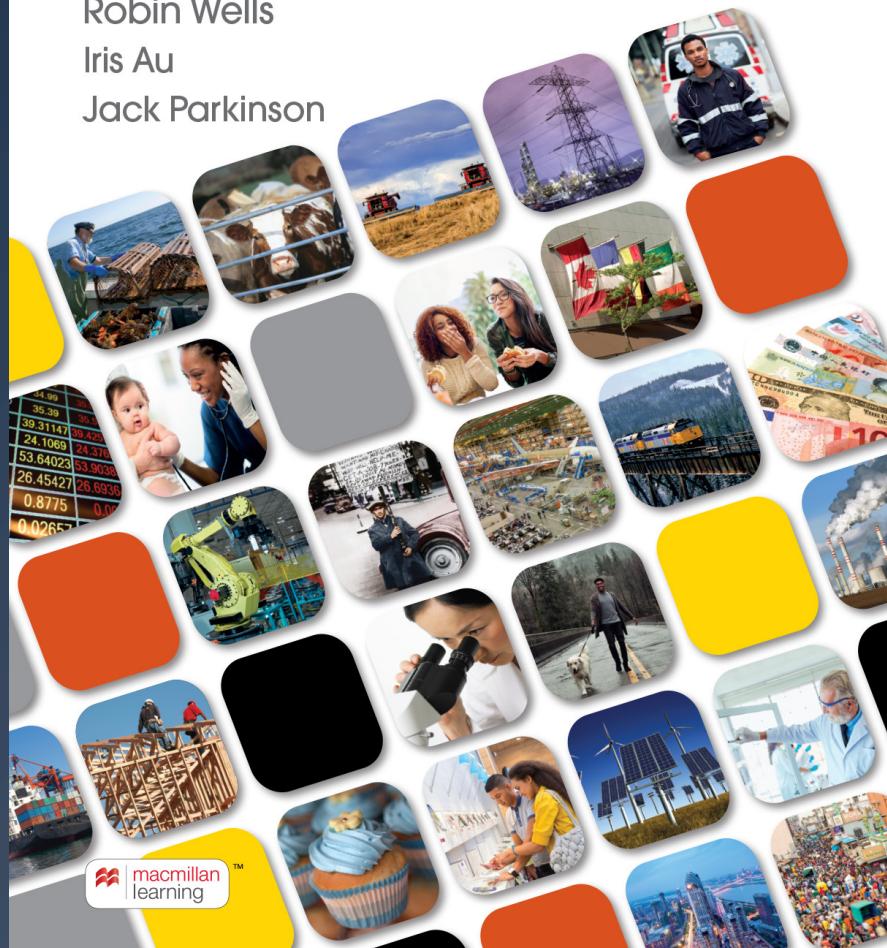


MICROECONOMICS

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Fourth Canadian Edition



6

Elasticity

Revised by Vitaly Terekhov

Krugman, *Microeconomics: Canadian Edition*, 4e, © 2021 Worth Publishers

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
Inelastic demand	
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
Elastic demand	
Nonalcoholic beverages	1.14
Housing	1.2
Airline travel (leisure, short-haul)	1.52
Coke/Pepsi	3.3

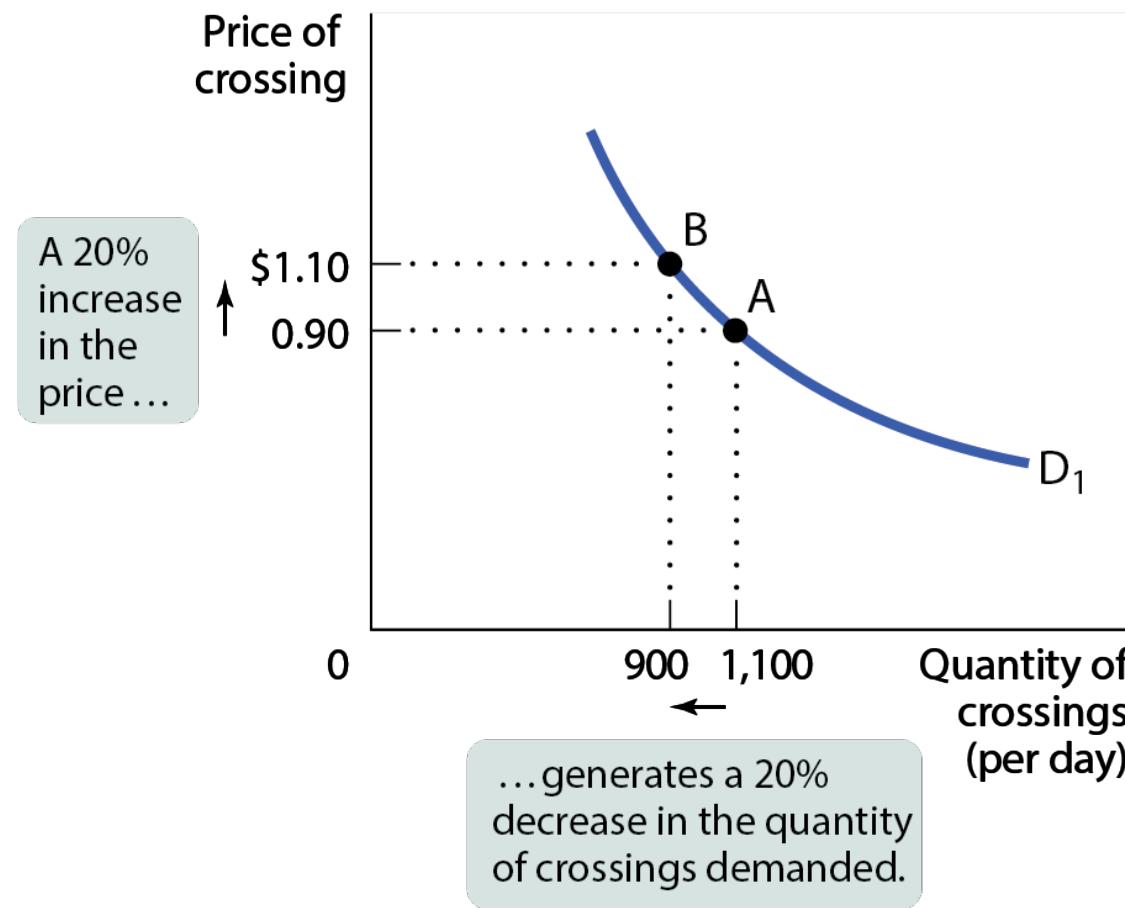
INTERPRETING THE PRICE ELASTICITY OF DEMAND

- 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)

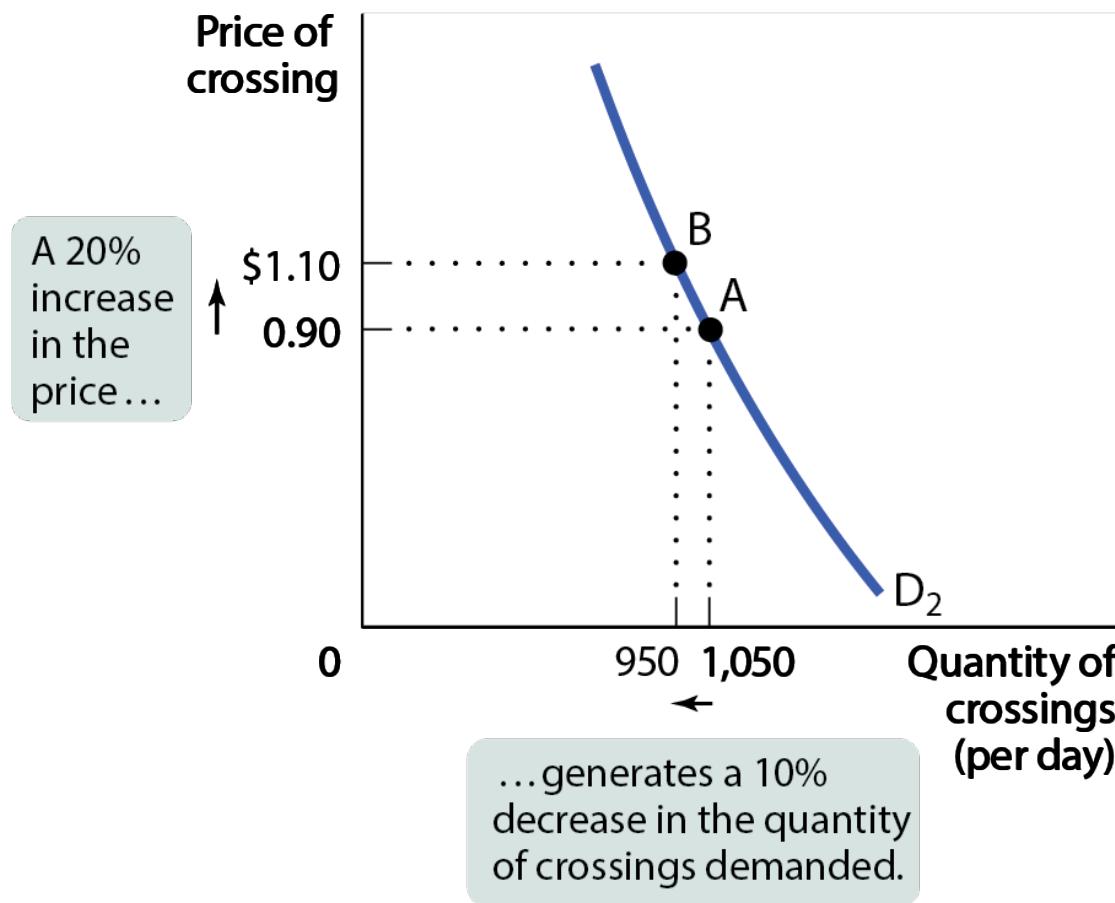
(a) Unit-Elastic Demand: Price Elasticity of Demand = 1



INELASTIC DEMAND

Figure 6-3(b)

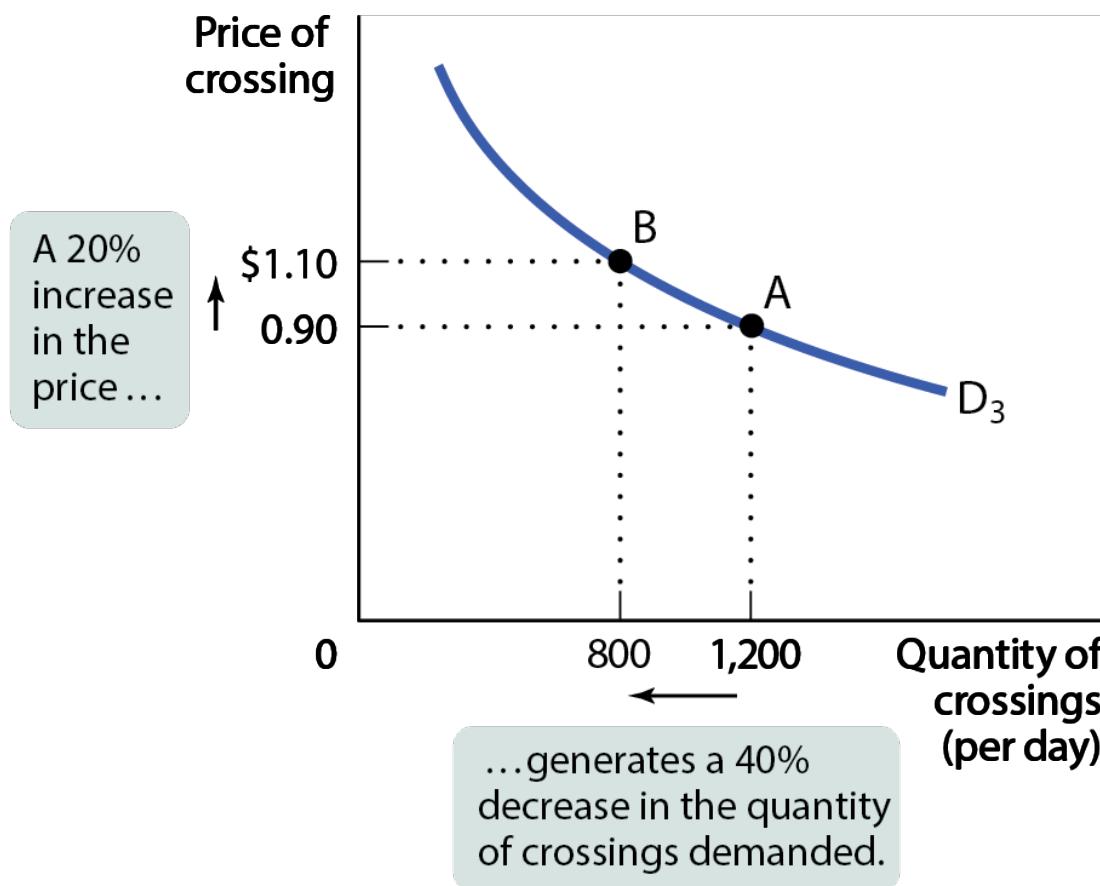
(b) Inelastic Demand: Price Elasticity of Demand = 0.5



ELASTIC DEMAND

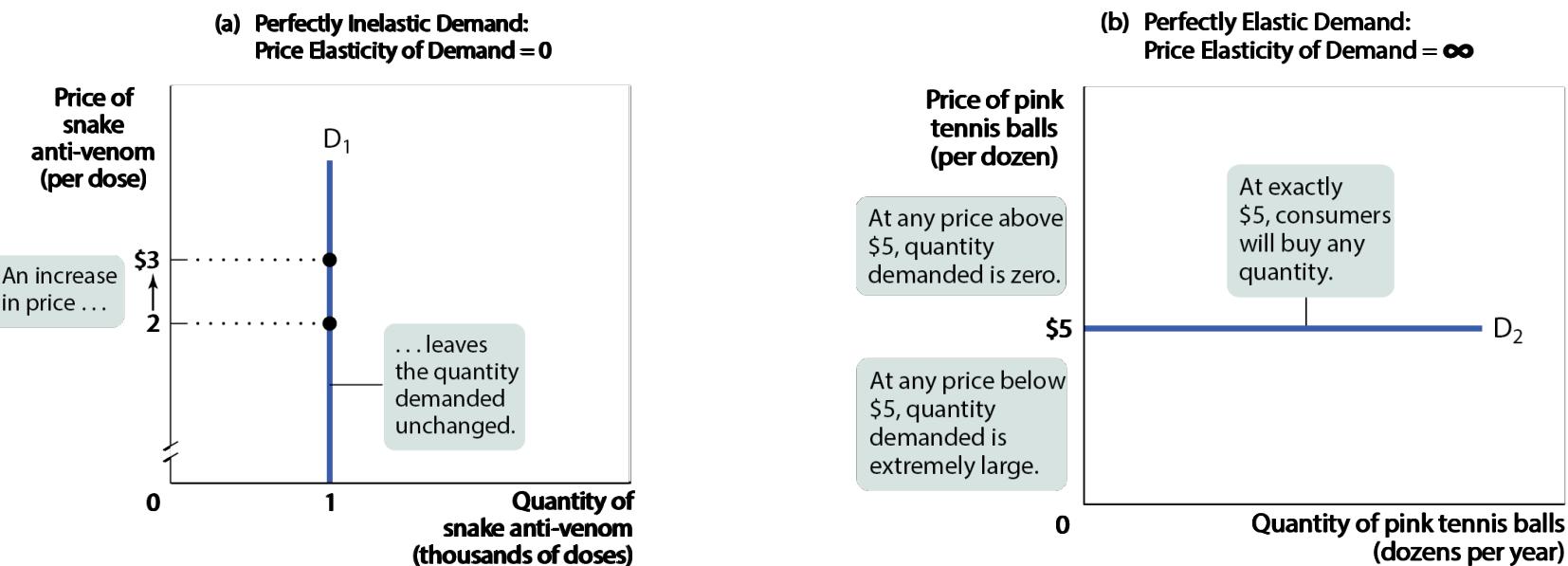
Figure 6-3(c)

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



TWO EXTREME CASES OF PRICE ELASTICITY OF DEMAND

Figure 6-2

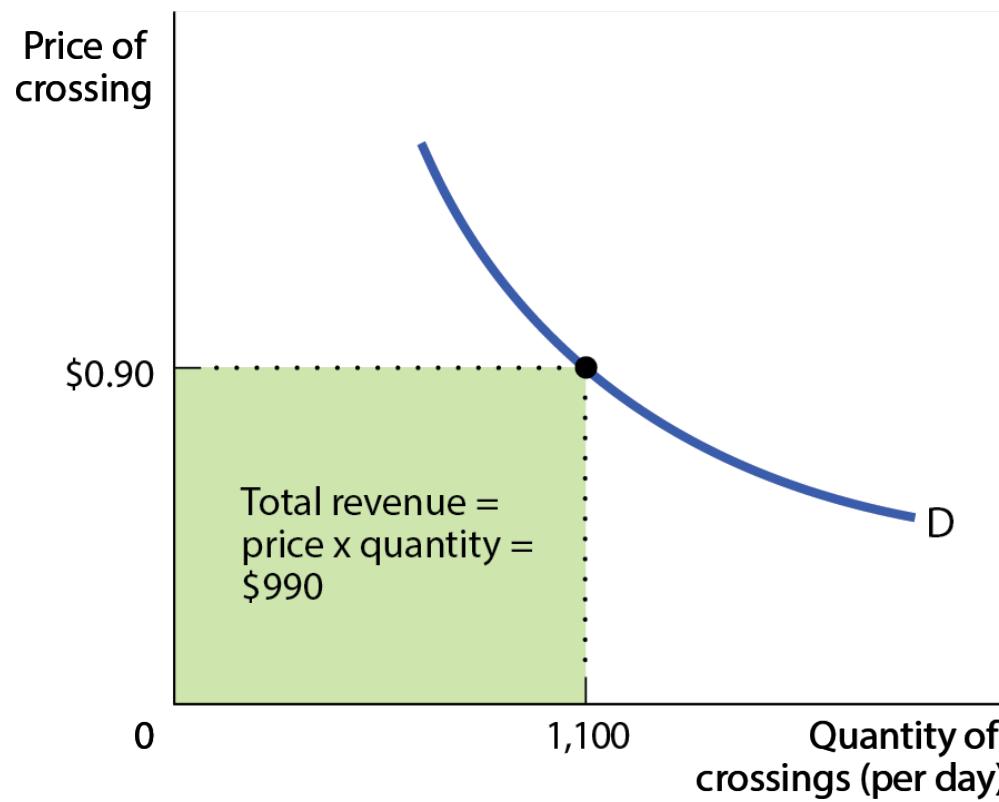


ELASTICITY AND TOTAL REVENUE, PART 1

- **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



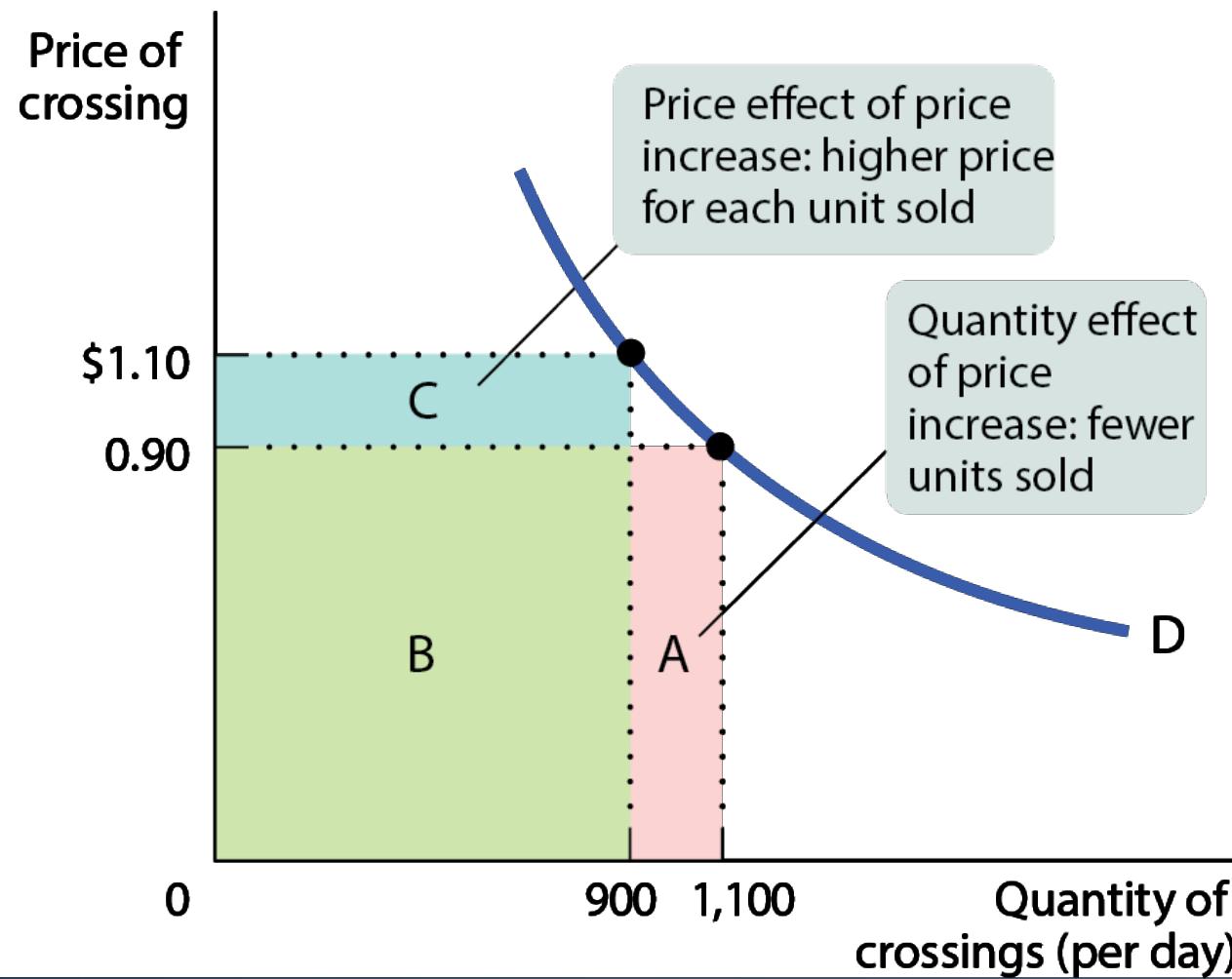
PRICE EFFECT AND QUANTITY EFFECT

- 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

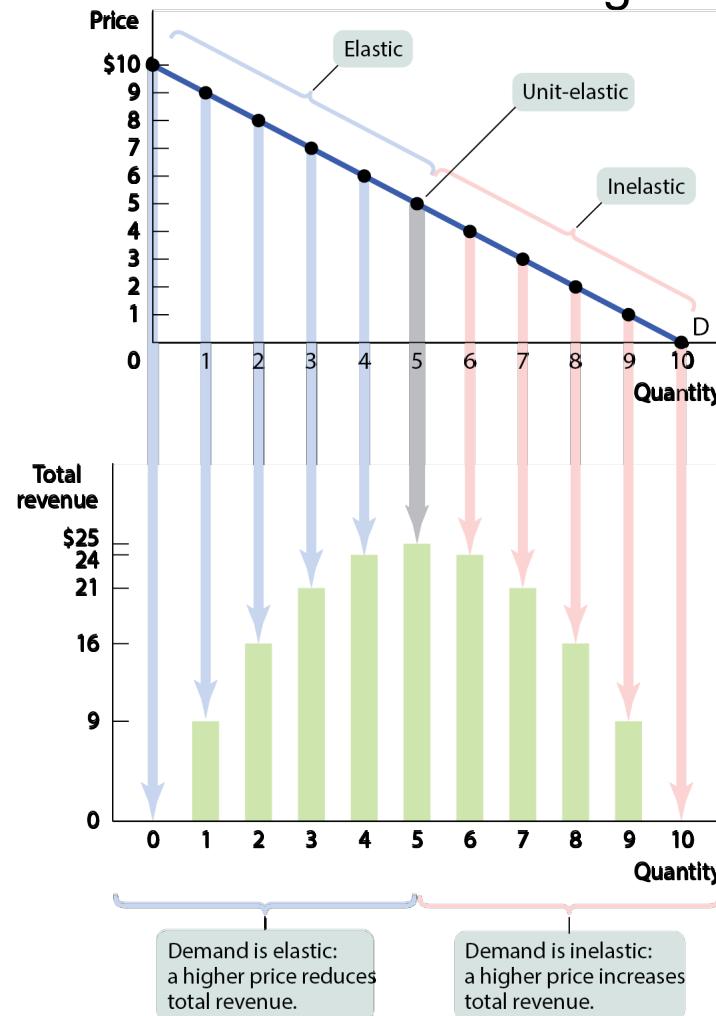
- When demand is **elastic**, the quantity effect dominates the price effect.
 - So an increase in price will cause significant reduction in the quantity demanded.
 - In this instance, total revenue will fall when the price rises.

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



Demand Schedule and Total Revenue for a Linear Demand Curve		
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

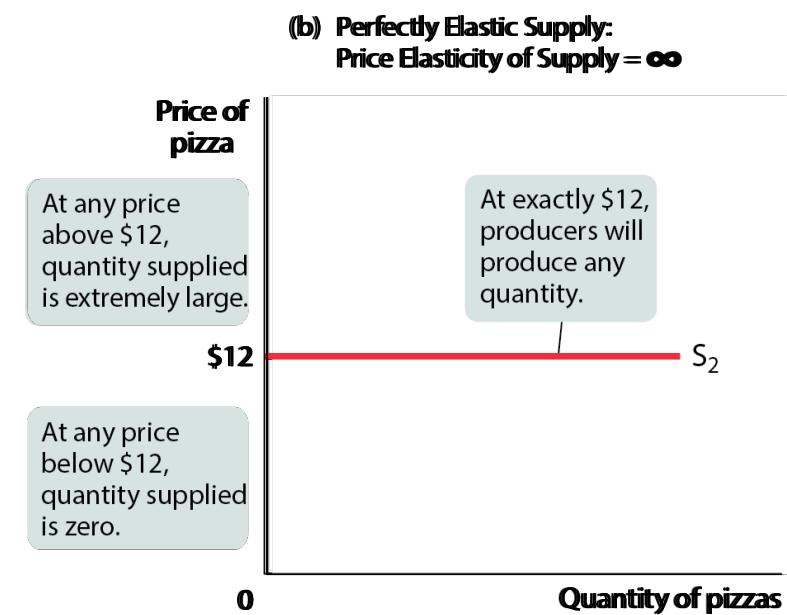
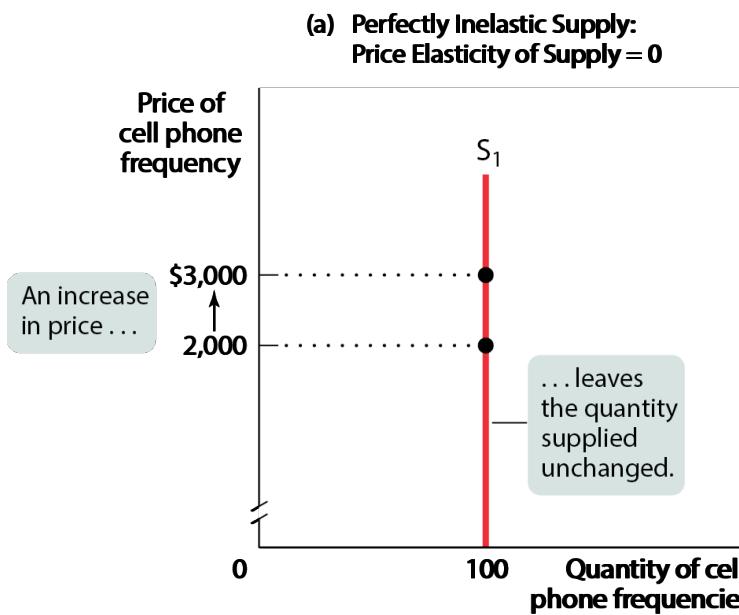
MEASURING THE PRICE ELASTICITY OF SUPPLY

- 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

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