

ENERGY MARKETS & GOVERNMENT POLICY

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By Vance Ginn

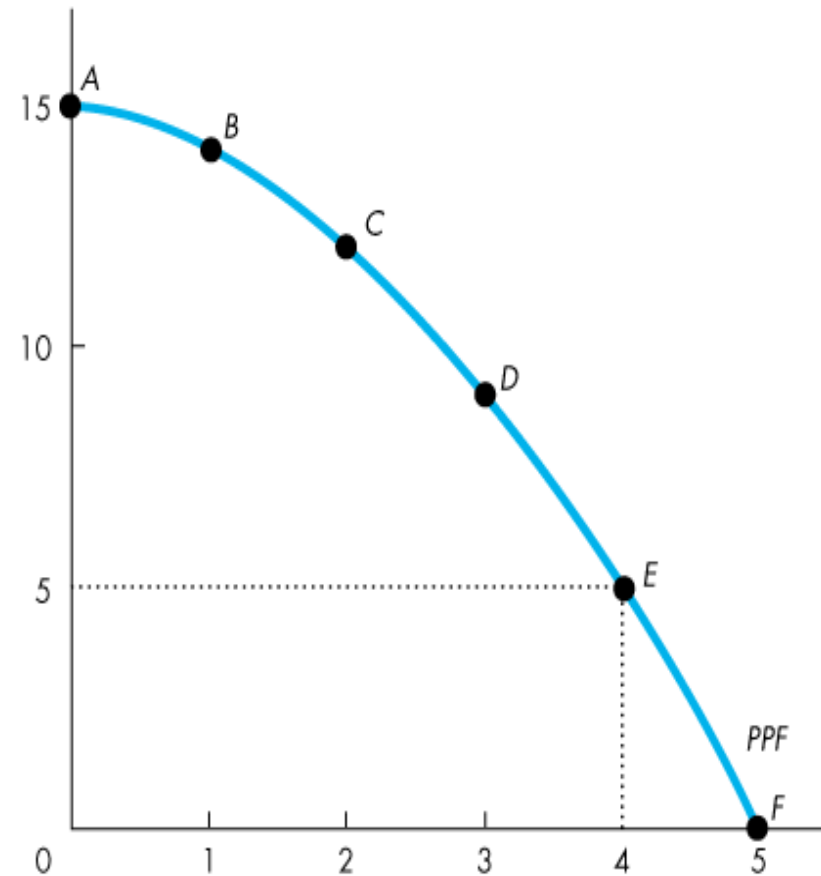
Opportunity Costs

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- Scarcity- the limited nature of society's resources.
(_____)
- Opportunity costs-video: the cost of the next best alternative that you forego in any decision that is made.
- This cost is a ratio of the total outputs of two goods given a constrained amount of time.
 - Ex. In one hour, Exxon-Mobil can produce 15 barrels of oil or 5 cubic feet of natural gas.
 - $15 O = 5 G$
 - _____
 - _____
 - These trade-offs provide valuable information to the firm.

Production Possibilities Frontier

- The *PPF* makes the concept of opportunity cost precise.
- As we move down along the *PPF*, we produce more gas but the quantity of oil we can produce decreases.
- The opportunity cost of gas is the oil forgone.
- Fixed PPF with given resources



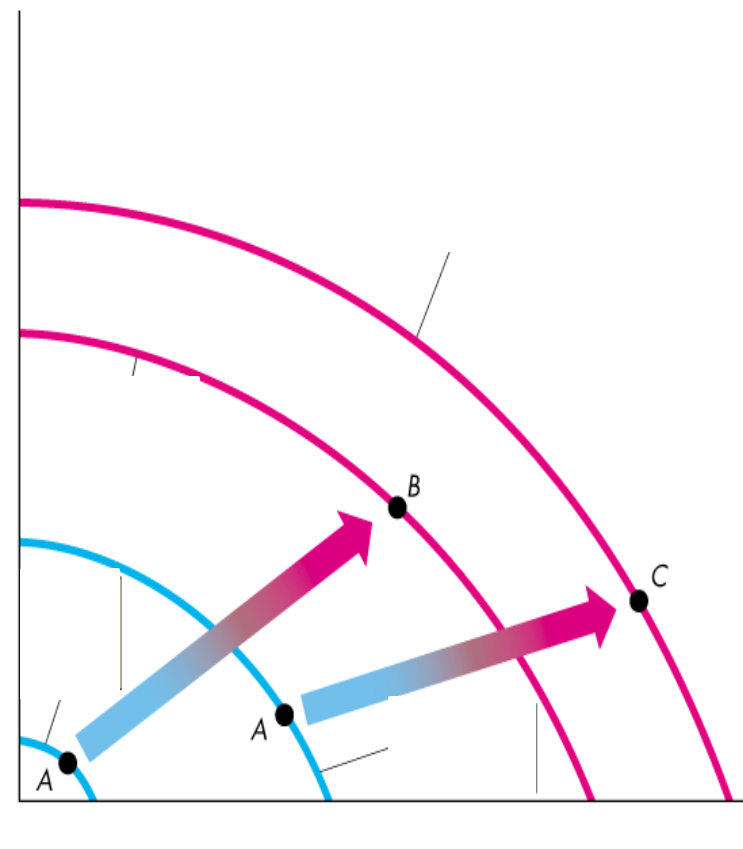
Economic Growth

▣ The expansion of production possibilities—and increase in the standard of living—is called economic growth-video.

▣ Two key factors influence economic growth:

■ _____ is the development of new goods and of better ways of producing goods and services.

■ _____ is the growth of capital resources, which includes *human capital*.



Incentives

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- Incentive- something that _____.
- Prices are a means of incentive or disincentive to purchase a good or service based on your value of these.
- There are costs associated with many policy choices such as a gas tax. You have fewer people driving, but this is a necessity for people to drive.

Markets & Competition

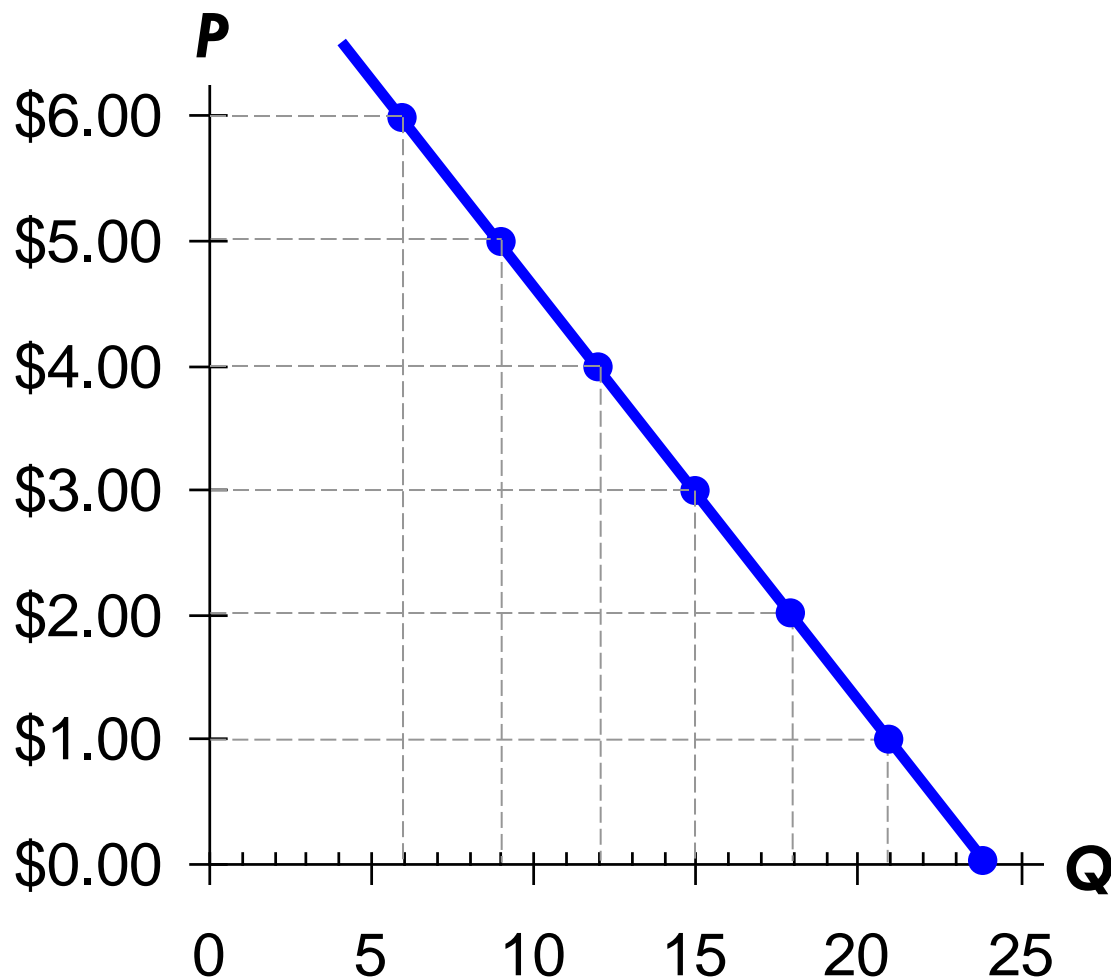
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- A **market-video** is a group of buyers and sellers of a particular product.
- A _____ is one with many buyers and sellers, each has a negligible effect on price.
- In a **perfectly competitive** market:
 - ▣ All goods exactly the same
 - ▣ Buyers & sellers so numerous that no one can affect market price – each is a “_____”
- We will assume markets are perfectly competitive.

Demand

- The _____ of any good is the amount of the good that buyers are willing and able to purchase.
- _____: the claim that the quantity demanded of a good falls when the price of the good rises, other things equal

The Market Demand Curve for Gasoline



P	Q^d (Market)
\$0.00	24
1.00	21
2.00	18
3.00	15
4.00	12
5.00	9
6.00	6

Demand Curve Shifters

- The demand curve shows how price affects quantity demanded, *other things being equal*.
- These “other things” are non-price determinants of demand (*i.e.*, things that determine buyers’ demand for a good, other than the good’s price).
- What shifts the demand curve?
 - ▣ Number of buyers
 - ▣ Tastes/Preferences
 - ▣ Income
 - ▣ Prices of Related Goods
 - ▣ Expectations

Demand Curve Shifters: Income

- Demand for a _____ is positively related to income.
 - ▣ Increase in income causes increase in quantity demanded at each price, shifts **D** curve to the right.

(Demand for an _____ is negatively related to income. An increase in income shifts **D** curves for inferior goods to the left.)

Demand Curve Shifters: Prices of Related Goods

- Two goods are **substitutes** if an increase in the price of one causes an increase in demand for the other.
- Natural Gas and Petroleum-[Read this article](#)
- Example: windmills and solar panels.
An increase in the price of solar panels increases demand for windmills, shifting windmills demand curve to the right.
- Other examples: Coke and Pepsi, laptops and desktop computers, CDs and music downloads

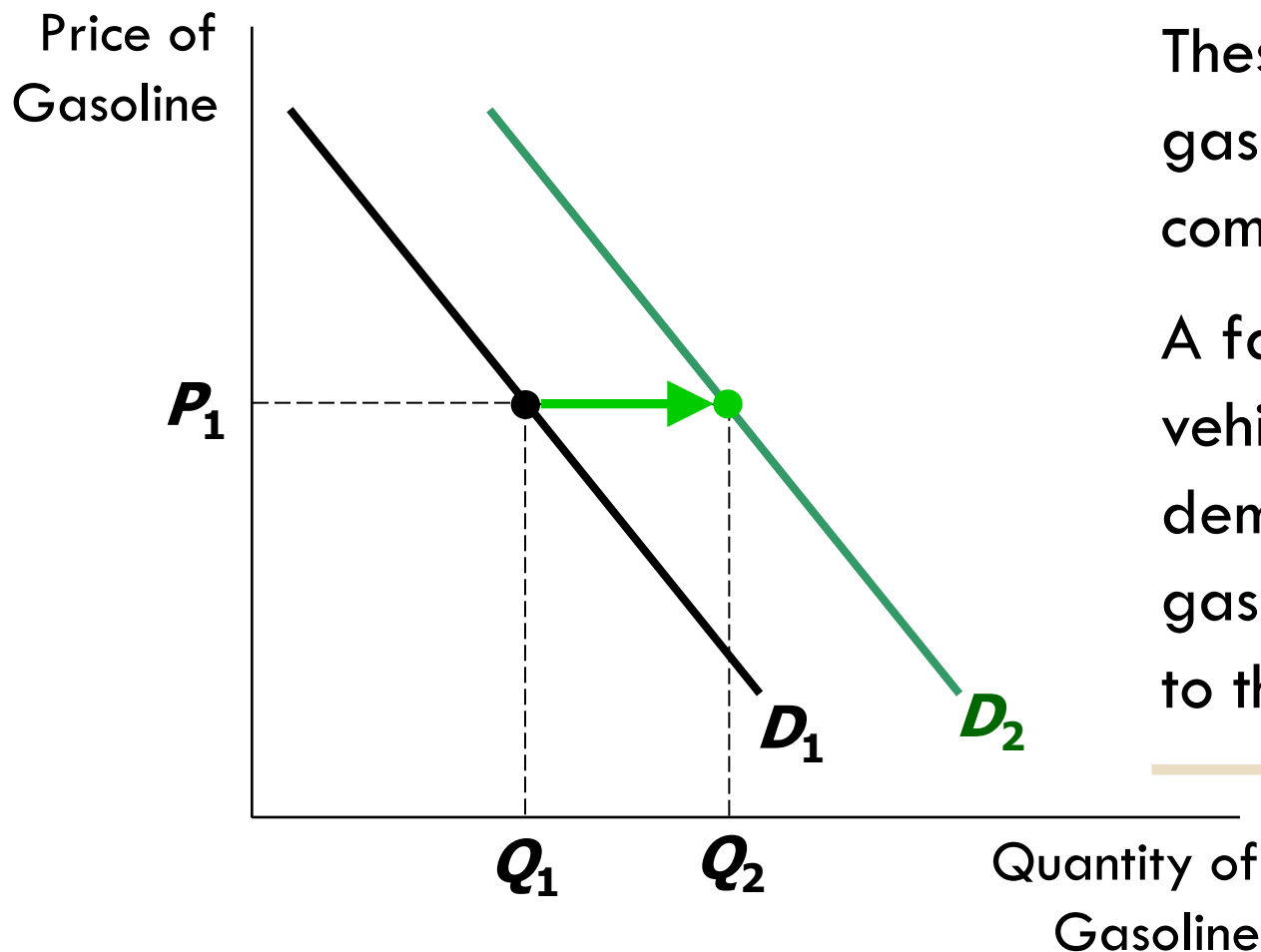
Demand Curve Shifters: Prices of Related Goods

- Two goods are **complements** if an increase in the price of one causes a fall in demand for the other.
- Example: internal combustion vehicle and gasoline.
If the price of this vehicle rises, people buy fewer vehicles, and therefore less gasoline.
Gasoline demand curve shifts left.
- Other examples: college tuition and textbooks, bagels and cream cheese, eggs and bacon

Example

A. Price of Internal Combustion Vehicles falls

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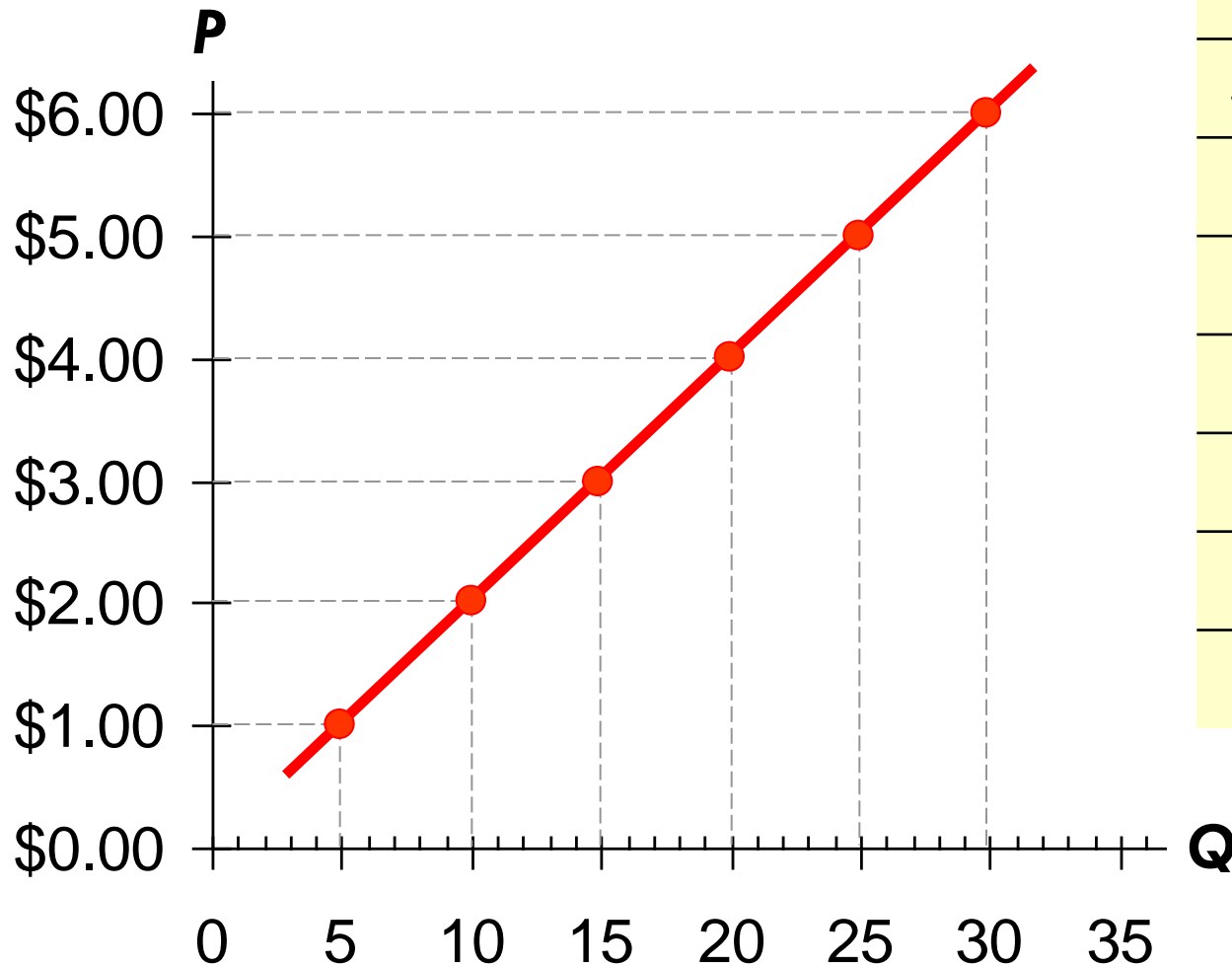
These vehicles and gasoline are complements.

A fall in price of vehicles shifts the demand curve for gasoline to the right.

Supply-video

- The **quantity supplied** of any good is the amount that sellers are willing and able to sell.
- **Law of supply**: the claim that the quantity supplied of a good rises when the price of the good rises, other things equal

The Market Supply Curve

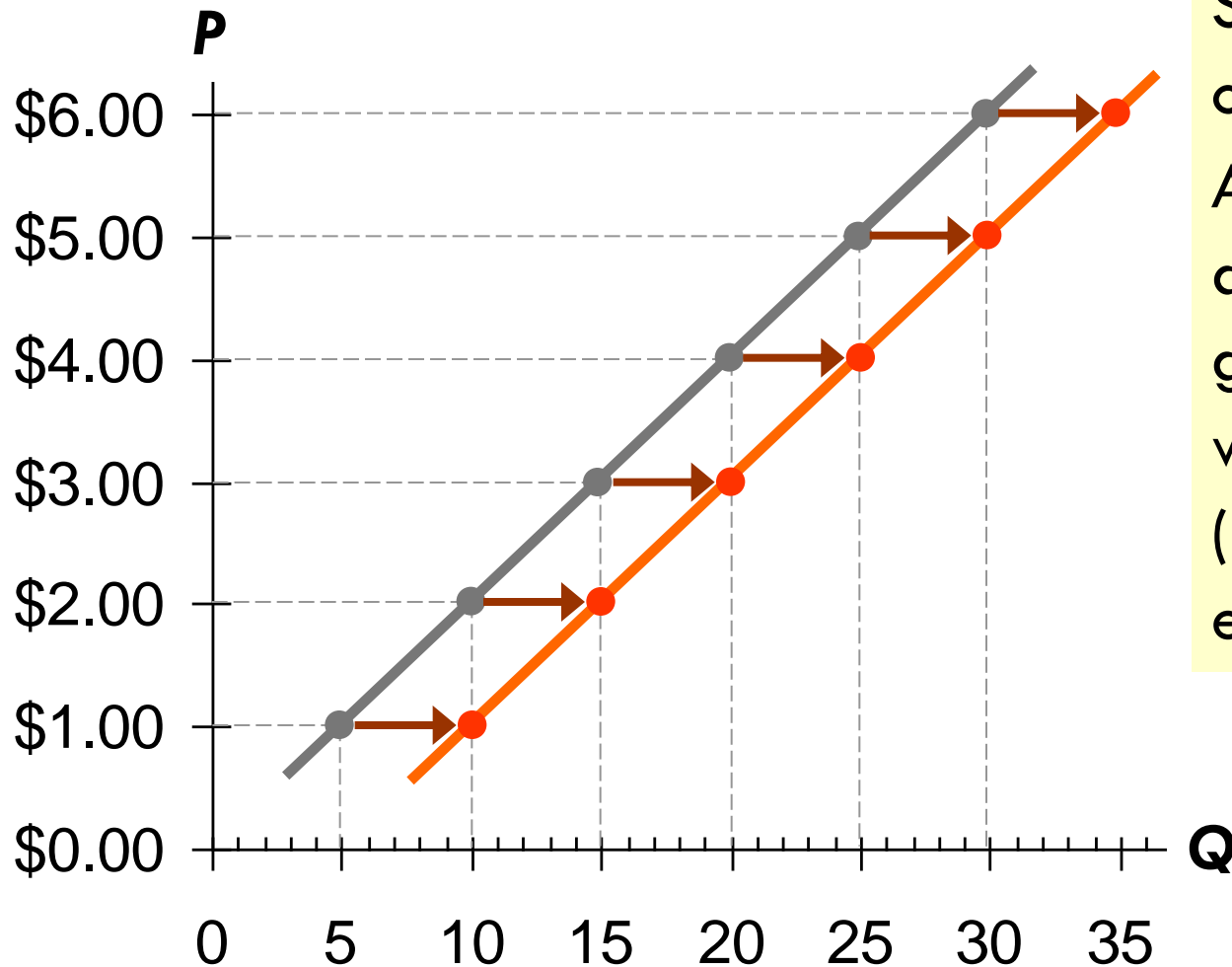


P	Q^s (Market)
\$0.00	0
1.00	5
2.00	10
3.00	15
4.00	20
5.00	25
6.00	30

Supply Curve Shifters

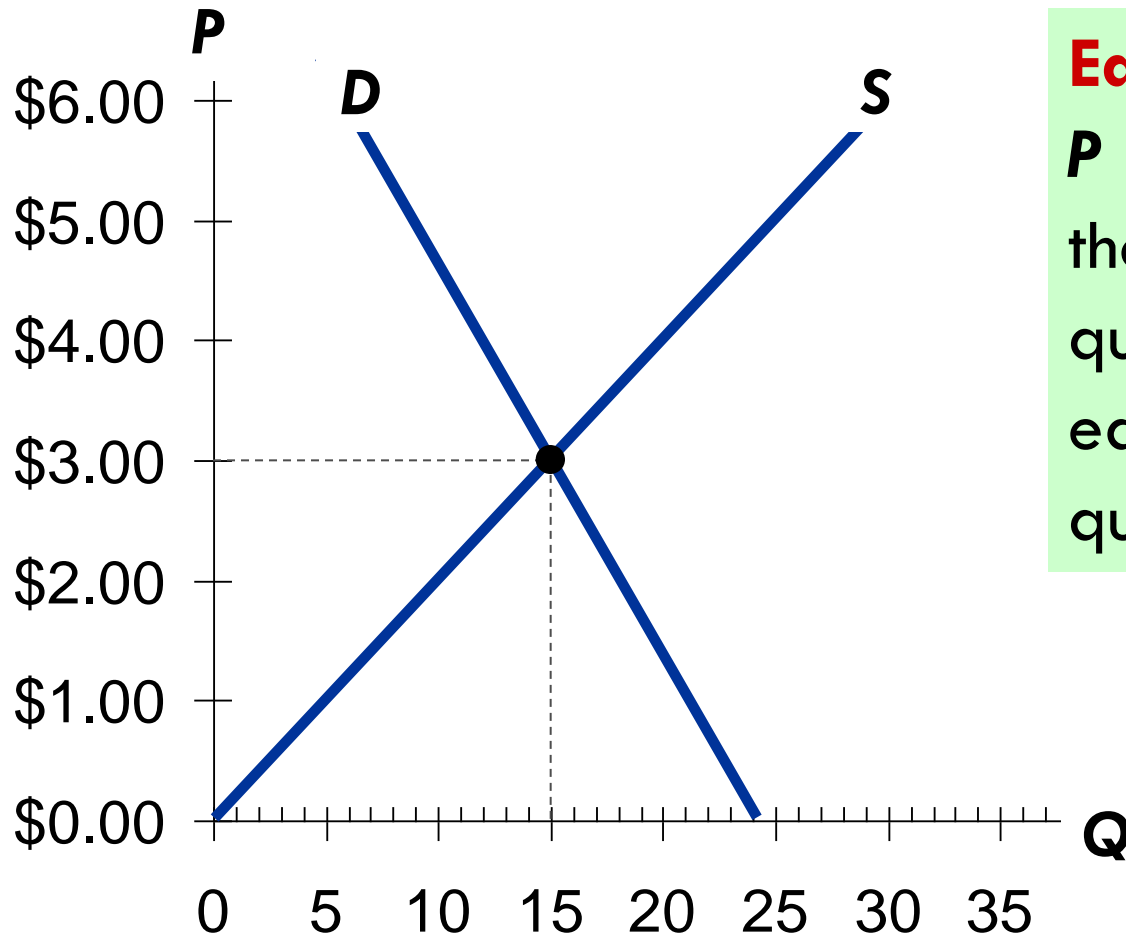
- The supply curve shows how price affects quantity supplied, *other things being equal*.
- These “other things” are non-price determinants of supply.
- What shifts the supply curve?
 - ▣ Number of sellers
 - ▣ Cost of production-Input price
 - ▣ Technology
 - ▣ Expectations

Supply Curve Shifters: Input Prices



Suppose the price of oil falls.
At each price, the quantity of gasoline supplied will increase (by 5 in this example).

Equilibrium

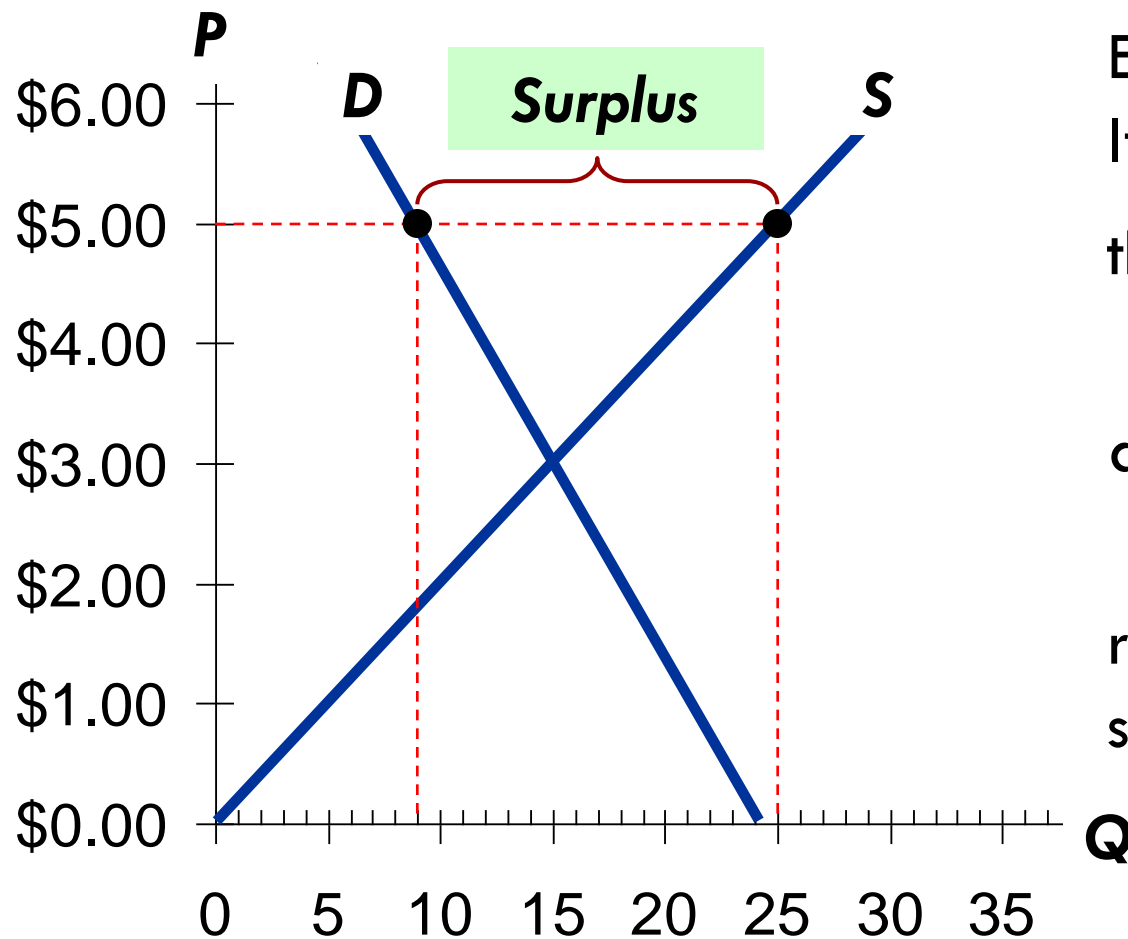


Equilibrium:

P has reached the level where quantity supplied equals quantity demanded

Surplus-video (a.k.a. excess supply):

when quantity supplied is greater than quantity demanded



Example:

If $P = \$5$,

then

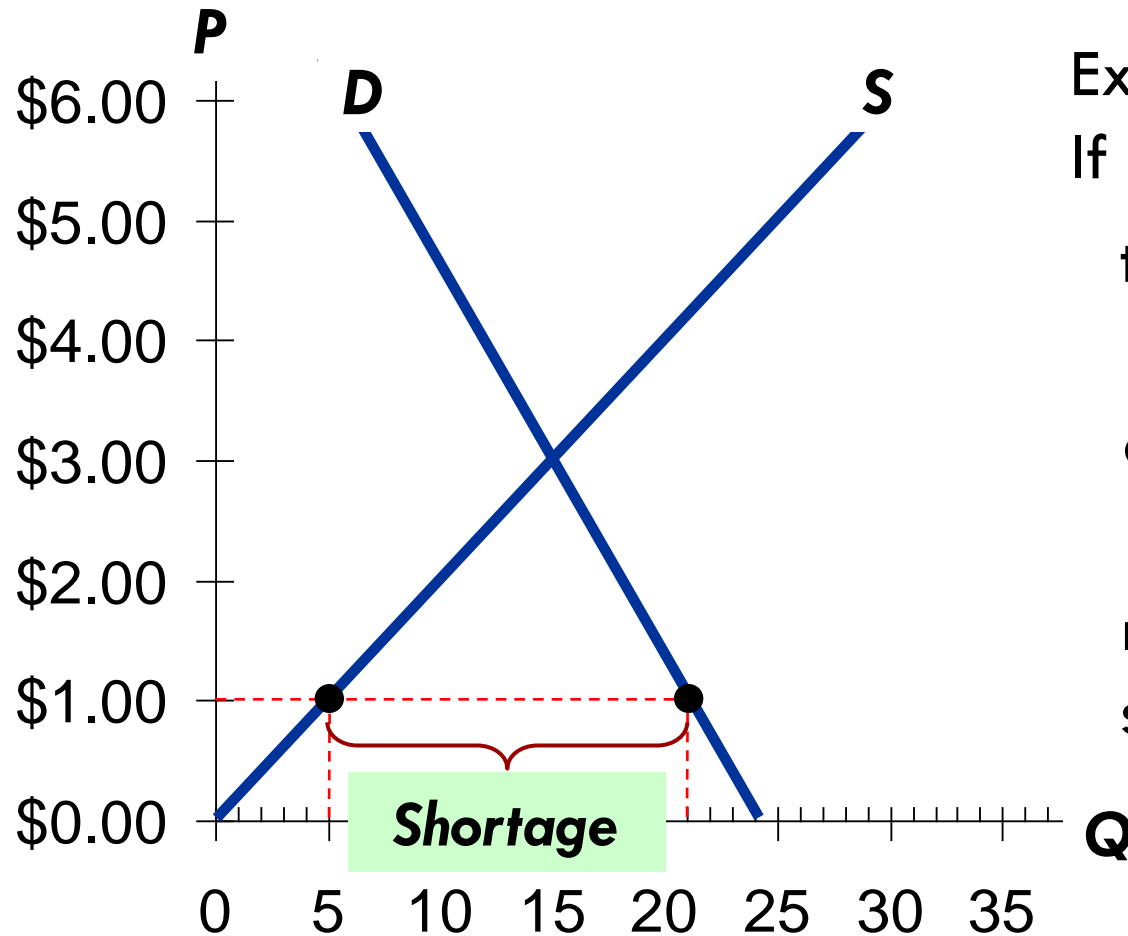
$Q^D = 9$ gallons

and

$Q^S = 25$ gallons

resulting in a
surplus of 16 gallons

Shortage (a.k.a. excess demand):
when quantity demanded is greater than
quantity supplied



Example:

If $P = \$1$,

then

$Q^D = 21$ gallons

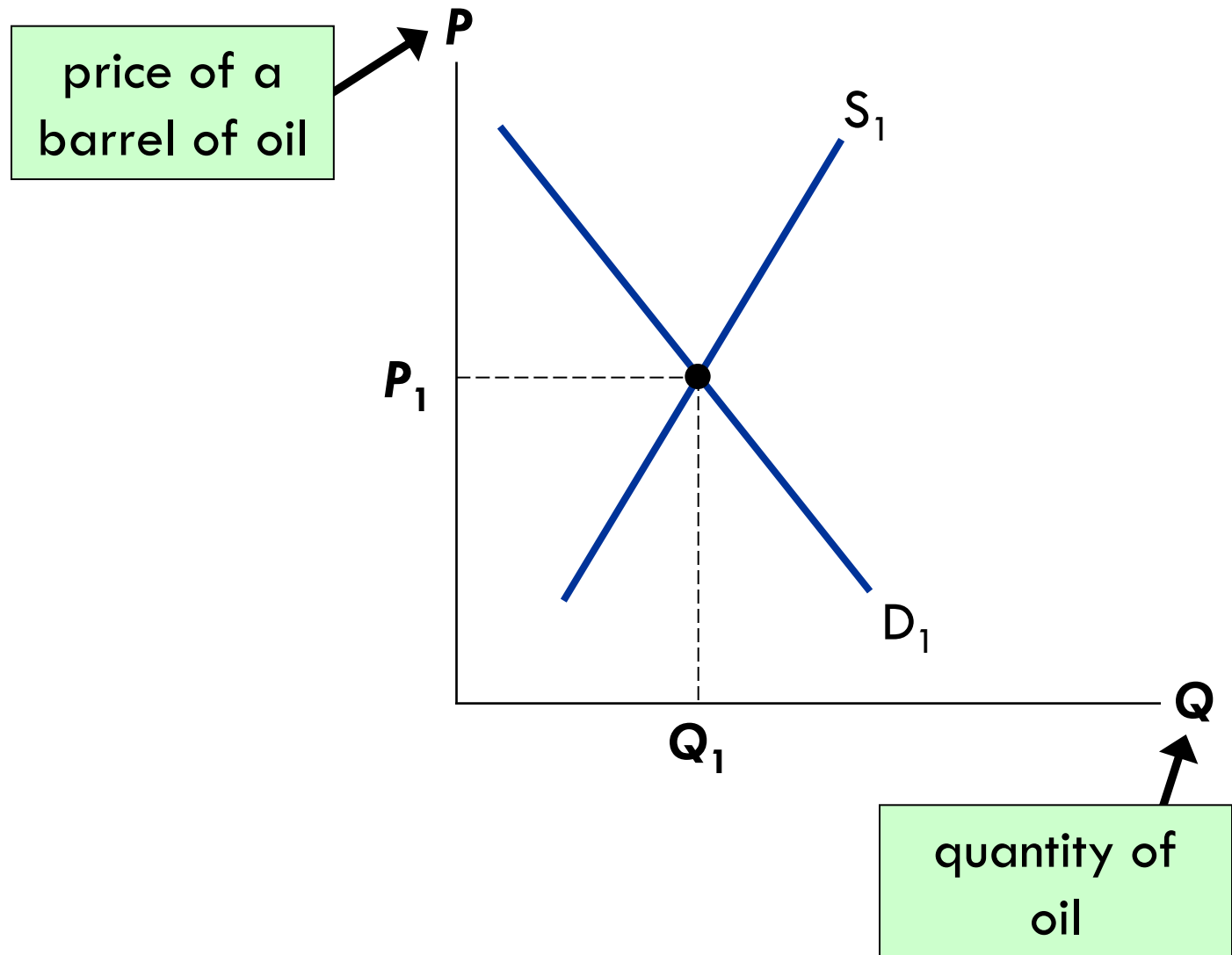
and

$Q^S = 5$ gallons

resulting in a
shortage of 16 gallons

EXAMPLE:

Petroleum Markets-See EIA



EXAMPLE 1: A Shift in Demand

EVENT TO BE

ANALYZED:

Increase in incomes.

STEP 1:

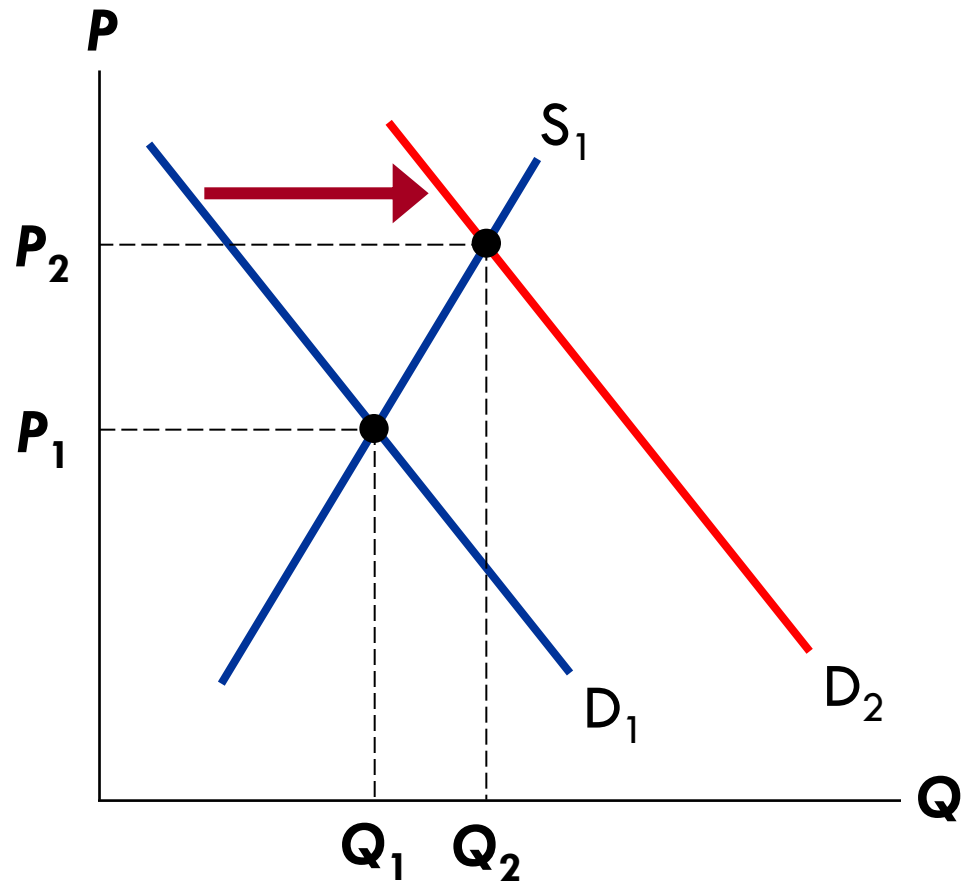
D curve shifts

STEP 2:

D shifts right

STEP 3:

The shift causes an increase in price and quantity of oil.

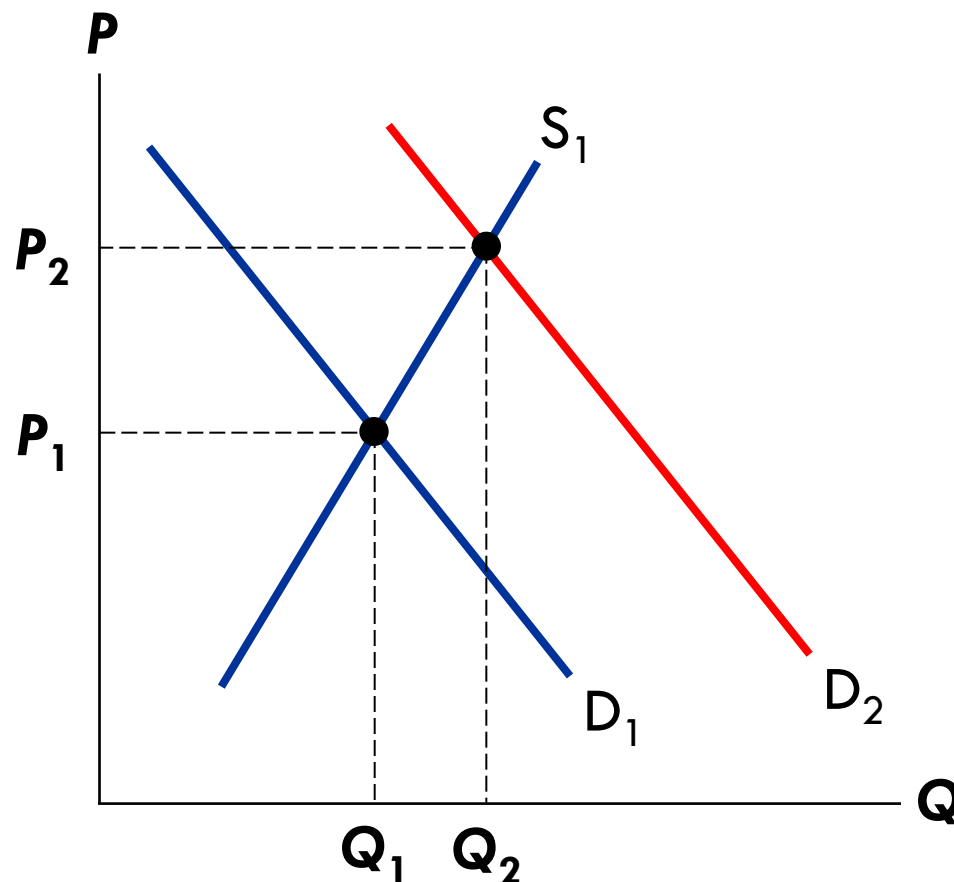


EXAMPLE 1: A Shift in Demand

Notice:

When P rises,
producers supply
a larger quantity
of oil, even though
the S curve has not
shifted.

Always be careful to distinguish b/w a shift in a curve and a movement along the curve.



EXAMPLE 2: A Shift in Supply

EVENT: New technology reduces cost of producing oil.

STEP 1:

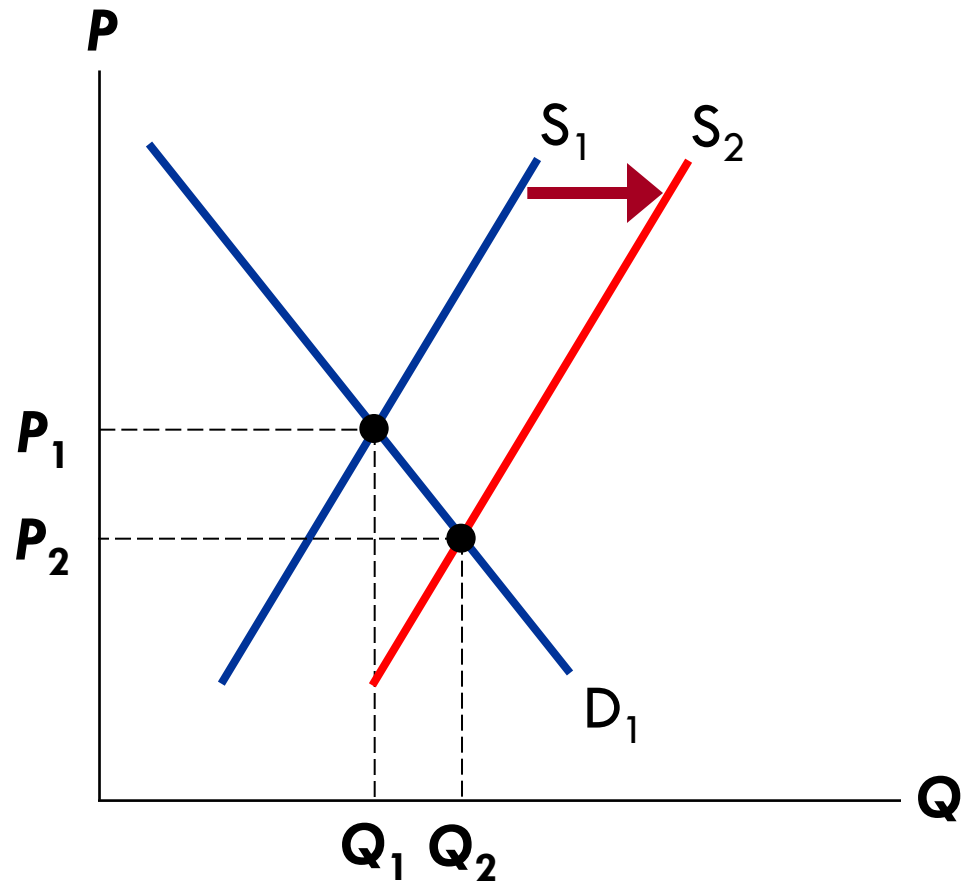
S curve shifts

STEP 2:

S shifts right

STEP 3:

The shift causes price to fall and quantity to rise.



EXAMPLE 3: A Shift in Both Supply and Demand

EVENTS:

incomes rise AND
new technology reduces
production costs

STEP 1:

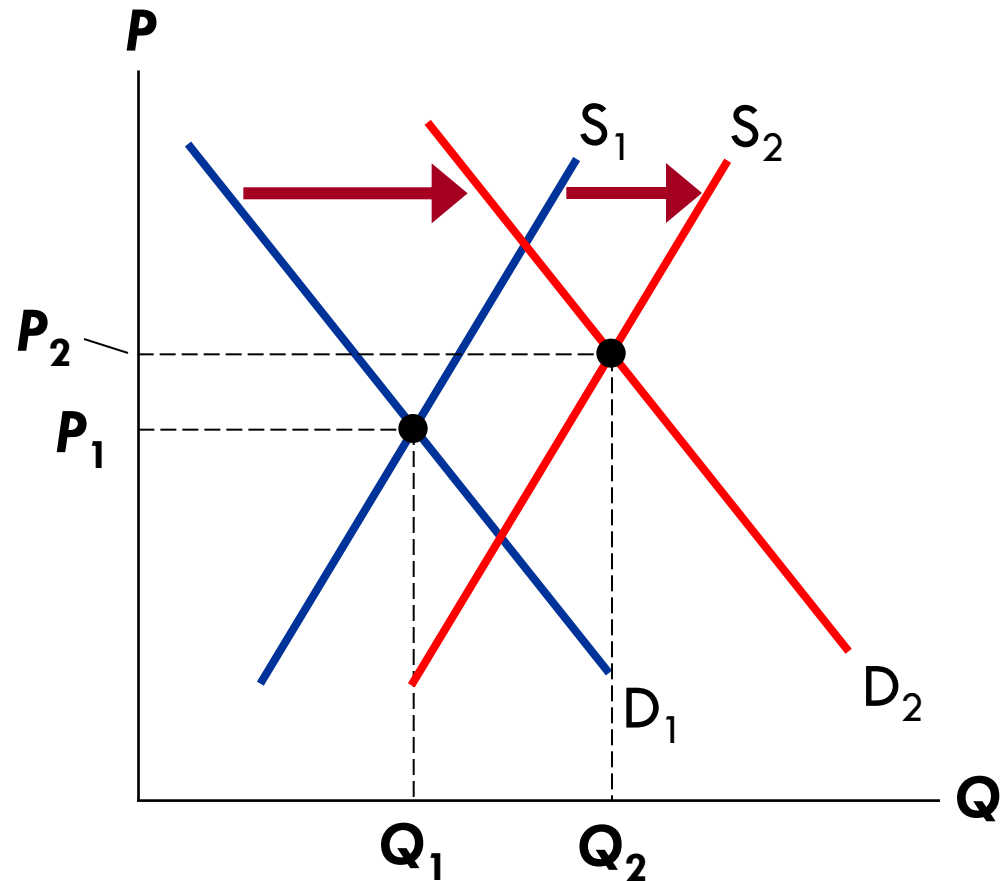
Both curves shift.

STEP 2:

Both shift to the right.

STEP 3:

Q rises, but effect
on P is ambiguous:
If demand increases more than
supply, P rises.



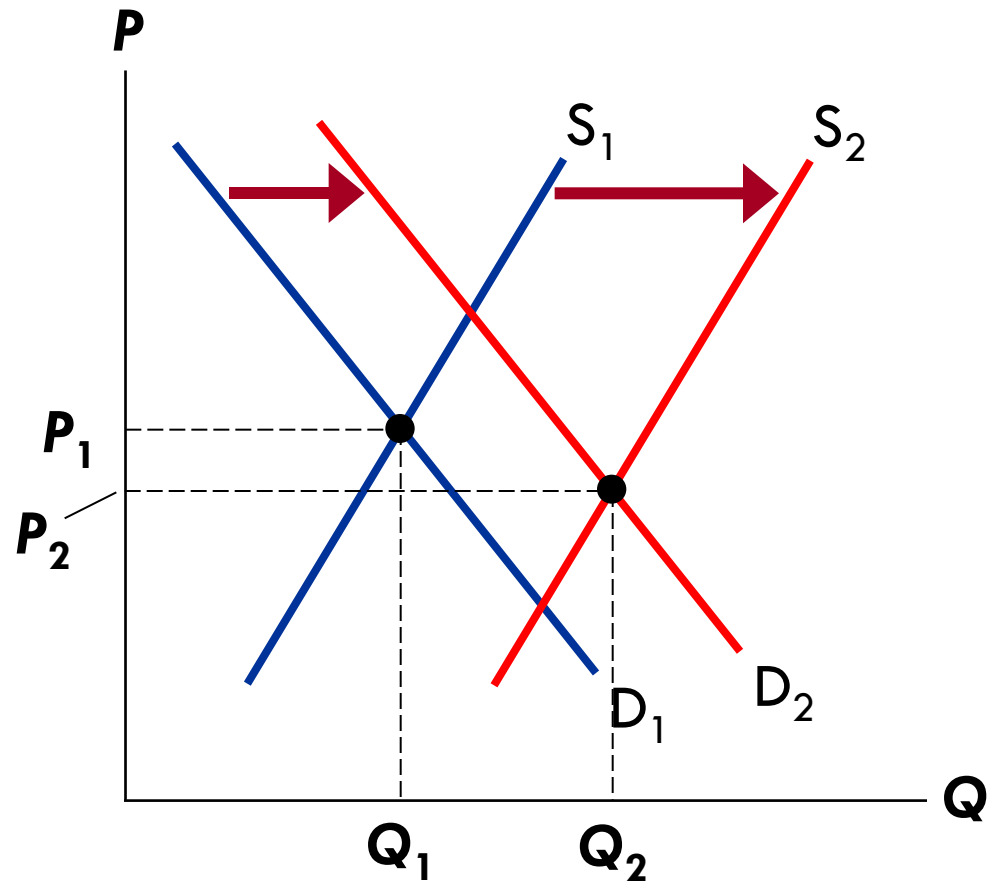
EXAMPLE 3: A Shift in Both Supply and Demand

EVENTS:

incomes rise AND
new technology reduces
production costs

STEP 3, cont.

But if supply
increases more
than demand,
 P falls.



Elasticity

- Elasticity measures how much
-

- One type of elasticity measures how much demand for oil/gas will fall if the price increases.

- Definition:

Elasticity (video) 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

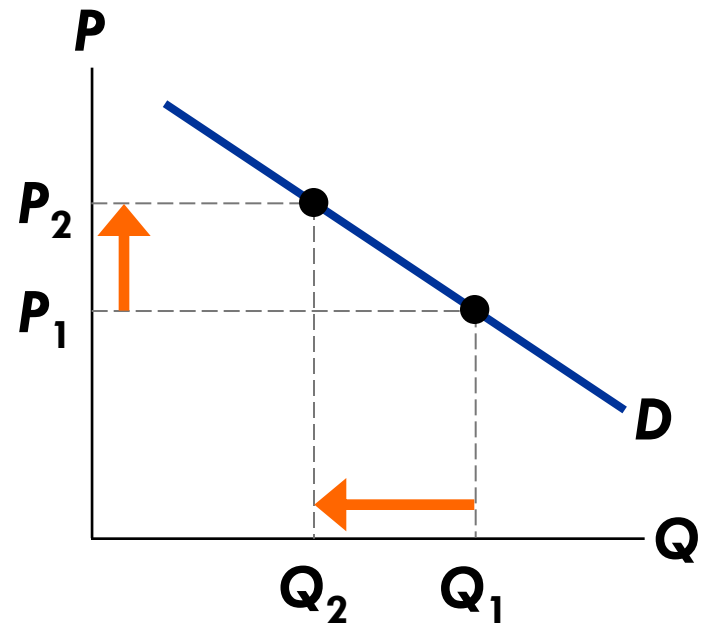
$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q^d}{\text{Percentage change in } P}$$

Example:

Price elasticity
of demand
equals

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

P rises
by 10%



Q falls
by 15%

ACTIVE LEARNING 1

Calculate an elasticity

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

if $P = \$3$, $Q^d = 15$

if $P = \$5$, $Q^d = 9$



ACTIVE LEARNING 1

Answers

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% change in Q^d

$$(9 - 15)/15 = 40\%$$

% change in P

$$(\$5 - \$3)/\$2 = 66\%$$

The price elasticity of demand equals

$$\frac{40\%}{66\%} = 0.6$$

Gasoline in the Short Run vs. Gasoline in the Long Run-[READ THIS ARTICLE](#)

- 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:
-
-

“Inelastic demand”

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

D curve:

relatively steep

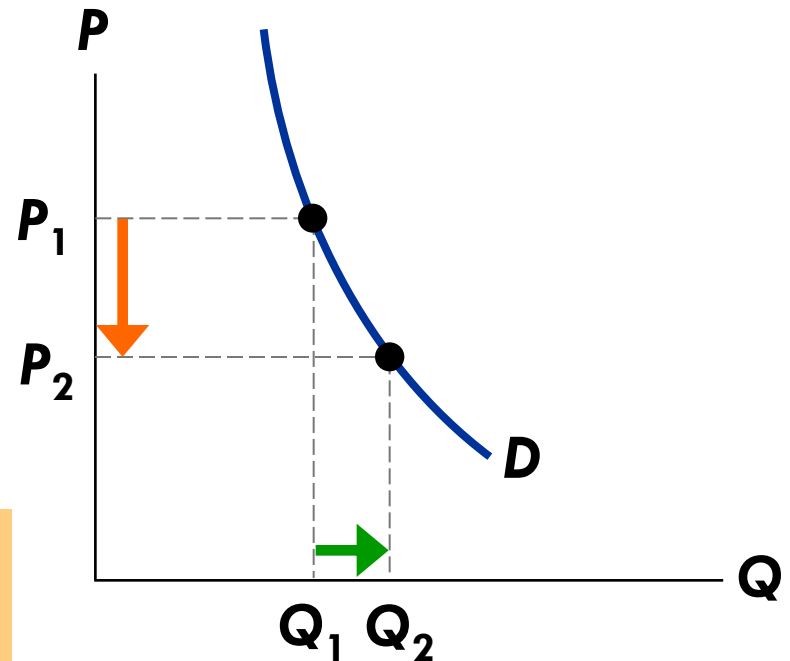
Consumers'

price sensitivity:

relatively low

Elasticity:

< 1



P falls
by 10%

Q rises less
than 10%

“Elastic demand”

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

D curve:

relatively flat

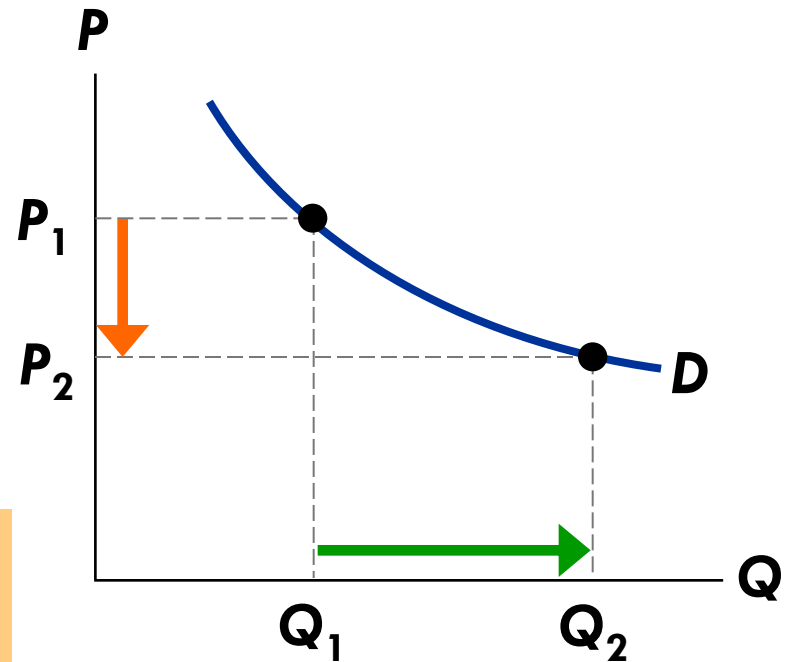
Consumers'

price sensitivity:

relatively high

Elasticity:

> 1



P falls
by 10%

Q rises more
than 10%

Other Elasticities

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

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

- An increase in income causes an increase in demand for a *normal* good.
- Hence, for normal goods, _____.
- For *inferior* goods, _____.

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, _____
(e.g., an increase in price of windmills causes an increase in demand for solar panels)
- For complements, _____
(e.g., an increase in price of vehicles causes a decrease in demand for gasoline)

Price Elasticity of Supply

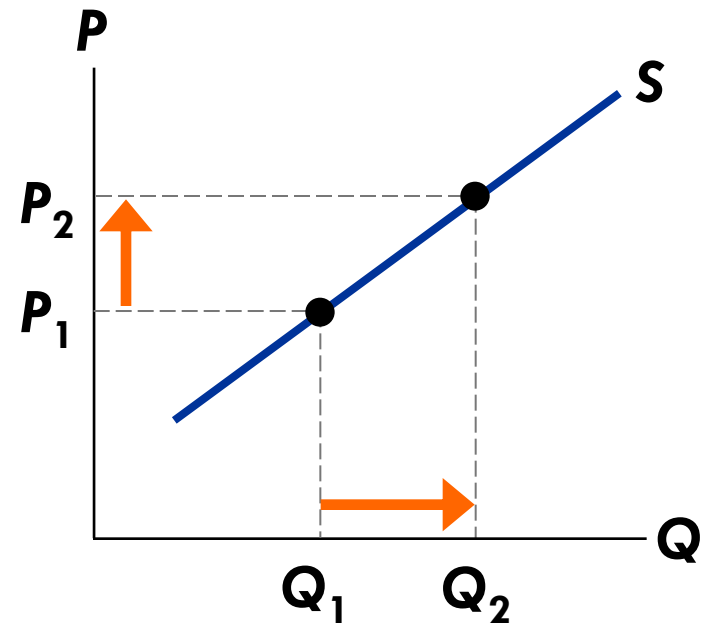
$$\text{Price elasticity of supply} = \frac{\text{Percentage change in } Q^s}{\text{Percentage change in } P}$$

Example:

Price
elasticity
of supply
equals

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

P rises
by 8%



Q rises
by 16%

“Inelastic”

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

S curve:

relatively steep

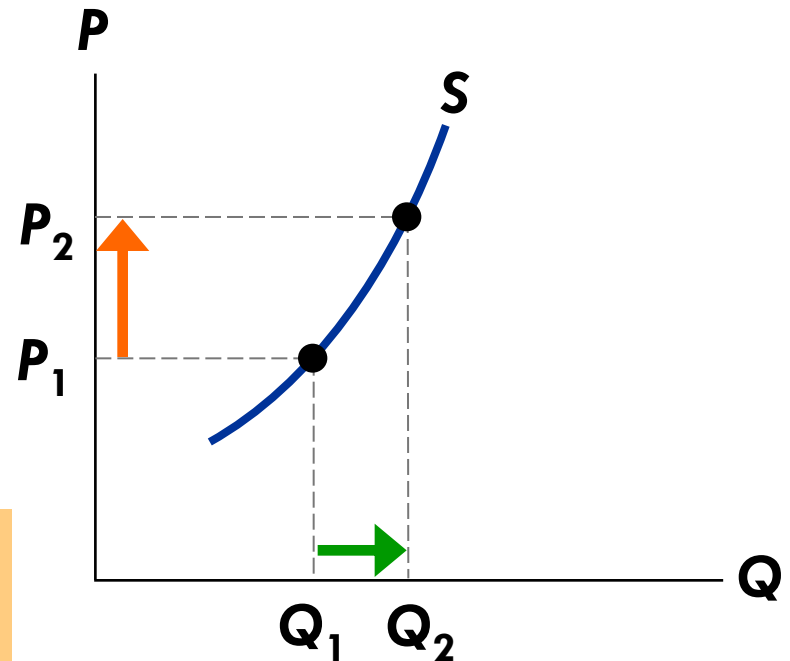
Sellers’

price sensitivity:

relatively low

Elasticity:

< 1



P rises
by 10%

Q rises less
than 10%

“Elastic”

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

S curve:

relatively flat

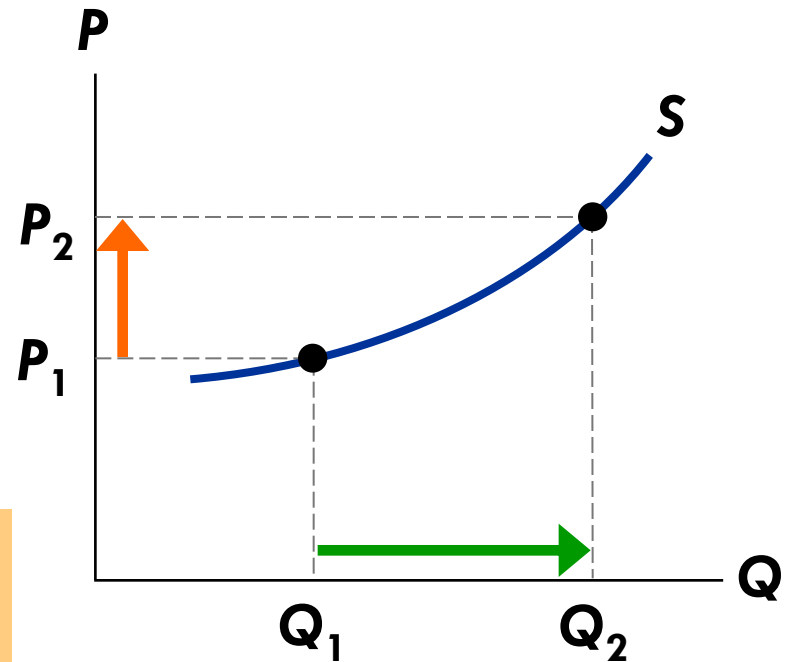
Sellers’

price sensitivity:

relatively high

Elasticity:

> 1



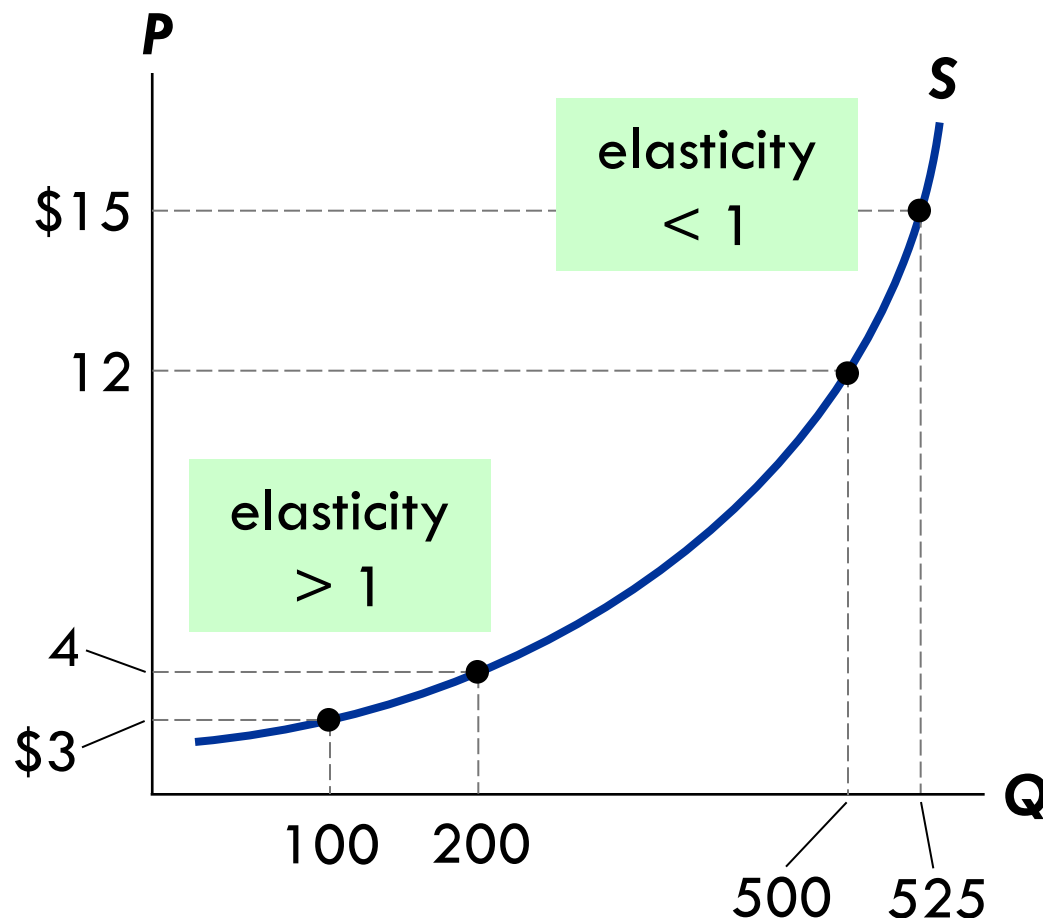
P rises
by 10%

Q rises more
than 10%

The Determinants of Supply Elasticity

- The more easily sellers can change the quantity they produce, the _____ the price elasticity of supply.
 - ▣ Example: Supply of offshore oil rigs is harder to vary and thus less elastic than supply of onshore oil rigs.
- For many goods, price elasticity of supply is _____ than in the short run, because firms can build new rigs or refineries, 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.

In the peak summer driving season, gasoline demand is highest.

Many refineries are producing near capacity, so the supply curve is steep.

In other months, when demand is lower, refineries have more excess capacity, and the supply curve is not as steep.

Applications

□ Why Did OPEC Fail to Keep the Price of Oil High?

□ What is OPEC?

■ _____ - [Read this](#)

■ 12 members—who are they?

■ [History—see this.](#)

□ Increase in prices:

□ 1973-1974: _____

□ 1979-1981: _____

□ Short-run: supply and demand are inelastic

■ Decrease in supply: large increase in price

□ Long-run: supply and demand are elastic

■ Decrease in supply: small increase in price

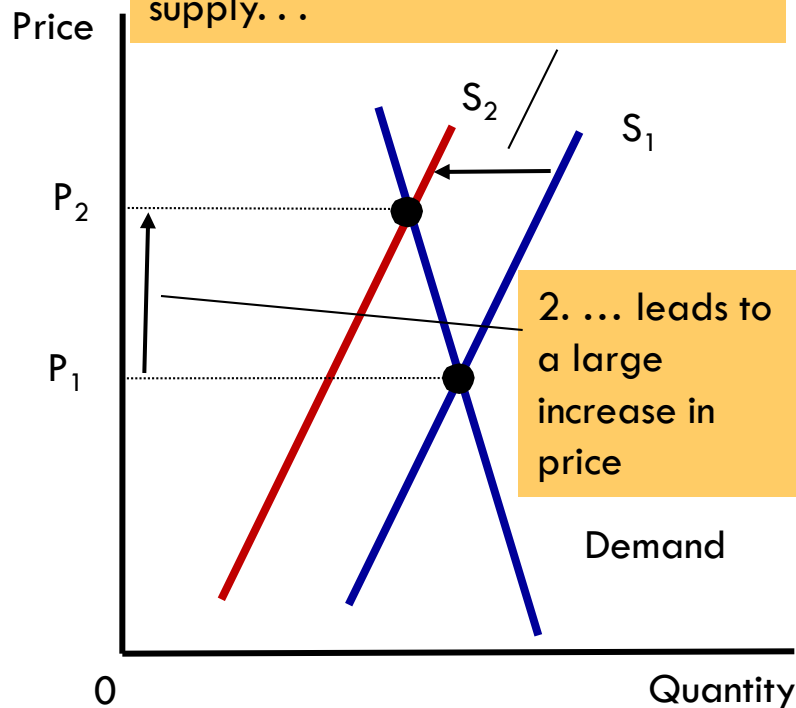
Figure 8

A Reduction in Supply in the World Market for Oil

(a) The Oil Market in the Short Run

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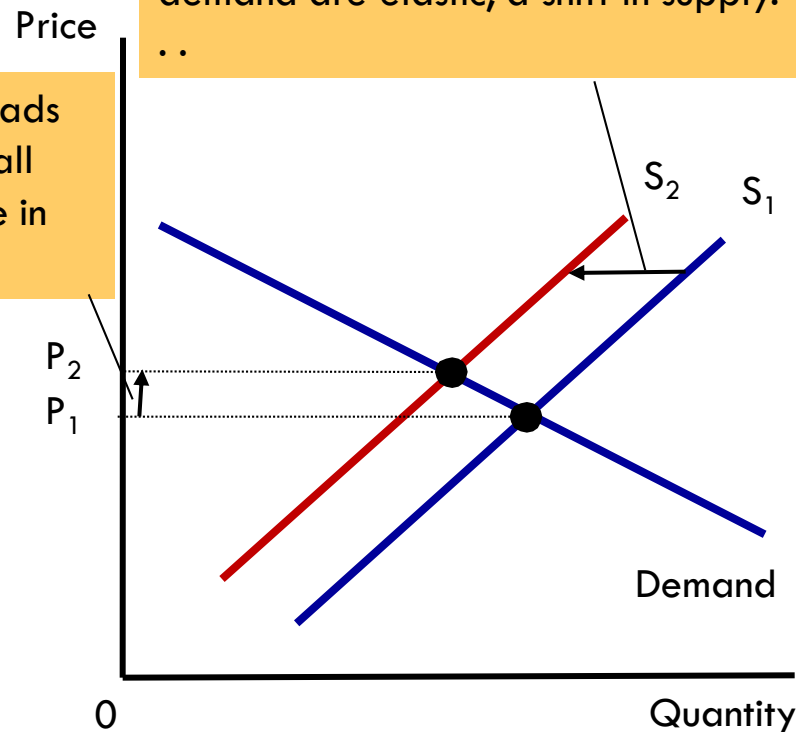
1. In the short run, when supply and demand are inelastic, a shift in supply. . .



(b) The Oil Market in the Long Run

1. In the long run, when supply and demand are elastic, a shift in supply. . .

2. ... leads to a small increase in price



When the supply of oil falls, the response depends on the time horizon. In the short run, supply and demand are relatively inelastic, as in panel (a). Thus, when the supply curve shifts from S_1 to S_2 , the price rises substantially. By contrast, in the long run, supply and demand are relatively elastic, as in panel (b). In this case, the same size shift in the supply curve (S_1 to S_2) causes a smaller increase in the price.

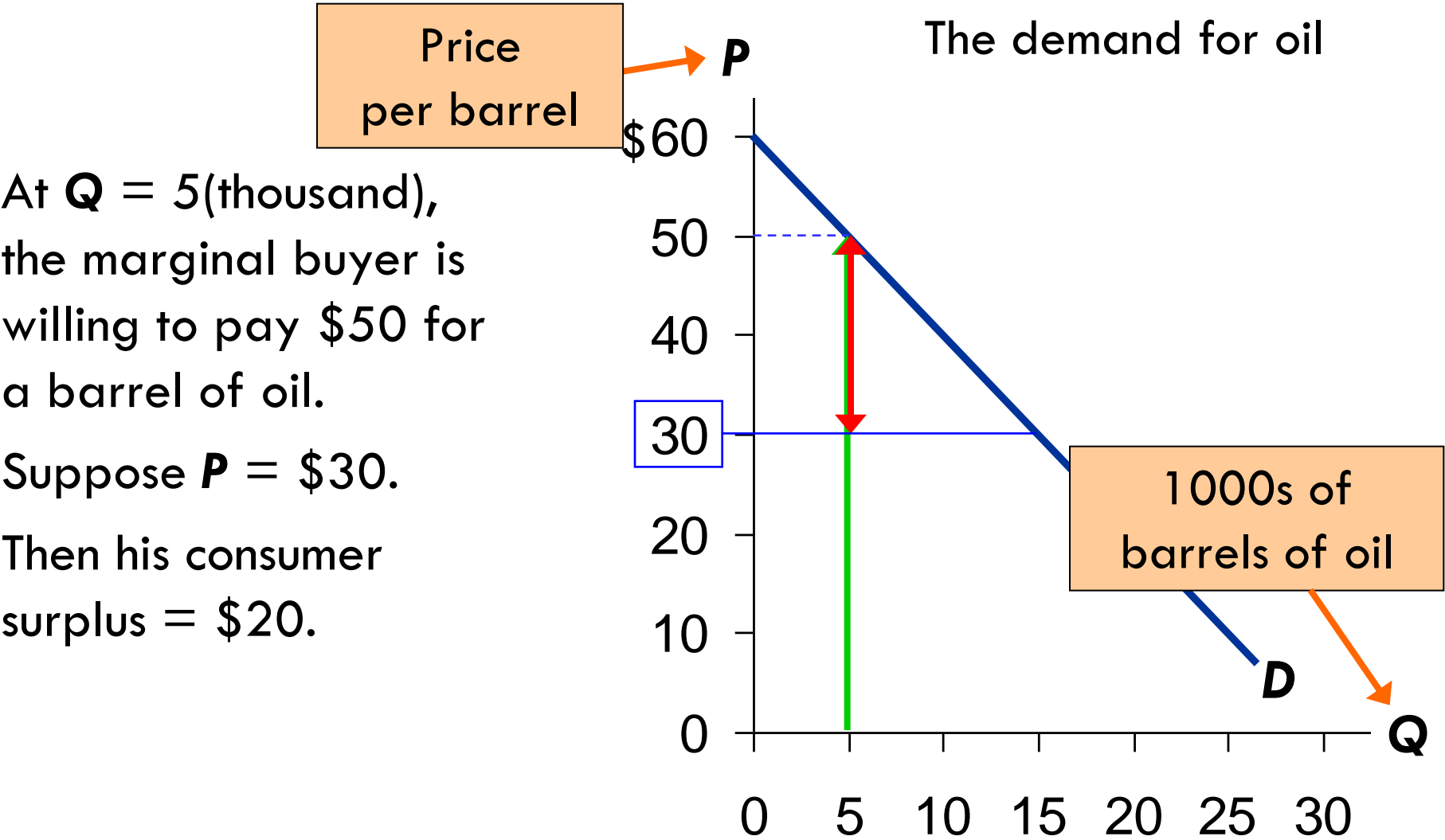
Consumer Surplus (CS)

Consumer surplus is the amount a buyer is willing to pay minus the amount the buyer actually pays:

$$CS = WTP - P$$

$$CS = \text{Height} \times \text{Base} \times \frac{1}{2} \text{ -- Area of a triangle}$$

CS with Lots of Buyers & a Smooth D Curve



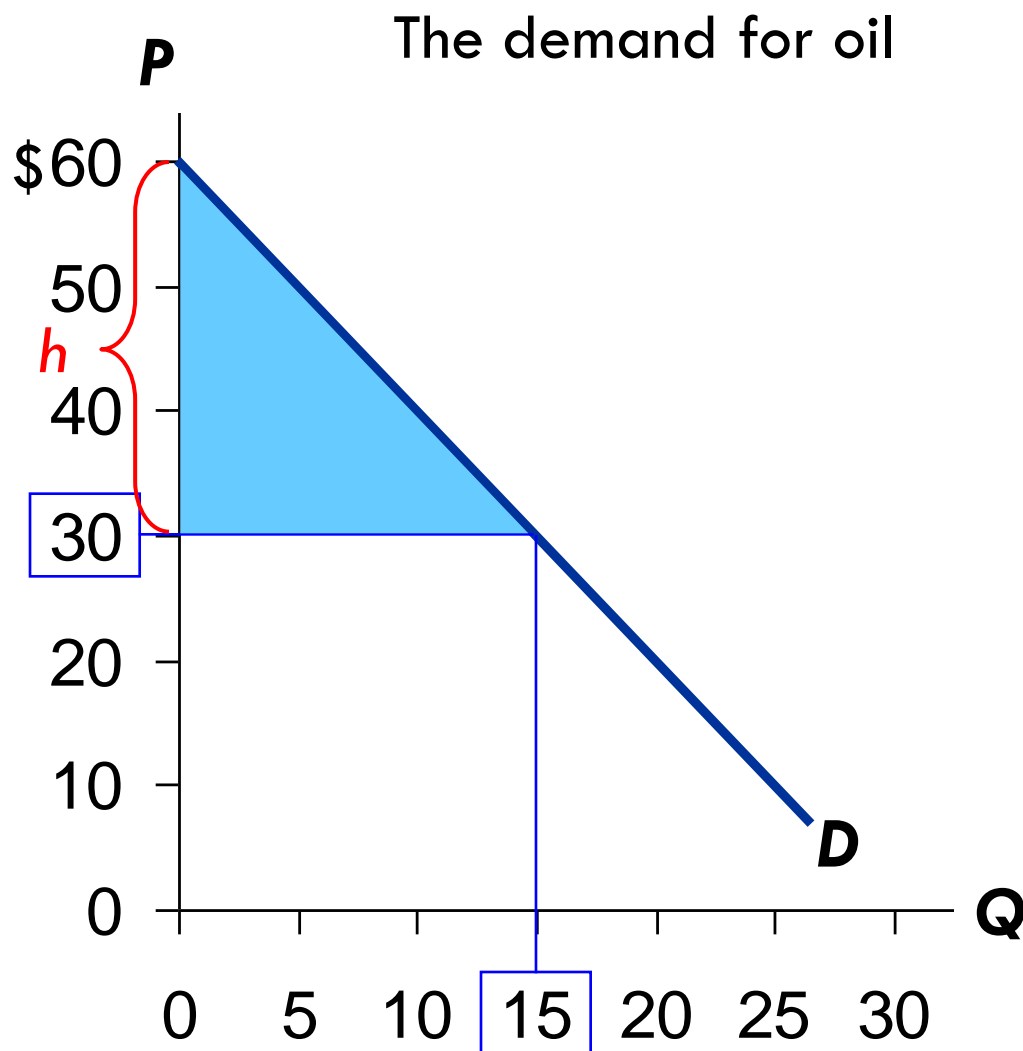
CS with Lots of Buyers & a Smooth D Curve

CS is the area b/w **P** and the **D** curve, from 0 to **Q**.

Recall: area of a triangle equals $\frac{1}{2} \times \text{base} \times \text{height}$

Height =
 $\$60 - 30 = \underline{\$30}$.

So,
 $\text{CS} = \frac{1}{2} \times 15 \times \30
 $= \underline{\$225}$.



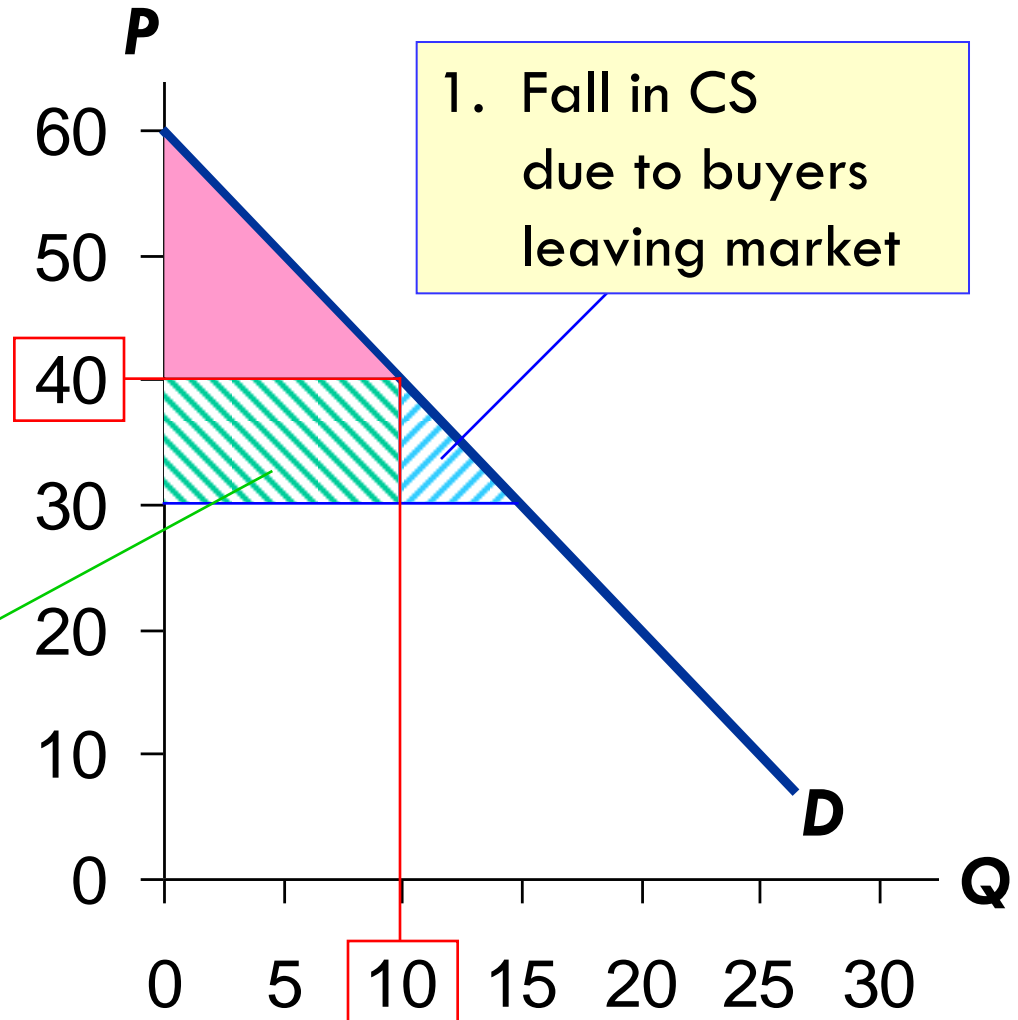
How a Higher Price Reduces CS

If **P** rises to \$40,

$$\begin{aligned} \text{CS} &= \frac{1}{2} \times 10 \times \$20 \\ &= \$100. \end{aligned}$$

Two reasons for the fall in CS.

2. Fall in CS due to remaining buyers paying higher **P**



ACTIVE LEARNING 1

Consumer surplus

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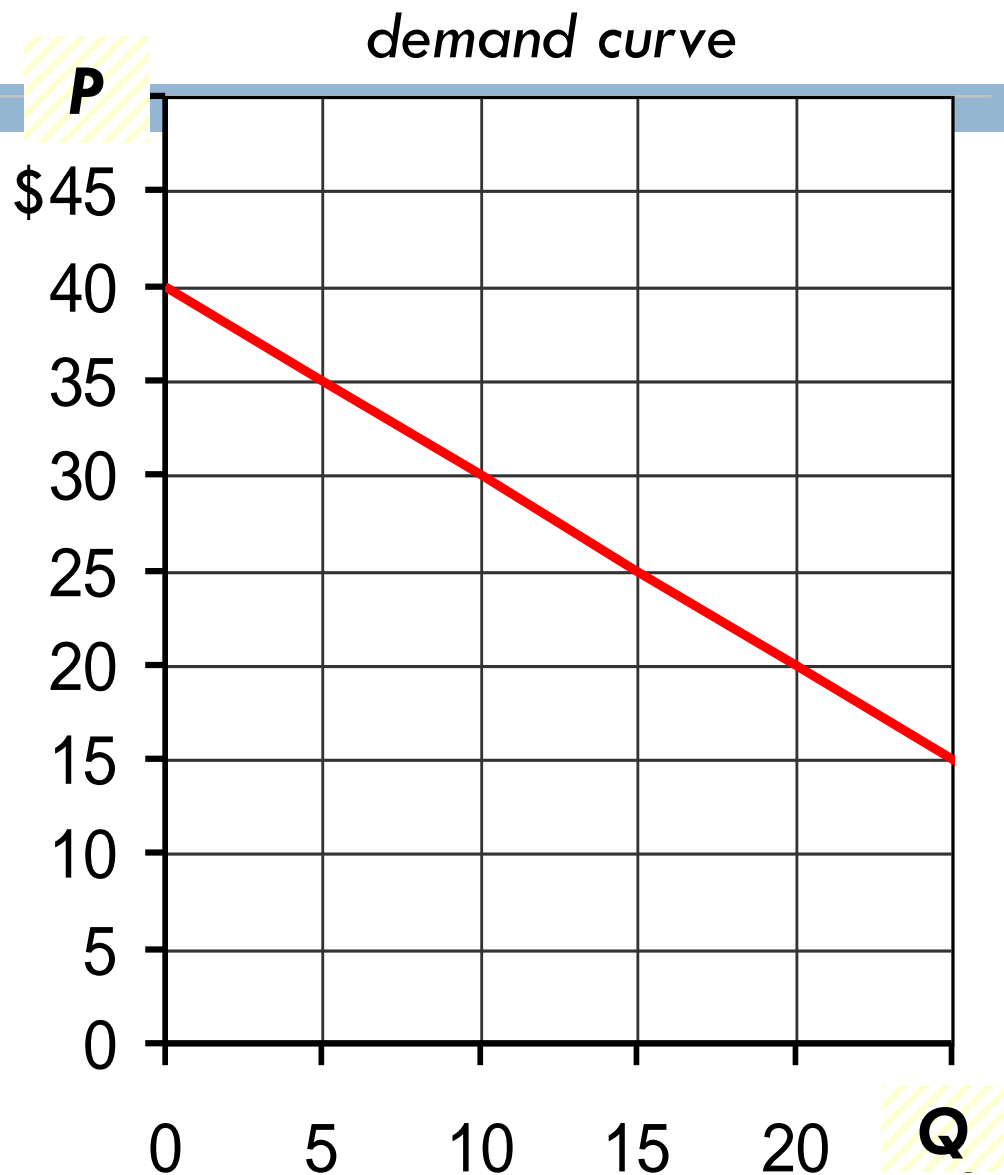
A. Find marginal buyer's WTP at $Q = 10$.

B. Find CS for $P = \$30$.

Suppose P falls to \$20.
How much will CS increase due to...

C. buyers entering the market

D. existing buyers paying lower price

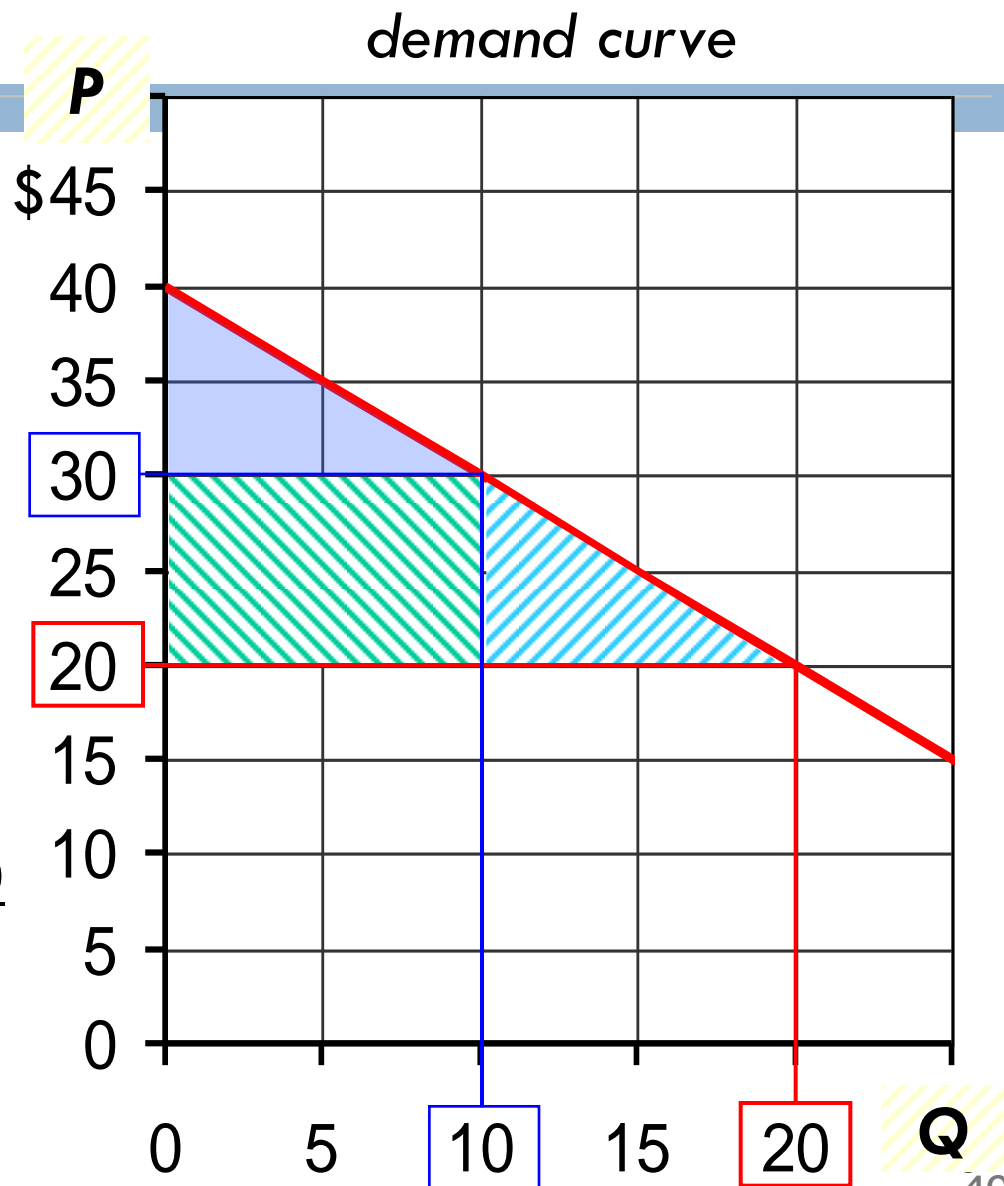


ACTIVE LEARNING 1

Answers

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- A.** At $Q = 10$, marginal buyer's WTP is \$30.
- B.** $CS = \frac{1}{2} \times 10 \times \$10 = \underline{\$50}$
- P** falls to \$20.
- C.** CS for the additional buyers
 $= \frac{1}{2} \times 10 \times \$10 = \underline{\$50}$
- D.** Increase in CS
on initial 10 units
 $= 10 \times \$10 = \underline{\$100}$



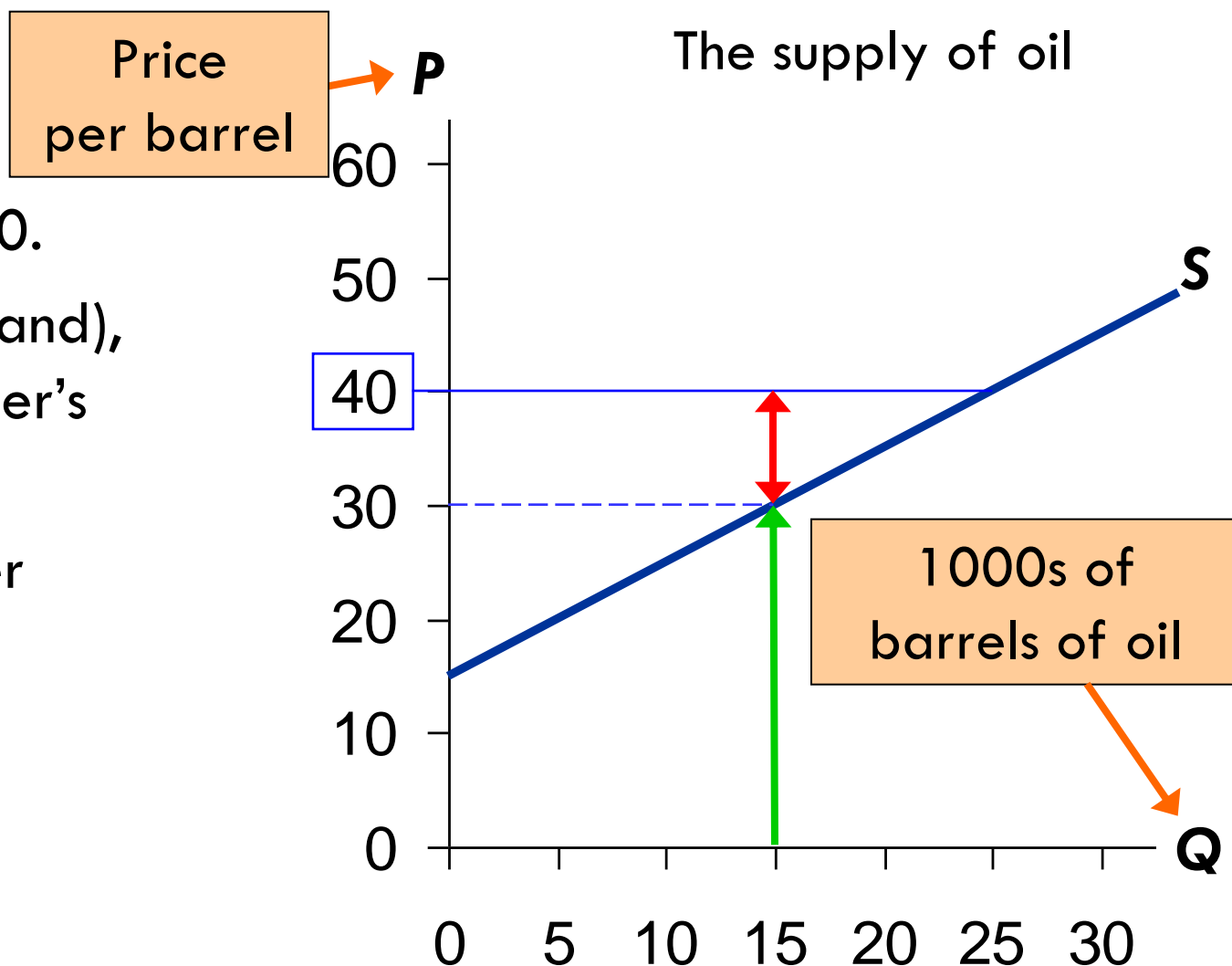
Cost and the Supply Curve

- **Cost** is the value of everything a seller must give up to _____ (i.e., opportunity cost).
- Includes cost of all resources used to produce good, including value of the seller's time.

A seller will produce and sell the good/service only if the price exceeds his or her cost.

Hence, cost is a measure of _____.

PS with Lots of Sellers & a Smooth S Curve



Suppose $P = \$40$.

At $Q = 15$ (thousand),
the marginal seller's
cost is \$30,
and her producer
surplus is \$10.

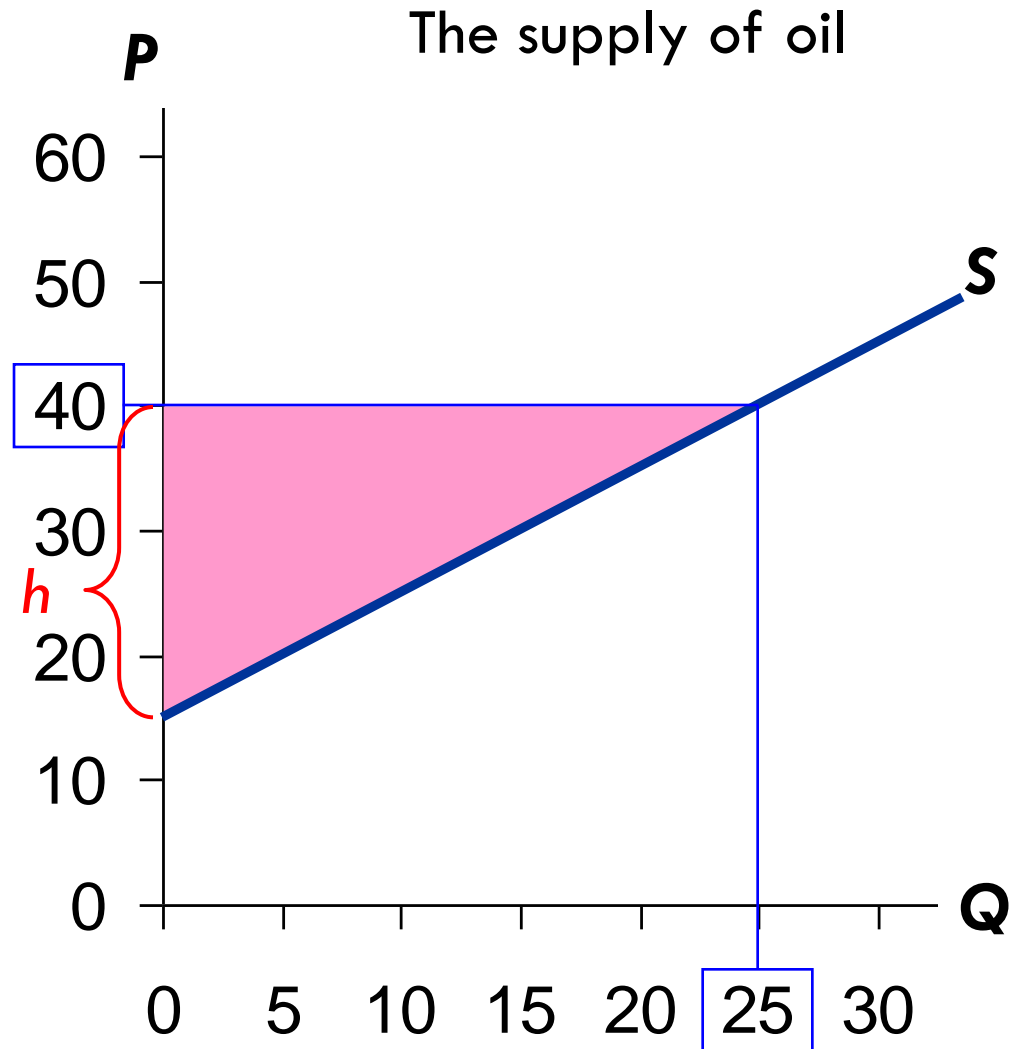
PS with Lots of Sellers & a Smooth S Curve

PS is the area b/w
P and the **S** curve, from
0 to **Q**.

The height of this
triangle is
 $\$40 - 15 = \25 .

So,

$$\begin{aligned} \text{PS} &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 25 \times \$25 \\ &= \underline{\underline{\$312.50}} \end{aligned}$$



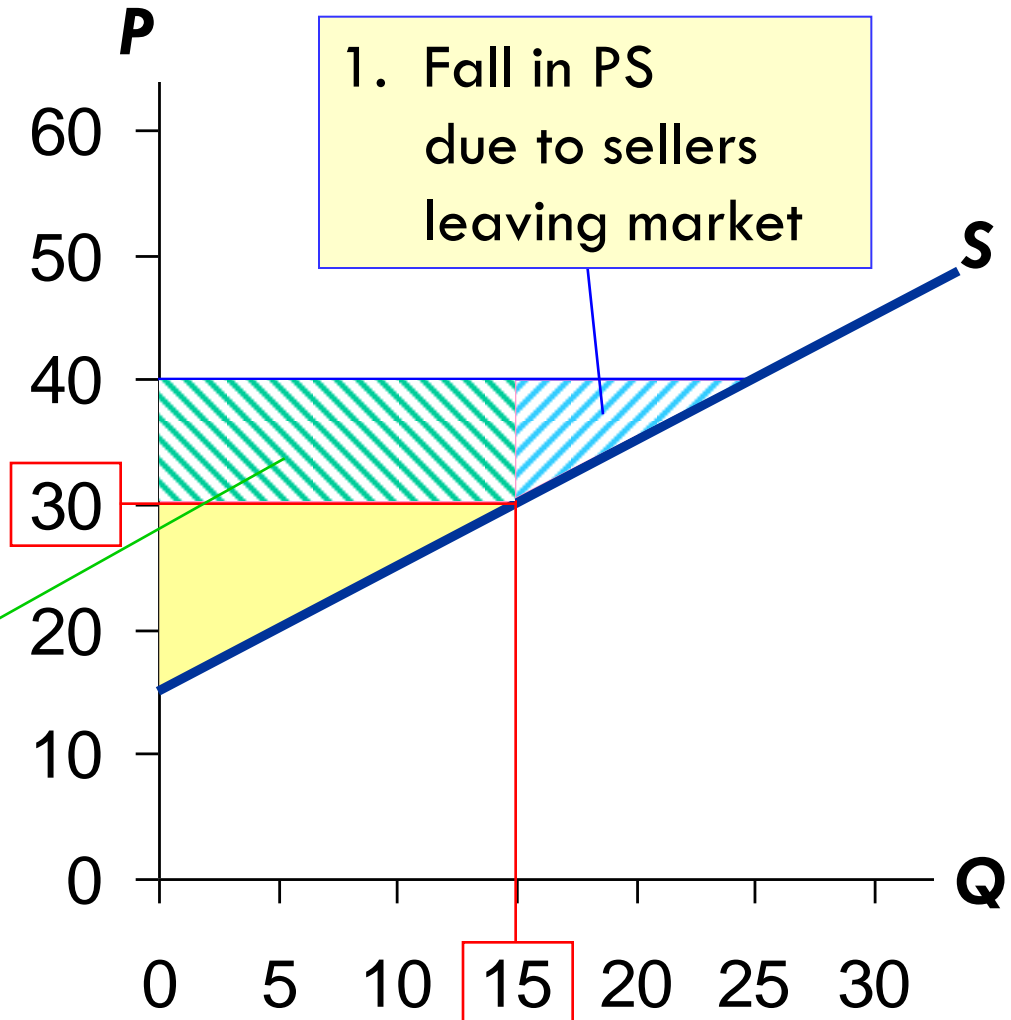
How a Lower Price Reduces PS

If P falls to \$30,

$$PS = \frac{1}{2} \times 15 \times \$15 \\ = \underline{\$112.50}$$

Two reasons for the fall in PS.

2. Fall in PS due to remaining sellers getting lower P



ACTIVE LEARNING 2

Producer surplus

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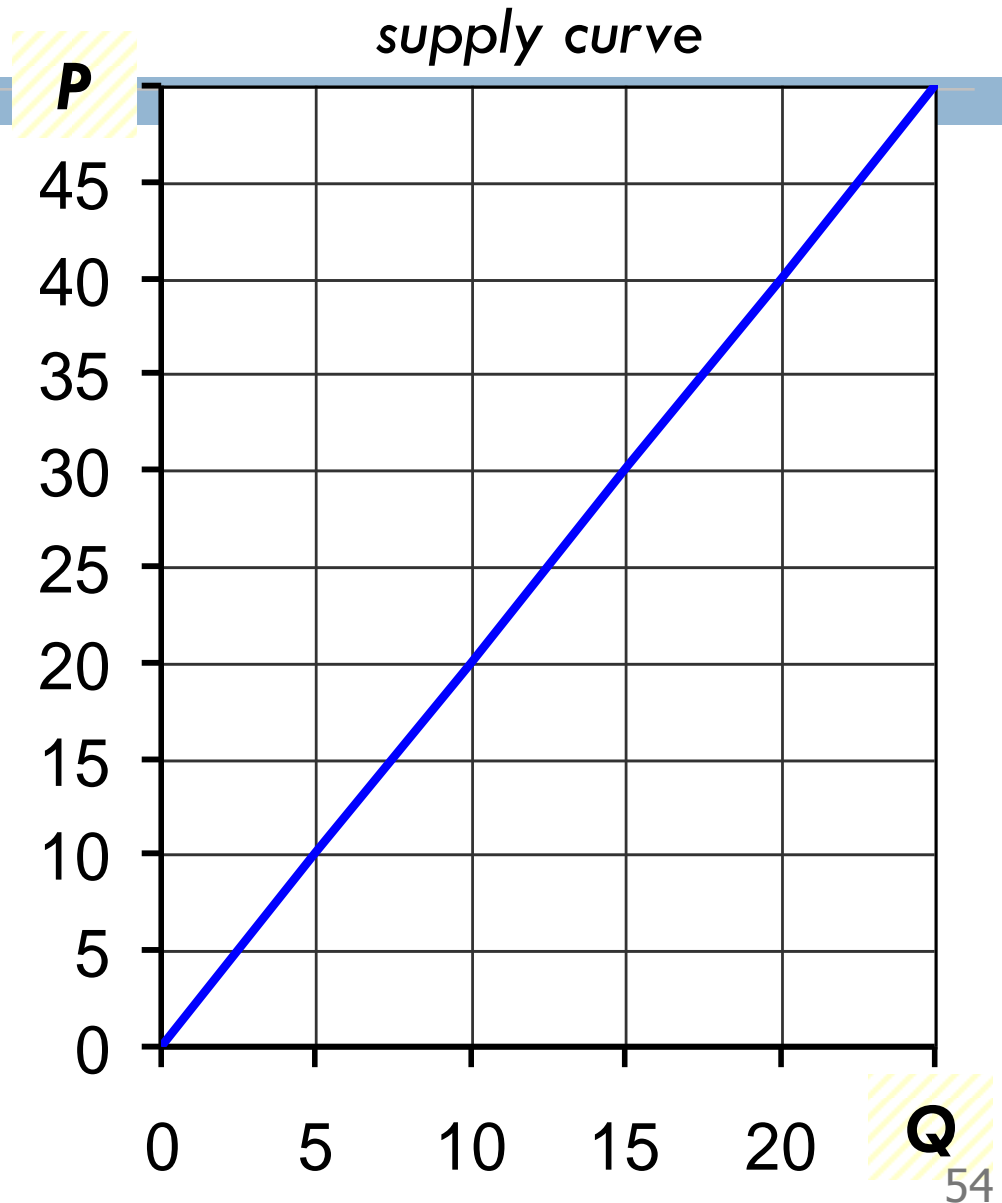
A. Find marginal seller's cost at $Q = 10$.

B. Find total PS for $P = \$20$.

Suppose P rises to \$30.
Find the increase in PS due to...

C. selling 5 additional units

D. getting a higher price on the initial 10 units



ACTIVE LEARNING 2

Answers

55

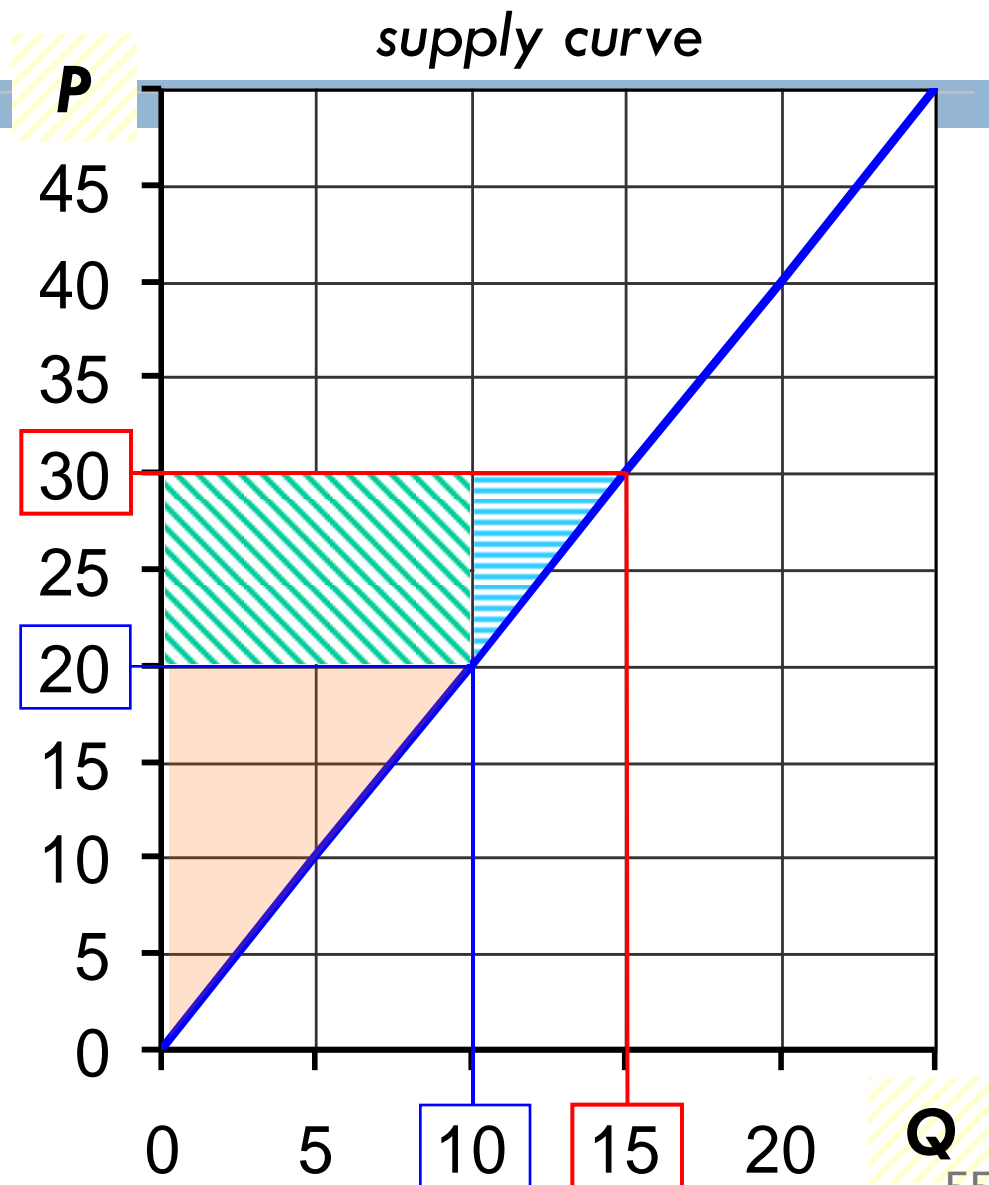
A. At $Q = 10$,
marginal cost = \$20

B. $PS = \frac{1}{2} \times 10 \times \20
= \$100

P rises to \$30.

C. PS on
additional units
= $\frac{1}{2} \times 5 \times \$10 =$ \$25

D. Increase in PS
on initial 10 units
= $10 \times \$10 =$ \$100



CS, PS, and Total Surplus

CS = (value to buyers) – (amount paid by buyers)
= buyers' gains from participating in the market

PS = (amount received by sellers) – (cost to sellers)
= sellers' gains from participating in the market

= total gains from trade in a market

= (value to buyers) – (cost to sellers)

“Pretty Woman” –video- allocation of resources.

The Market's Allocation of Resources

- In a market economy, the allocation of resources is _____, determined by the interactions of many self-interested buyers and sellers.
 - Is the market's allocation of resources desirable?
 - Or would a different allocation of resources make society better off?
 - To answer this, we use total surplus as a measure of society's well-being, and we consider whether the market's allocation is _____.
- (Policymakers also care about *equality*, though the focus here is on efficiency.)

Evaluating the Market Equilibrium

Market eq'm:

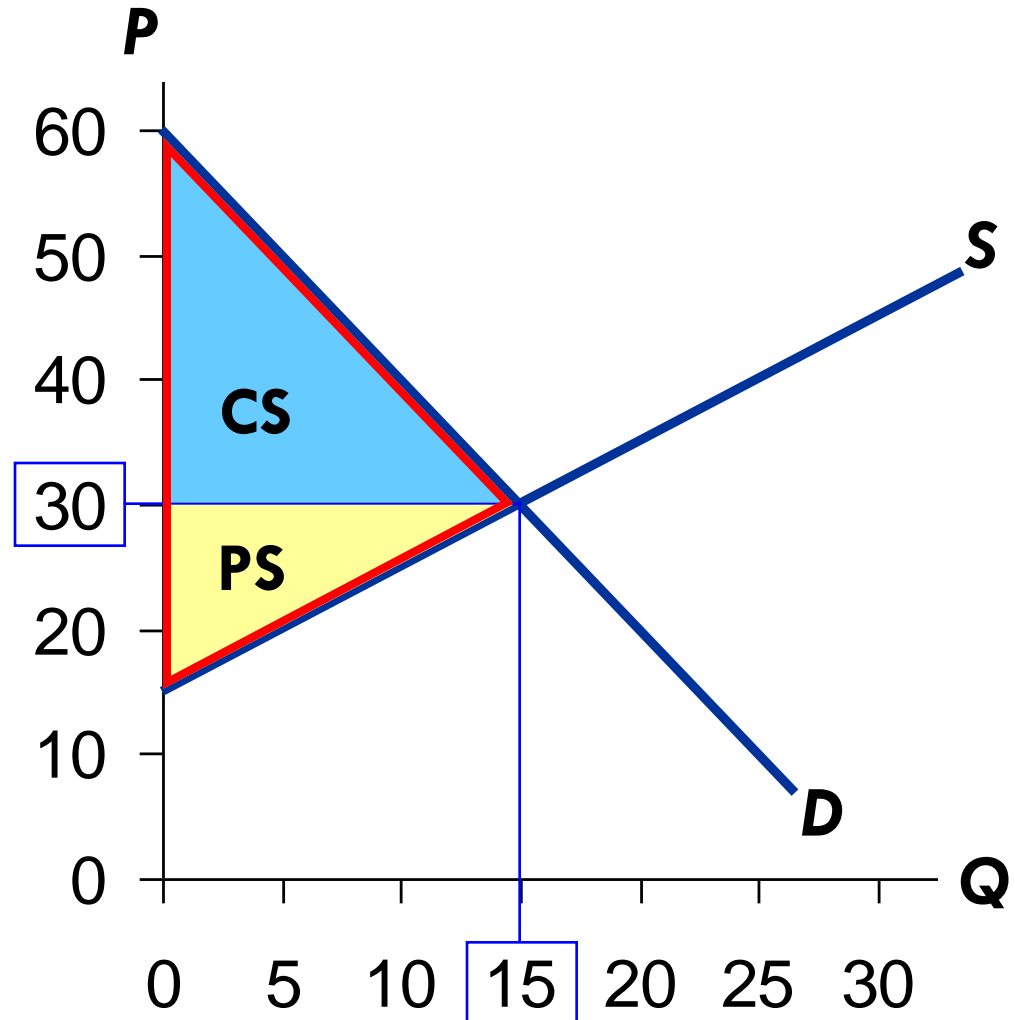
$$P = \$30$$

$$Q = 15,000$$

Total surplus

$$= CS + PS$$

Is the market eq'm
efficient?

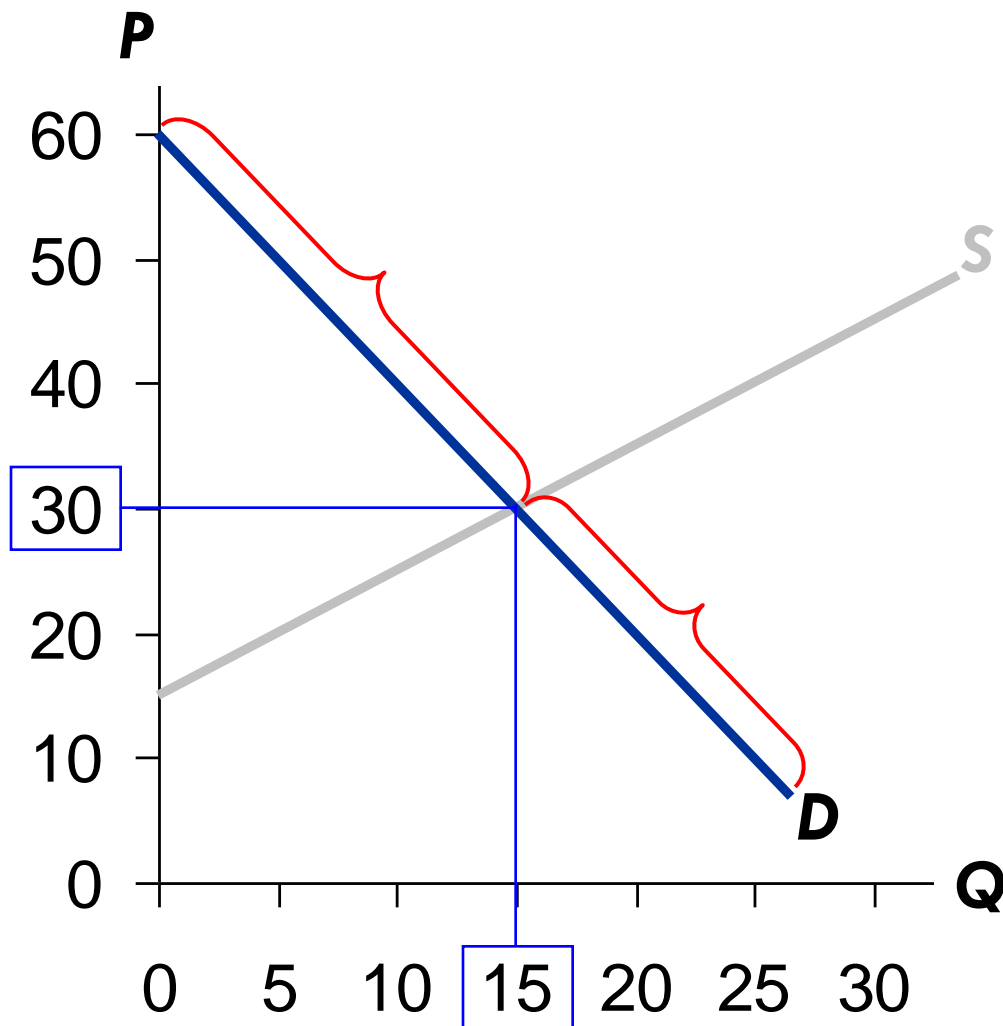


Which Buyers Consume the Good?

Every buyer
whose WTP is
 $\geq \$30$ will buy.

Every buyer
whose WTP is
 $< \$30$ will not.

So, *the buyers who
value the good most
highly are the ones who
consume it.*

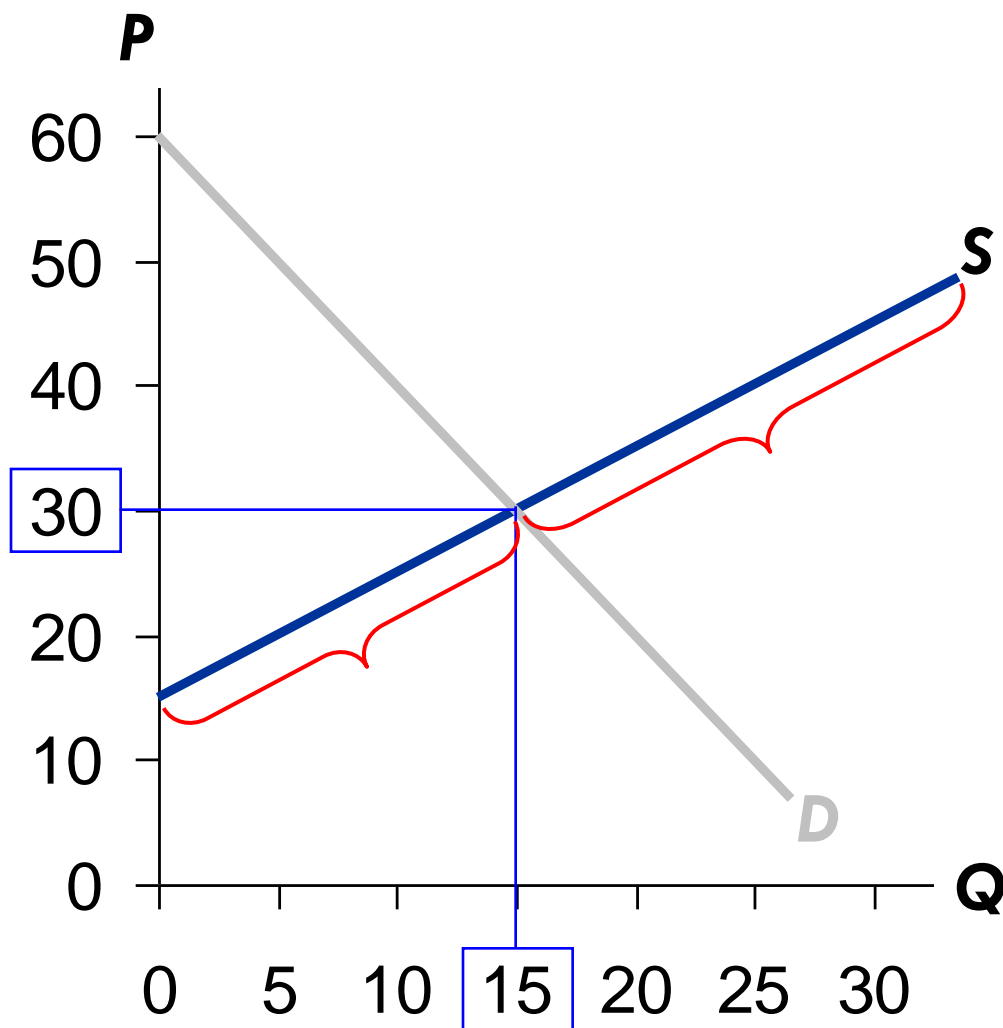


Which Sellers Produce the Good?

Every seller whose cost is $\leq \$30$ will produce the good.

Every seller whose cost is $> \$30$ will not.

So, *the sellers with the lowest cost produce the good.*

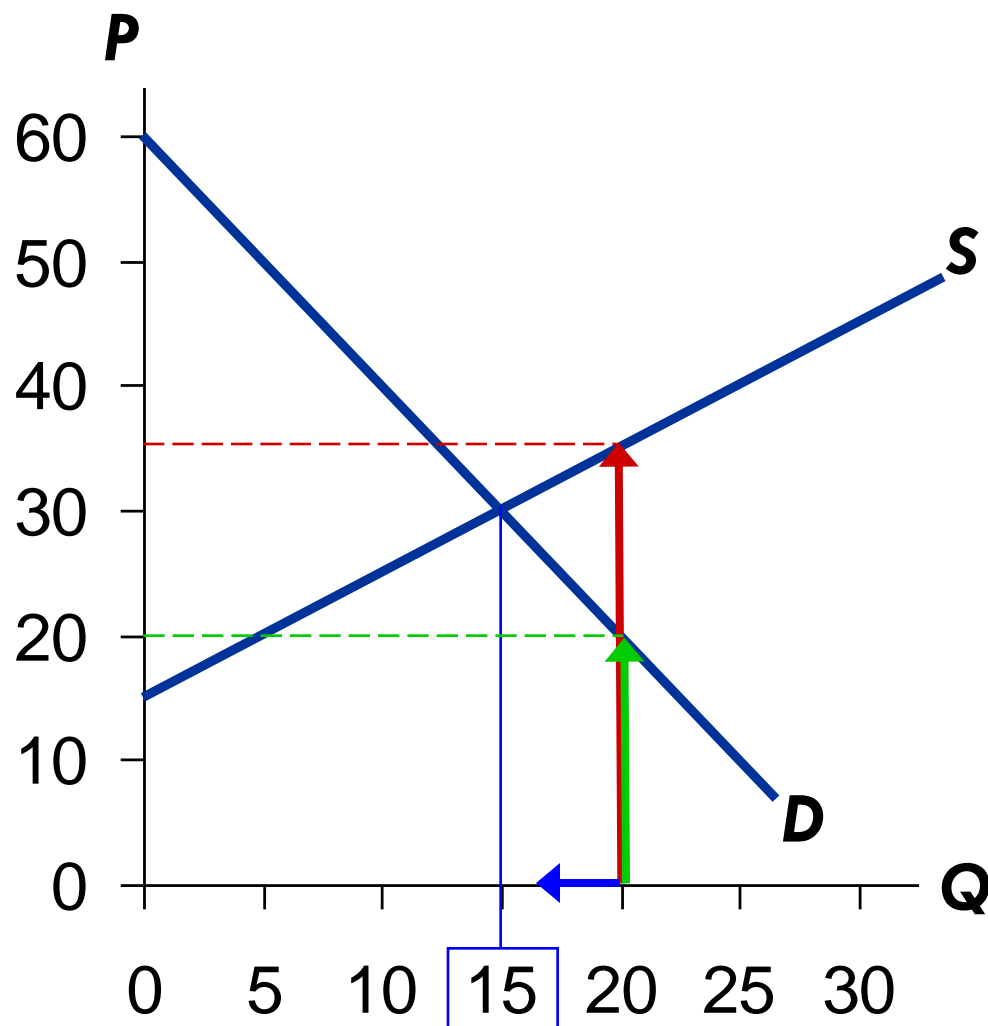


Does Eq'm Q Maximize Total Surplus?

At $Q = 20$,
cost of producing
the marginal unit
is \$35
value to consumers
of the marginal unit
is only \$20

Hence, can increase total
surplus
by reducing Q .

*This is true at any Q
greater than 15.*

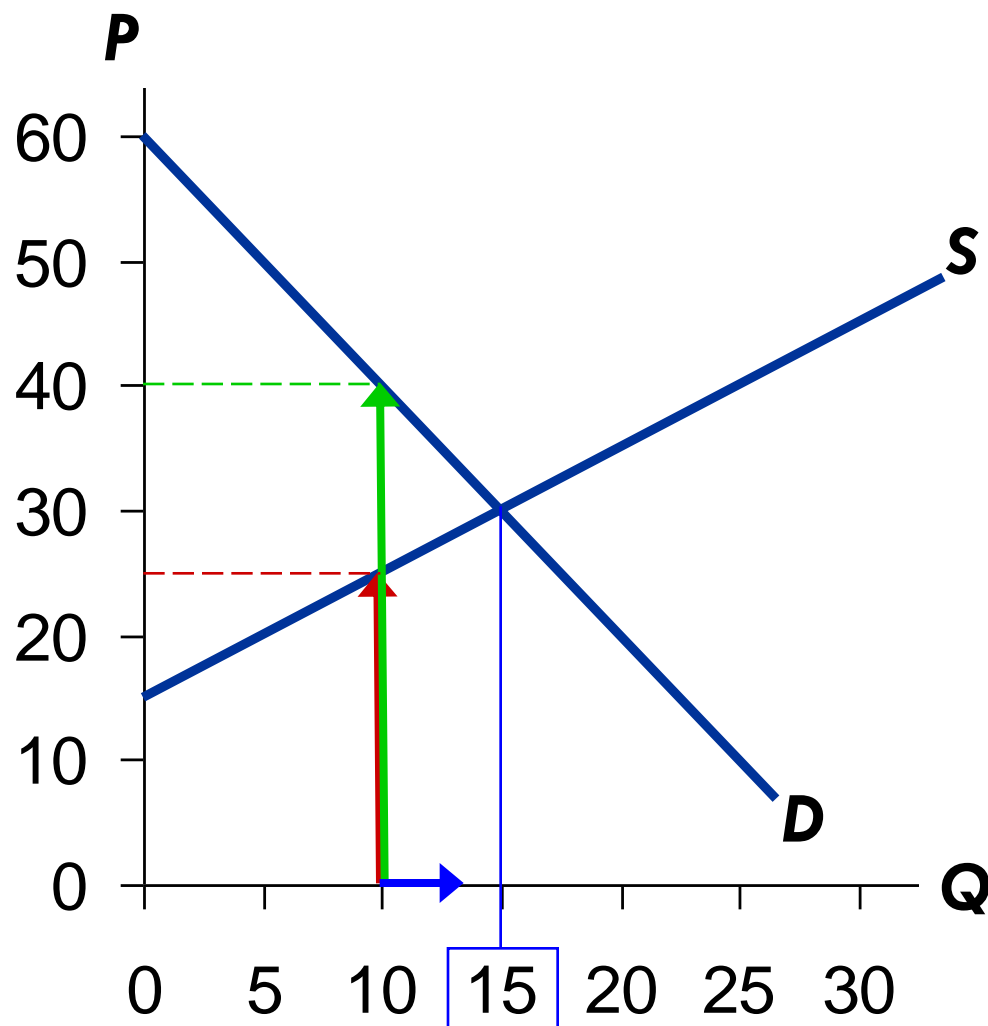


Does Eq'm Q Maximize Total Surplus?

At $Q = 10$,
cost of producing
the marginal unit
is \$25
value to consumers
of the marginal unit
is \$40

Hence, can increase total
surplus
by increasing Q .

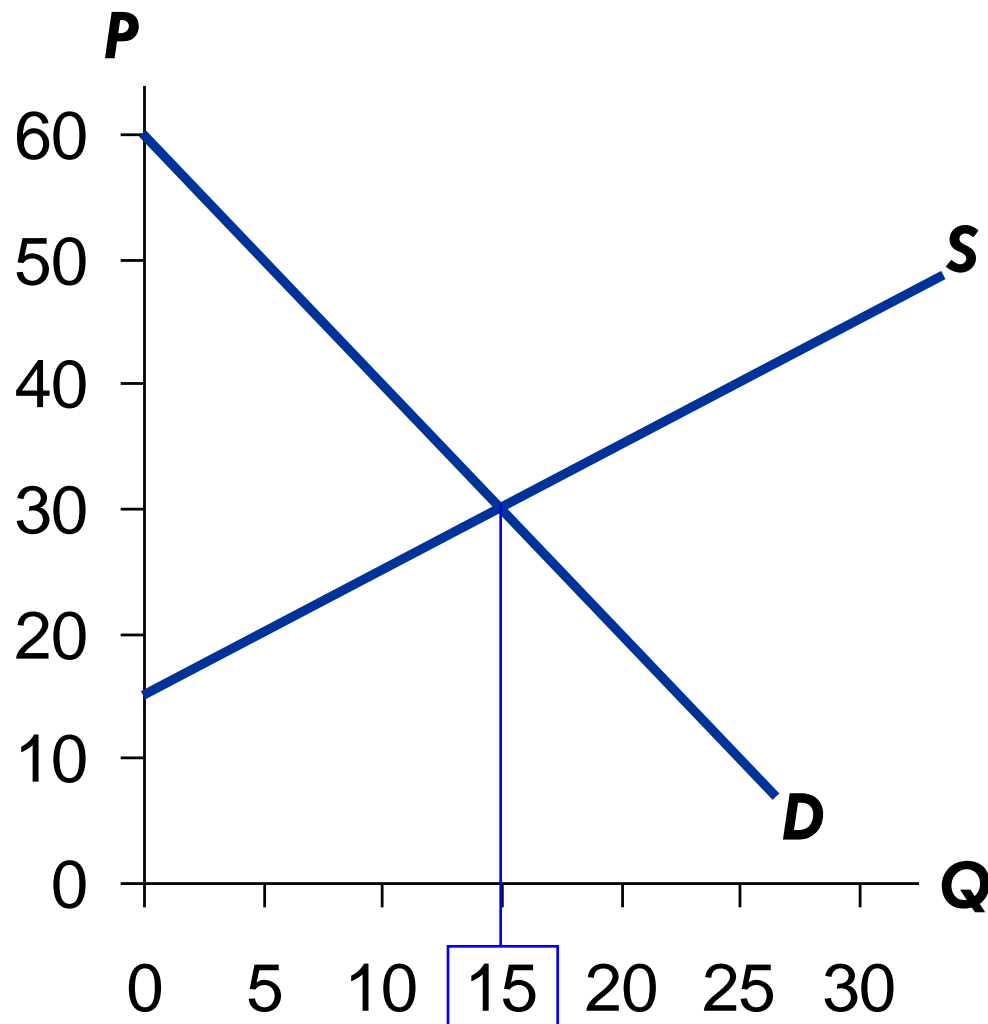
*This is true at any Q less
than 15.*



Does Eq'm Q Maximize Total Surplus?

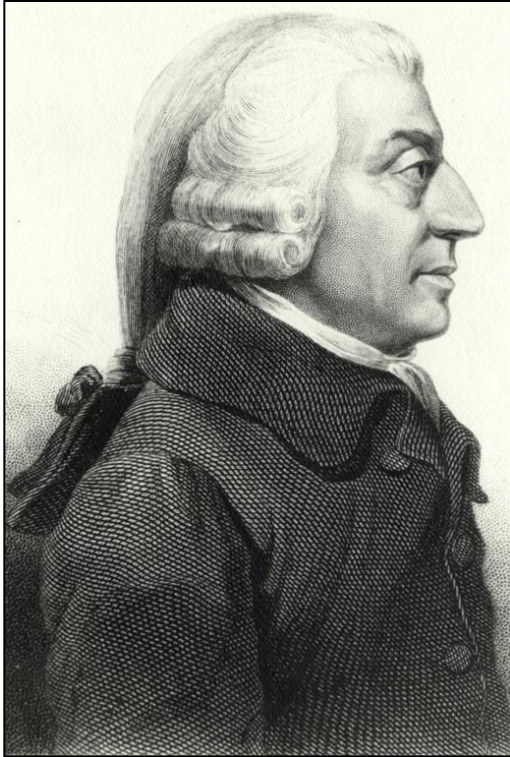
The market eq'm quantity maximizes total surplus:

At any other quantity, can increase total surplus by moving toward the market eq'm quantity.



Adam Smith and the Invisible Hand

Passages from *The Wealth of Nations*, 1776



Adam Smith,
1723-1790

“Every individual...neither intends to promote the public interest, nor knows how much he is promoting it....

He intends only his own gain, and he is in this, as in many other cases, led by **an invisible hand** to promote an end which was no part of his intention.

Nor is it always the worse for the society that it was no part of it. By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.”

The Free Market vs. Govt Intervention

65

- The market equilibrium is efficient. No other outcome achieves higher total surplus.
 - What about a market for kidneys???-video
- Govt cannot raise total surplus by changing the market's allocation of resources.
- _____ (French for “allow them to do”):
the notion that govt should not interfere with the market.

Government Policies That Alter the Private Market Outcome

□ Price controls (video)

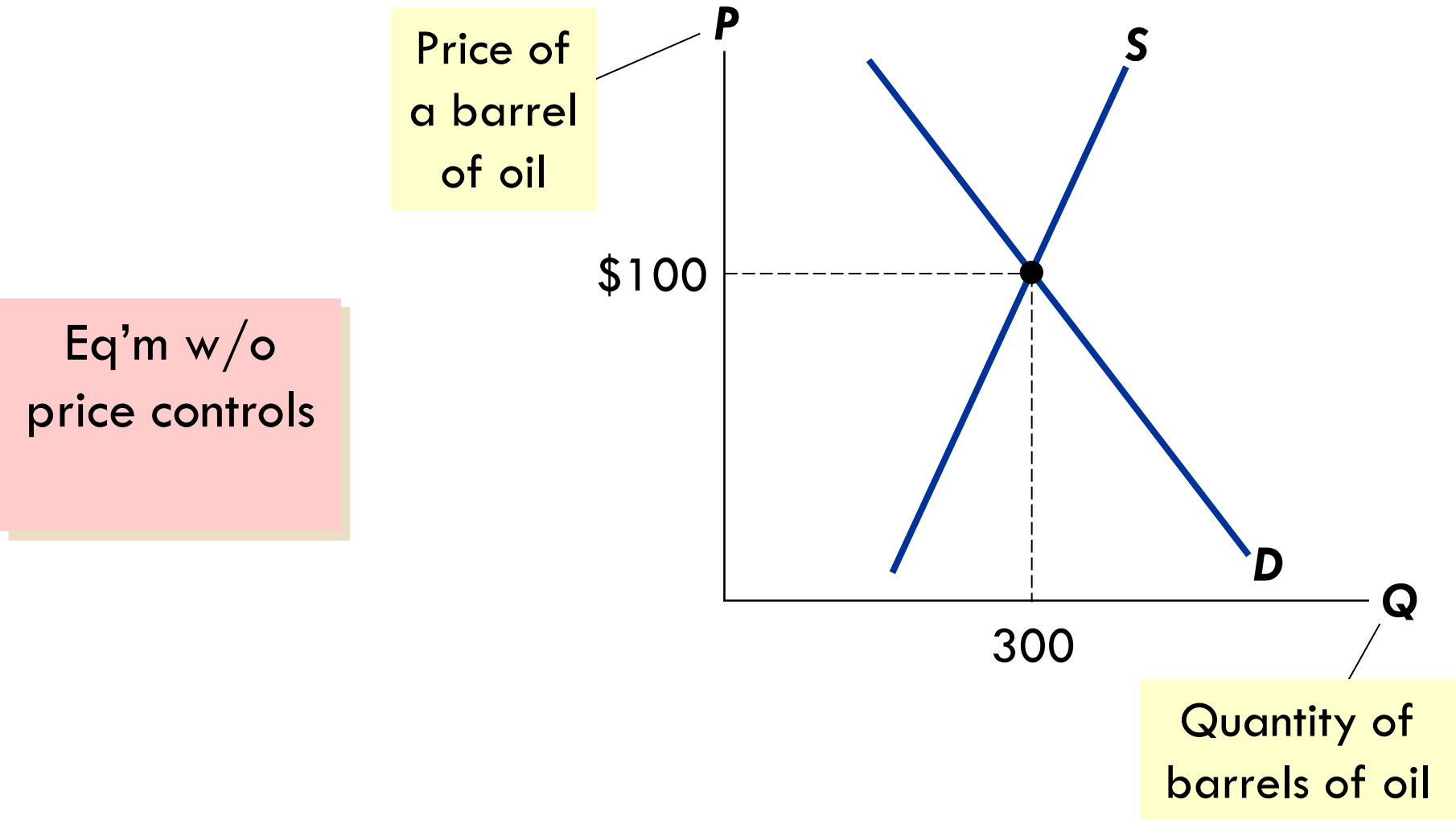
- _____: a legal maximum on the price of a good or service *Example: rent control*
- _____: a legal minimum on the price of a good or service *Example: minimum wage*

□ 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).

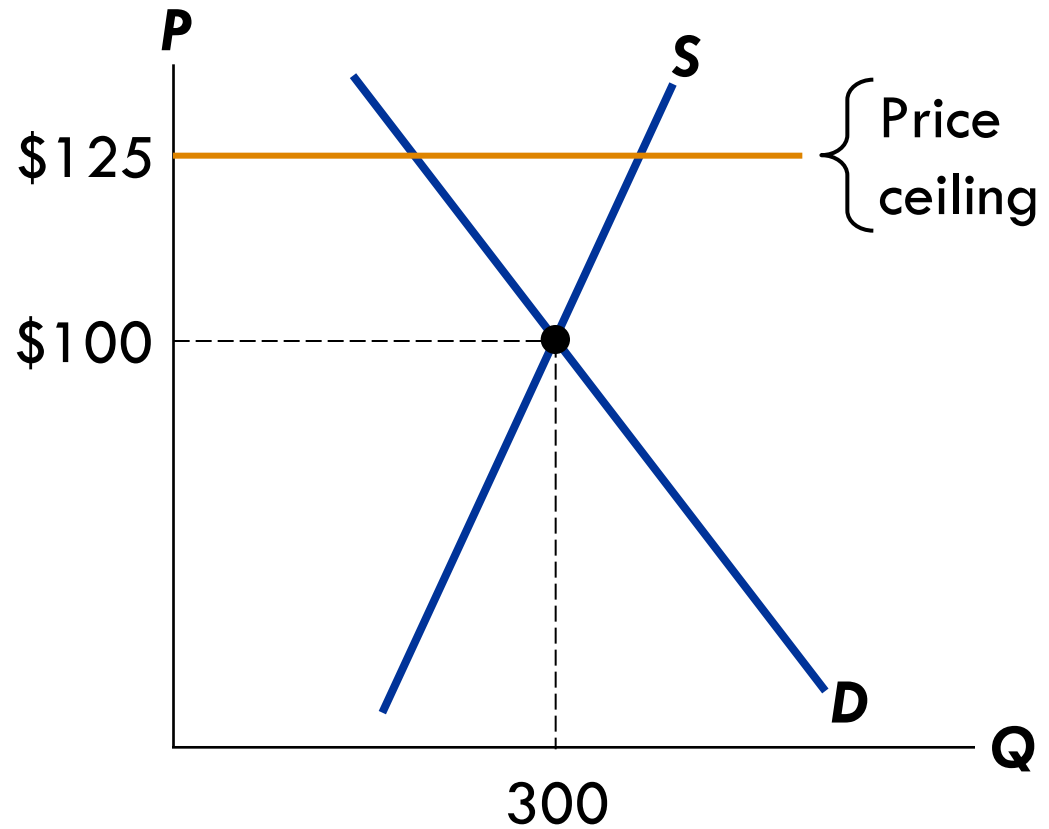
EXAMPLE 1: The Oil Market



How Price Ceilings Affect Market Outcomes

A price ceiling
above the
eq'm price is

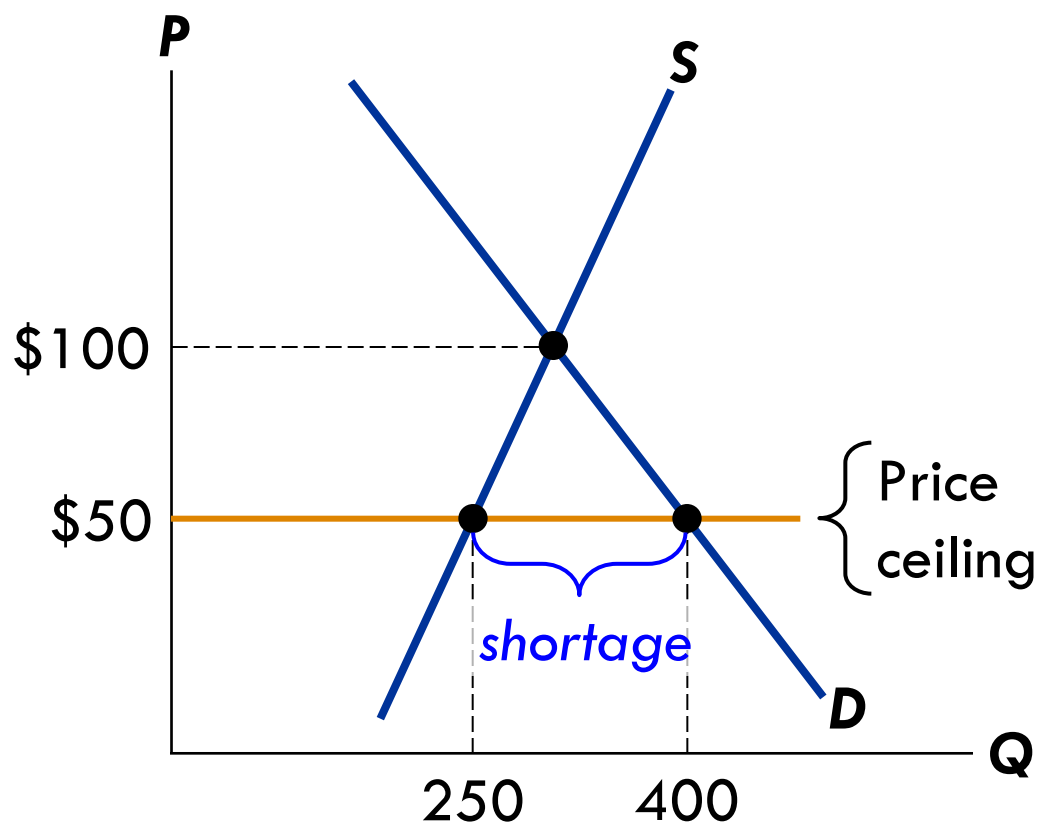
—
has no effect
on the market outcome.



How Price Ceilings Affect Market Outcomes

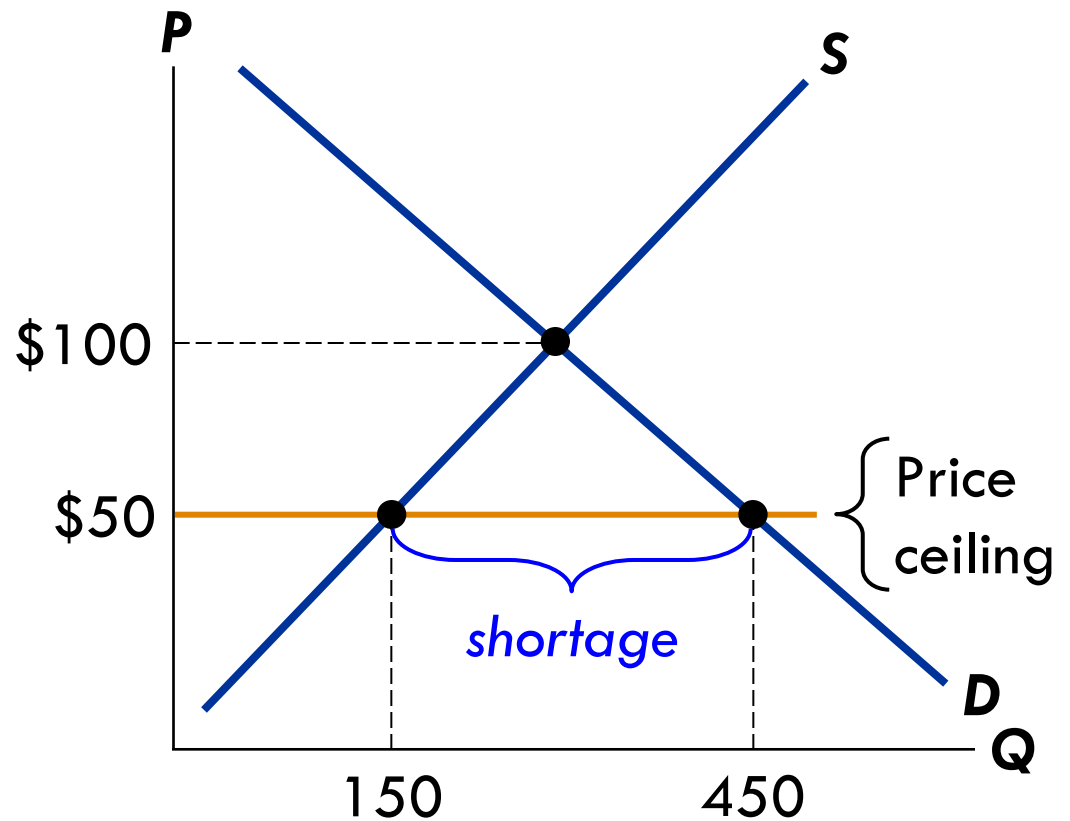
The eq'm price (\$100) is above the ceiling and therefore _____.

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.



Shortages and Rationing

- With a shortage, sellers must _____ the goods among buyers.
- Some rationing mechanisms:
 - ▣ Long lines
 - ▣ Discrimination according to sellers' biases
- These mechanisms are often unfair, and inefficient: the goods do not necessarily go to the buyers who value them most highly.
- In contrast, when prices are not controlled, the rationing mechanism is efficient (the goods go to the buyers that value them most highly) and impersonal (and thus fair).

Natural Gas: Price Controls

- A natural gas shortage of 2 trillion cubic feet, or 10 percent of the marketed production, occurred in 1974–1975.
- In 1938 the Natural Gas Act was passed.
 - ▣ The Federal Power Commission (FPC) was charged with maintaining “just” prices.
 - ▣ Price controls were imposed on natural gas shipped across state lines.
- In *Phillips Petroleum Co., v. Wisconsin* (1954), the Supreme Court forced the FPC to extend its price control regulations to the producers.

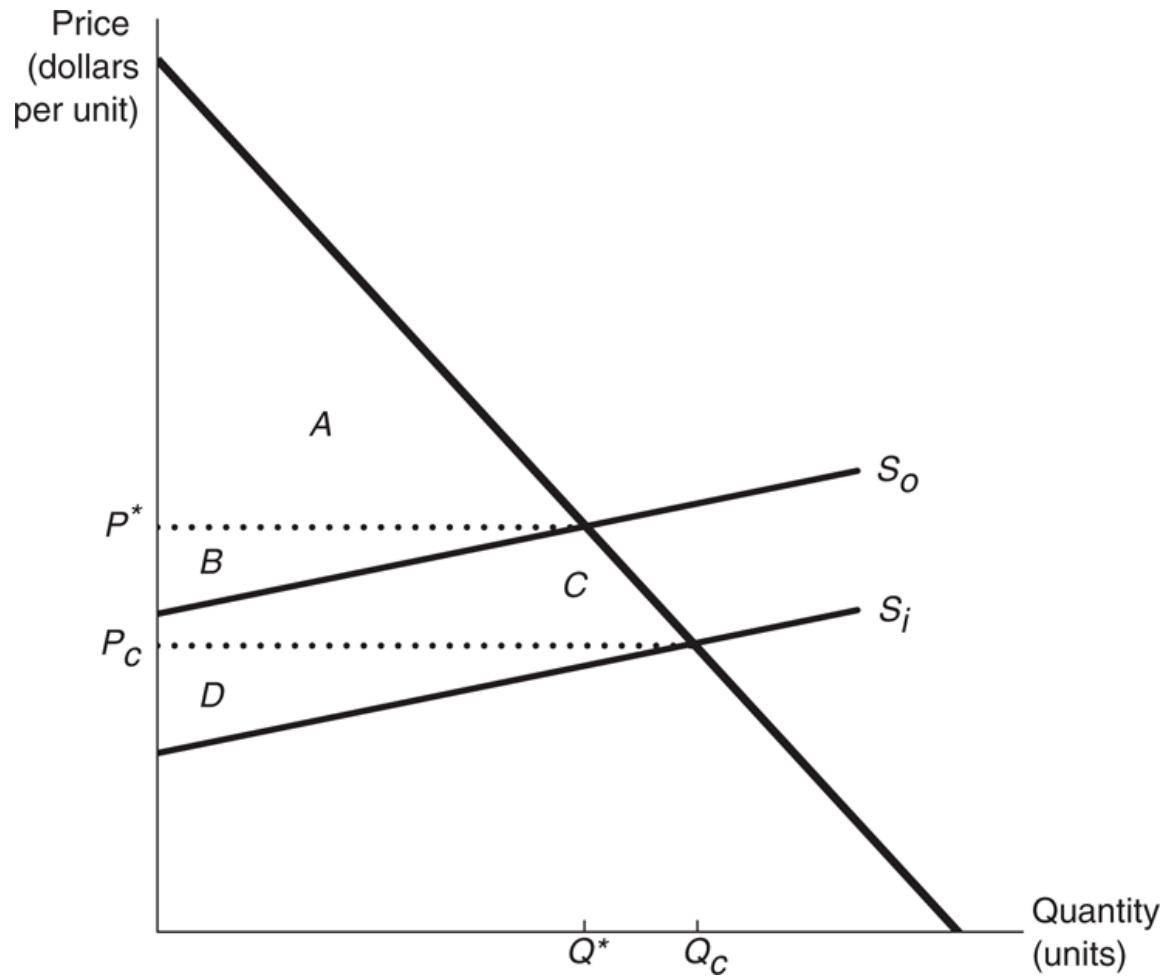
Natural Gas: Price Controls

- Price ceilings were imposed which prevented prices from reaching their normal levels:
 - ▣ overconsumption of natural gas, causing shortages,
 - ▣ causing more of the resource to be used in earlier years and with a sudden jump in price.
- On the supply side, producers who expect price ceilings to be lifted have incentives to slow production and wait for higher prices, thus exacerbating existing shortages.

Natural Gas: Price Controls

- Artificially low prices of natural gas created a bias toward substitutes that could be blended with natural gas and away from substitutes that could not.
- This inefficient policy was pursued based on rent-seeking behavior.

FIGURE 7.2 The Effect of Price Controls



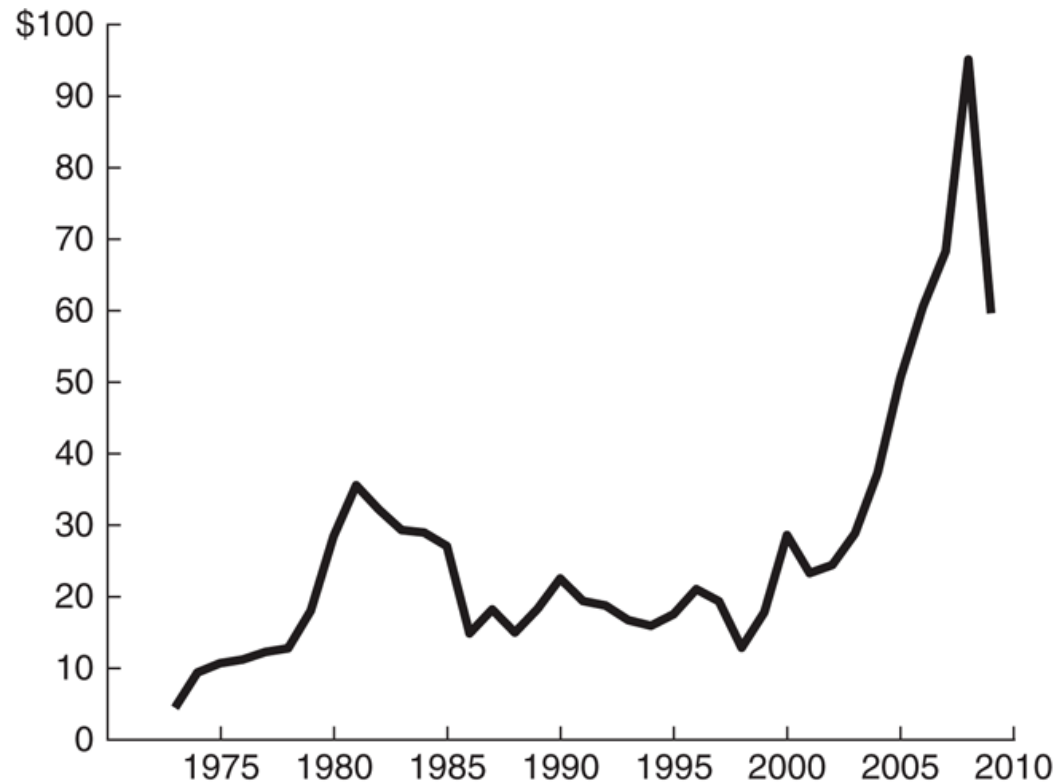
Natural Gas: Price Controls

- The Natural Gas Policy Act was passed on November 9, 1977.
 - ▣ Natural gas prices began to be decontrolled in the early 1980s causing rapid price rises.
 - ▣ By 1993, no sources of natural gas were subject to price controls.
- The demand for natural gas has been rising and as such prices have also been rising.
- Imports have also risen, much in the form of Liquefied Natural Gas (LNG).

Oil: The Cartel Problem

- The member countries of the international cartel called the Organization of Petroleum Exporting Countries (OPEC) *collude* in order to gain monopoly power.
- Effective cartelization needs to consider:
 - ▣ Price elasticity of demand for OPEC oil
 - ▣ Income elasticity of demand for oil
 - ▣ Competitiveness from non-OPEC producers
 - ▣ Compatibility among OPEC member countries

FIGURE 7.3 Real Crude Oil Price (1973–2009)



Sources: Monthly Energy Review (MER), U.S. Energy Information Administration (EIA) (<http://www.eia.doe.gov/mer/prices.html>); Consumer Price Index (CPI), Bureau of Labor Statistics (<http://www.bls.gov/cpi/data.htm>).

Note: Prices are in 2009 dollars.

Oil: The Cartel Problem

- Price elasticity of demand for oil
 - ▣ The lower the price elasticity of demand (in absolute value), the larger the potential gains from cartelization.
 - ▣ Oil and oil products are price inelastic.
 - ▣ Price elasticity of demand depends in part on the availability of substitutes.
 - Substitutes for oil are expensive and transition times are long. Solar energy sets a long-run upper limit on the ability of OPEC to raise prices.

Oil: The Cartel Problem

- Income elasticity of demand
 - ▣ At constant prices, as income grows, oil demand should grow.
 - ▣ The higher the income elasticity of demand, the more sensitive demand is to the business cycle.
 - Recessions can thus put pressure on OPEC and expansions are beneficial to the cartel.
- Non-OPEC Suppliers
 - ▣ OPEC must take non-OPEC members into account when setting prices.
 - ▣ Pressure on the cartel was evident in the mid-1980s when production was down and prices fell.

Oil: The Cartel Problem

- Compatibility of Member Interest
 - ▣ Individual cartel members have incentives to cheat on production agreements.
 - ▣ Price elasticity of demand facing each individual member is higher than for the cartel. With higher price elasticity, lowering price maximizes profit.
 - ▣ Enforcing the collusive agreement is essential for the success of the cartel.

TABLE 7.1 The World's Largest Oil Reserves

Country	Reserves (in billions of barrels)
Saudi Arabia	266.7
Canada ¹	178.1
Iran	136.2
Iraq	115.0
Kuwait	104.0
Venezuela	99.0
United Arab Emirates	97.8
Russia	60.0
Libya	43.7
Nigeria	36.2
Kazakhstan	30.0
United States	21.3

¹ PennWell Corporation, *Oil & Gas Journal*, Vol. 106, No. 48 (December 22, 2008), except United States. Oil includes crude oil and condensate. Data for the United States are from the Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 2007 Annual Report*, DOE/EIA-0216(2007) (February 2009). *Oil & Gas Journal's* oil reserve estimate for Canada includes 5.392 billion barrels of conventional crude oil and condensate reserves and 172.7 billion barrels of oil sands reserves.

Source: <http://www.eia.doe.gov/emeu/international/oilreserves.html> compiled from PennWell Corporation, *Oil & Gas Journal*, Vol. 106, No. 48 (December 22, 2008).

EXAMPLE 1.5: LINES AT THE GAS PUMP

1973, OPEC raised the price of crude oil-video

Reduced the supply of gasoline

Long lines at gas stations

What was responsible for the long gas lines?

OPEC: created shortage of gasoline

U.S. government regulations: price ceiling on gasoline

Before OPEC raised the price of crude oil

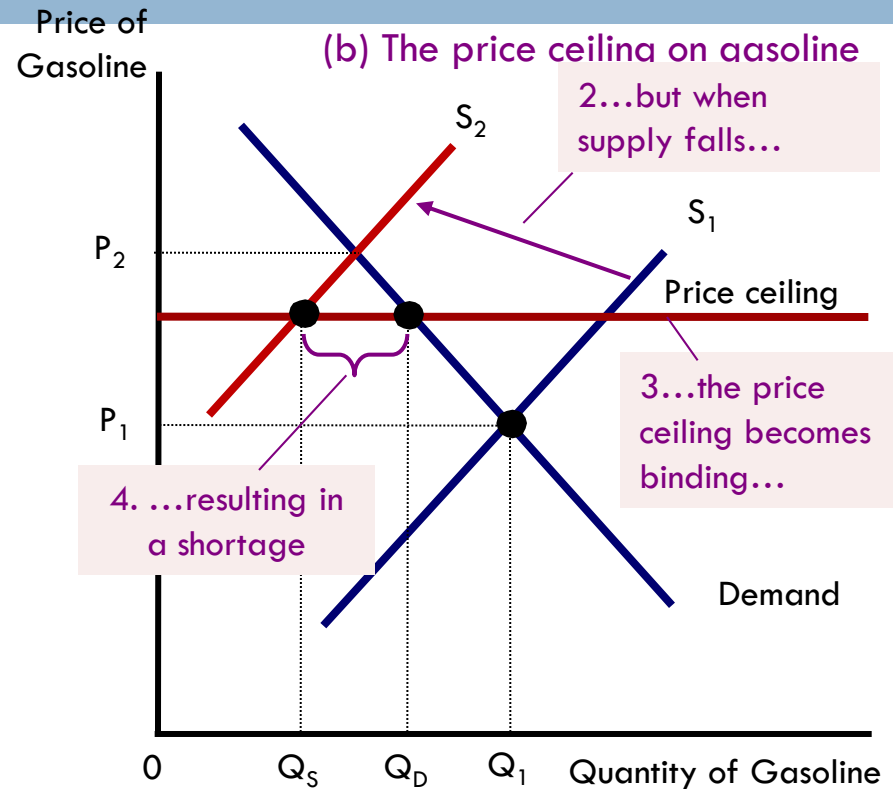
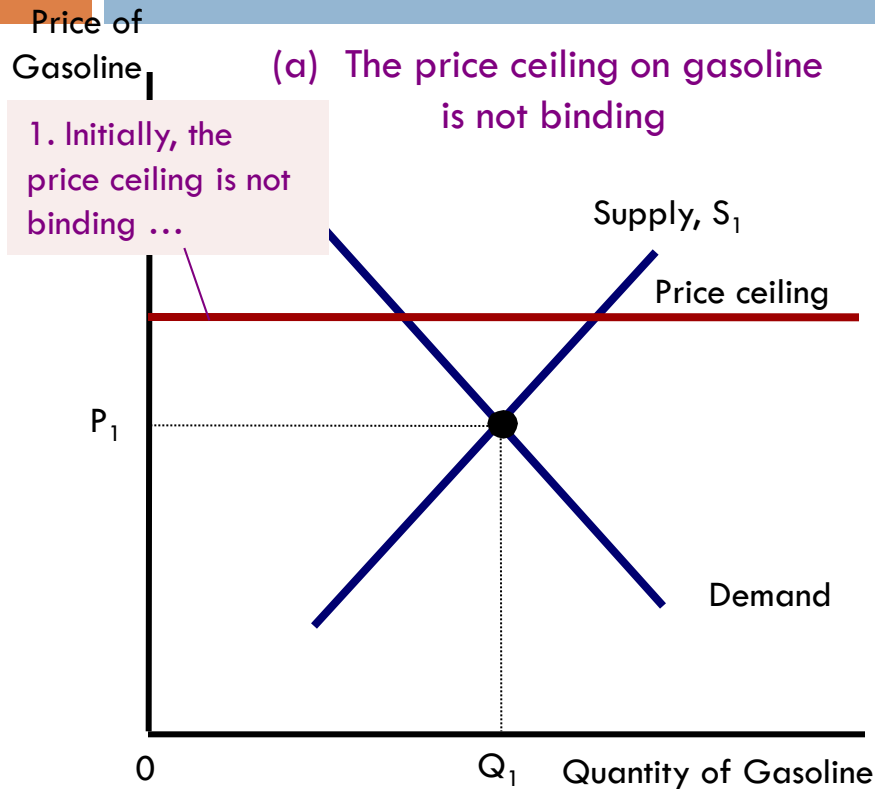
Equilibrium price - below price ceiling: no effect

When the price of crude oil rose

Reduced the supply of gasoline

Equilibrium price - above price ceiling: shortage

The market for gasoline with a price ceiling



Panel (a) shows the gasoline market when the price ceiling is not binding because the equilibrium price, P_1 , is below the ceiling. Panel (b) shows the gasoline market after an increase in the price of crude oil (an input into making gasoline) shifts the supply curve to the left from S_1 to S_2 . In an unregulated market, the price would have risen from P_1 to P_2 . The price ceiling, however, prevents this from happening. At the binding price ceiling, consumers are willing to buy Q_D , but producers of gasoline are willing to sell only Q_S . The difference between quantity demanded and quantity supplied, $Q_D - Q_S$, measures the gasoline shortage.