

PRICE ELASTICITY OF DEMAND/SUPPLY

Chapter 5

A scenario...

You design websites for local businesses.
You charge \$200 per website,
and currently sell 12 websites per month.

Your costs are rising
(including the opportunity cost of your time),
so you consider raising the price to \$250.

The law of demand says that you won't sell as
many websites if you raise your price.

How many fewer websites? How much will your
revenue fall, or might it increase?

Elasticity

- Basic idea:
Elasticity measures how much one variable responds to changes in another variable.
 - One type of elasticity measures how much demand for your websites will fall if you raise your price.
- Definition:
Elasticity is a numerical measure of the responsiveness of Q^d or Q^s to one of its determinants.

Price Elasticity of Demand

- **Price elasticity of demand** measures how much Q^d responds to a change in P .
- Loosely speaking, it measures the price-sensitivity of buyers' demand.

The Formula for Price Elasticity of Demand (PeoD)

$$\frac{(Q2-Q1) / [(Q2+Q1) / 2]}{(P2-P1) / [(P2+P1) / 2]}$$

Calculate an elasticity

Use the following information to calculate the price elasticity of demand for hotel rooms:

if $P = \$70$, $Q^d = 5000$

if $P = \$90$, $Q^d = 3000$



Answers

Use midpoint method to calculate
% change in Q^d

$$(5000 - 3000)/4000 = .5$$

% change in P

$$(\$90 - \$70)/\$80 = .25$$

The price elasticity of demand equals

$$\frac{.5}{.25} = 2.0$$

Elastic, Inelastic, Unit Elastic

- The price elasticity of demand will sometimes be negative (or zero) because price changes always move in the opposite direction from changes in quantity demanded.
- For convenience, we drop the negative sign and speak of price elasticities in absolute value terms.
- The demand for a good is said to be **elastic** with respect to price if its price elasticity is **greater than 1**.
- The demand for a good is **inelastic** with respect to price if its price elasticity is **less than 1**.
- Demand is **unit elastic** with respect to price if its price elasticity is **equal to 1**.

Breakfast cereal vs. Sunscreen

- The prices of both of these goods rise by 20%. For which good does Q^d drop the most? Why?
 - Breakfast cereal has close substitutes (e.g., pancakes, Eggo waffles, leftover pizza), so buyers can easily switch if the price rises.
 - Sunscreen has no close substitutes, so consumers would probably not buy much less if its price rises.
- Lesson: ***Price elasticity is higher when close substitutes are available.***

“Blue Jeans” vs. “Clothing”

- The prices of both goods rise by 20%.

For which good does Q^d drop the most? Why?

- For a narrowly defined good such as blue jeans, there are many substitutes (khakis, shorts, Speedos).
- There are fewer substitutes available for broadly defined goods.
(There aren't too many substitutes for clothing, other than living in a nudist colony.)

- Lesson: ***Price elasticity is higher for narrowly defined goods than broadly defined ones.***

Insulin vs. Caribbean Cruises

- The prices of both of these goods rise by 20%. For which good does Q^d drop the most? Why?
 - To millions of diabetics, insulin is a necessity. A rise in its price would cause little or no decrease in demand.
 - A cruise is a luxury. If the price rises, some people will forego it.
- Lesson: ***Price elasticity is higher for luxuries than for necessities.***

Gasoline in the Short Run vs. Gasoline in the Long Run

- The price of gasoline rises 20%. Does Q^d drop more in the short run or the long run? Why?
 - There's not much people can do in the short run, other than ride the bus or carpool.
 - In the long run, people can buy smaller cars or live closer to where they work.
- Lesson: ***Price elasticity is higher in the long run than the short run.***

The Determinants of Price Elasticity: A Summary

The price elasticity of demand depends on:

- the extent to which close substitutes are available
- whether the good is a necessity or a luxury
- how broadly or narrowly the good is defined
- the time horizon – elasticity is higher in the long run than the short run

The Variety of Demand Curves

- The price elasticity of demand is closely related to the slope of the demand curve.
- Rule of thumb:
The flatter the curve, the more elastic.
The steeper the curve, the more inelastic.

“Perfectly inelastic demand” (one extreme case)

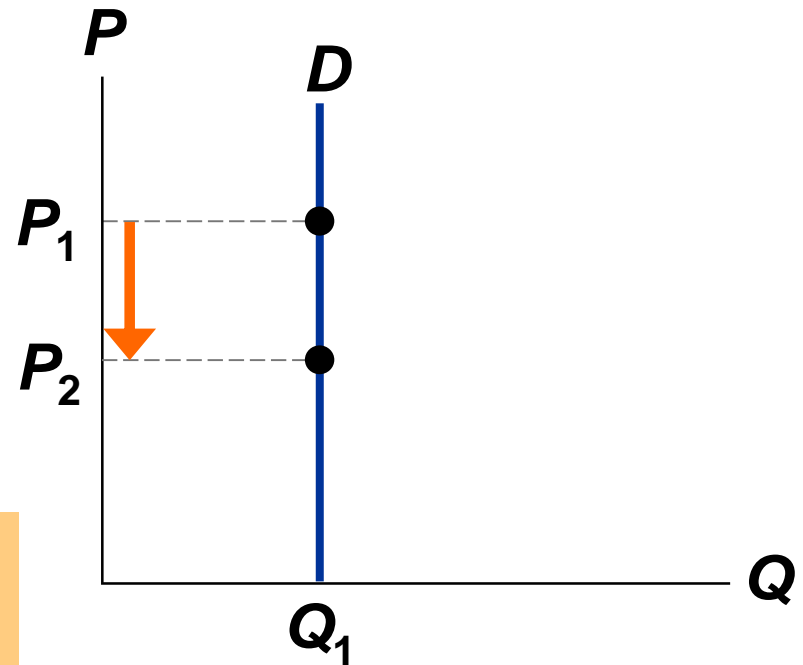
$$\text{Price elasticity of demand} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{0\%}{10\%} = 0$$

D curve:
vertical

Consumers’
price sensitivity:
none

Elasticity:
0

P falls
by 10%



Q changes
by 0%

“Inelastic demand”

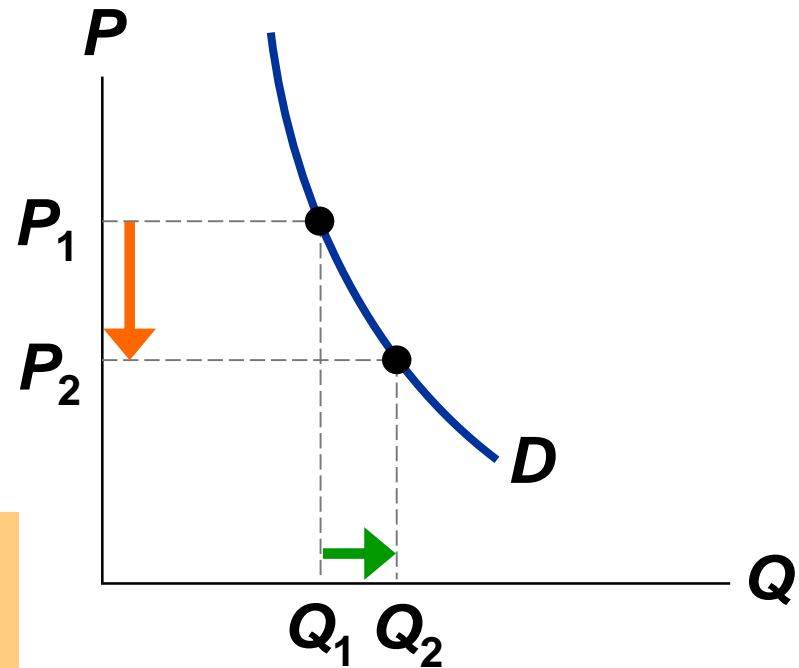
$$\text{Price elasticity of demand} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{< 10\%}{10\%} < 1$$

D curve:
relatively steep

Consumers'
price sensitivity:
relatively low

Elasticity:
< 1

P falls
by 10%



Q rises less
than 10%

“Unit elastic demand”

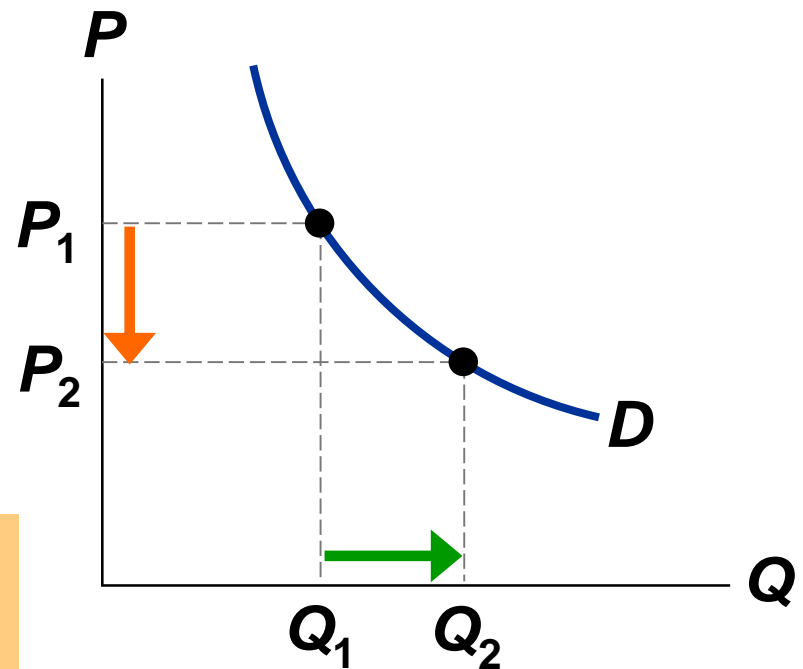
$$\text{Price elasticity of demand} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{10\%}{10\%} = 1$$

D curve:
intermediate slope

Consumers’
price sensitivity:
intermediate

Elasticity:
1

P falls
by 10%



Q rises by 10%

“Elastic demand”

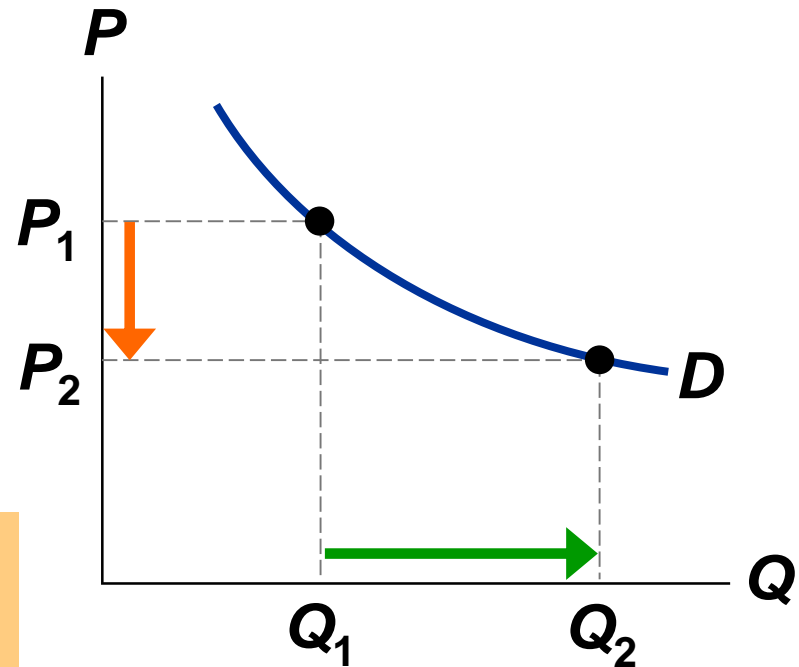
$$\text{Price elasticity of demand} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{> 10\%}{10\%} > 1$$

D curve:
relatively flat

Consumers’
price sensitivity:
relatively high

Elasticity:
> 1

P falls
by 10%



Q rises more
than 10%

“Perfectly elastic demand” (the other extreme)

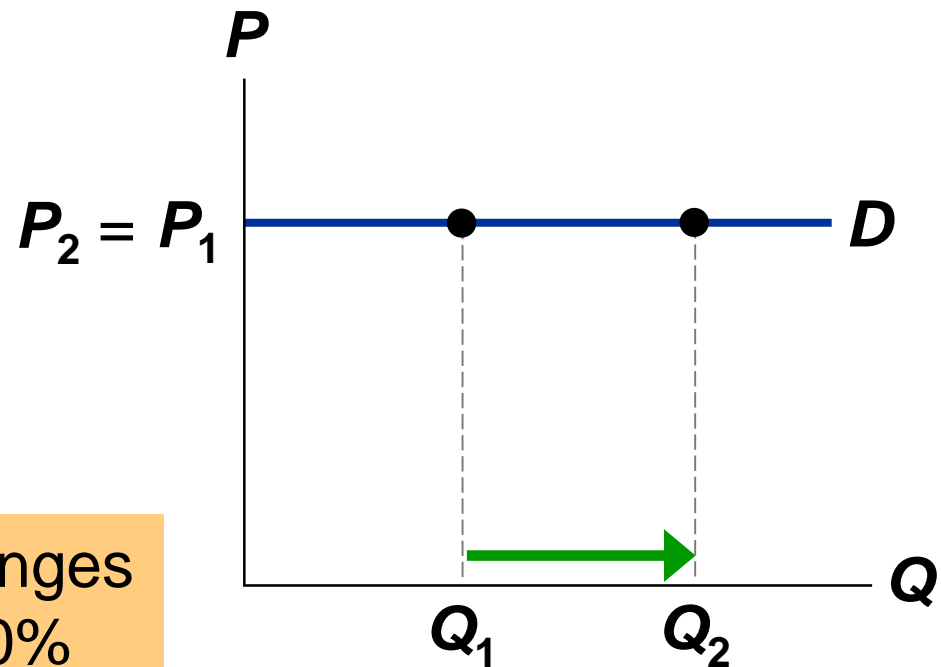
$$\text{Price elasticity of demand} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{\text{any } \%}{0\%} = \text{infinity}$$

D curve:
horizontal

Consumers’
price sensitivity:
extreme

Elasticity:
infinity

P changes
by 0%



Q changes
by any %

Price Elasticity and Total Revenue

- Continuing our scenario, if you raise your price from \$200 to \$250, would your revenue rise or fall?

$$\text{Revenue} = P \times Q$$

- A price increase has two effects on revenue:
 - Higher **P** means more revenue on each unit you sell.
 - But you sell fewer units (lower **Q**), due to Law of Demand.
- Which of these two effects is bigger?
It depends on the price elasticity of demand.

What Will Revenue Do?

1. When the product has an elasticity greater than 1 (**elastic**) a price increase **will decrease** total revenue.
2. When the product has an elasticity of less than 1 (**inelastic**) a price increase **will increase** total revenue.
3. If the product is **unit elastic**, the revenue will remain unchanged with a price increase because quantity demanded will fall by an equal percentage.

Helpful Hints

1. An easy way to remember the difference between the terms elastic and inelastic is to substitute the word *sensitivity* for elasticity. For example, price elasticity of demand becomes price *sensitivity* of demand. If the quantity demanded is sensitive to a change in price (demand is relatively flat), demand is elastic. If the quantity demanded is insensitive to a change in price (demand is relatively steep), demand is inelastic. The same is true for the price elasticity of supply. If the quantity supplied is sensitive to a change in price, supply is elastic. If the quantity supplied is insensitive to a change in price, supply is inelastic.
2. While elasticity and slope are similar, they are not the same. Along a straight line, slope is constant. Slope (rise over run) is the same anywhere on the line and is measured as the change in the dependent variable divided by the change in the independent variable. Elasticity, however, is measured as the *percent* change in the dependent variable divided by the *percent* change in the independent variable. This value changes as we move along a line, because a one-unit change in a variable is a larger percentage change when the initial values are small as opposed to when they are large. In practice, however, it is still reasonable to suggest that flatter curves tend to be more elastic and steeper curves tend to be more inelastic.
3. The term “elasticity” is used to describe how much the quantity stretches (or changes) in response to some economic event such as a change in price or income. If the quantity stretches a great deal in response to a change in price or income, it is considered elastic. This mental picture should also help you to remember how to calculate an elasticity—in the numerator, you will always find the percent change in quantity, and in the denominator, you will always find the percent change in the variable that is the source of the change in quantity.

Terms and Definitions

Choose a definition for each key term.

Key Terms

- ___ Elasticity
- ___ Price elasticity of demand
- ___ Elastic
- ___ Inelastic
- ___ Total revenue
- ___ Income elasticity of demand
- ___ Cross-price elasticity of demand
- ___ Price elasticity of supply
- ___ Normal good
- ___ Inferior good

Definitions

1. A measure of how much the quantity demanded of a good responds to a change in consumers' income.
2. When the quantity demanded or supplied responds substantially to a change in one of its determinants.
3. A good characterized by a negative income elasticity.
4. A measure of the responsiveness of the quantity demanded or quantity supplied to one of its determinants.
5. A good characterized by a positive income elasticity.
6. A measure of how much the quantity supplied of a good responds to a change in the price of that good.
7. When the quantity demanded or supplied responds only slightly to a change in one of its determinants.
8. The amount paid by buyers and received by sellers of a good computed as $P \times Q$.
9. A measure of how much the quantity demanded of a good responds to a change in the price of that good.
10. A measure of how much the quantity demanded of one good responds to a change in the price of another good.

PROBLEMS AND SHORT-ANSWER QUESTIONS

Problems

1. For each pair of goods listed below, which good would you expect to have the more elastic demand? Why?

a. cigarettes; a trip to Florida over spring break

b. an AIDS vaccine over the next month; an AIDS vaccine over the next five years

c. beer; Budweiser

d. insulin; aspirin

2. Suppose the *Daily Newspaper* estimates that if it raises the price of its newspaper from \$1.00 to \$1.50 then the number of subscribers will fall from 50,000 to 40,000.

a. What is the price elasticity of demand for the *Daily Newspaper* when elasticity is calculated using the midpoint method?

b. What is the advantage of using the midpoint method?

c. If the *Daily Newspaper's* only concern is to maximize total revenue, should it raise the price of a newspaper from \$1.00 to \$1.50? Why or why not?

3. The table below provides the demand schedule for motel rooms at Small Town Motel. Use the information provided to complete the table. Answer the following questions based on your responses in the table. Use the midpoint method to calculate the percentage changes used to generate the elasticities.

Price	Quantity Demanded	Total Revenue	% Change In Price	% Change In Quantity	Elasticity
\$ 20	24	_____	_____	_____	_____
40	20	_____	_____	_____	_____
60	16	_____	_____	_____	_____
80	12	_____	_____	_____	_____
100	8	_____	_____	_____	_____
120	4	_____	_____	_____	_____

- a. Over what range of prices is the demand for motel rooms elastic? To maximize total revenue, should Small Town Motel raise or lower the price within this range?

- b. Over what range of prices is the demand for motel rooms inelastic? To maximize total revenue, should Small Town Motel raise or lower the price within this range?

- c. Over what range of prices is the demand for motel rooms unit elastic? To maximize total revenue, should Small Town Motel raise or lower the price within this range?

4. The demand schedule from question 3 above is reproduced below along with another demand schedule when consumer incomes have risen to \$60,000 from \$50,000. Use this information to answer the following questions. Use the midpoint method to calculate the percentage changes used to generate the elasticities.

Price	Quantity Demanded When Income is \$50,000	Quantity Demanded When Income is \$60,000
\$ 20	24	34
40	20	30
60	16	26
80	12	22
100	8	18
120	4	14

a. What is the income elasticity of demand when motel rooms rent for \$40?

b. What is the income elasticity of demand when motel rooms rent for \$100?

c. Are motel rooms normal or inferior goods? Why?

d. Are motel rooms likely to be necessities or luxuries? Why?

5. For each pair of goods listed below, which good would you expect to have the more elastic supply? Why?

a. televisions; beachfront property

b. crude oil over the next week; crude oil over the next year

c. a painting by van Gogh; a print of the same painting by van Gogh

Price Elasticity of Supply

- **Price elasticity of supply** measures how much Q^s responds to a change in P .
- Loosely speaking, it measures sellers' price-sensitivity.
- Again, use the midpoint method to compute the percentage changes.

The Formula for Price Elasticity of Supply (PeoS)

$$\frac{(Q_2 - Q_1) / [(Q_2 + Q_1) / 2]}{(P_2 - P_1) / [(P_2 + P_1) / 2]}$$

The Variety of Supply Curves

- The slope of the supply curve is closely related to price elasticity of supply.
- Rule of thumb:
The flatter the curve, the bigger the elasticity.
The steeper the curve, the smaller the elasticity.
- Five different classifications....

“Perfectly inelastic” (one extreme)

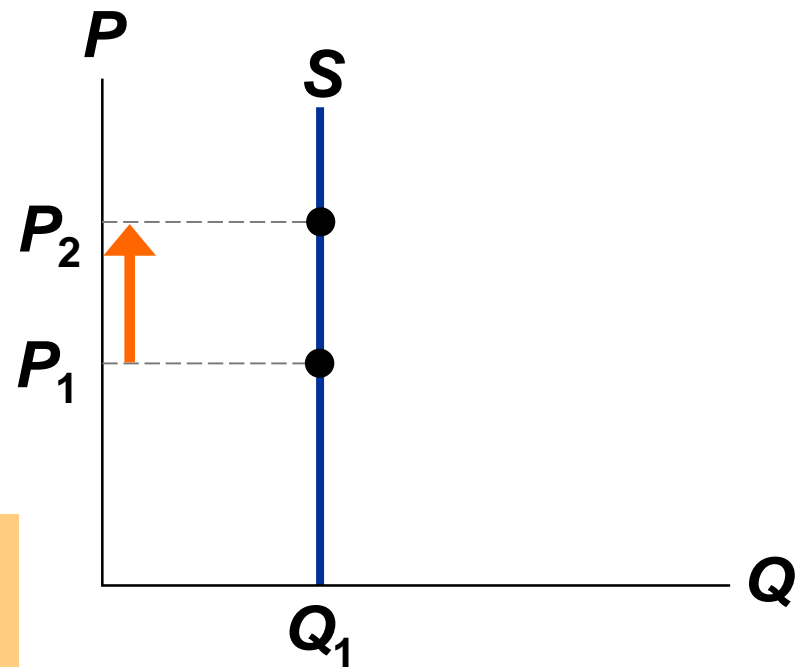
$$\text{Price elasticity of supply} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{0\%}{10\%} = 0$$

S curve:
vertical

Sellers’
price sensitivity:
none

Elasticity:
0

P rises
by 10%



Q changes
by 0%

“Inelastic”

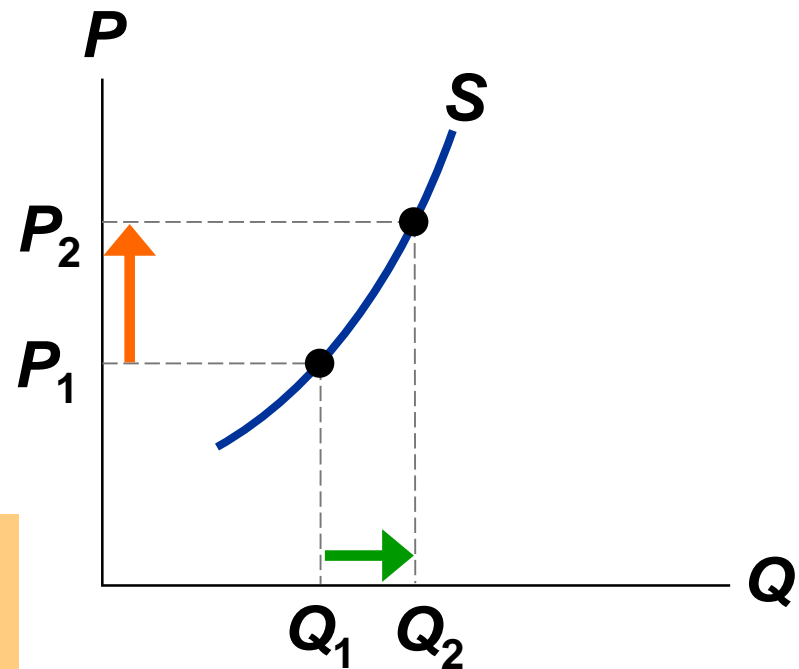
$$\text{Price elasticity of supply} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{< 10\%}{10\%} < 1$$

S curve:
relatively steep

Sellers’
price sensitivity:
relatively low

Elasticity:
< 1

P rises
by 10%



Q rises less
than 10%

“Unit elastic”

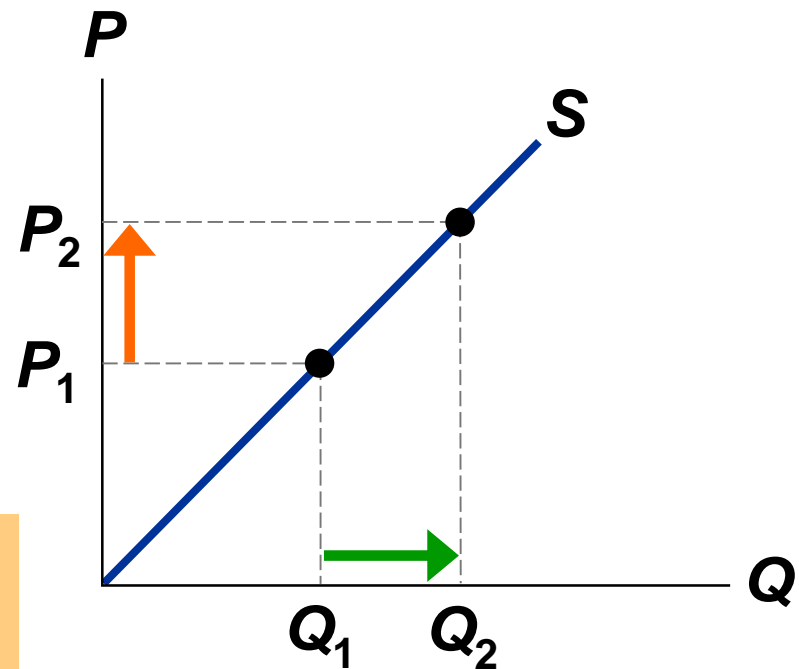
$$\text{Price elasticity of supply} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{10\%}{10\%} = 1$$

S curve:
intermediate slope

Sellers’
price sensitivity:
intermediate

Elasticity:
= 1

P rises
by 10%



Q rises
by 10%

“Elastic”

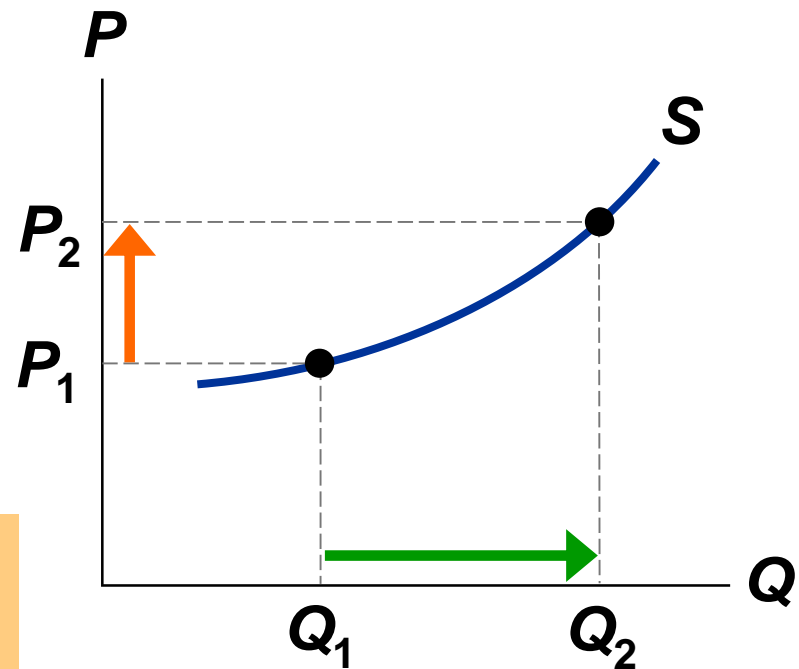
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S curve:
relatively flat

Sellers’
price sensitivity:
relatively high

Elasticity:
> 1

P rises
by 10%



Q rises more
than 10%

“Perfectly elastic” (the other extreme)

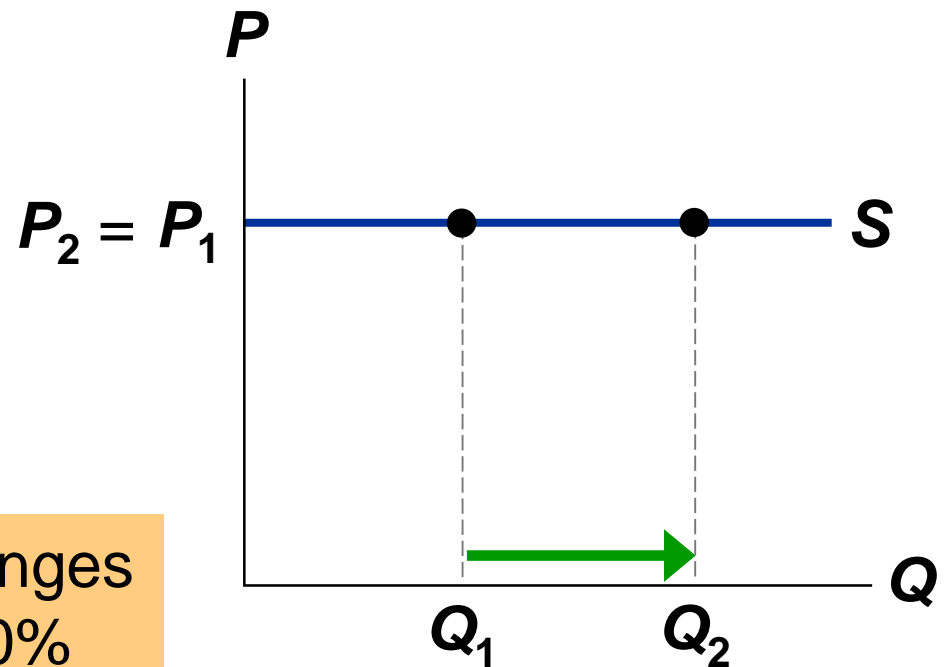
$$\text{Price elasticity of supply} = \frac{\% \text{ change in } Q}{\% \text{ change in } P} = \frac{\text{any } \%}{0\%} = \text{infinity}$$

S curve:
horizontal

Sellers’
price sensitivity:
extreme

Elasticity:
infinity

P changes
by 0%



Q changes
by any %

The Determinants of Supply Elasticity

- The more easily sellers can change the quantity they produce, the greater the price elasticity of supply.
 - Example: Supply of beachfront property is harder to vary and thus less elastic than supply of new cars.
- For many goods, price elasticity of supply is greater in the long run than in the short run, because firms can build new factories, or new firms may be able to enter the market.

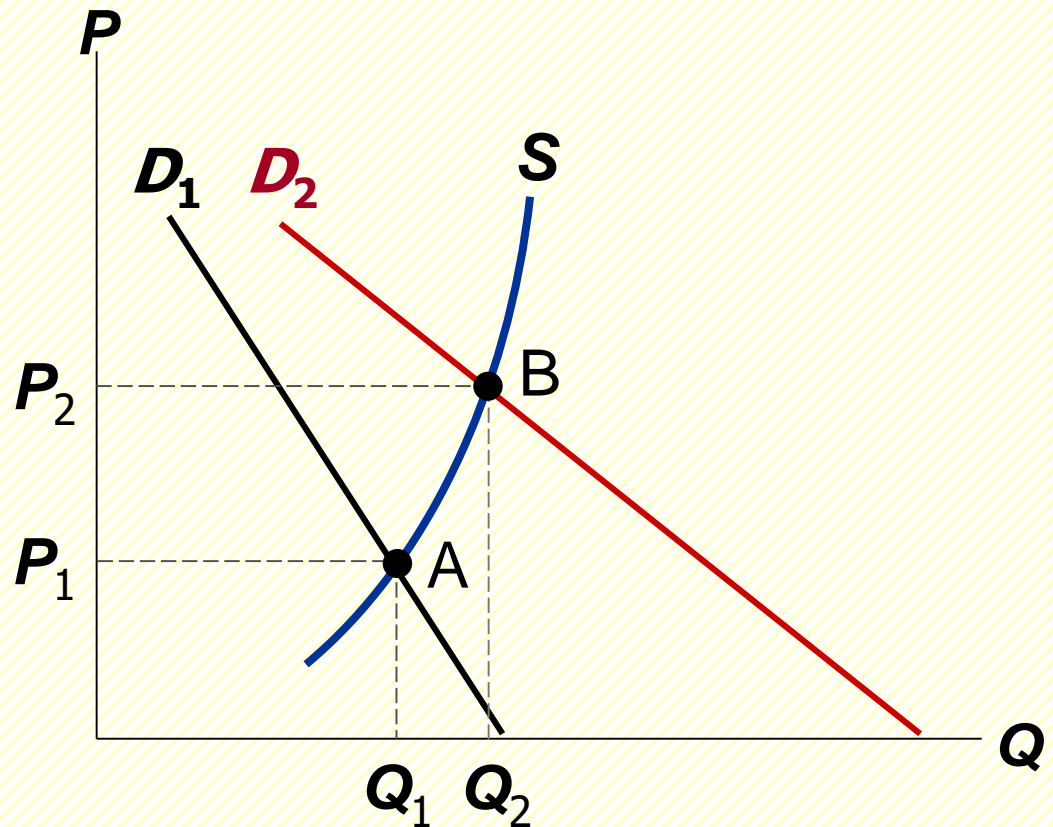
Elasticity and changes in equilibrium

- The supply of beachfront property is inelastic. The supply of new cars is elastic.
- Suppose population growth causes demand for both goods to double (at each price, Q^d doubles).
- For which product will P change the most?
- For which product will Q change the most?

Answers

When supply is *inelastic*, an increase in demand has a bigger impact on price than on quantity.

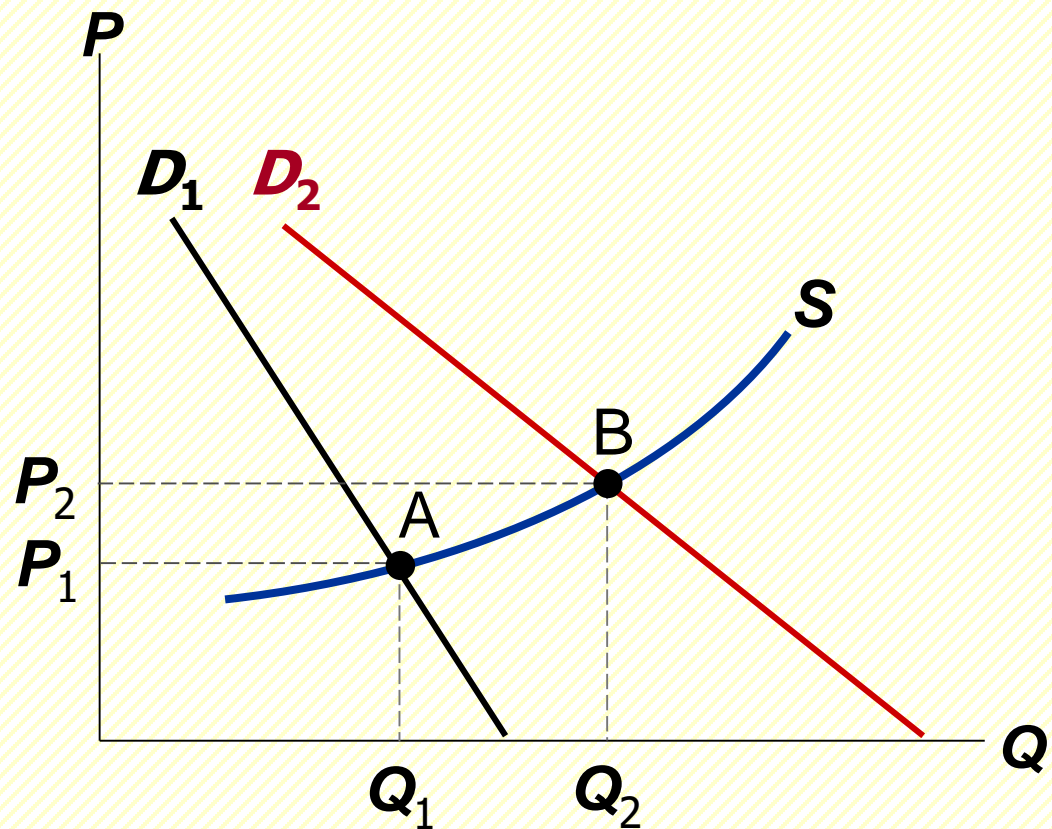
Beachfront property
(inelastic supply):



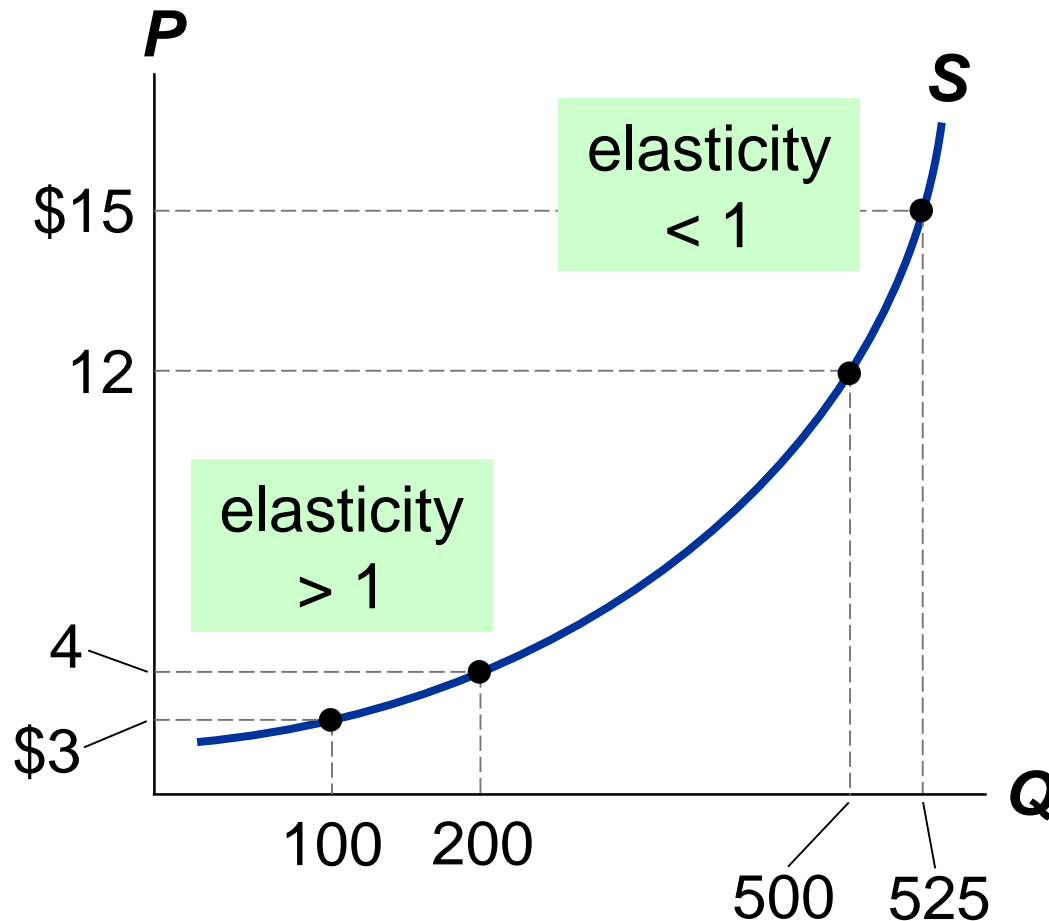
Answers

When supply is *elastic*, an increase in demand has a bigger impact on quantity than on price.

New cars
(elastic supply):



How the Price Elasticity of Supply Can Vary



Supply often becomes less elastic as Q rises, due to capacity limits.

Other Elasticities

- **Income elasticity of demand:** measures the response of Q^d to a change in consumer income

$$\text{Income elasticity of demand} = \frac{\text{Percent change in } Q^d}{\text{Percent change in income}}$$

- Recall from Chapter 4: An increase in income causes an increase in demand for a *normal* good.
- Hence, for normal goods, income elasticity > 0 .
- For *inferior* goods, income elasticity < 0 .
- Luxury goods, income elasticity > 1

Other Elasticities

- **Cross-price elasticity of demand:**
measures the response of demand for one good to changes in the price of another good

$$\text{Cross-price elast. of demand} = \frac{\% \text{ change in } Q^d \text{ for good 1}}{\% \text{ change in price of good 2}}$$

- For substitutes, cross-price elasticity > 0
(e.g., an increase in price of beef causes an increase in demand for chicken)
- For complements, cross-price elasticity < 0
(e.g., an increase in price of computers causes decrease in demand for software)

Cross-Price Elasticities in the News

“As Gas Costs Soar, Buyers Flock to Small Cars”

-New York Times, 5/2/2008

“Gas Prices Drive Students to Online Courses”

-Chronicle of Higher Education, 7/8/2008

“Gas prices knock bicycle sales, repairs into higher gear”

-Associated Press, 5/11/2008

“Camel demand soars in India”

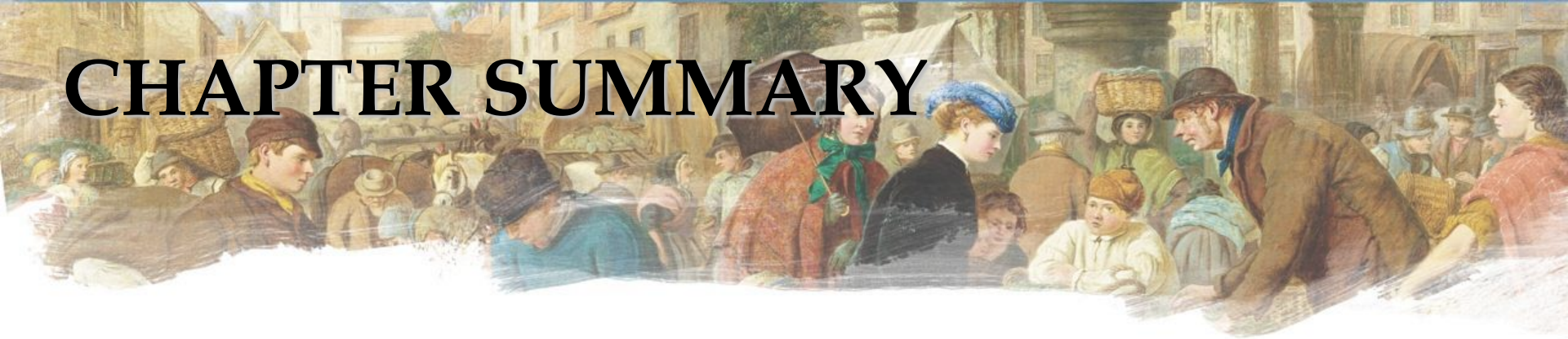
(as a substitute for “gas-guzzling tractors”)

-Financial Times, 5/2/2008

“High gas prices drive farmer to switch to mules”

-Associated Press, 5/21/2008

CHAPTER SUMMARY



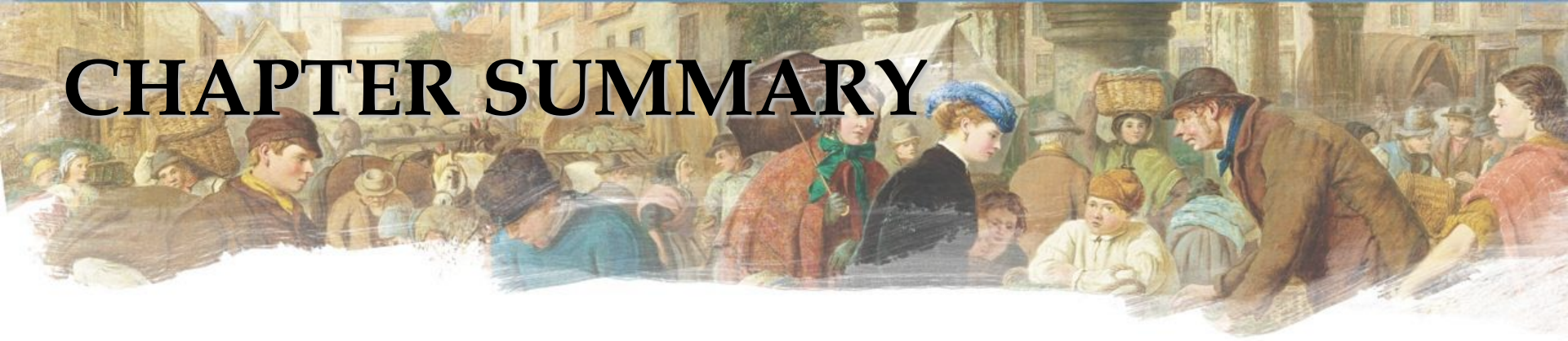
- Elasticity measures the responsiveness of Q^d or Q^s to one of its determinants.
- Price elasticity of demand equals percentage change in Q^d divided by percentage change in P . When it's less than one, demand is “inelastic.” When greater than one, demand is “elastic.”
- When demand is inelastic, total revenue rises when price rises. When demand is elastic, total revenue falls when price rises.

CHAPTER SUMMARY



- Demand is less elastic in the short run, for necessities, for broadly defined goods, or for goods with few close substitutes.
- Price elasticity of supply equals percentage change in Q^s divided by percentage change in P . When it's less than one, supply is “inelastic.” When greater than one, supply is “elastic.”
- Price elasticity of supply is greater in the long run than in the short run.

CHAPTER SUMMARY



- The income elasticity of demand measures how much quantity demanded responds to changes in buyers' incomes.
- The cross-price elasticity of demand measures how much demand for one good responds to changes in the price of another good.