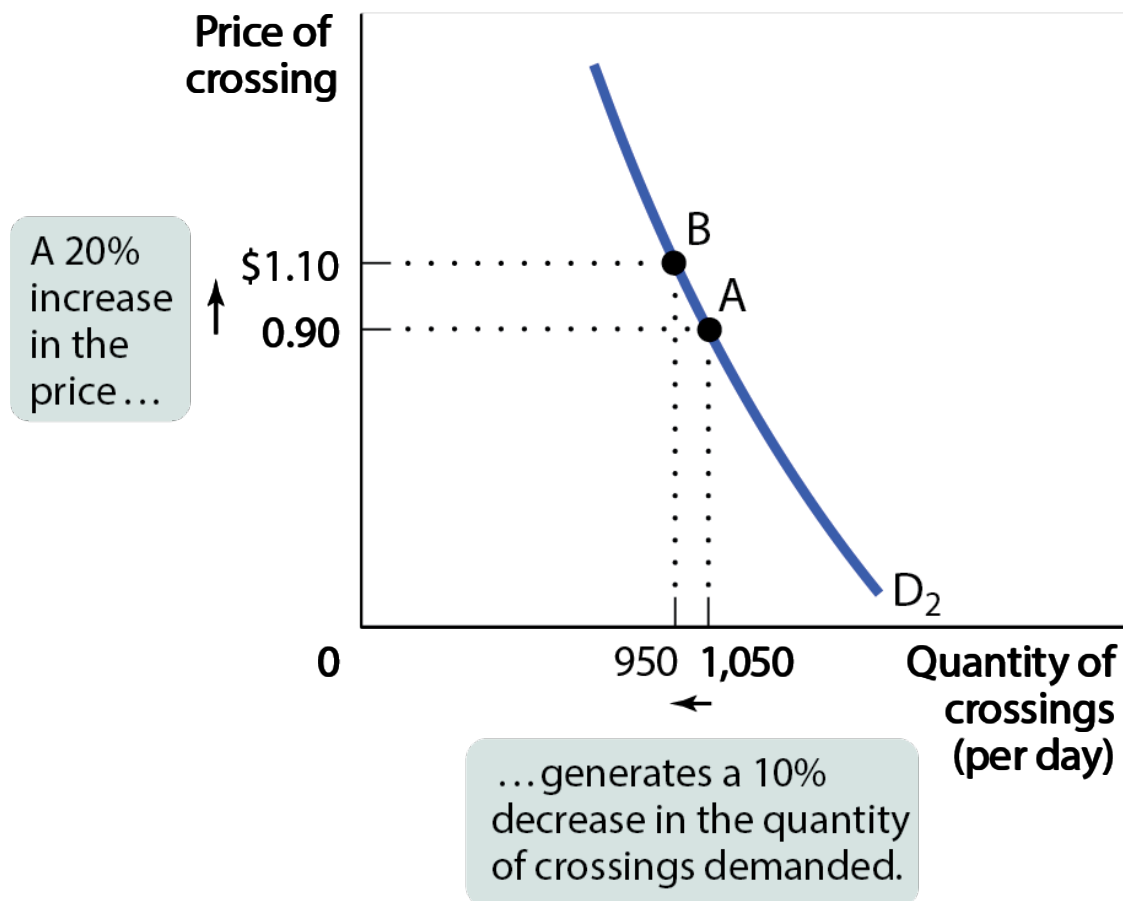
(a) Unit-Elastic Demand: Price Elasticity of Demand = 1



# INELASTIC DEMAND

Figure 6-3(b)

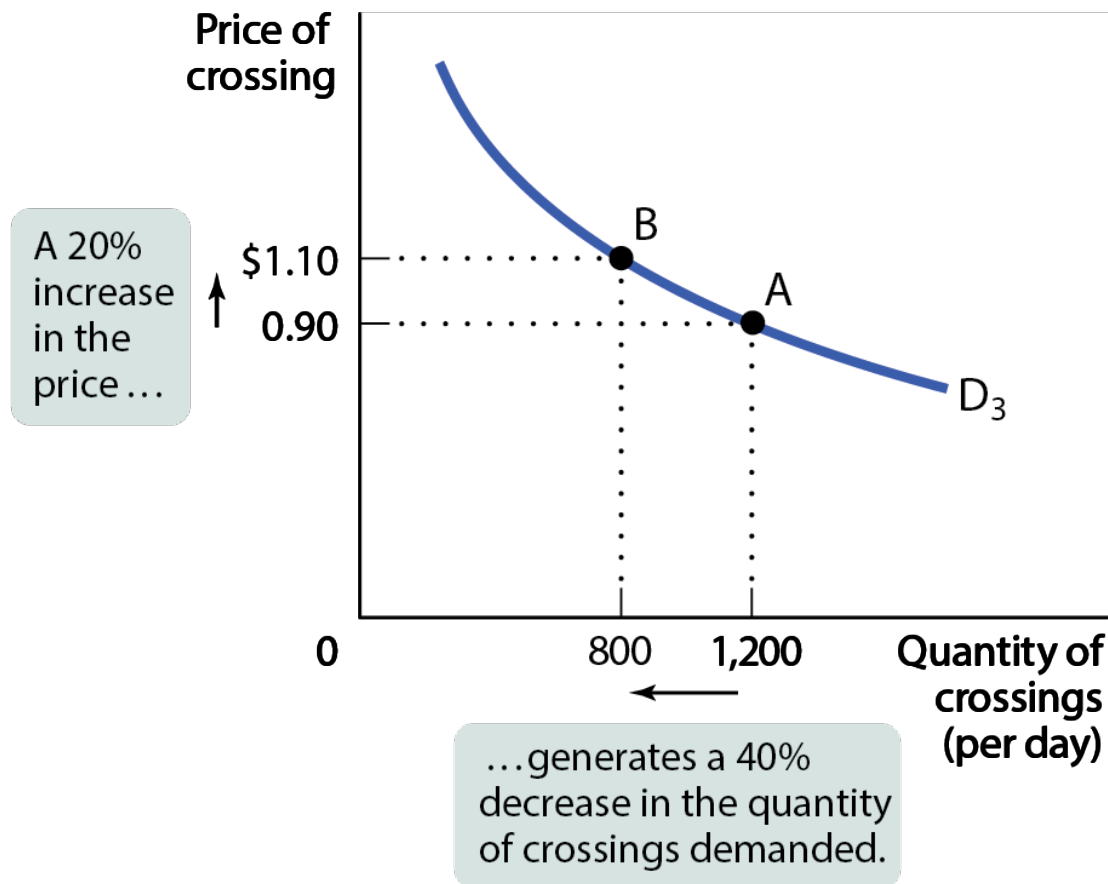
(b) Inelastic Demand: Price Elasticity of Demand = 0.5



# ELASTIC DEMAND

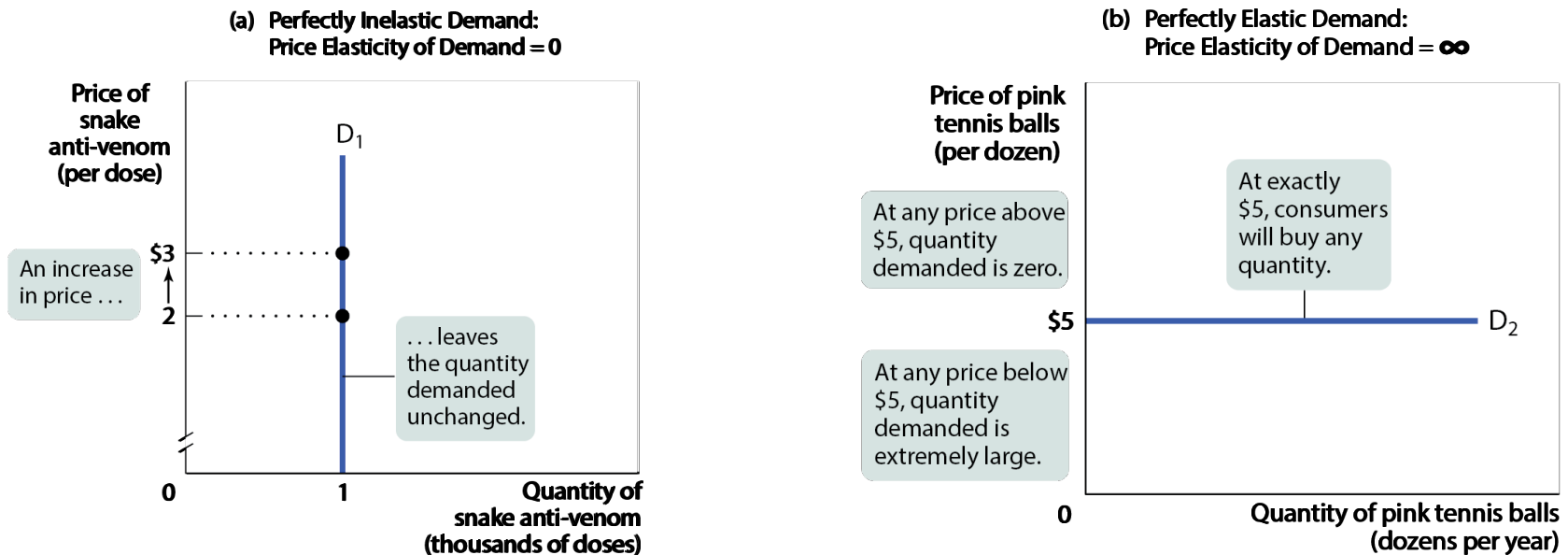
Figure 6-3(c)

(c) Elastic Demand: Price Elasticity of Demand = 2



# TWO EXTREME CASES OF PRICE ELASTICITY OF DEMAND

Figure 6-2





# ELASTICITY AND TOTAL REVENUE, PART 1

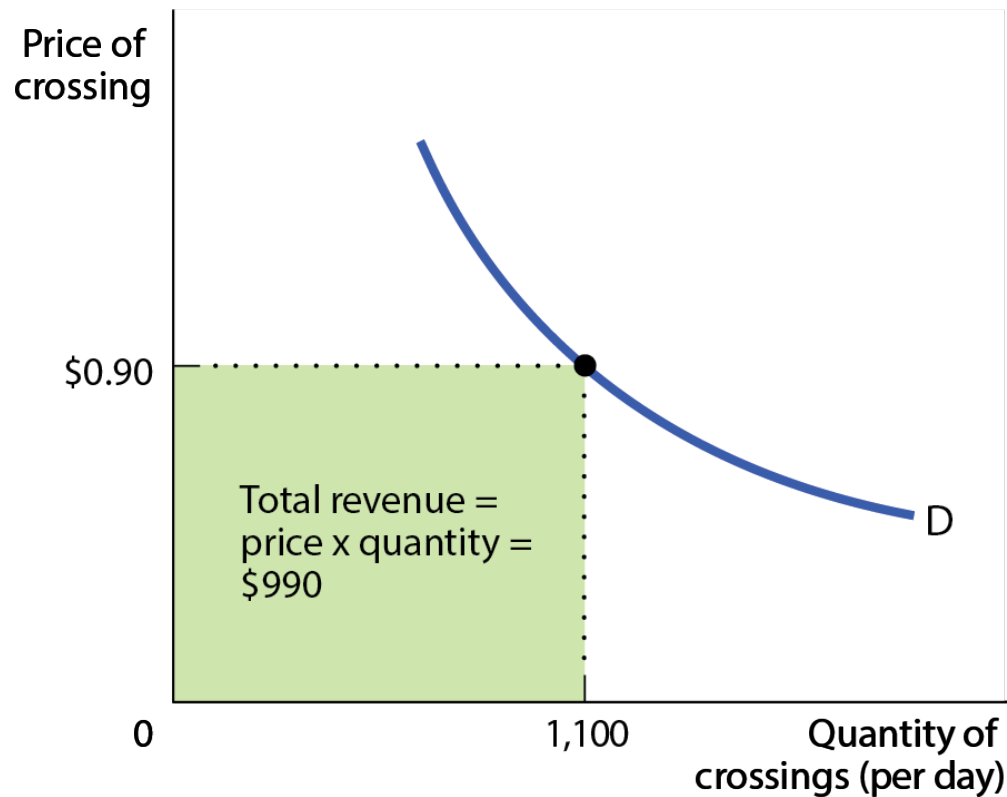
- **Total revenue:** price times quantity sold.

$$TR = P \times Q$$

- Sellers need to know how elastic demand is so they can plan.

# TOTAL REVENUE BY AREA

Figure 6-4(a)  
(a) Total Revenue



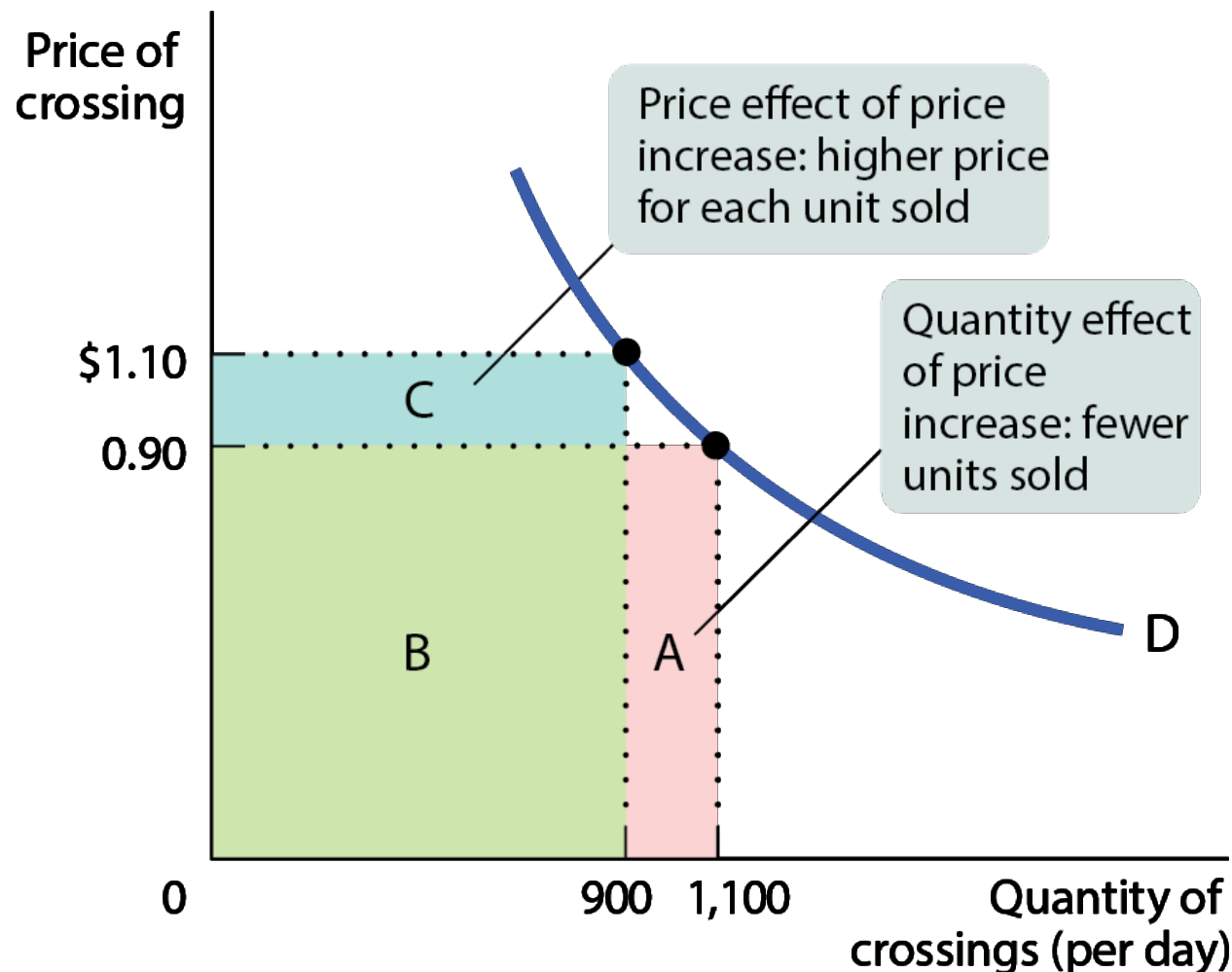
# PRICE EFFECT AND QUANTITY EFFECT

- When a seller raises the price of a good, there are two countervailing effects:
  - **A price effect:** after a price increase, each unit sells at a higher price, which tends to raise revenue.
  - **A quantity effect:** after a price increase, fewer units are sold, which tends to lower revenue.

# EFFECT OF A PRICE INCREASE ON TOTAL REVENUE

Figure 6-4(b)

(b) Effect of a Price Increase on Total Revenue



# ELASTICITY AND TOTAL REVENUE, PART 2

- When demand is **inelastic**, the price effect dominates the quantity effect.
- So an **increase in price will cause only a slight reduction in the quantity demanded**.
- In this instance, **total revenue will rise when the price rises** (and vice versa).
- *What happens if salt (inelastic) prices go up?*

# ELASTICITY AND TOTAL REVENUE, PART 3

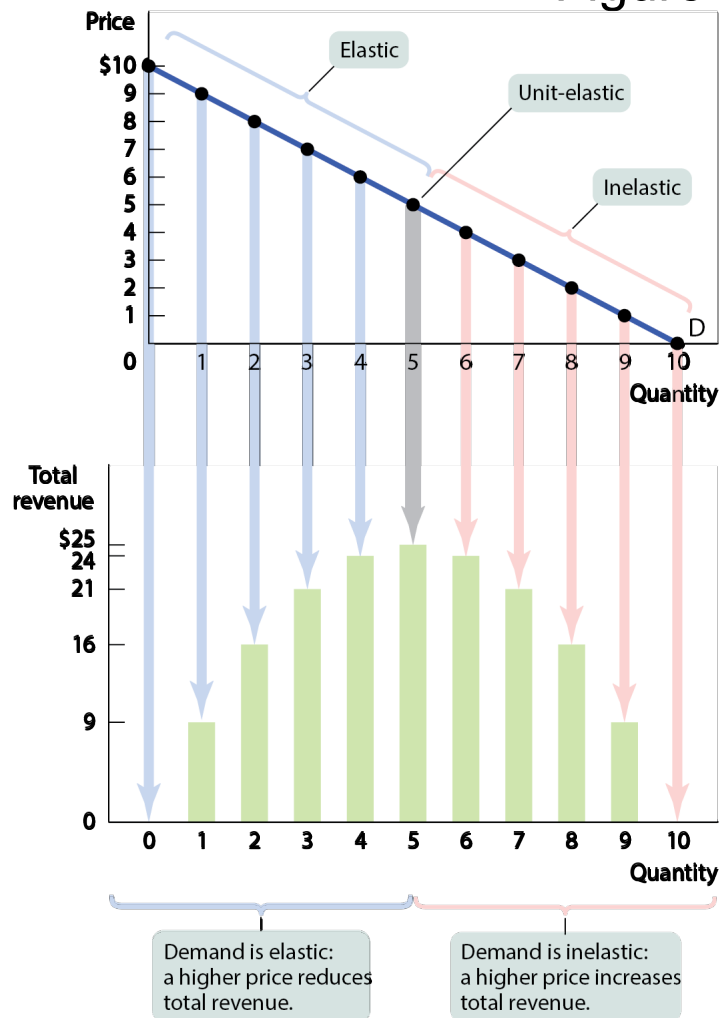
- When demand is **elastic**, the quantity effect dominates the price effect.
  - So an increase in price will cause significant reduction in the quantity demanded.
  - In this instance, total revenue will fall when the price rises.

# ELASTICITY AND TOTAL REVENUE PART 4

- When demand is unit-elastic, the quantity effect equals the price effect.
- So an **increase in price exactly balances the reduction in the quantity demanded.**
- In this instance, **total revenue doesn't change.**
- *What happens if tire (unit-elastic) prices go up?*

# DEMAND SCHEDULE AND TOTAL REVENUE

Figure 6-5



Price	Quantity demanded	Total revenue
\$0	10	\$0
1	9	9
2	8	16
3	7	21
4	6	24
5	5	25
6	4	24
7	3	21
8	2	16
9	1	9
10	0	0

- The price elasticity of demand changes along the demand curve.



# LEARN BY DOING: PRACTICE QUESTION 2

- The elasticity of demand for eggs has been estimated to be 0.1. If egg producers raise their prices by 10%, what will happen to their total revenue?
  - a) It will increase.
  - b) It will decrease.
  - c) It won't change.

# LEARN BY DOING: PRACTICE QUESTION 3

- If a fashionable clothing store raised its prices by 25%, what does that tell you about the store's estimate of demand for its products?
  - a) They think it's elastic.
  - b) They think it's inelastic.

# WHAT FACTORS DETERMINE THE PRICE ELASTICITY OF DEMAND? PART 1

## 1. Whether the good is a **necessity** or a **luxury**:

- For **necessities**, quantity demanded does not change much in response to a change in  $P$ .
- For **luxuries**, quantity demanded is more sensitive to a change in price.

# WHAT FACTORS DETERMINE THE PRICE ELASTICITY OF DEMAND? PART 2

## 2. The **availability of close substitutes**:

- Fewer substitutes make it harder for consumers to adjust  $Q$  when  $P$  changes, so **demand is inelastic**.
- Many substitutes make it easier for consumers to switch brands when prices change, so **demand is elastic**.

# LEARN BY DOING: PRACTICE QUESTION 4

- When the patent expires on a brand-name drug and five generic drugs come on the market, what happens to elasticity of demand for the original drug?
  - a) It rises.
  - b) It falls.

# WHAT FACTORS DETERMINE THE PRICE ELASTICITY OF DEMAND? PART 3

## 3. The **share of income spent on the good**:

- It feels cheaper when we spend a smaller share of income on the good.
- It feels more expensive when we spend a greater share of income on the good.

# WHAT FACTORS DETERMINE THE PRICE ELASTICITY OF DEMAND? PART 4

## 4. Time elapsed since the price change:

- Less time to adjust means lower elasticity.
- **Over time**, consumers can adjust their behavior by finding substitutes (making demand more elastic).

# OTHER DEMAND ELASTICITIES

- The cross-price elasticity of demand measures how sensitive the quantity demanded of good A is to the price of good B.
- **Cross-price elasticity of demand =**

$$\frac{\% \text{ change in quantity of } A \text{ demanded}}{\% \text{ change in price of } B}$$



# CROSS-PRICE ELASTICITY OF DEMAND

- For **substitutes**, cross-price elasticity of demand is **positive**.
  - An increase in the price of one brand of cookies will increase the demand for other brands.
  - The size of the cross-price elasticity shows how closely substitutable the two goods are. (Close substitute – value large)
- For **complements**, cross-price elasticity of demand is **negative**.
  - An increase in the price of milk causes a decrease in demand for Oreos.
  - The size of the cross-price elasticity shows how closely complementary the two goods are. (value slightly below zero weak complements, very negative indicates strong complements)

# LEARN BY DOING: PRACTICE QUESTION 5

- The price of good B increases by 4%, causing the quantity demanded of good A to decrease by 6%. The cross-price elasticity of demand is \_\_\_\_\_, and the goods are \_\_\_\_\_.
- a) 1.5; substitutes
  - b) -1.5; complements
  - c) 0.67; complements
  - d) -2.4; substitutes

# INCOME ELASTICITY OF DEMAND, PART 1

- The **income elasticity of demand** measures how sensitive the quantity demanded of a good is to changes in income.
- **Income elasticity of demand =**

$$\frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}}$$

# INCOME ELASTICITY OF DEMAND, PART 2

- The income elasticity of demand can be used to distinguish normal from inferior goods.
  - For **normal goods**, income elasticity is **positive**.
  - For **inferior goods**, income elasticity is **negative**.

# INCOME ELASTICITY OF DEMAND, PART 3

- Normal goods can be income-elastic or not.
- For **income-elastic goods**, income elasticity is **greater than 1**.
- For **income-inelastic goods**, income elasticity is **positive but less than 1**.

# LEARN BY DOING: PRACTICE QUESTION 6

- Tonya consumes 10 boxes of ramen noodles a year when her yearly income is \$40,000. After her income falls to \$30,000 a year, she consumes 40 boxes of ramen noodles a year. Calculate her income elasticity of demand for ramen noodles using the midpoint method.
  - a) 4.2
  - b) -4.2
  - c) -2.25
  - d) 2.25

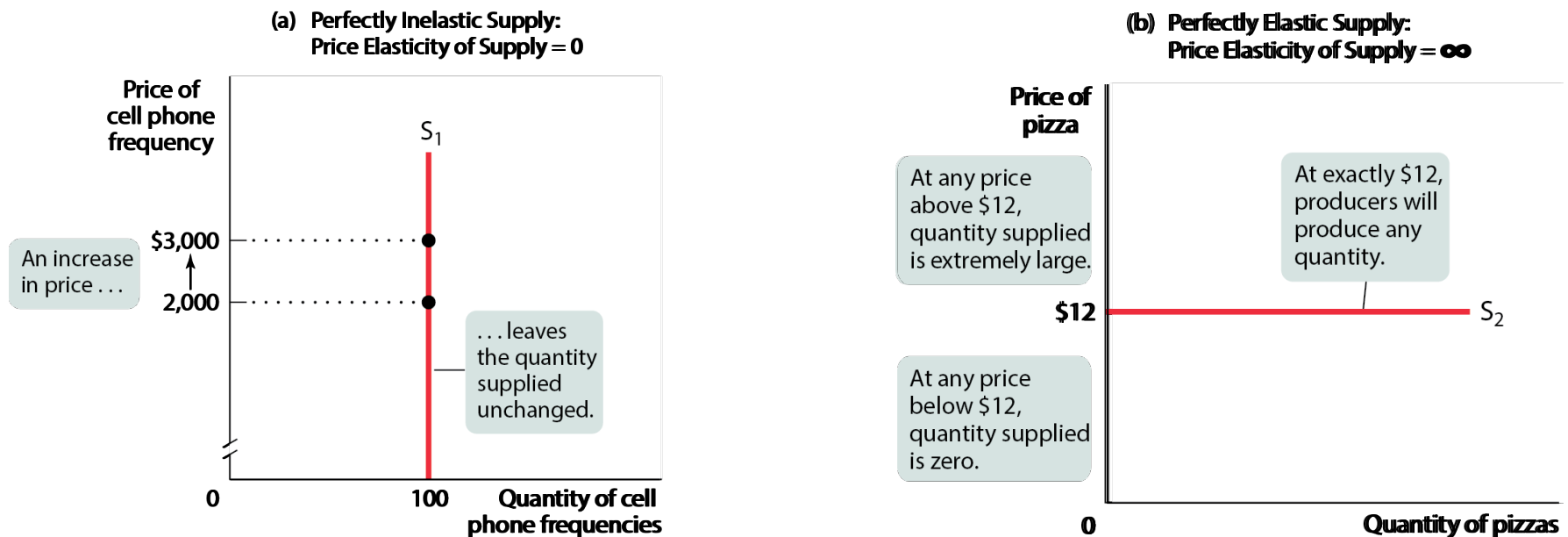
# MEASURING THE PRICE ELASTICITY OF SUPPLY

- Usually, sellers offer more when prices are higher, but how strong is that relationship?
- Similar to price elasticity of demand:

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

# TWO EXTREME CASES OF PRICE ELASTICITY OF SUPPLY

Figure 6-6(a, b)



- Elasticity of supply captures the sensitivity of quantity supplied to changes in price.



# ELASTICITY OF SUPPLY

- Supply curve is **elastic** if a rise in price increases the quantity supplied a lot.
- Supply curve is **inelastic** if a rise in price increases the quantity supplied just a little.

# WHAT FACTORS DETERMINE THE PRICE ELASTICITY OF SUPPLY? (1 of 2)

## 1. Availability of inputs

- If an increase in production is very expensive (inputs are not easily available or cannot be shifted), then the supply will be **inelastic**.

Ex- The price elasticity of cell phone frequencies is zero because an essential input — the radio spectrum — cannot be increased at all.

- If production can be increased cheaply, then the supply will be **elastic**.

Ex- The price elasticity of the supply of pizza is very high because the inputs needed to expand the industry are readily available.

# WHAT FACTORS DETERMINE THE PRICE ELASTICITY OF SUPPLY? (2 of 2)

## 2. Time

- Price elasticity of supply increases as producers have more time to respond to price changes. That means the long-run price elasticity of supply is usually higher than the short-run elasticity.
- Agricultural markets provide a good example. When Canadian farmers receive much higher prices for a given commodity, like wheat (because of a drought in a big wheat-producing country like Australia), in the next planting season they are likely to switch their acreage planted from other crops to wheat.
- For this reason, economists often make a distinction between the short-run elasticity of supply, usually referring to a few weeks or months, and the long-run elasticity of supply, usually referring to several years. In most industries, the long-run elasticity of supply is larger than the short-run elasticity.

# Summary

**TABLE 6-3 An Elasticity Menagerie**

<b>Price elasticity of demand</b> = $\frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$ (dropping the minus sign)	
0	<b>Perfectly inelastic:</b> price has no effect on quantity demanded (vertical demand curve).
Between 0 and 1	<b>Inelastic:</b> a rise in price increases total revenue.
Exactly 1	<b>Unit-elastic:</b> changes in price have no effect on total revenue.
Greater than 1, less than $\infty$	<b>Elastic:</b> a rise in price reduces total revenue.
$\infty$	<b>Perfectly elastic:</b> any rise in price causes quantity demanded to fall to 0. Any fall in price leads to an infinite quantity demanded (horizontal demand curve).
<b>Cross-price elasticity of demand</b> = $\frac{\% \text{ change in quantity demanded of one good}}{\% \text{ change in price of another good}}$	
Negative	<b>Complements:</b> quantity demanded of one good falls when the price of another rises.
Positive	<b>Substitutes:</b> quantity demanded of one good rises when the price of another rises.
<b>Income elasticity of demand</b> = $\frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}}$	
Negative	<b>Inferior good:</b> quantity demanded falls when income rises.
Positive, less than 1	<b>Normal good, income-inelastic:</b> quantity demanded rises when income rises, but not as rapidly as income.
Greater than 1	<b>Normal good, income-elastic:</b> quantity demanded rises when income rises, and more rapidly than income.
<b>Price elasticity of supply</b> = $\frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$	
0	<b>Perfectly inelastic:</b> price has no effect on quantity supplied (vertical supply curve).
Greater than 0, less than $\infty$	ordinary upward-sloping supply curve.
$\infty$	<b>Perfectly elastic:</b> any fall in price causes quantity supplied to fall to 0. Any rise in price elicits an infinite quantity supplied (horizontal supply curve).