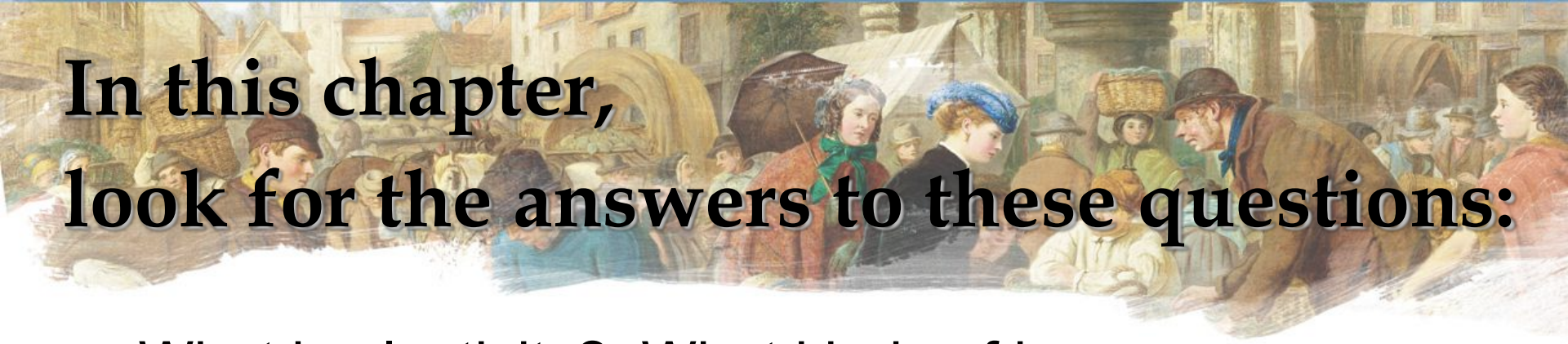
Chapter 5 – Elasticity and its Application



In this chapter, look for the answers to these questions:

- What is elasticity? What kinds of issues can elasticity help us understand?
- What is the price elasticity of demand?
  How is it related to the demand curve?
  How is it related to revenue & expenditure?
- What is the price elasticity of supply?
  How is it related to the supply curve?
- What are the income and cross-price elasticities of demand?

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

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q^d}{\text{Percentage change in } P}$$

- **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.

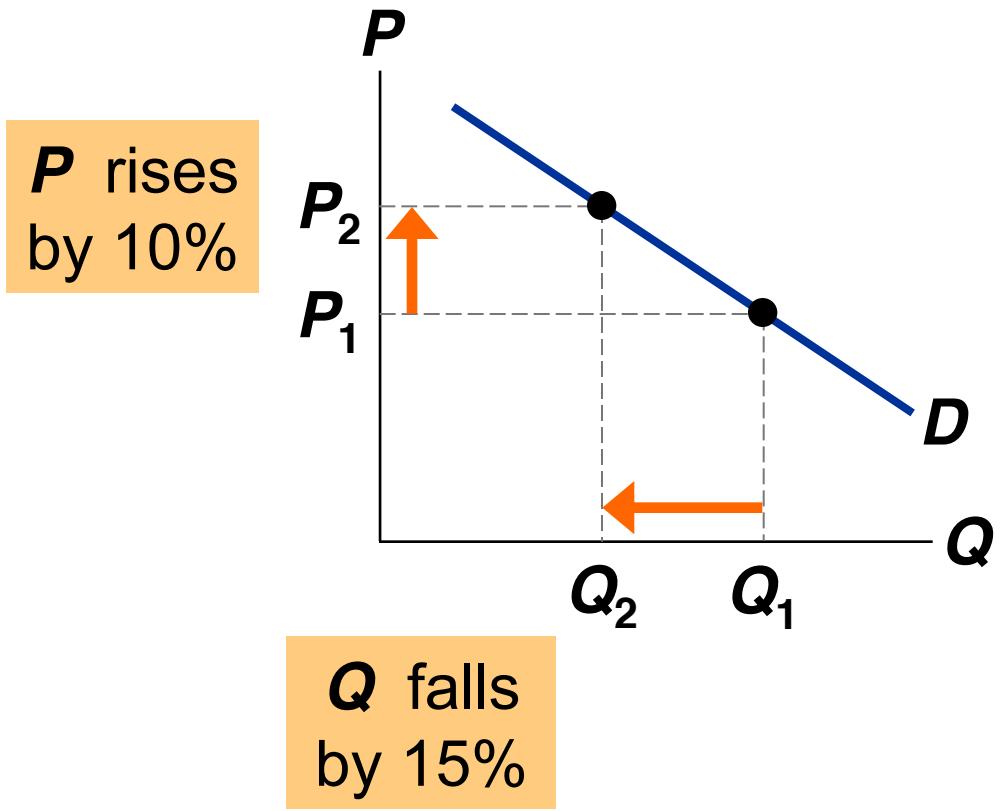
Price Elasticity of Demand

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q^d}{\text{Percentage change in } P}$$

Example:

Price elasticity of demand equals

$$\frac{15\%}{10\%} = 1.5$$

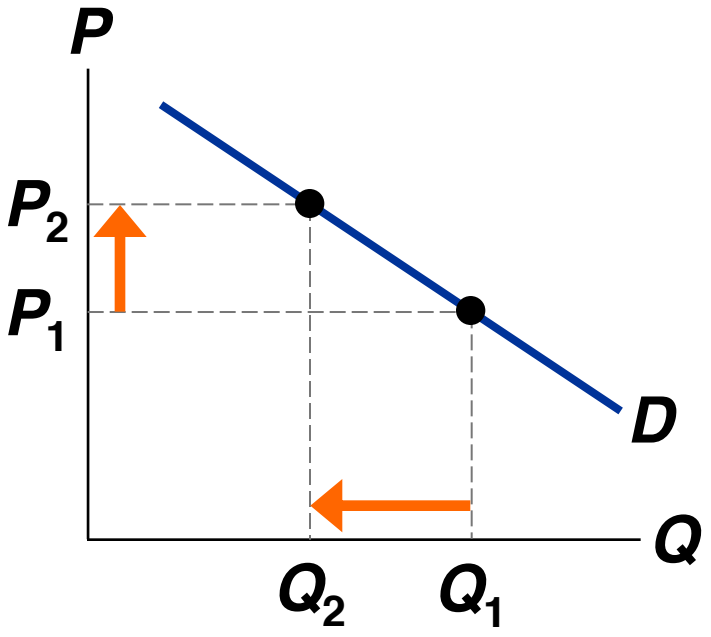


Price Elasticity of Demand

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q^d}{\text{Percentage change in } P}$$

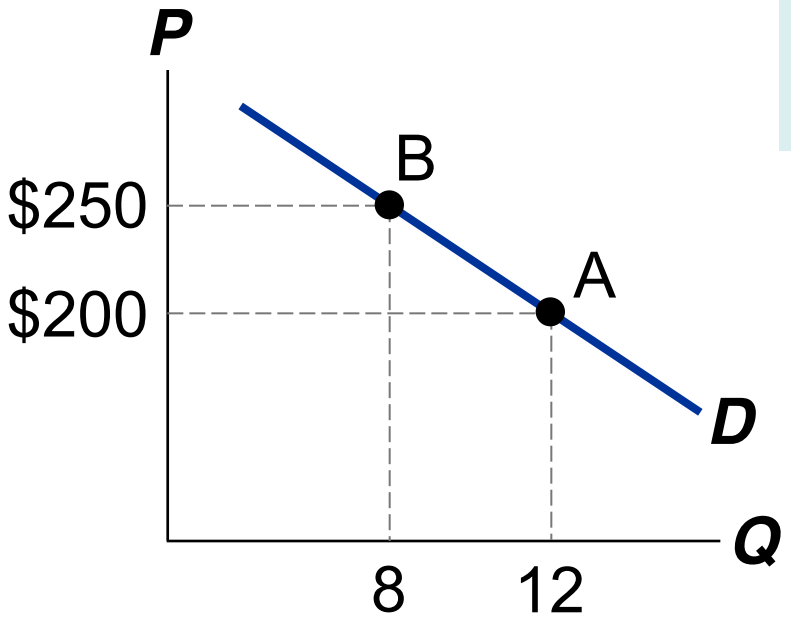
Along a ***D*** curve, ***P*** and ***Q*** move in opposite directions, which would make price elasticity negative.

We will drop the minus sign and report all price elasticities as positive numbers.



Calculating Percentage Changes

Demand for your websites



Standard method of computing the percentage (%) change:

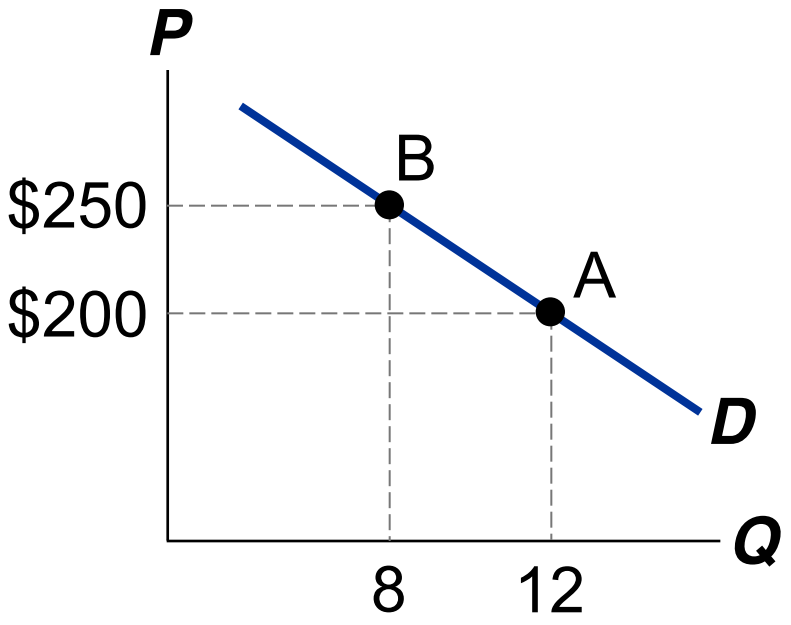
$$\frac{\text{end value} - \text{start value}}{\text{start value}} \times 100\%$$

Going from A to B, the % change in ***P*** equals

($250–$200)/$200 = 25%

Calculating Percentage Changes

Demand for your websites



Problem:

The standard method gives different answers depending on where you start.

From A to B,

P rises 25%, ***Q*** falls 33%,

elasticity = 33/25 = 1.33

From B to A,

P falls 20%, ***Q*** rises 50%,

elasticity = 50/20 = 2.50

Calculating Percentage Changes

- So, we instead use the **midpoint method**:

$$\frac{\text{end value} - \text{start value}}{\text{midpoint}} \times 100\%$$

- The midpoint is the number halfway between the start & end values, the average of those values.
- It doesn't matter which value you use as the "start" and which as the "end" – you get the same answer either way!

Calculating Percentage Changes

- Using the midpoint method, the % change in ***P*** equals

$$\frac{\$250 - \$200}{\$225} \times 100\% = \boxed{22.2\%}$$

- The % change in ***Q*** equals

$$\frac{12 - 8}{10} \times 100\% = \boxed{40.0\%}$$

- The price elasticity of demand equals

$$40/22.2 = \boxed{1.8}$$

What determines price elasticity?

To learn the determinants of price elasticity,
we look at a series of examples.
Each compares two common goods.

In each example:

- Suppose the prices of both goods rise by 20%.
- The good for which Q^d falls the most (in percent) has the highest price elasticity of demand.
  Which good is it? Why?
- What lesson does the example teach us about the determinants of the price elasticity of demand?

EXAMPLE 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.***

EXAMPLE 2:
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.***

EXAMPLE 3:
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
- 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 bigger the elasticity.
  The steeper the curve, the smaller the elasticity.
- Five different classifications of ***D*** curves….

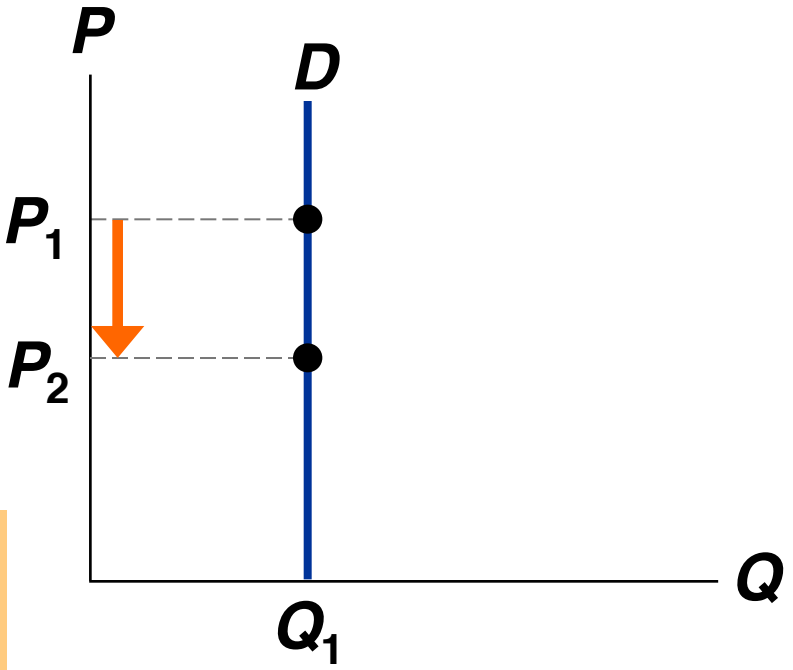
"Perfectly inelastic demand" (one extreme case)

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

D curve:
vertical

Consumers' price sensitivity:
none

Elasticity:
0



P falls by 10%

Q changes by 0%

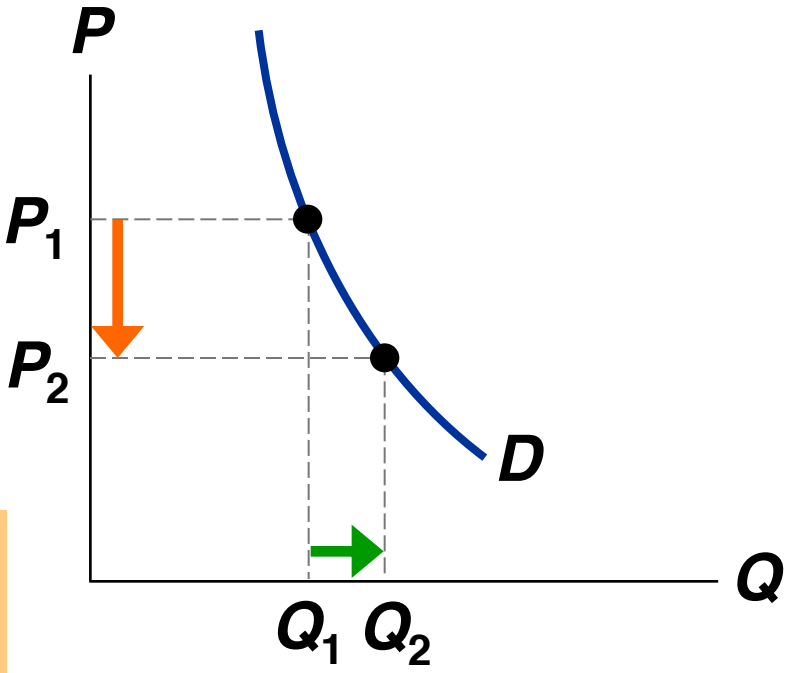
"Inelastic demand"

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

D curve:
relatively steep

Consumers' price sensitivity:
relatively low

Elasticity:
< 1



P falls by 10%

Q rises less than 10%

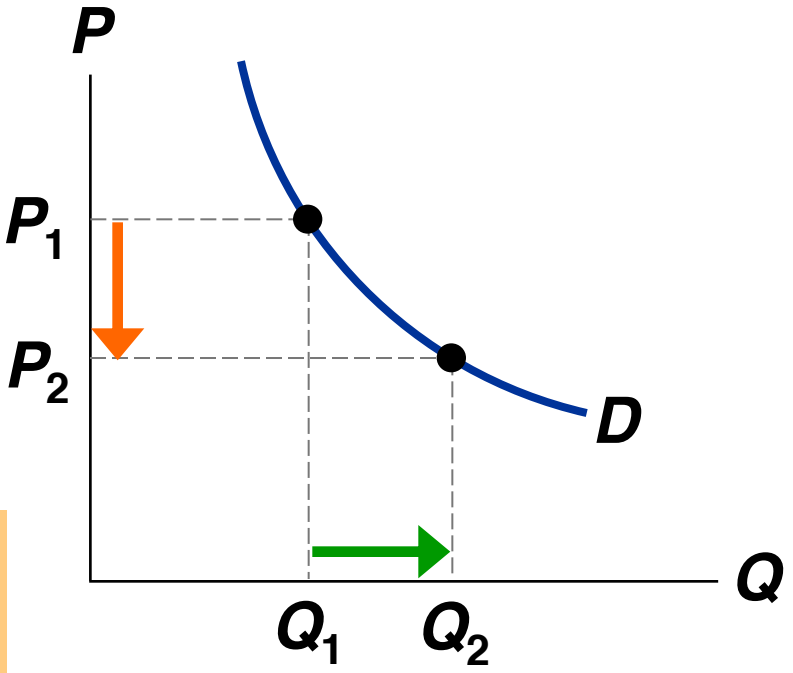
"Unit elastic demand"

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

D curve:
intermediate slope

Consumers' price sensitivity:
intermediate

Elasticity:
1



P falls by 10%

Q rises by 10%

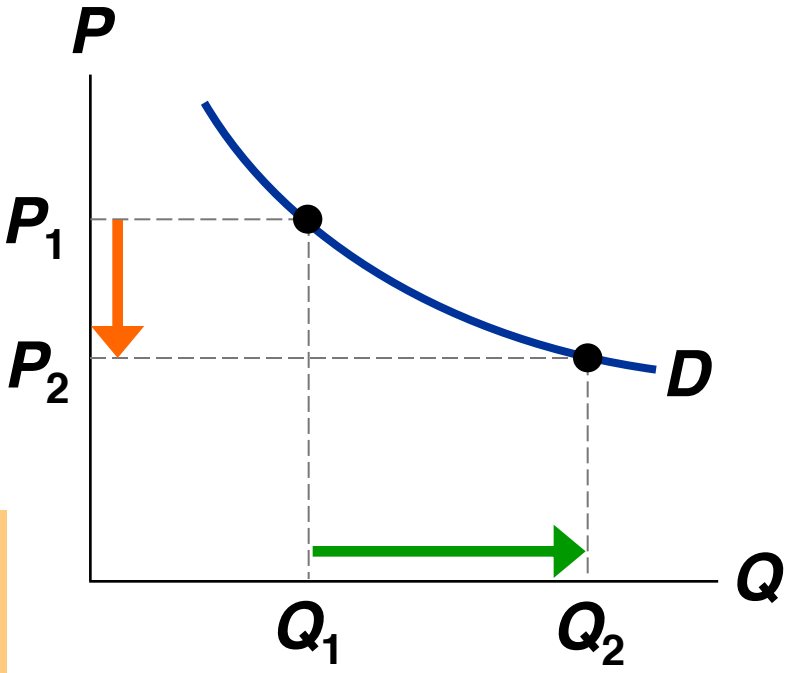
"Elastic demand"

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

D curve:
relatively flat

Consumers' price sensitivity:
relatively high

Elasticity:
> 1



P falls by 10%

Q rises more than 10%

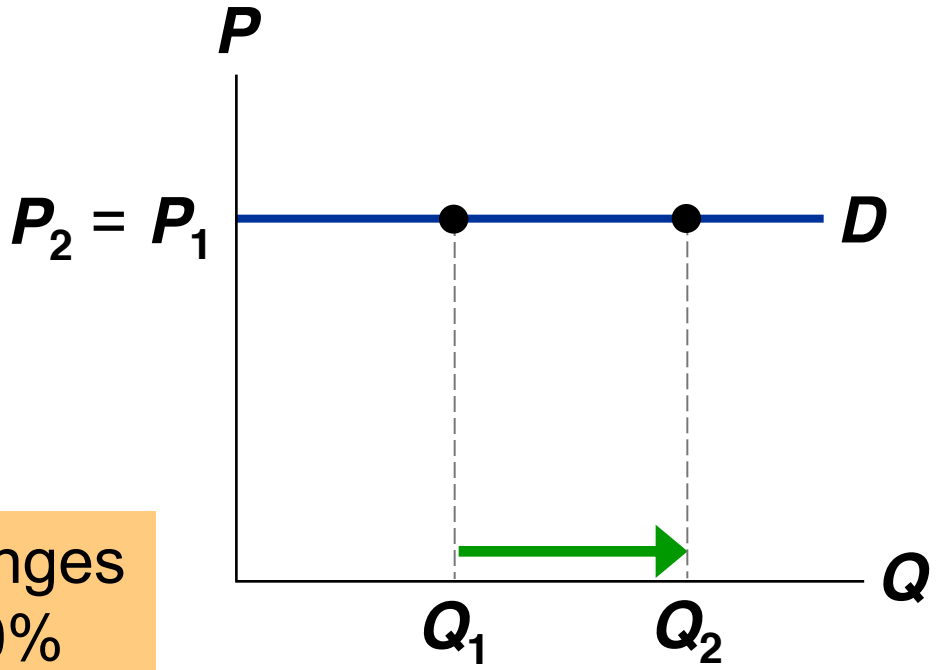
"Perfectly elastic demand" (the other extreme)

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

D curve:
horizontal

Consumers' price sensitivity:
extreme

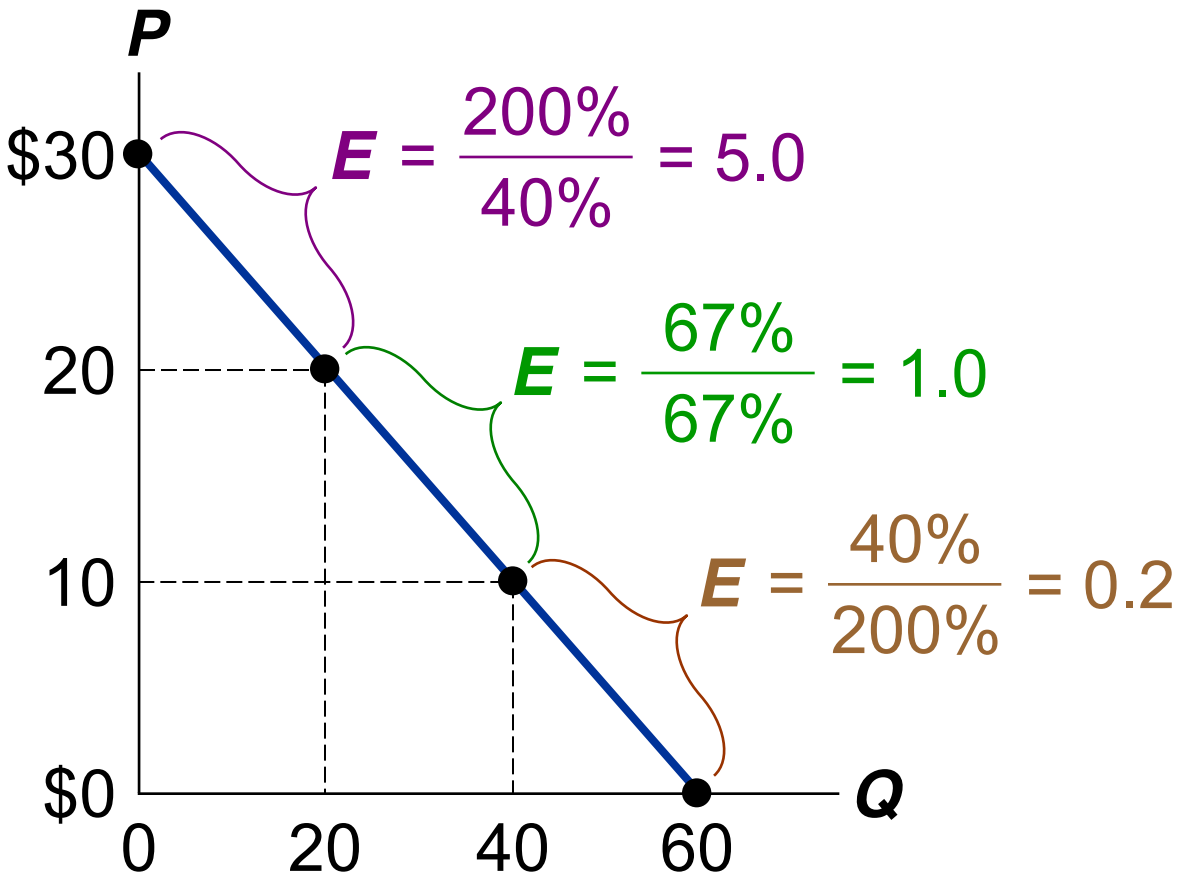
Elasticity:
infinity



P changes by 0%

Q changes by any %

Elasticity of a Linear Demand Curve



The slope of a linear demand curve is constant, but its elasticity is not.

Price Elasticity and Total Revenue

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

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

- 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.

Price Elasticity and Total Revenue

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } \boldsymbol{Q}}{\text{Percentage change in } \boldsymbol{P}}$$

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

- If demand is elastic, then

  price elast. of demand > 1

  % change in $\boldsymbol{Q}$ > % change in $\boldsymbol{P}$

- The fall in revenue from lower $\boldsymbol{Q}$ is greater than the increase in revenue from higher $\boldsymbol{P}$, so revenue falls.

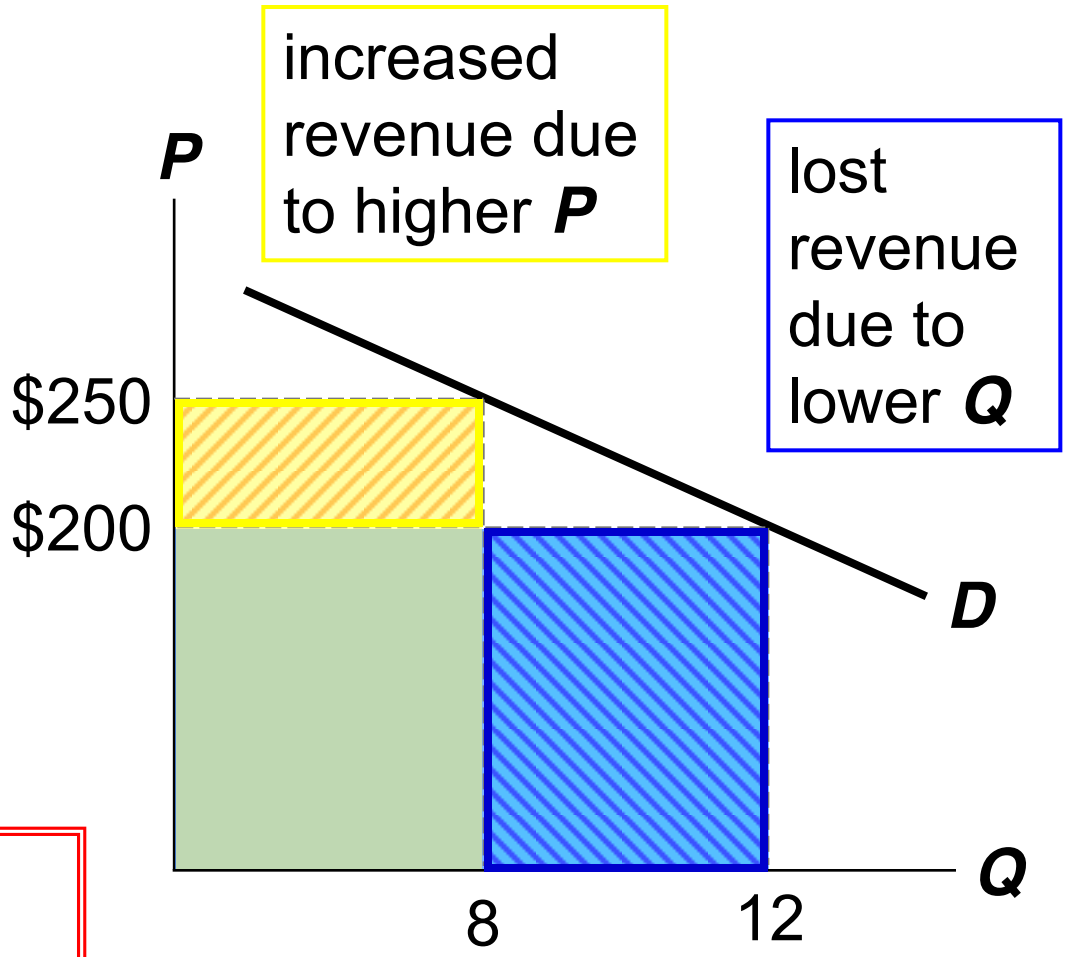
Price Elasticity and Total Revenue

Elastic demand
(elasticity = 1.8)

If ***P*** = \$200,
Q = 12 and
revenue = \$2400.

If ***P*** = \$250,
Q = 8 and
revenue = \$2000.

When ***D*** is elastic,
a price increase
causes revenue to fall.



Price Elasticity and Total Revenue

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } \boldsymbol{Q}}{\text{Percentage change in } \boldsymbol{P}}$$

Revenue = $\boldsymbol{P}$ x $\boldsymbol{Q}$

- If demand is inelastic, then

  price elast. of demand < 1

  % change in $\boldsymbol{Q}$ < % change in $\boldsymbol{P}$

- The fall in revenue from lower $\boldsymbol{Q}$ is smaller than the increase in revenue from higher $\boldsymbol{P}$, so revenue rises.
- In our example, suppose that $\boldsymbol{Q}$ only falls to 10 (instead of 8) when you raise your price to $250.

Price Elasticity and Total Revenue

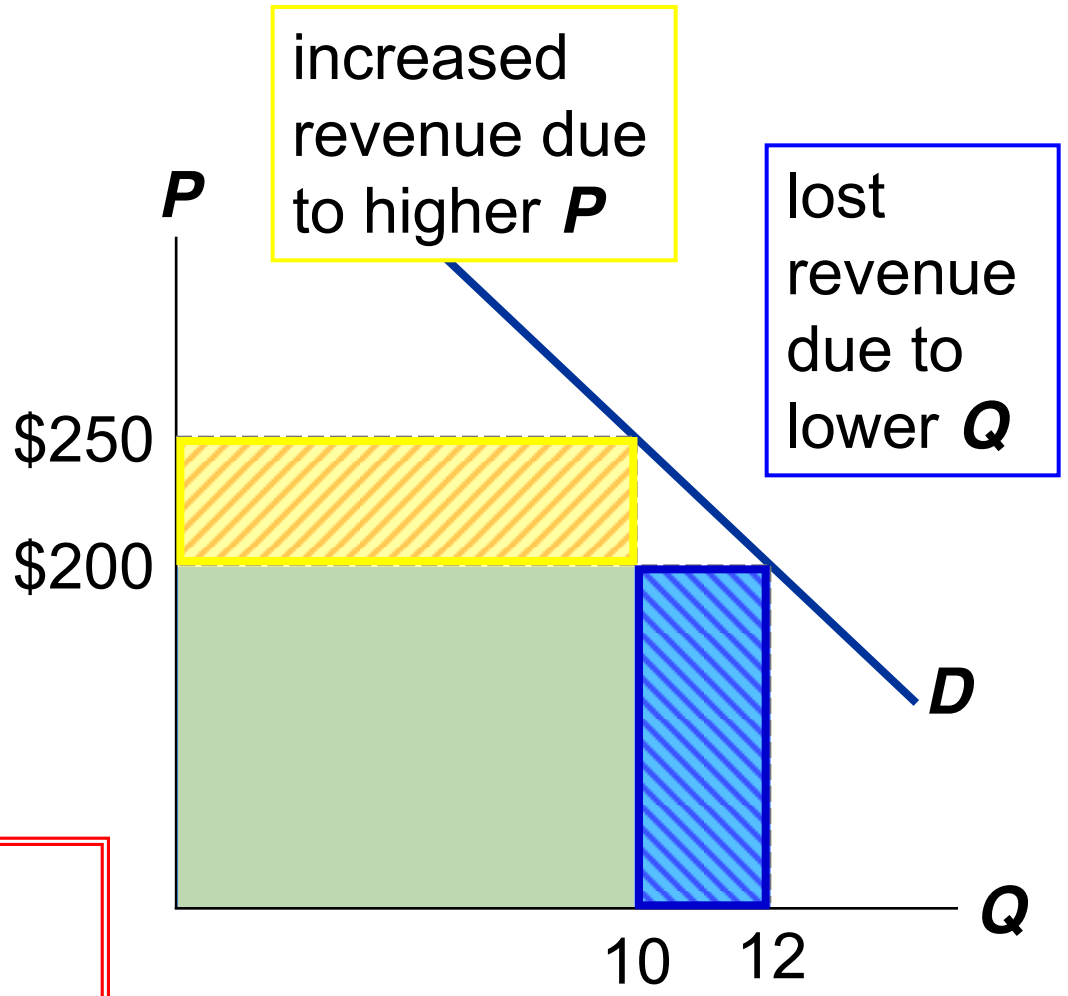
Now, demand is inelastic:

elasticity = 0.82

If ***P*** = \$200, ***Q*** = 12 and revenue = \$2400.

If ***P*** = \$250, ***Q*** = 10 and revenue = \$2500.

When ***D*** is inelastic, a price increase causes revenue to rise.



Price Elasticity of Supply

$$\text{Price elasticity of supply} = \frac{\text{Percentage change in } Q^s}{\text{Percentage change in } P}$$

- **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.

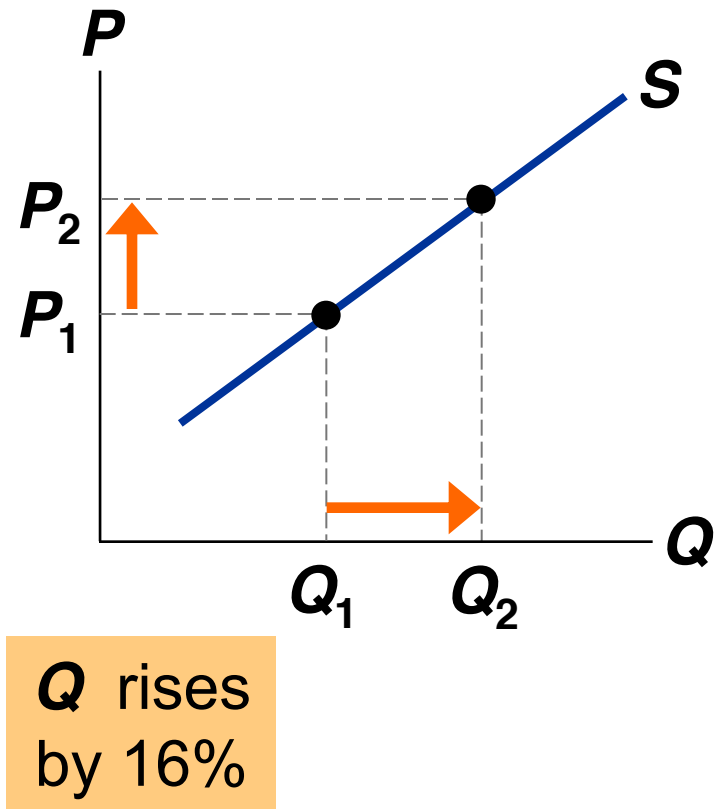
Price Elasticity of Supply

$$\text{Price elasticity of supply} = \frac{\text{Percentage change in } Q^s}{\text{Percentage change in } P}$$

Example:

Price elasticity of supply equals

$$\frac{16\%}{8\%} = 2.0$$



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:

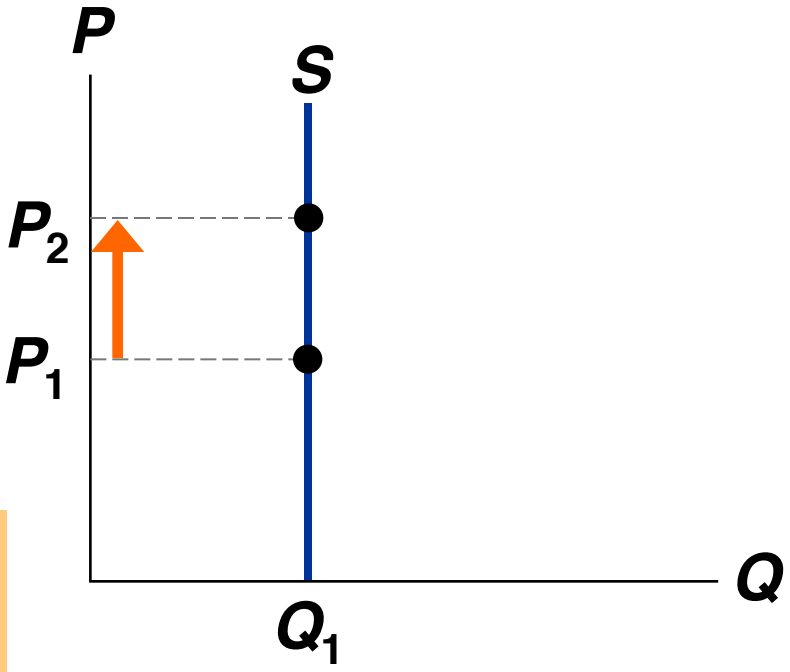
vertical

Sellers' price sensitivity:

none

Elasticity:

0



P rises by 10%

Q changes by 0%

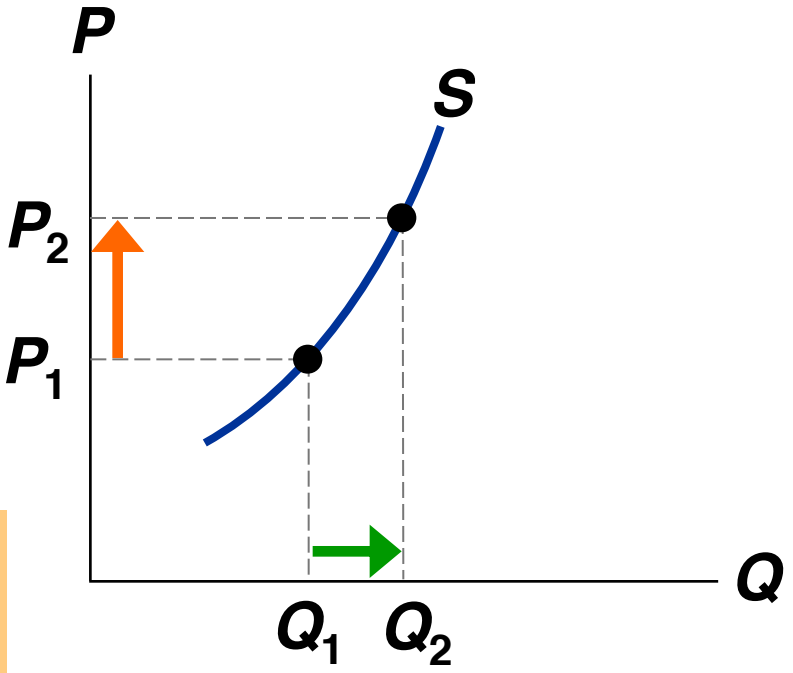
"Inelastic"

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

S curve:
relatively steep

Sellers' price sensitivity:
relatively low

Elasticity:
< 1



P rises by 10%

Q rises less than 10%

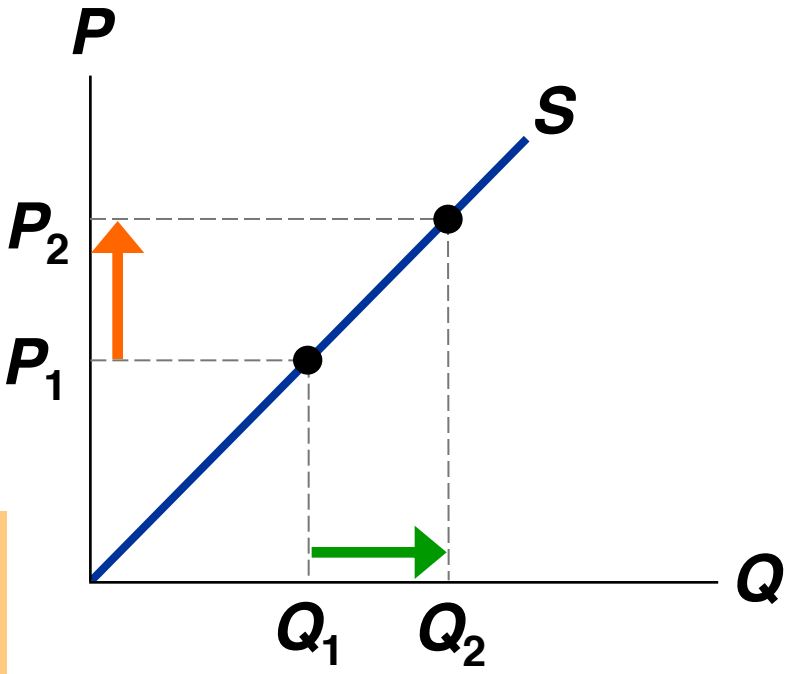
"Unit elastic"

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

S curve:
intermediate slope

Sellers' price sensitivity:
intermediate

Elasticity:
= 1



P rises by 10%

Q rises by 10%

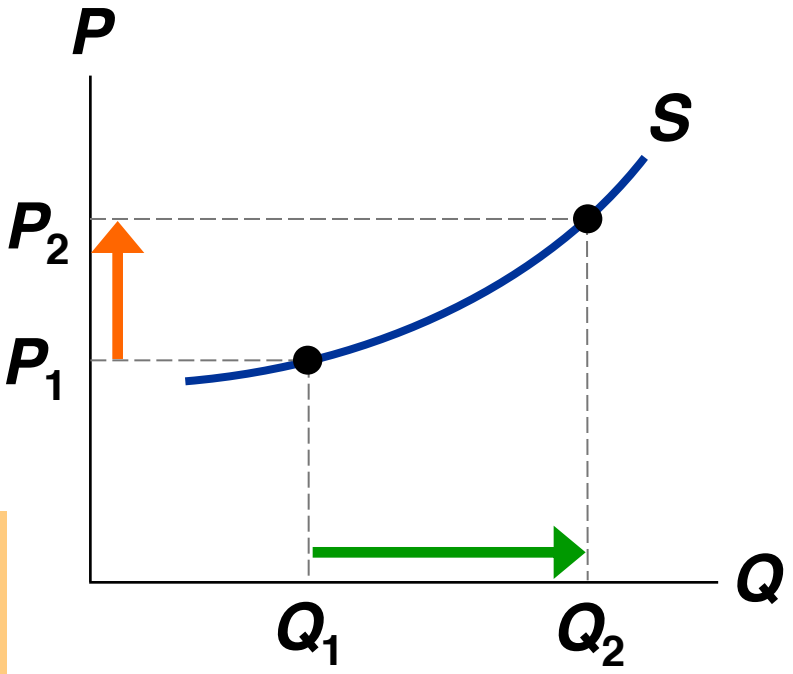
"Elastic"

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

S curve:
relatively flat

Sellers' price sensitivity:
relatively high

Elasticity:
> 1



P rises by 10%

Q rises more than 10%

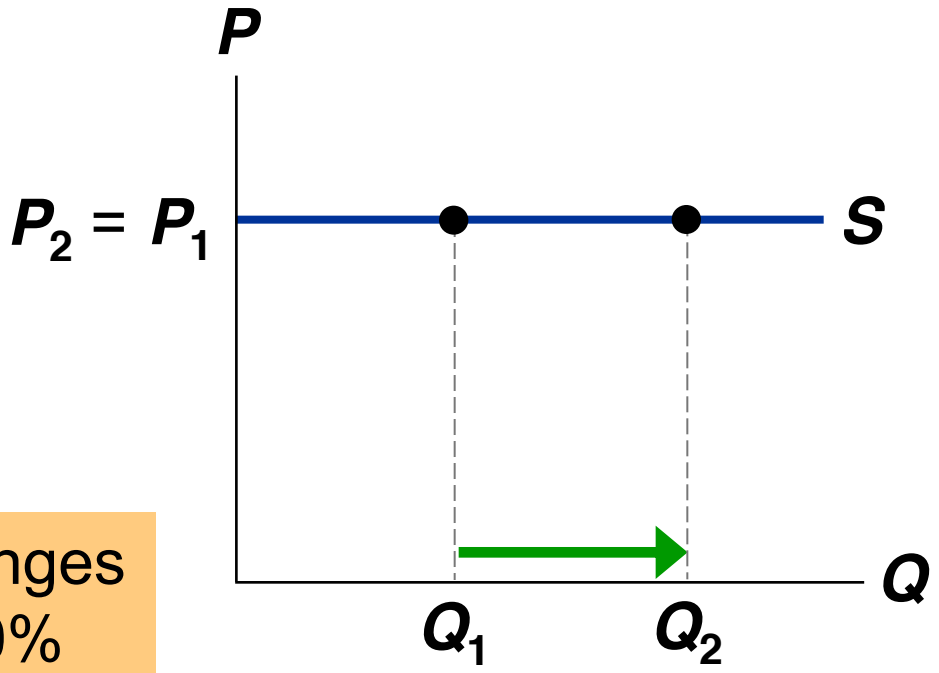
"Perfectly elastic" (the other extreme)

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

S curve:
horizontal

Sellers' price sensitivity:
extreme

Elasticity:
infinity



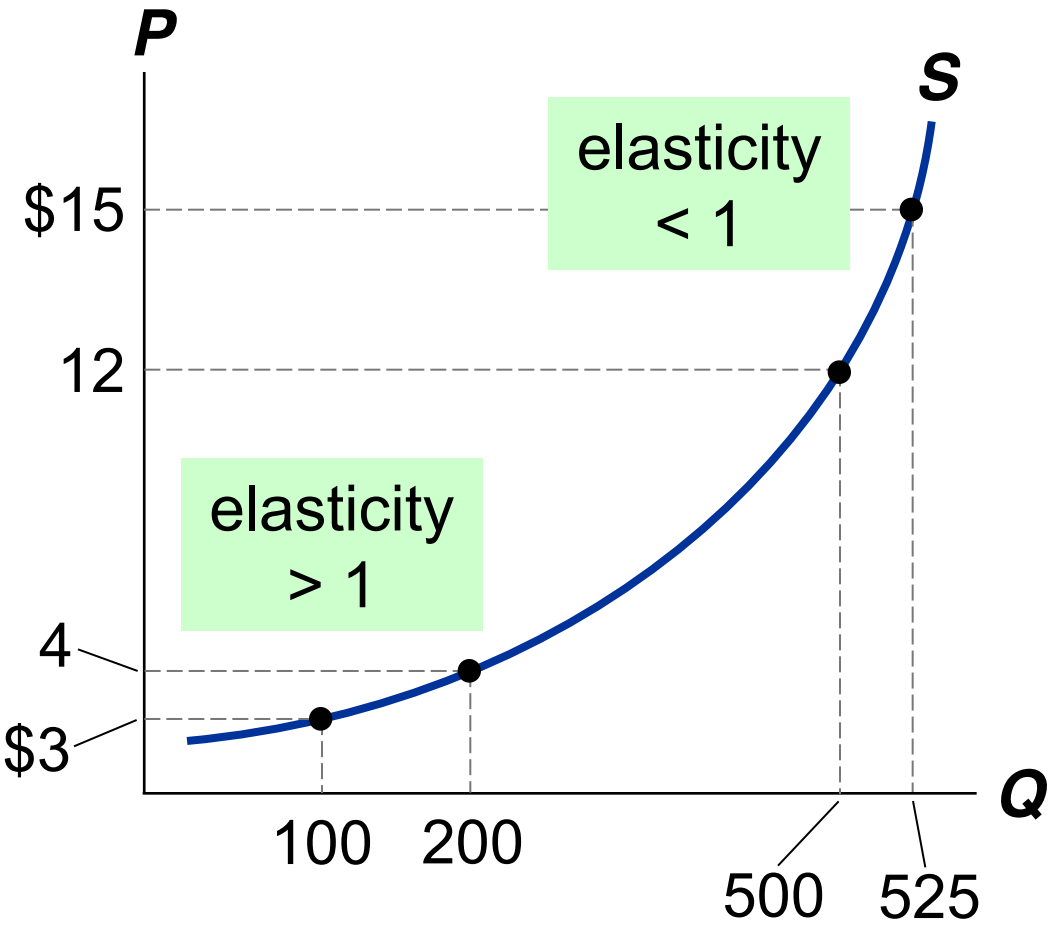
P changes by 0%

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.

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

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

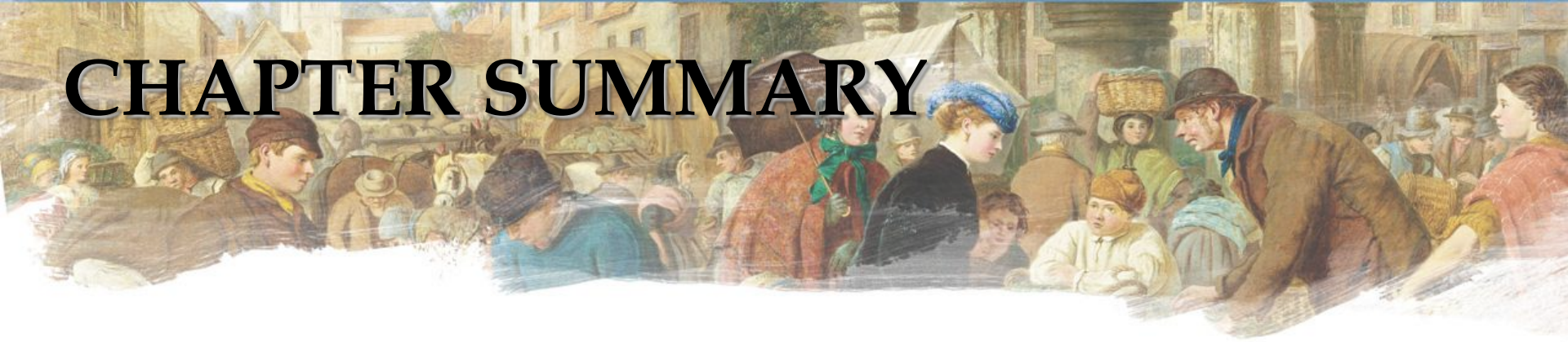
- Recall from Chapter 4: An increase in income causes an increase in demand for a *normal* good.
- Hence, for normal goods, income elasticity > 0.
- For *inferior* goods, income elasticity < 0.

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)

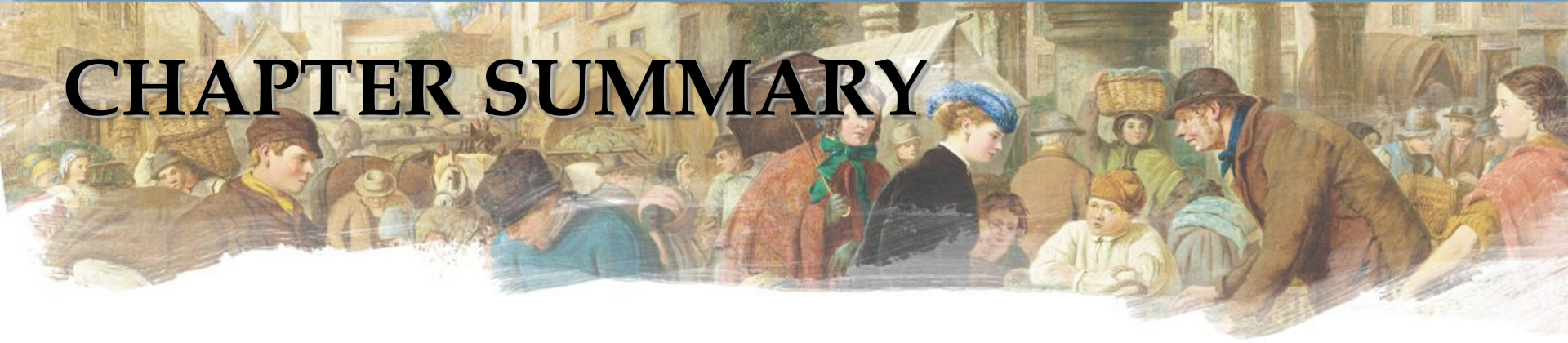


CHAPTER SUMMARY

- 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.

Chapter 6 – Supply, Demand and Government Policies

In this chapter, look for the answers to these questions:

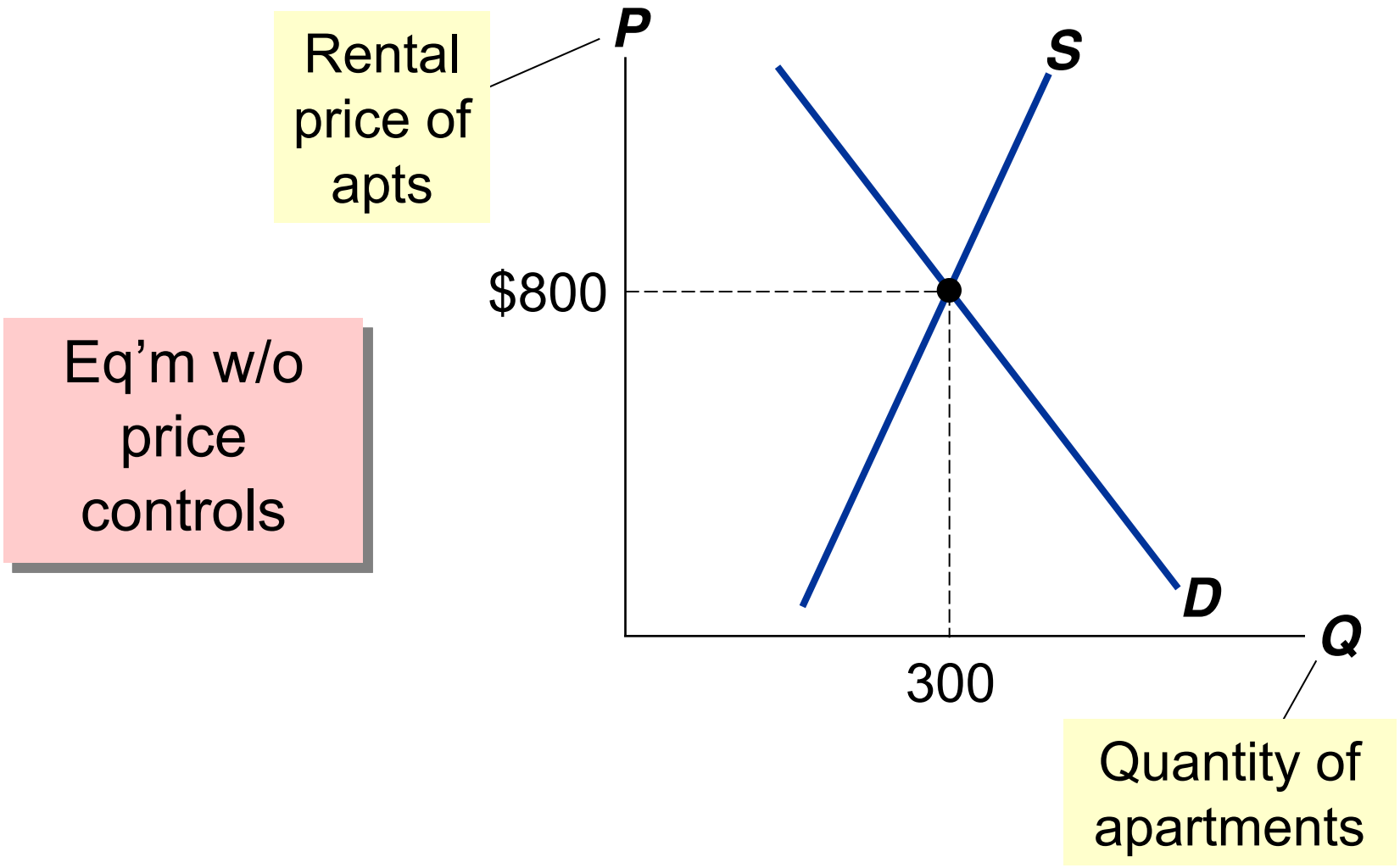
- What are price ceilings and price floors? What are some examples of each?
- How do price ceilings and price floors affect market outcomes?
- How do taxes affect market outcomes? How do the effects depend on whether the tax is imposed on buyers or sellers?
- What is the incidence of a tax? What determines the incidence?

Government Policies That Alter the Private Market Outcome

- Price controls
  - **Price ceiling**: a legal maximum on the price of a good or service *Example: rent control*
  - **Price floor**: a legal minimum on the price of a good or service *Example: minimum wage*
- Taxes
  - The govt can make buyers or sellers pay a specific amount on each unit bought/sold.

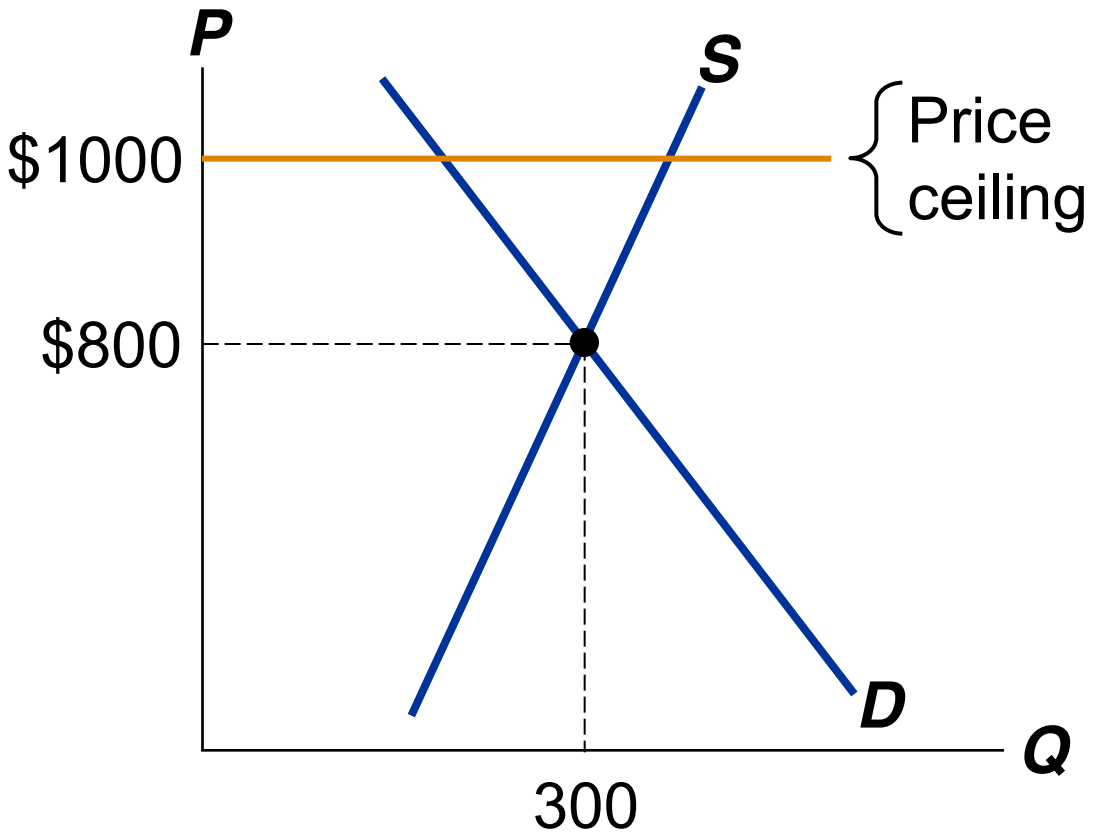
We will use the supply/demand model to see how each policy affects the market outcome (the price buyers pay, the price sellers receive, and eq'm quantity).

EXAMPLE 1: The Market for Apartments



How Price Ceilings Affect Market Outcomes

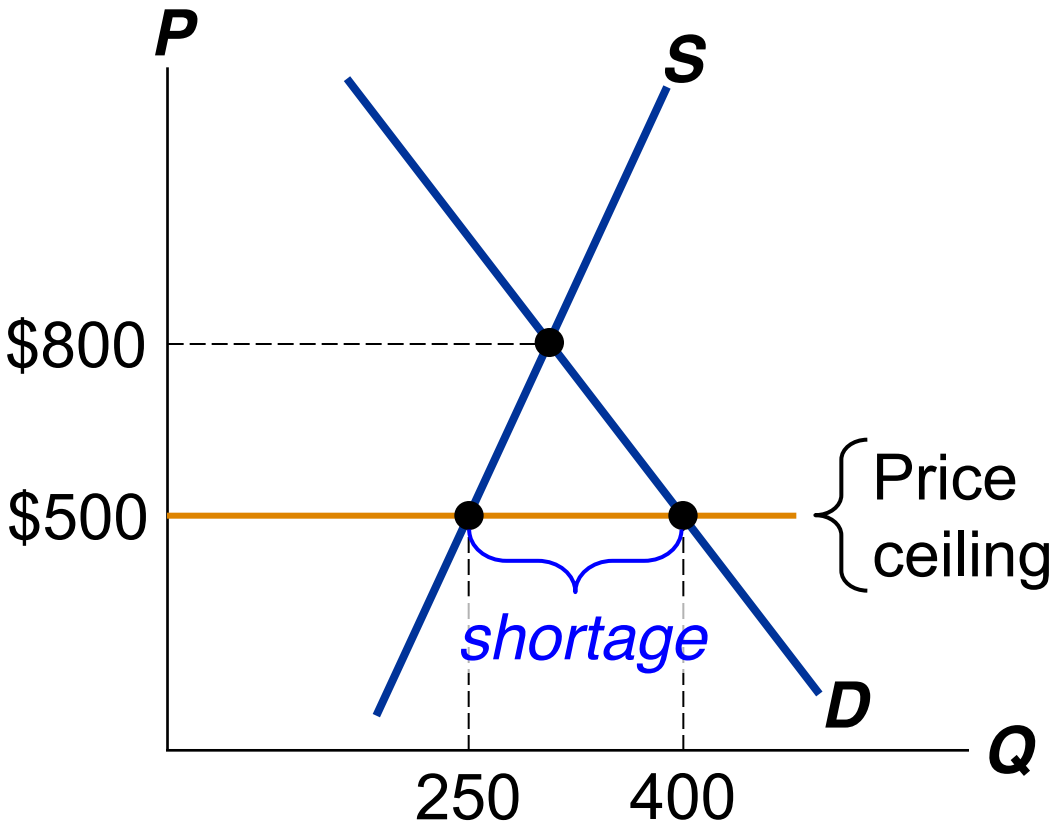
A price ceiling above the eq'm price is **not binding** – has no effect on the market outcome.



How Price Ceilings Affect Market Outcomes

The eq'm price ($800) is above the ceiling and therefore illegal.

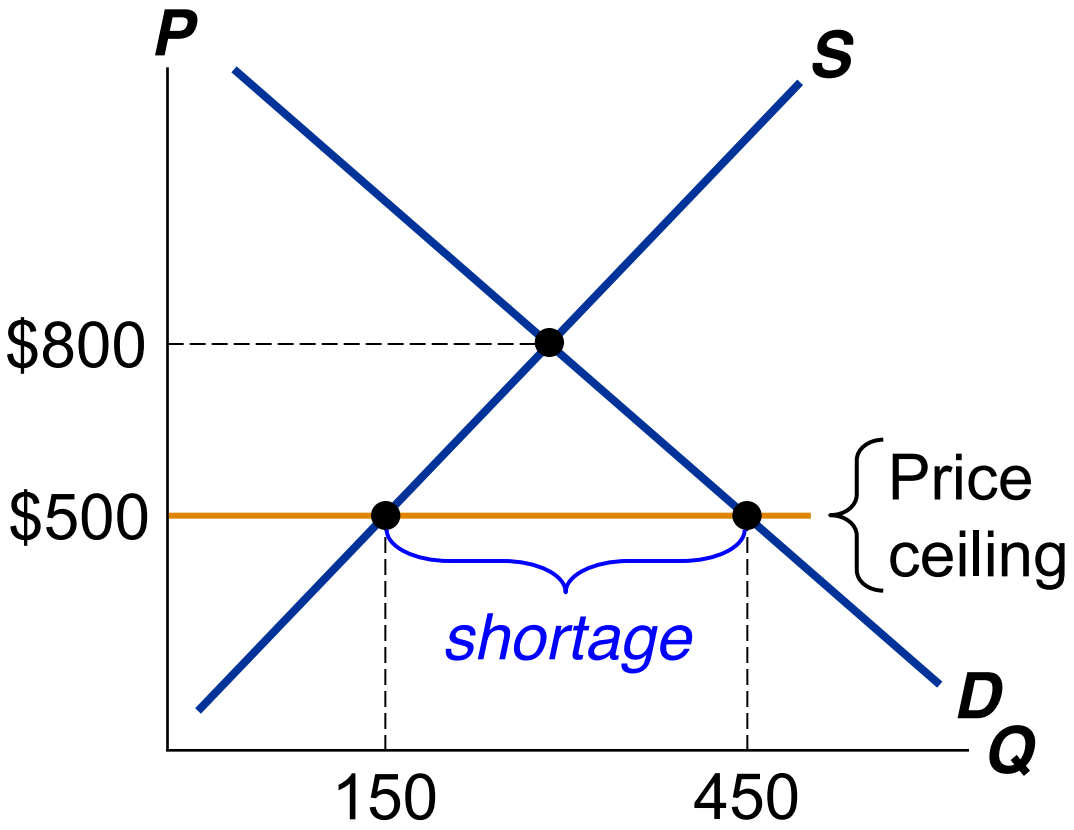
The ceiling is a **binding constraint** on the price, causes a shortage.



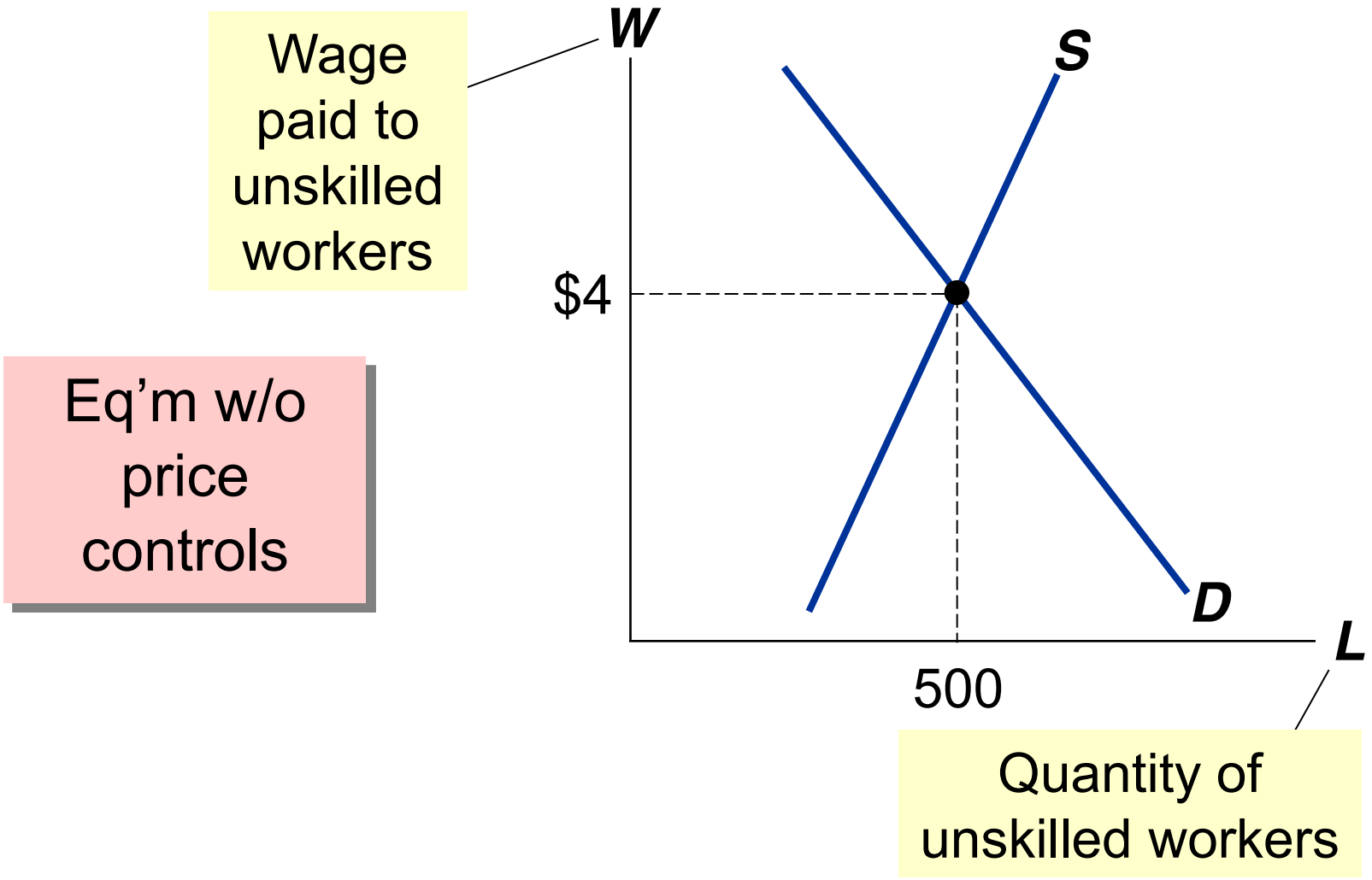
How Price Ceilings Affect Market Outcomes

In the long run, supply and demand are more price-elastic.

So, the shortage is larger.

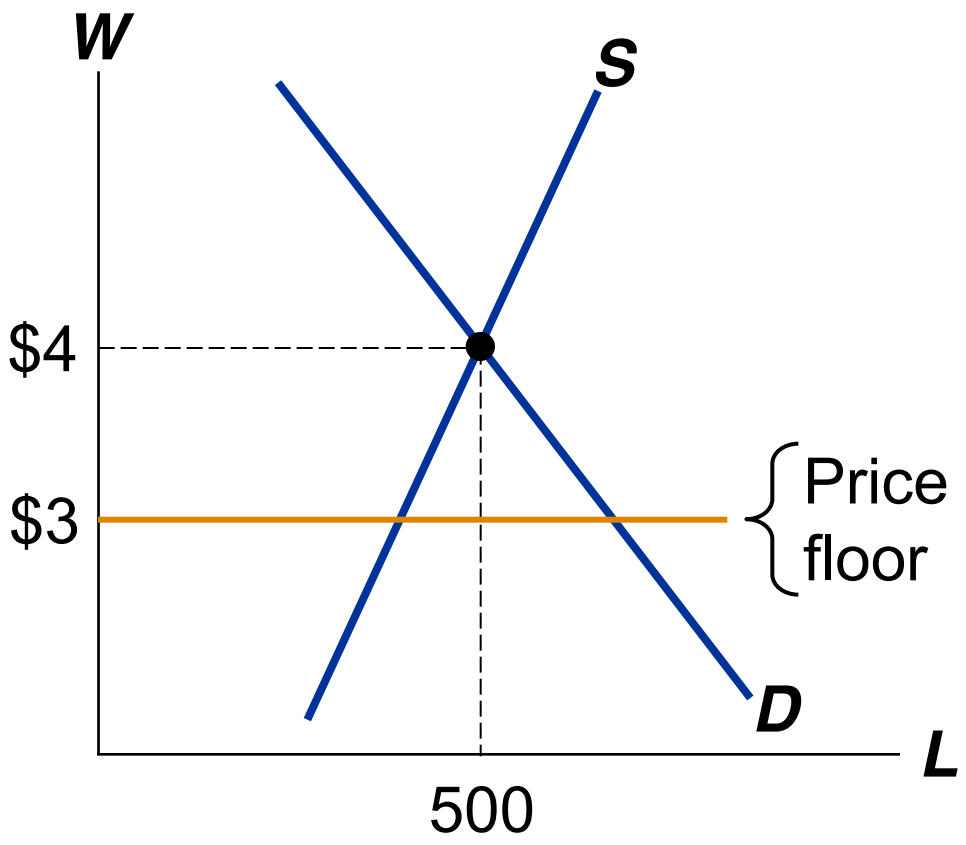


EXAMPLE 2: The Market for Unskilled Labor



How Price Floors Affect Market Outcomes

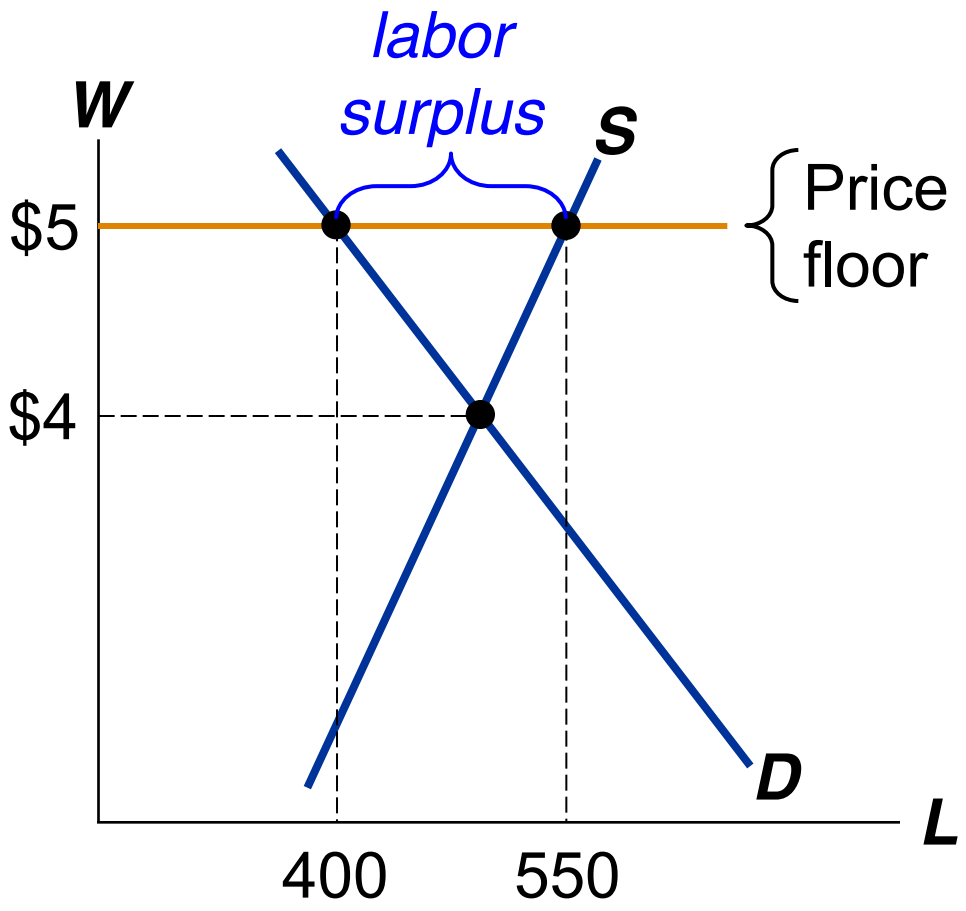
A price floor below the eq'm price is **not binding** – has no effect on the market outcome.



How Price Floors Affect Market Outcomes

The eq'm wage ($4) is below the floor and therefore illegal.

The floor is a **binding constraint** on the wage, causes a surplus (*i.e.*, unemployment).

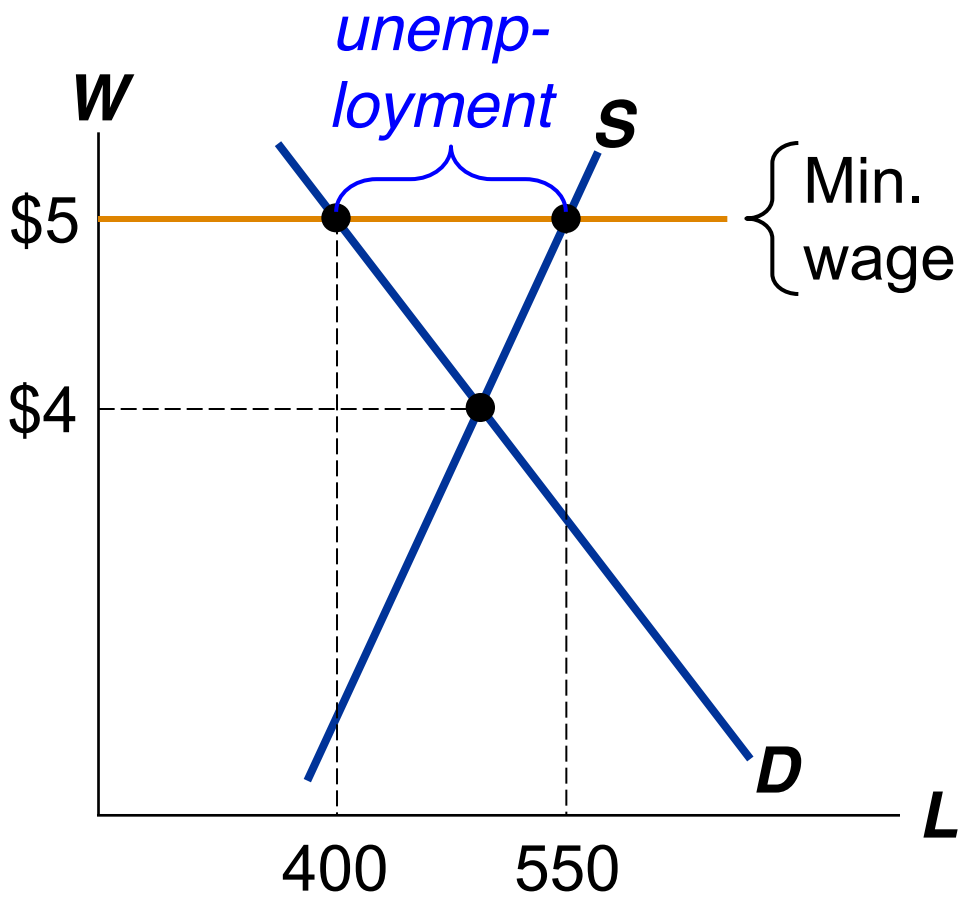


The Minimum Wage

Min wage laws do not affect highly skilled workers.

They do affect teen workers.

Studies:
A 10% increase in the min wage raises teen unemployment by 1-3%.

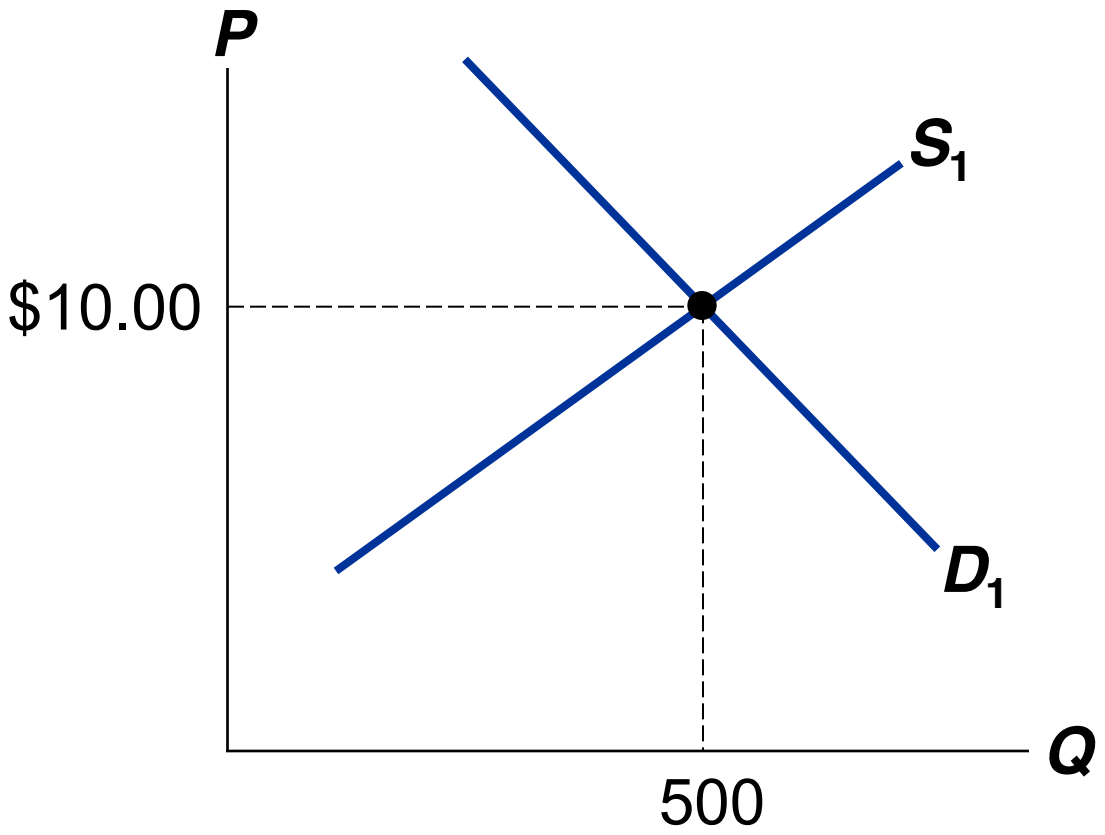


Taxes

- The govt levies taxes on many goods & services to raise revenue to pay for national defense, public schools, etc.
- The govt can make buyers or sellers pay the tax.
- The tax can be a % of the good's price, or a specific amount for each unit sold.
  - For simplicity, we analyze per-unit taxes only.

EXAMPLE 3: The Market for Pizza

Eq'm
w/o tax



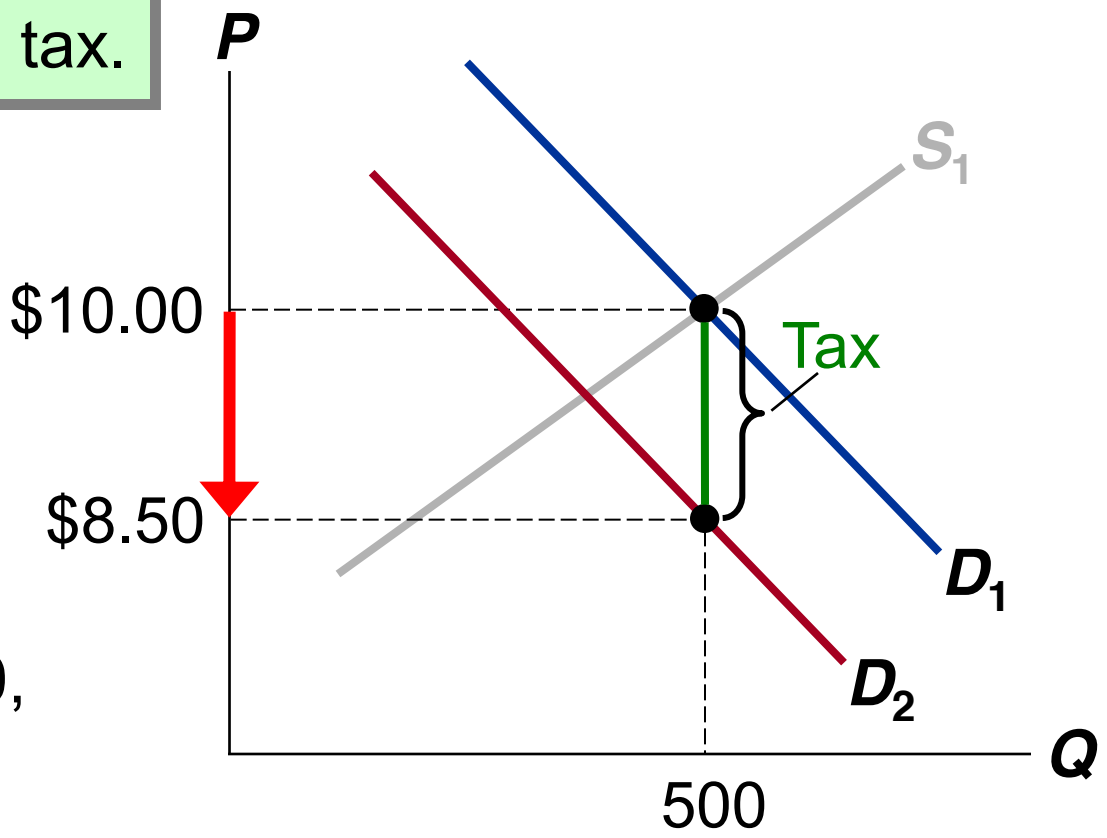
A Tax on Buyers

Hence, a tax on buyers shifts the ***D*** curve down by the amount of the tax.

P would have to fall by $1.50 to make buyers willing to buy same ***Q*** as before.

E.g., if ***P*** falls from $10.00 to $8.50, buyers still willing to purchase 500 pizzas.

Effects of a $1.50 per unit tax on buyers



A Tax on Buyers

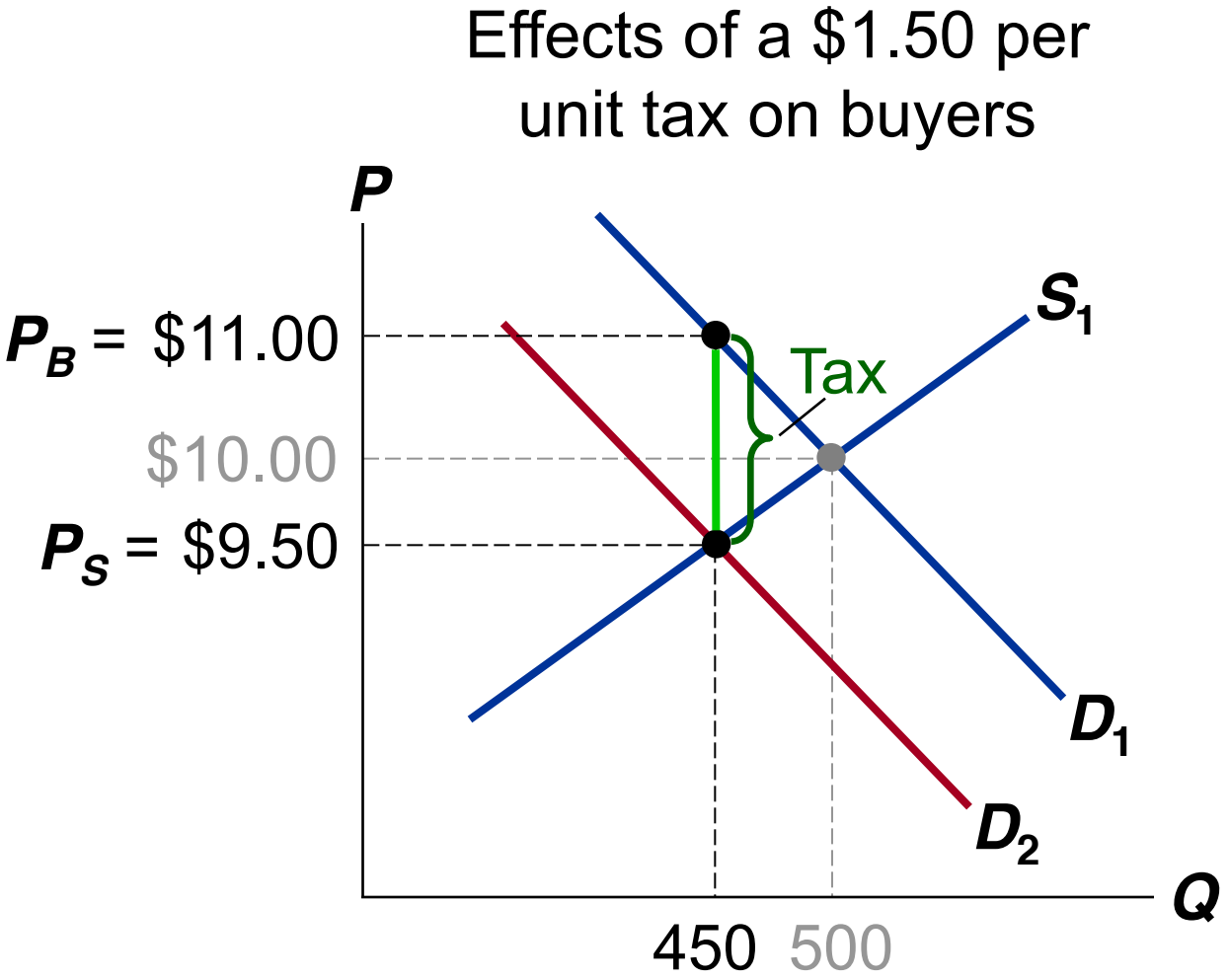
New eq'm:

$Q = 450$

Sellers receive $P_S = \$9.50$

Buyers pay $P_B = \$11.00$

Difference between them = \$1.50 = tax



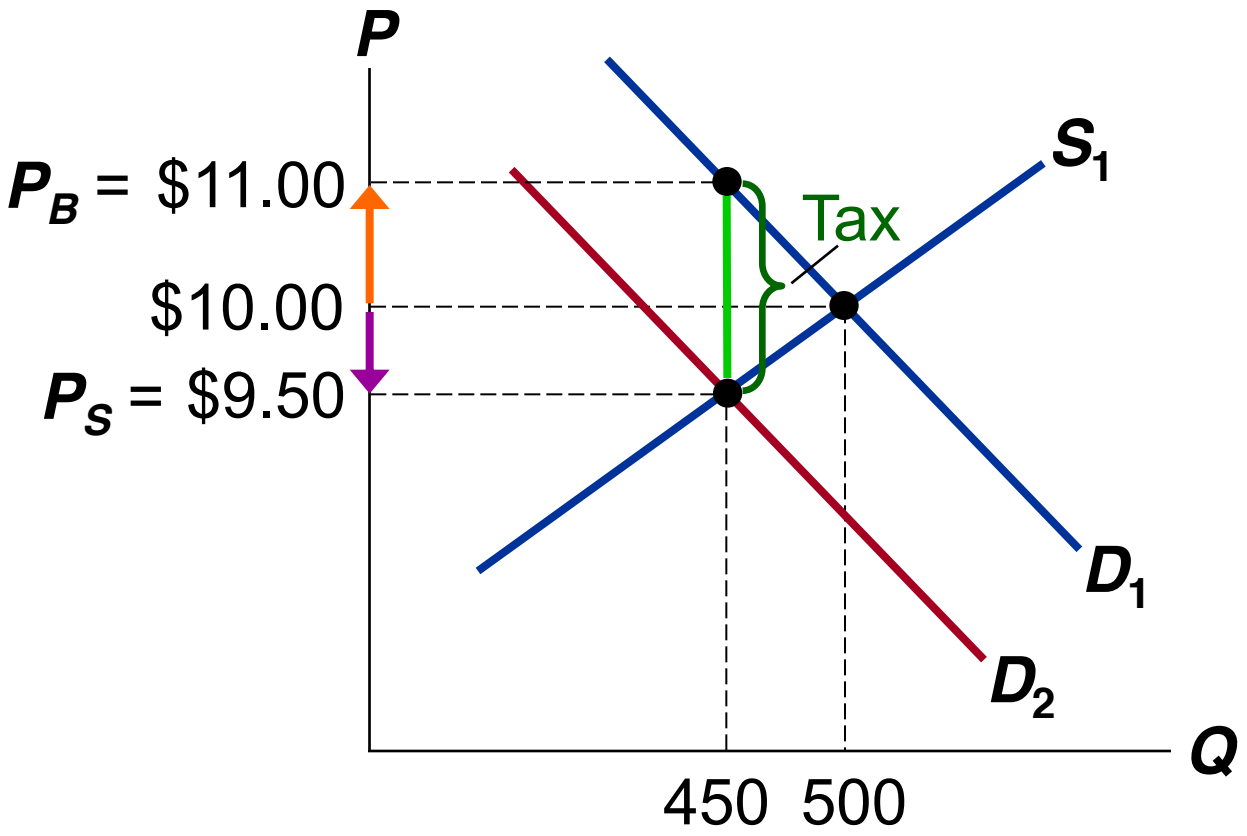
The **Incidence** of a Tax:

how the burden of a tax is shared among market participants

In our example,

buyers pay $1.00 more,

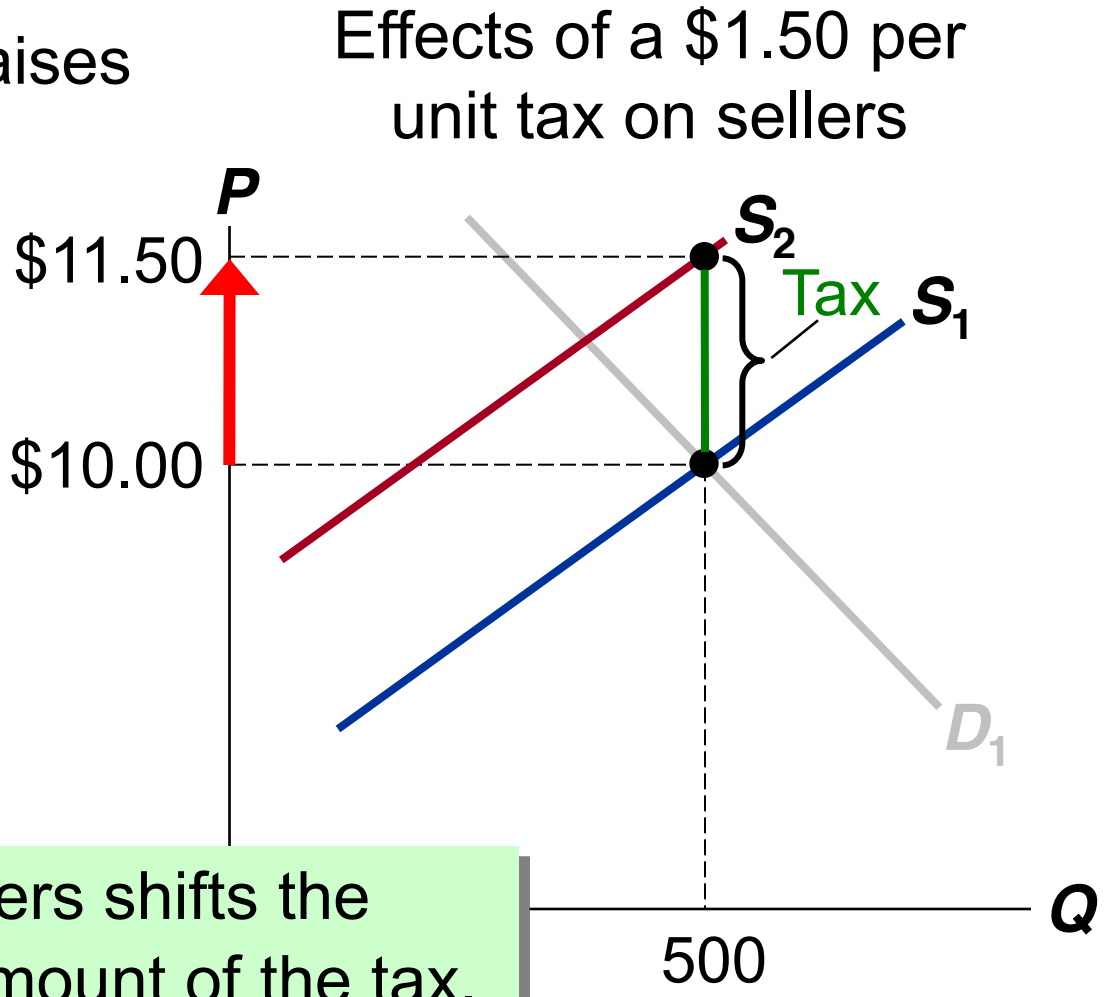
sellers get $0.50 less.



A Tax on Sellers

The tax effectively raises sellers' costs by $1.50 per pizza.

Sellers will supply 500 pizzas only if ***P*** rises to $11.50, to compensate for this cost increase.



Hence, a tax on sellers shifts the ***S*** curve up by the amount of the tax.

A Tax on Sellers

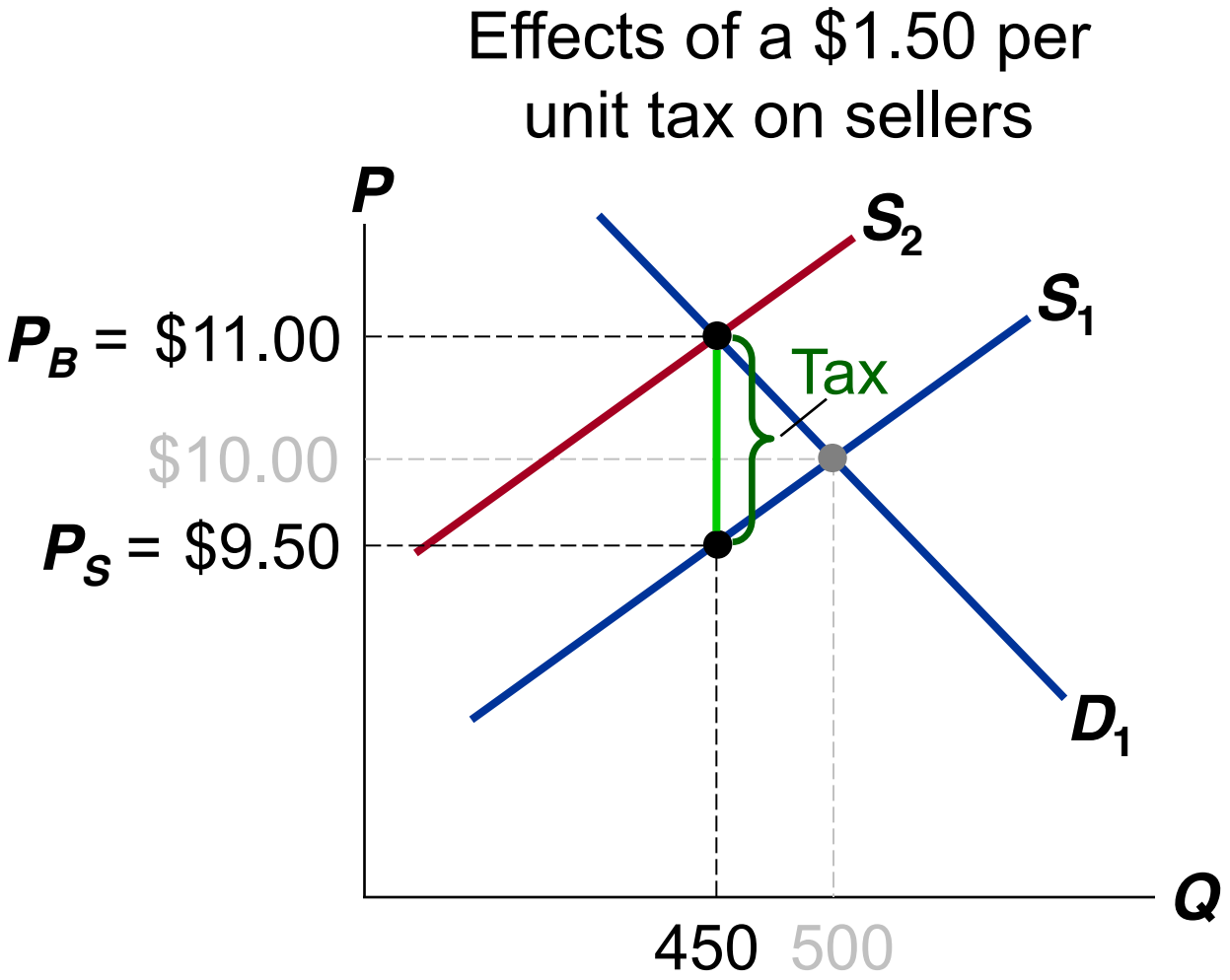
New eq'm:

$Q = 450$

Buyers pay
$P_B = \$11.00$

Sellers receive
$P_S = \$9.50$

Difference between them
= \$1.50 = tax

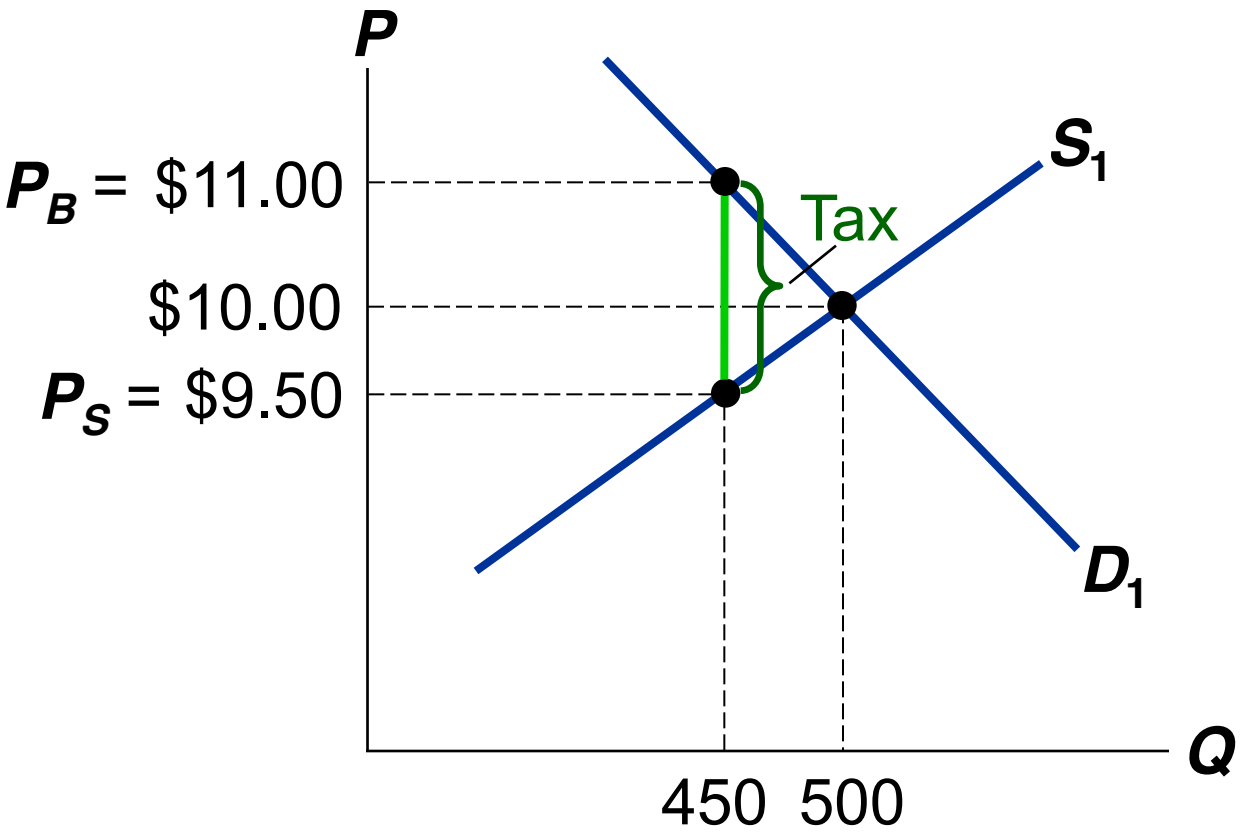


The Outcome Is the Same in Both Cases!

The effects on ***P*** and ***Q***, and the tax incidence are the same whether the tax is imposed on buyers or sellers!

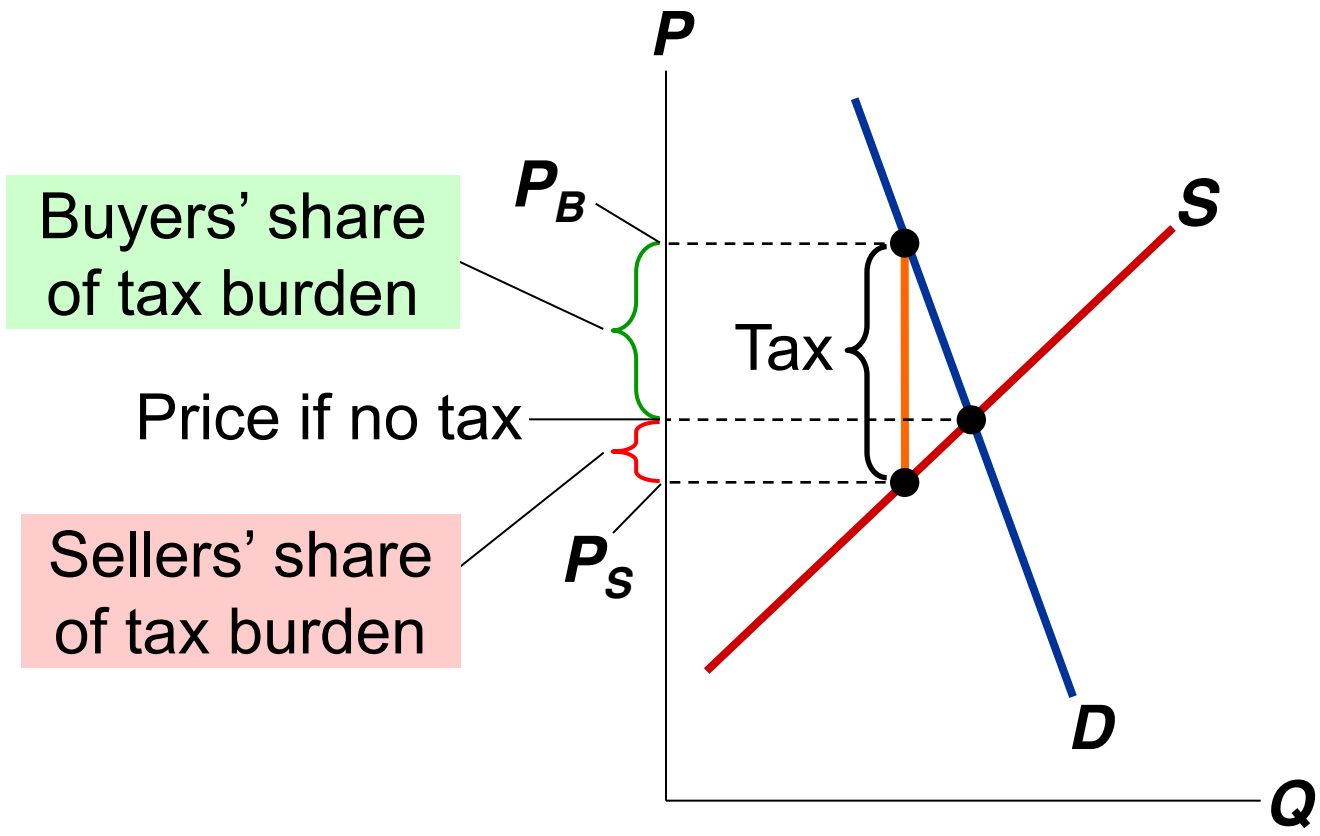
What matters is this:

A tax drives a wedge between the price buyers pay and the price sellers receive.



Elasticity and Tax Incidence

CASE 1: Supply is more elastic than demand

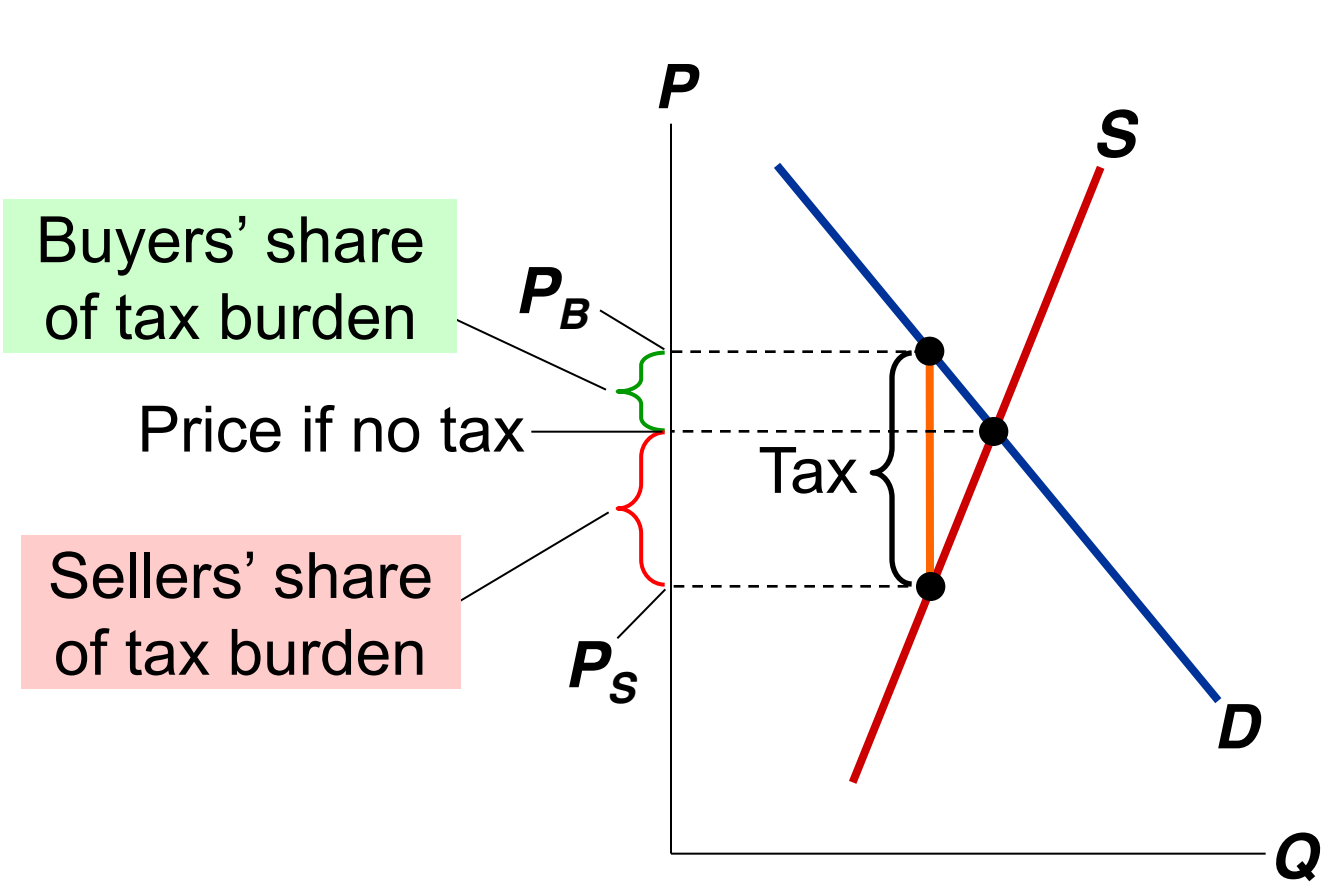


It's easier for sellers than buyers to leave the market.

So buyers bear most of the burden of the tax.

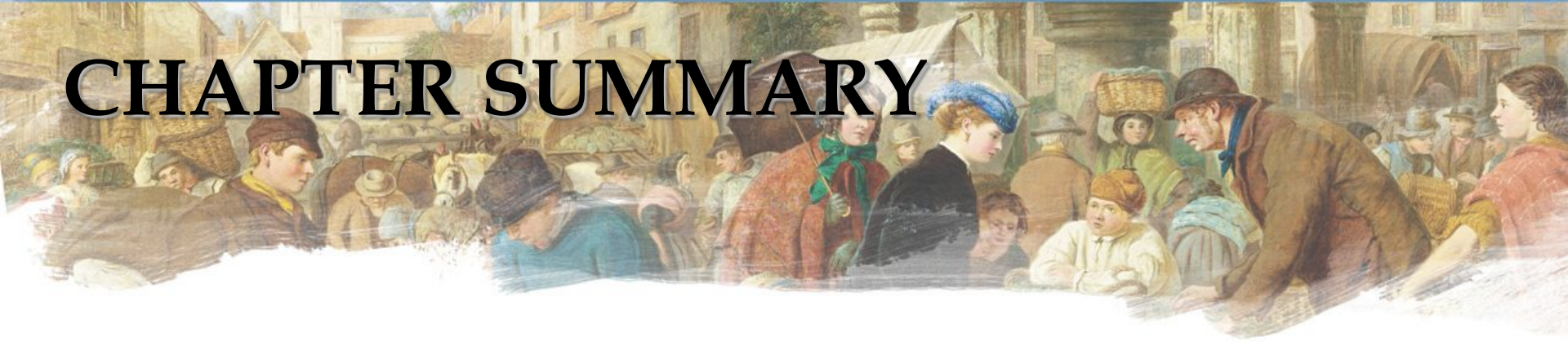
Elasticity and Tax Incidence

CASE 2: Demand is more elastic than supply



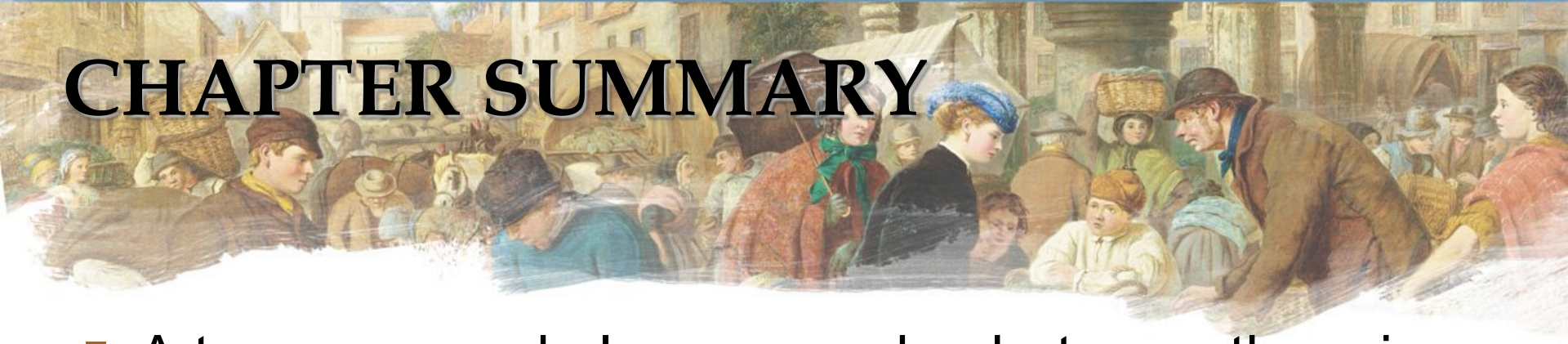
It's easier for buyers than sellers to leave the market.

Sellers bear most of the burden of the tax.



CHAPTER SUMMARY

- A price ceiling is a legal maximum on the price of a good. An example is rent control. If the price ceiling is below the eq'm price, it is binding and causes a shortage.
- A price floor is a legal minimum on the price of a good. An example is the minimum wage. If the price floor is above the eq'm price, it is binding and causes a surplus. The labor surplus caused by the minimum wage is unemployment.



CHAPTER SUMMARY

- A tax on a good places a wedge between the price buyers pay and the price sellers receive, and causes the eq'm quantity to fall, whether the tax is imposed on buyers or sellers.
- The incidence of a tax is the division of the burden of the tax between buyers and sellers, and does not depend on whether the tax is imposed on buyers or sellers.
- The incidence of the tax depends on the price elasticities of supply and demand.