

Intermediate Microeconomic

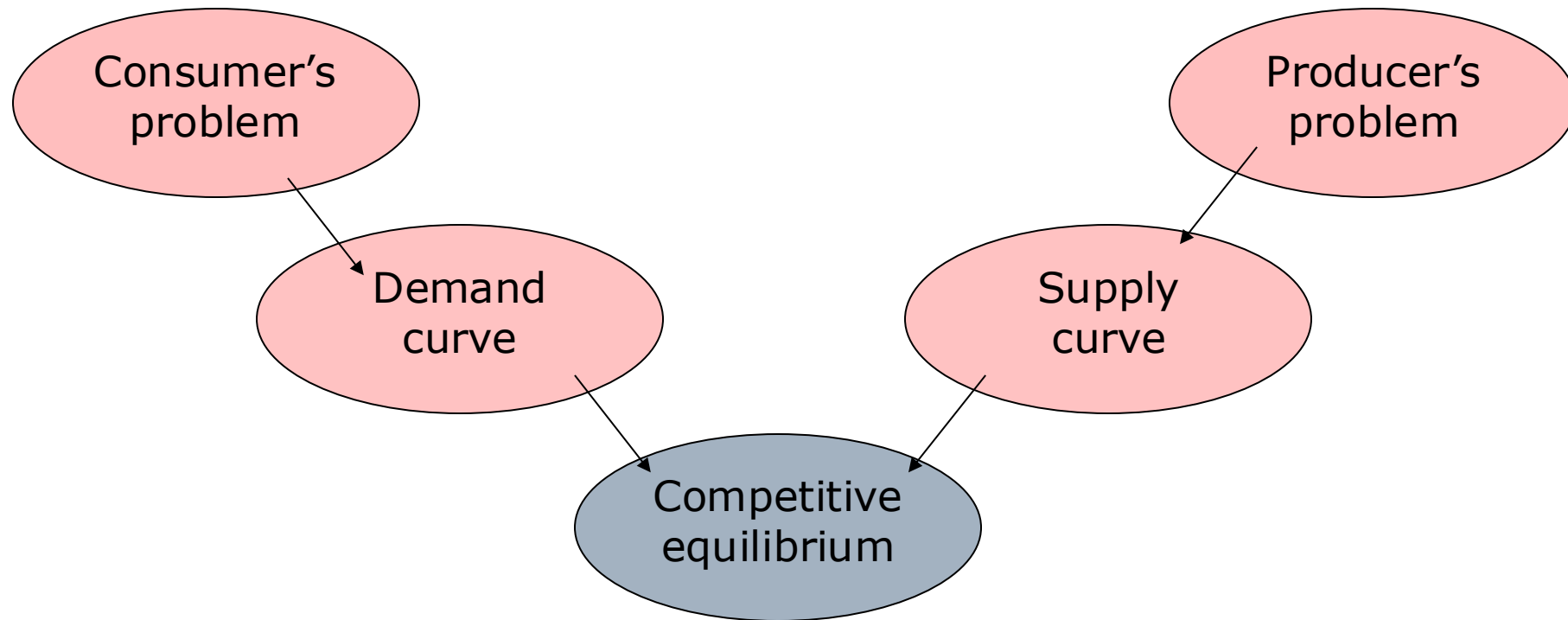
Spring 2025

Part four: Competitive markets

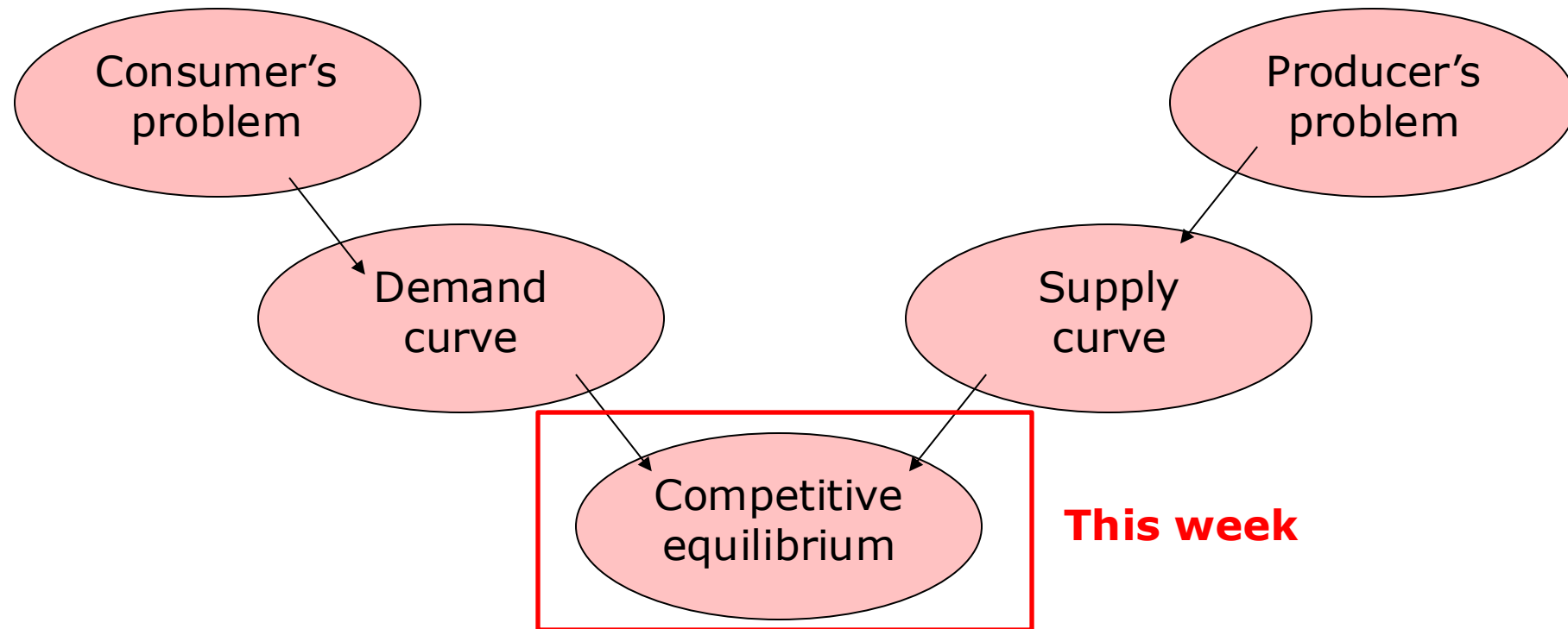
Week 6(a): Markets and efficiency (I)

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Big Picture



Big Picture



Competitive Equilibrium: Assumptions

1. Utility-maximizing consumers; profit-maximizing firms
2. Consumers and firms take prices as given (they both “looked outside the window and observe prices”)
3. Perfect tradability
 - Complete market: there is a market for every commodity
 - Perfect information: no difficult-to-observe product characteristics
 - No transaction costs: buy price = sell price
4. Commodities are homogeneous and are private goods
 - My consumption of a product does not affect you directly

Competitive Equilibrium: Assumptions

- We begin with competitive markets NOT because we think these assumptions hold in reality, but because
 - They are the simplest to study;
 - They give rise to simple (but powerful) conclusions;
 - Thus, competitive markets serve as a good baseline (some people say “ideal”) in microeconomics
- In later parts of the class, we’ll see how violations of the competitive assumptions can lead to different outcomes
- From now on, I will use these terms interchangeably:
 - Competitive equilibrium
 - Competitive market equilibrium
 - Market equilibrium

Competitive Equilibrium: Roadmap

- Market demand and supply curve
- Compute competitive market equilibrium
- Properties of market equilibrium
 - Efficiency
 - Equity
- Three examples of government interventions and their welfare implications
 - Price controls
 - Minimum wages
 - Taxation

Competitive Equilibrium: Roadmap

- **Market demand and supply curve**
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Market Demand

- Only two goods (x and y)
 - An individual's demand for x is

$$\text{Quantity of } x \text{ demanded} = x(P_x, P_y, I)$$

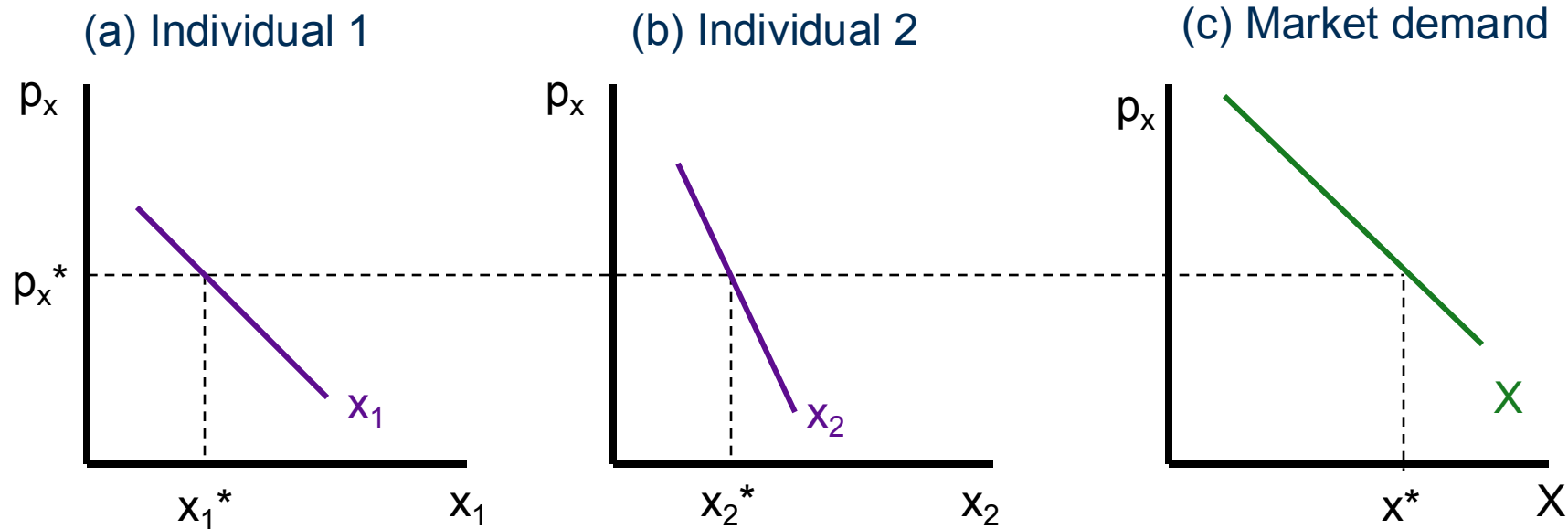
- If we use i to reflect each individual in the market

$$\text{Market demand for } X = \sum_{i=1}^n x_i(p_x, p_y, I_i)$$

Market Demand Curve

- Market demand curve for good X
 - p_x is allowed to vary
 - p_y and the income of each individual are held constant
 - If each individual's demand for x is downward sloping, the market demand curve will also be downward sloping

Construction of a Market Demand Curve from Individual Demand Curves



A market demand curve is the “horizontal sum” of each individual’s demand curve. At each price the quantity demanded in the market is the sum of the amounts each individual demands. For example, at p_x^* the demand in the market is $x_1^* + x_2^* = x^*$

Shifts in the Market Demand Curve

- The market demand
 - Summarizes the *ceteris paribus* relationship between X and p_x
 - Changes in p_x result in movements along the curve (change in quantity demanded)
 - Changes in other determinants of the demand for X cause the demand curve to shift to a new position (change in demand)

Shifts in Market Demand

- Suppose that individual 1's demand for oranges is given by: $x_1 = 10 - 2p_x + 0.1I_1 + 0.5p_y$
 - p_x = price of oranges
 - I_1 = individual's 1 income
 - p_y = price of grapefruit
- and individual 2's demand for oranges is $x_2 = 17 - p_x + 0.05I_2 + 0.5p_y$
- What is the market demand curve?

Shifts in Market Demand

- If $p_y = 4$, $I_1 = 40$, and $I_2 = 20$, the market demand curve becomes:
$$X = 27 - 3p_x + 4 + 1 + 4 = 36 - 3p_x$$
- If p_y rises to 6, the market demand curve shifts outward to:
$$X = 27 - 3p_x + 4 + 1 + 6 = 38 - 3p_x$$
 - Note that X and Y are substitutes
- If I_1 fell to 30 while I_2 rose to 30, the market demand would shift inward to
$$X = 27 - 3p_x + 3 + 1.5 + 4 = 35.5 - 3p_x$$
 - Note that X is a normal good for both buyers

Generalizations

- Suppose that there are n goods
 - $x_i, i = 1, \dots, n$
 - With prices $p_i, i = 1, \dots, n$
- Assume that there are m individuals in the economy
 - The j^{th} individual's demand for the i^{th} good will depend on all prices and on I_j

$$x_{i,j} = x_{i,j}(p_1, \dots, p_n, I_j)$$

Generalizations

- The market demand function for x_i
 - Sum of each individual's demand for that good

$$X_i(p_1, \dots, p_n, I_1, \dots, I_m) = \sum_{j=1}^m x_{i,j}(p_1, \dots, p_n, I_j)$$

- The market demand function depends on the prices of all goods and the incomes and preferences of all buyers

Elasticity of Market Demand

- A simplified notation: the market demand function: $Q_D = D(P, P', I)$
- Define elasticities:

$$\text{Price Elasticity of Market Demand} = e_{D,P} = \frac{\partial D(P, P', I)}{\partial P} \cdot \frac{P}{Q_D}$$

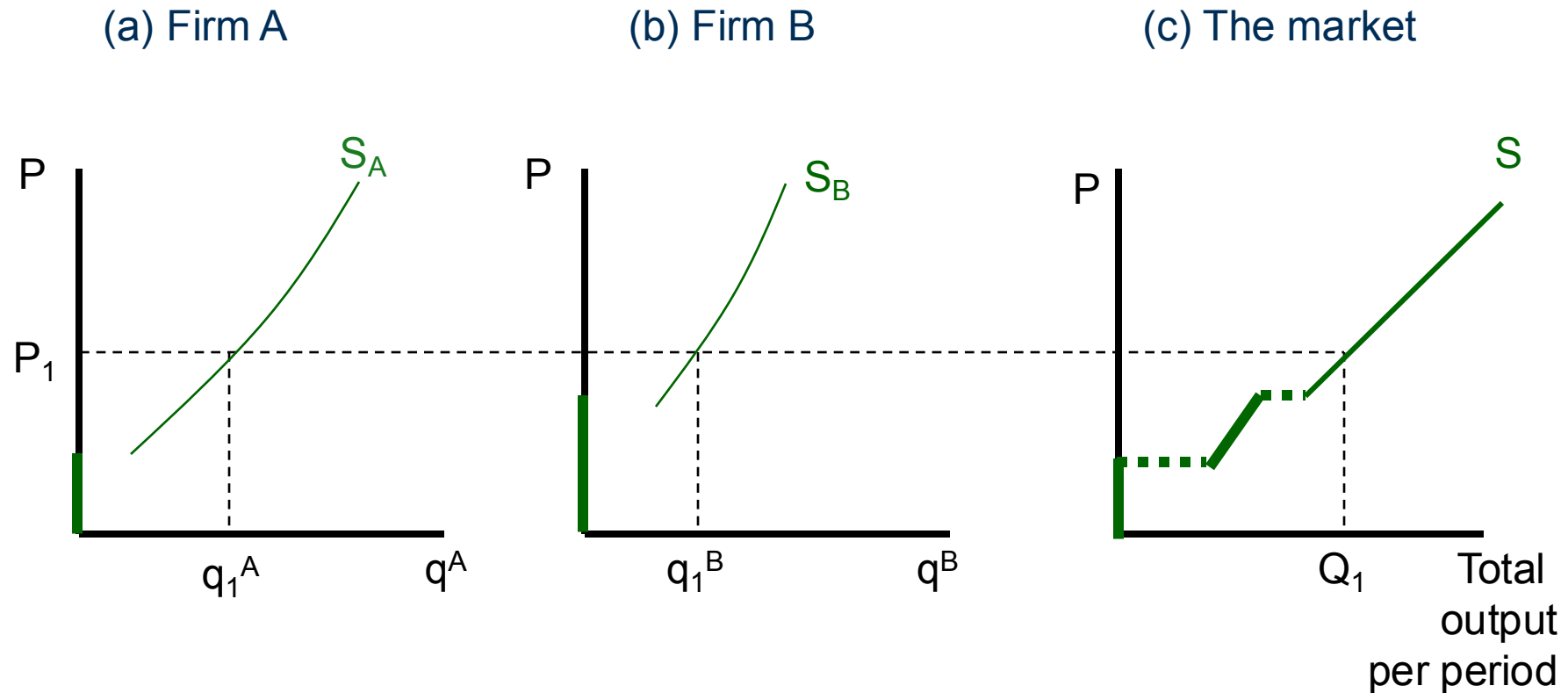
$$\text{Cross Price Elasticity of Market Demand} = e_{D,P'} = \frac{\partial D(P, P', I)}{\partial P'} \cdot \frac{P'}{Q_D}$$

$$\text{Income Elasticity of Market Demand} = e_{D,I} = \frac{\partial D(P, P', I)}{\partial I} \cdot \frac{I}{Q_D}$$

Short-Run Market Supply

- Quantity of output supplied
 - To the entire market in the short run
 - Is the sum of the quantities supplied by each firm
 - The amount supplied by each firm depends on price
- Short-run market supply curve
 - Upward-sloping: each firm's short-run supply curve has a positive slope

Short-Run Market Supply Curve



- The supply (marginal cost) curves of two firms are shown in (a) and (b).
- The market supply curve (c) is the horizontal sum of these curves.
- For example, at P_1 firm A supplies q_1^A , firm B supplies q_1^B , and total market supply is given by $Q_1 = q_1^A + q_1^B$.

Short-Run Market Supply Function

□ Short-run market supply function

- Shows total quantity supplied by each firm to a market

$$Q_s(P, v, w) = \sum_{i=1}^n q_i(P, v, w)$$

- Firms are assumed to face the same market price and the same prices for inputs

Short-Run Market Supply Function

- Short-run market supply curve
 - Shows the two-dimensional relationship between Q and P
 - Holding v and w (and each firm's underlying technology) constant
 - If v , w , or technology were to change, the supply curve would shift

Short-Run Supply Elasticity

□ Short-run supply elasticity

- Describes the responsiveness of quantity supplied to changes in market price

$$e_{S,P} = \frac{\text{\% change in } Q \text{ supplied}}{\text{\% change in } P} = \frac{\partial Q_S}{\partial P} \cdot \frac{P}{Q_S}$$

- Because price and quantity supplied are positively related, $e_{S,P} > 0$

A Short-Run Supply Function

□ Cobb-Douglas production function:

$$q_i(P, v, w, k_1) = \left(\frac{w}{\beta} \right)^{-\beta/(1-\beta)} k_1^{\alpha/(1-\beta)} P^{\beta/(1-\beta)}$$

Let $\alpha = \beta = 0.5, w = 12, k_1 = 80$

- What is the single firm's supply function?
- 100 identical firms
 - Each with the same short-run supply function
- Short-run market supply function:
- Short-run elasticity of supply:

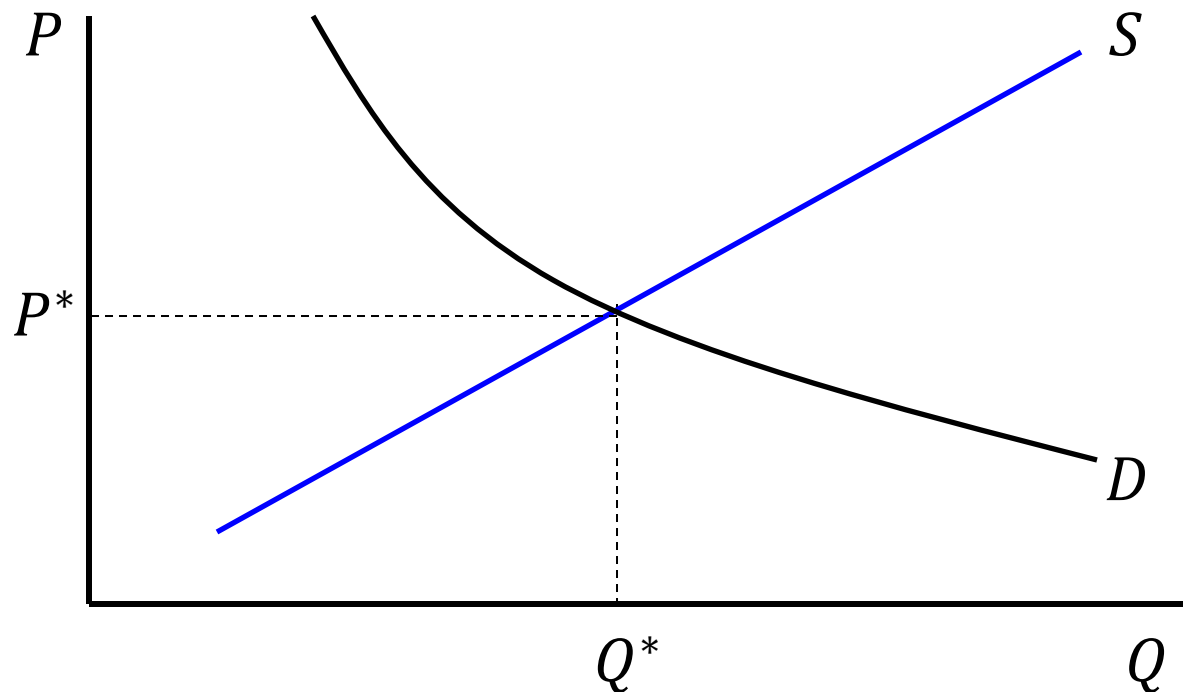
Competitive Equilibrium: Roadmap

- Market demand and supply curve
- **Compute competitive market equilibrium**
- Properties of market equilibrium
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Market Equilibrium

An **equilibrium** is a pair (Q^*, P^*) such that, at P^* :

$$S(P^*) = D(P^*) = Q^*.$$

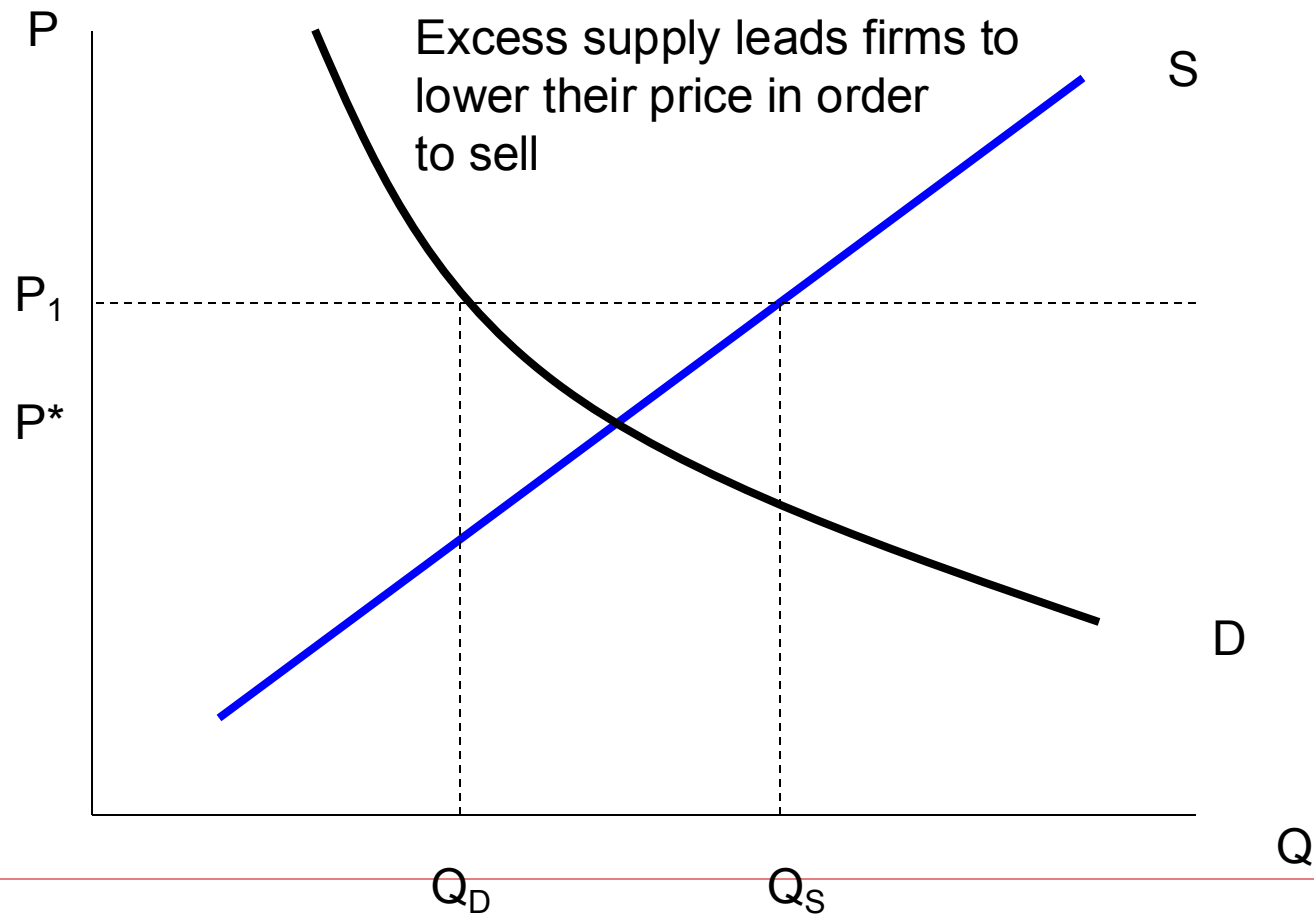


Why is (Q^*, P^*) an "equilibrium"?

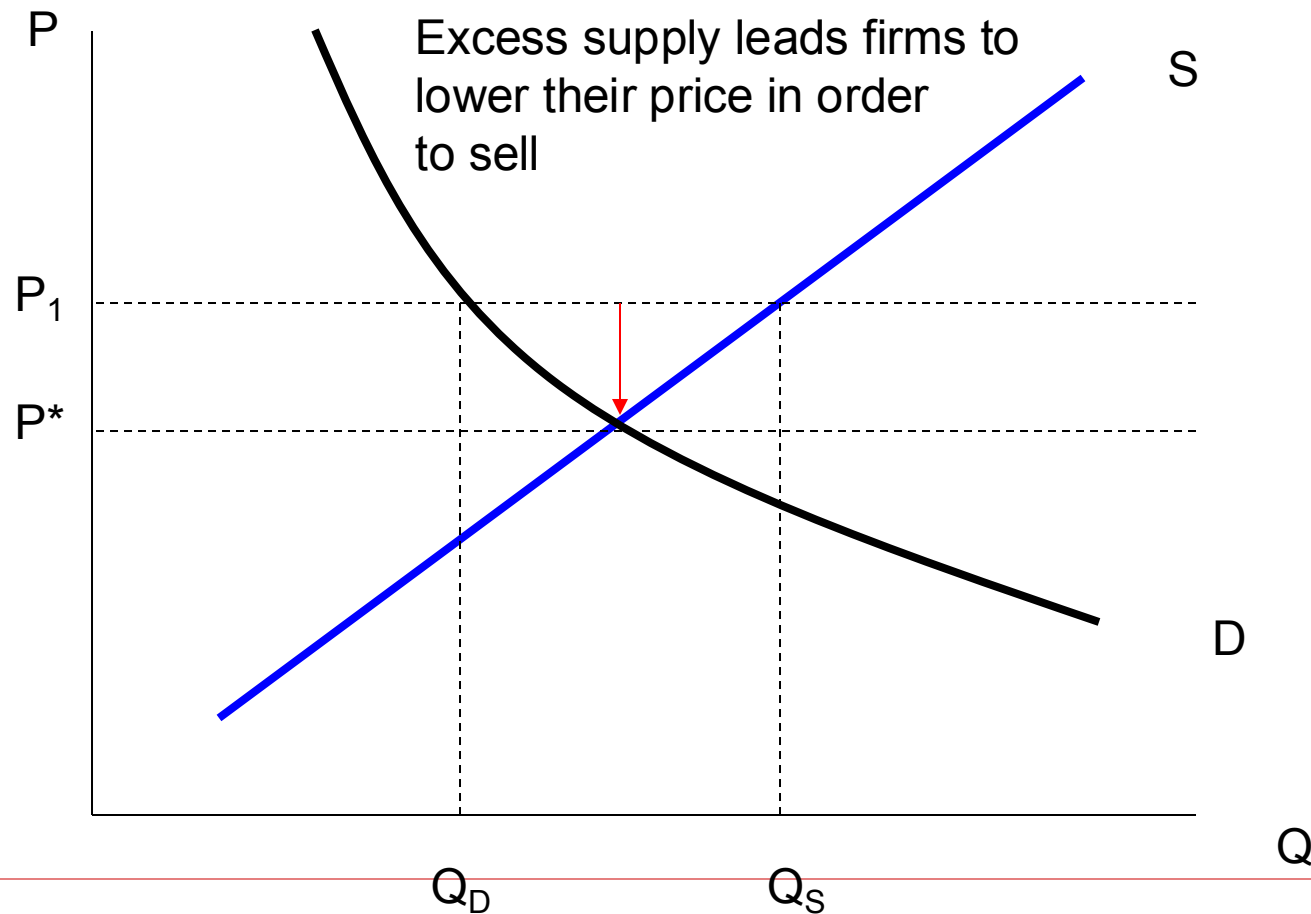
At P^* :

1. Consumers are willing to buy Q^* .
2. Producers are willing to sell Q^* .
3. Markets clear.

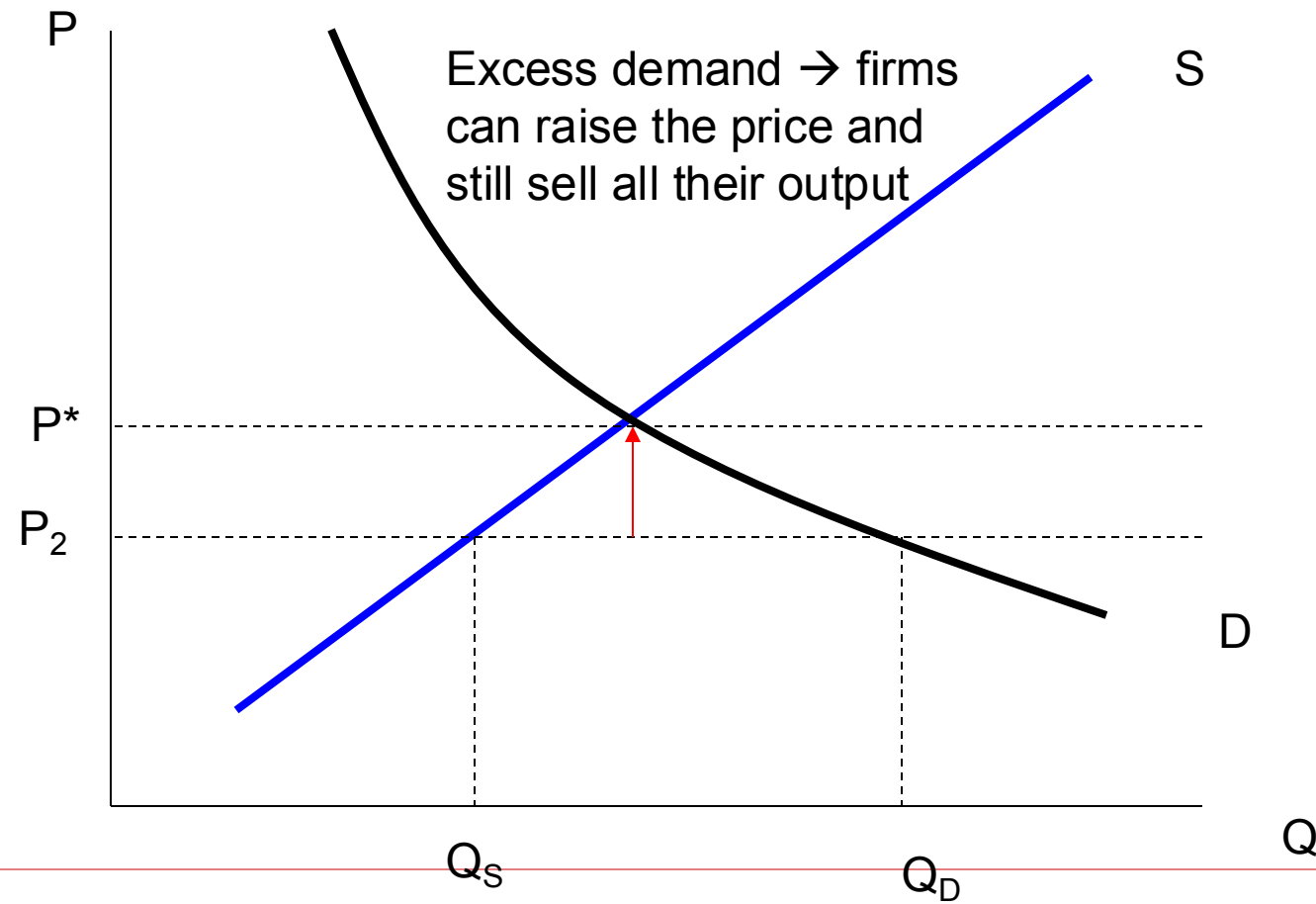
What if we are out of equilibrium?



What if we are out of equilibrium?



What if we are out of equilibrium?



Reasons for Shifts in Demand or Supply Curves

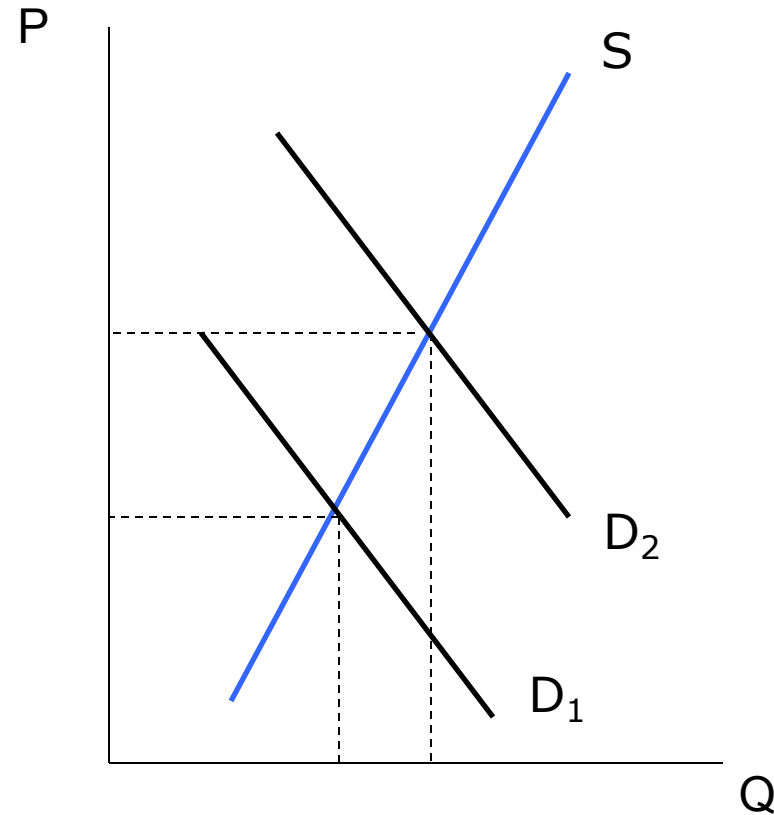
Demand Curves Shift Because	Supply Curves Shift Because
Incomes change	Input prices change
Prices of substitutes or complements change	Technology changes
Preferences change	Number of producers changes

When either a supply curve or a demand curve shift

- Equilibrium price and quantity will change
- The relative magnitudes of these changes depends on the shapes of the supply and demand curves

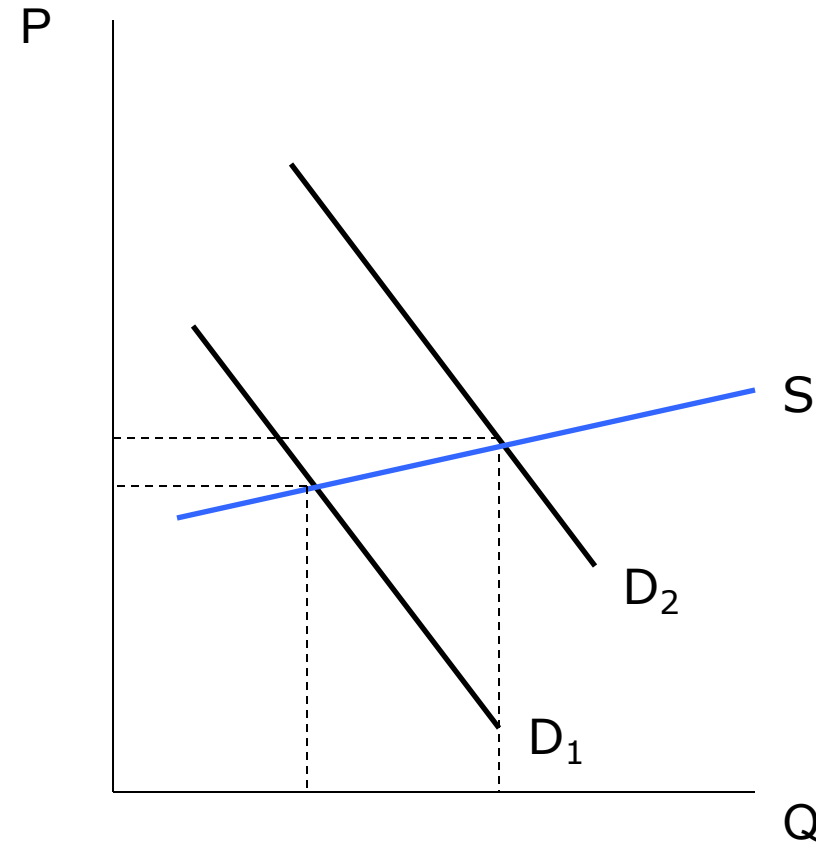
Equilibrium and Shifts in Demand

- When demand shifts, effect on P^* and Q^* depends on the shape of the supply curve
- Demand shifts from D_1 to D_2 .
- With relatively inelastic (steep) supply, large change in P , small change in Q .

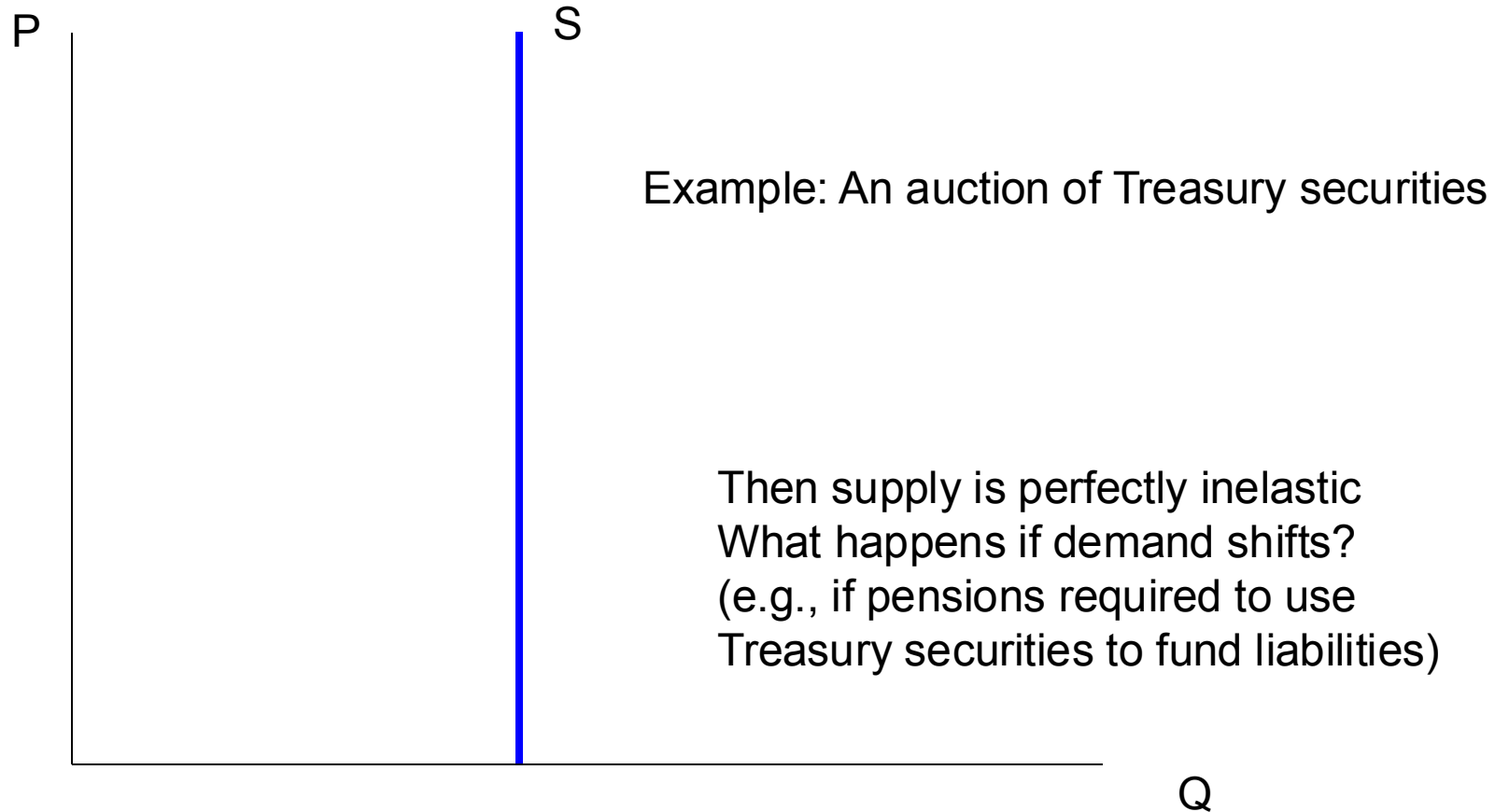


Equilibrium and Shifts in Demand

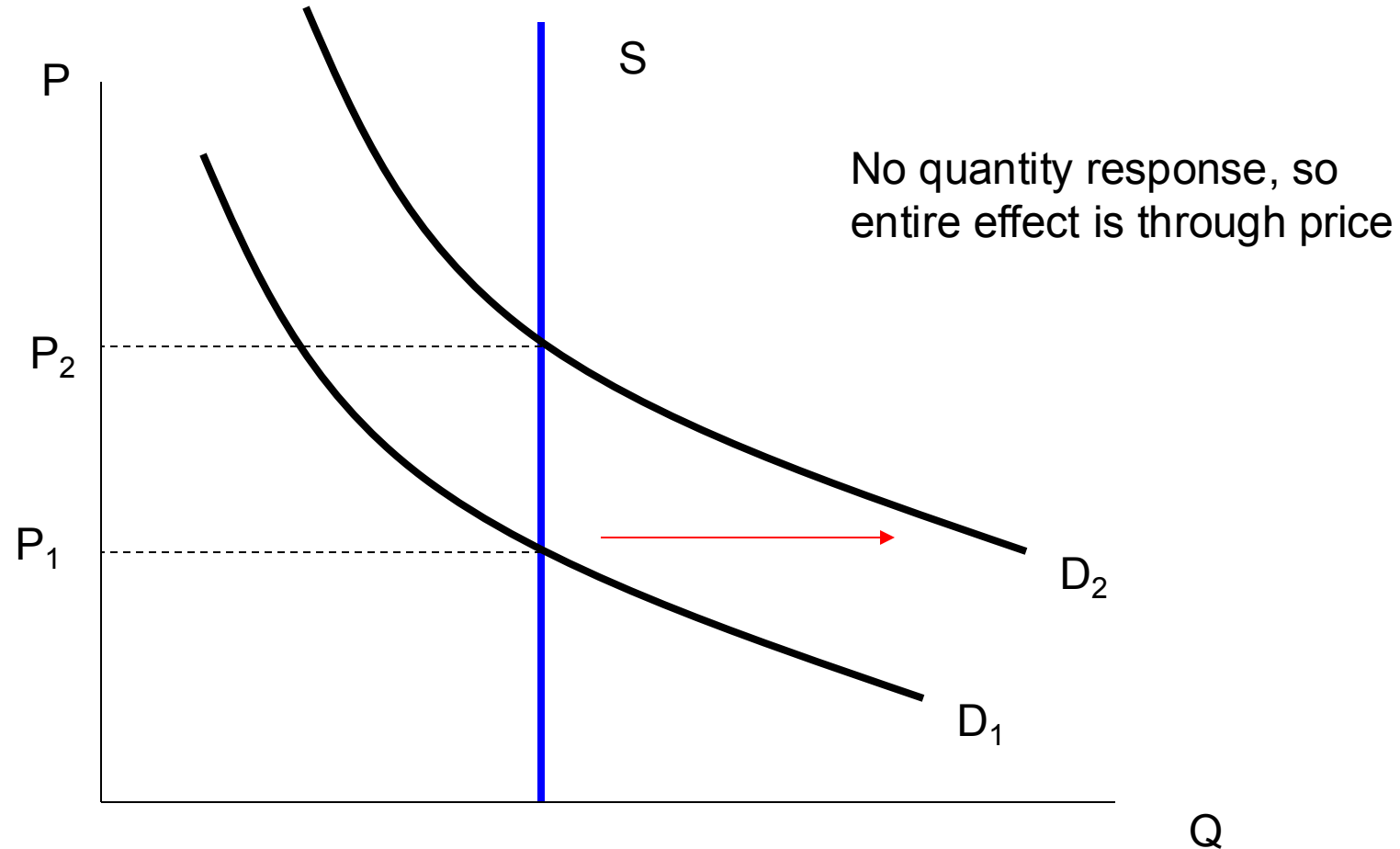
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What if the supply of a particular security is fixed in the short-run?

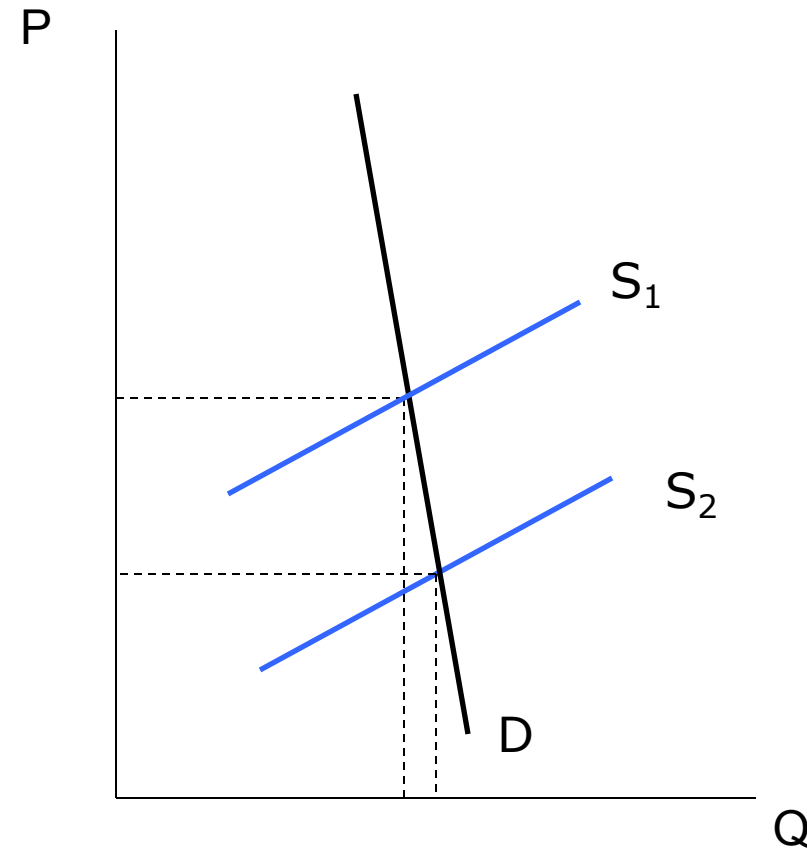


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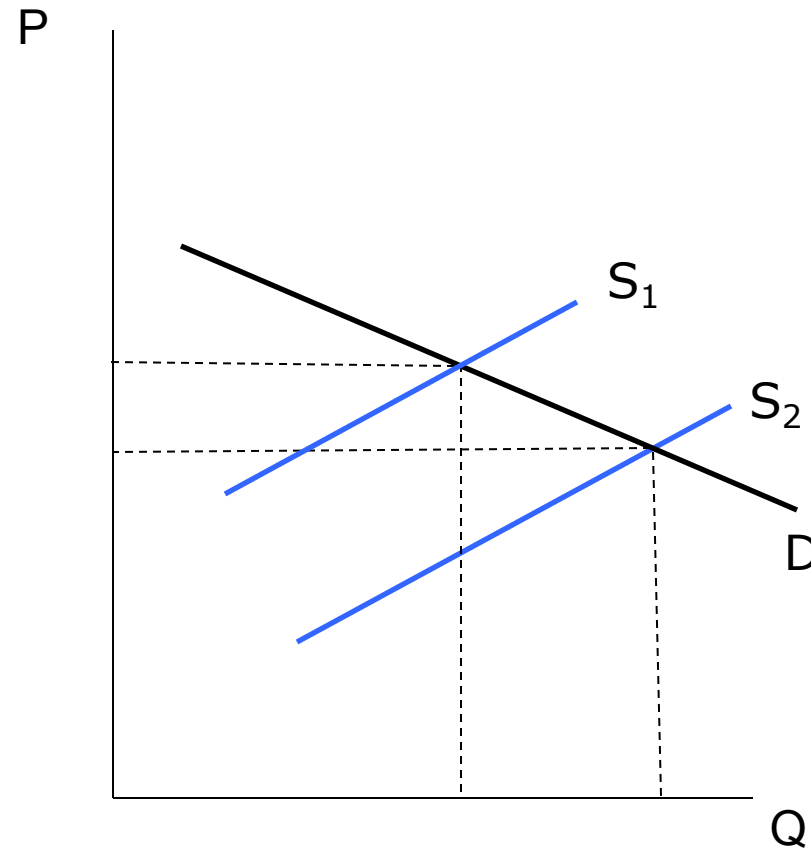
Equilibrium and Shifts in Supply

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Equilibrium and Shifts in Supply

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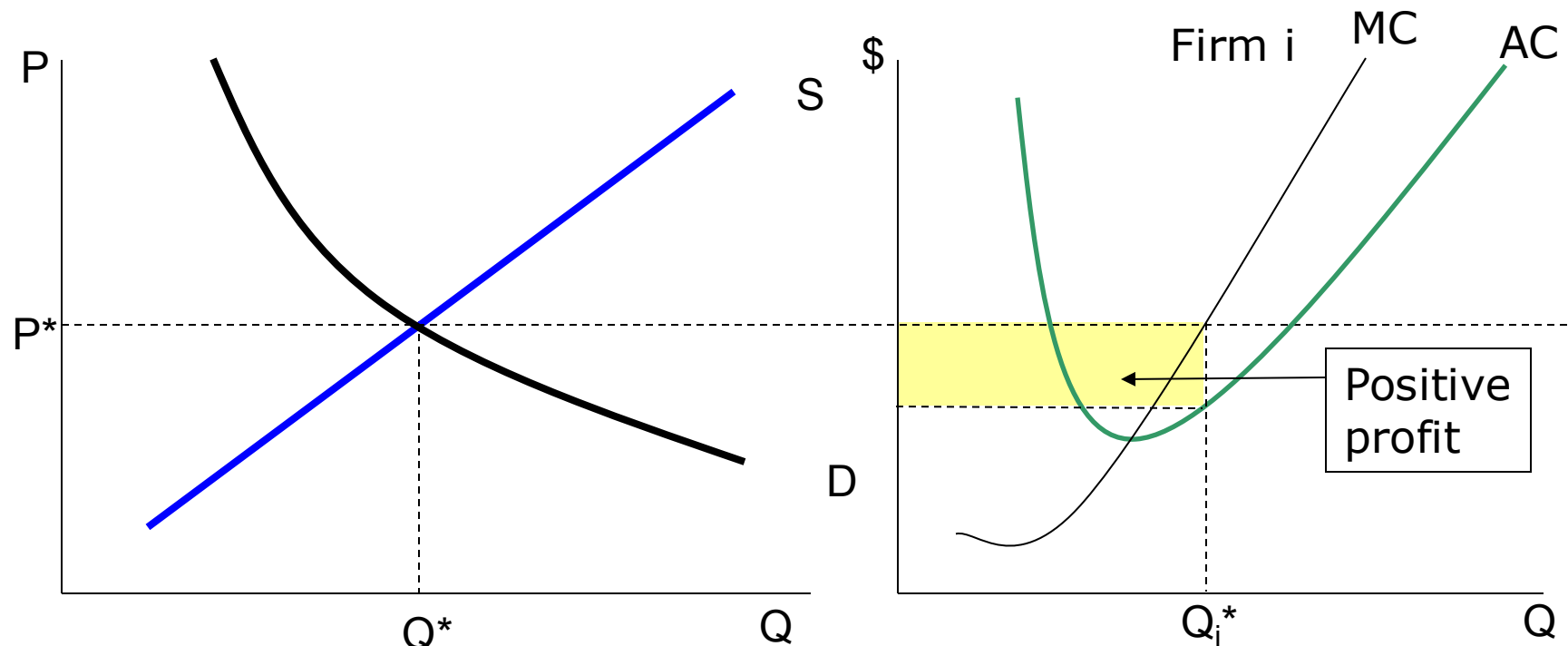


Short-run vs long-run market equilibrium

- When we draw supply-demand chart, what we are looking for is “short-run” equilibrium
 - Short-run: there are fixed number of firms in the market
 - Each firm may earn positive economic profit
- A short-term equilibrium almost surely cannot sustain in the long run
 - If some firm's making positive economic profit, then in the long run, new firms will keep entering the market, more goods become available on the market, price goes down
 - This keeps happening until the price of the good is driven down to the point where profitability in the market is exhausted

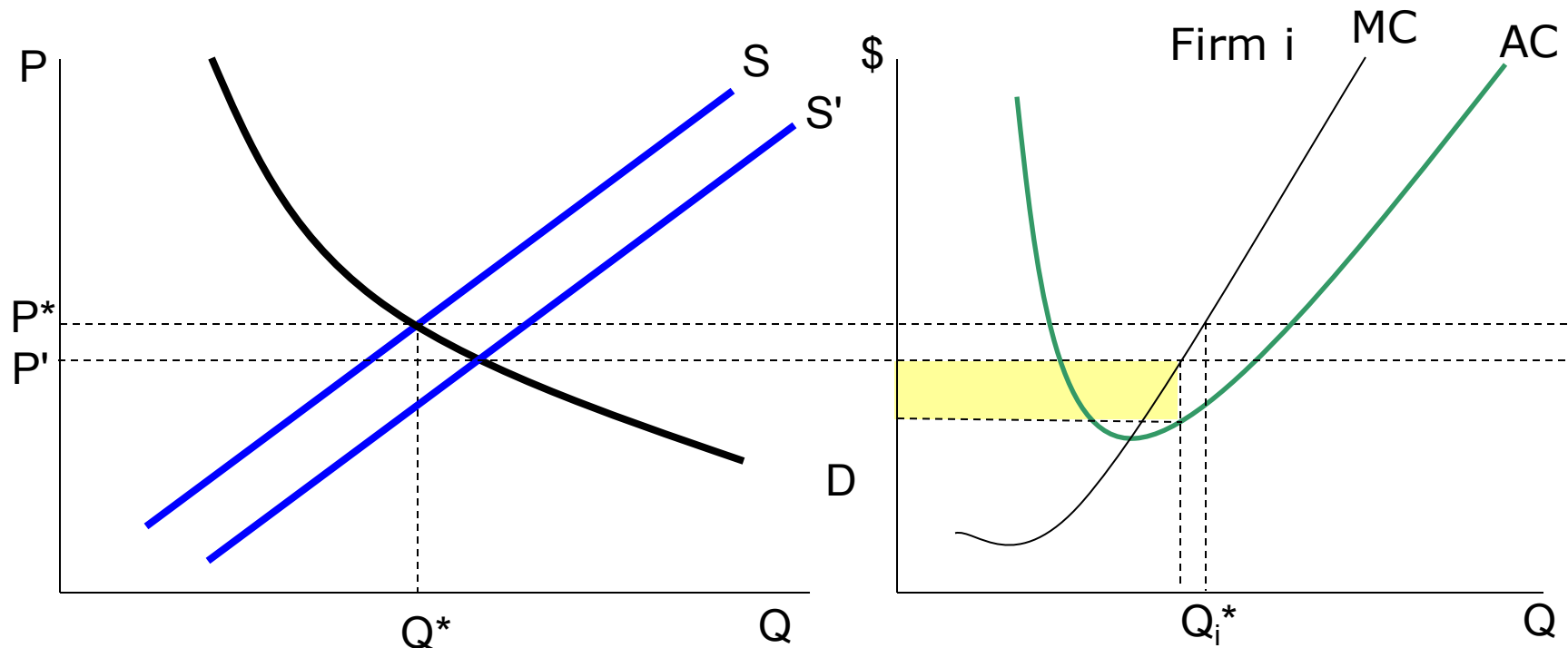
Short Run Equilibrium and Profit

- In the short run, the number of firms is fixed.
- Firms may earn an economic profit.
- This will lead additional firms to enter the industry.



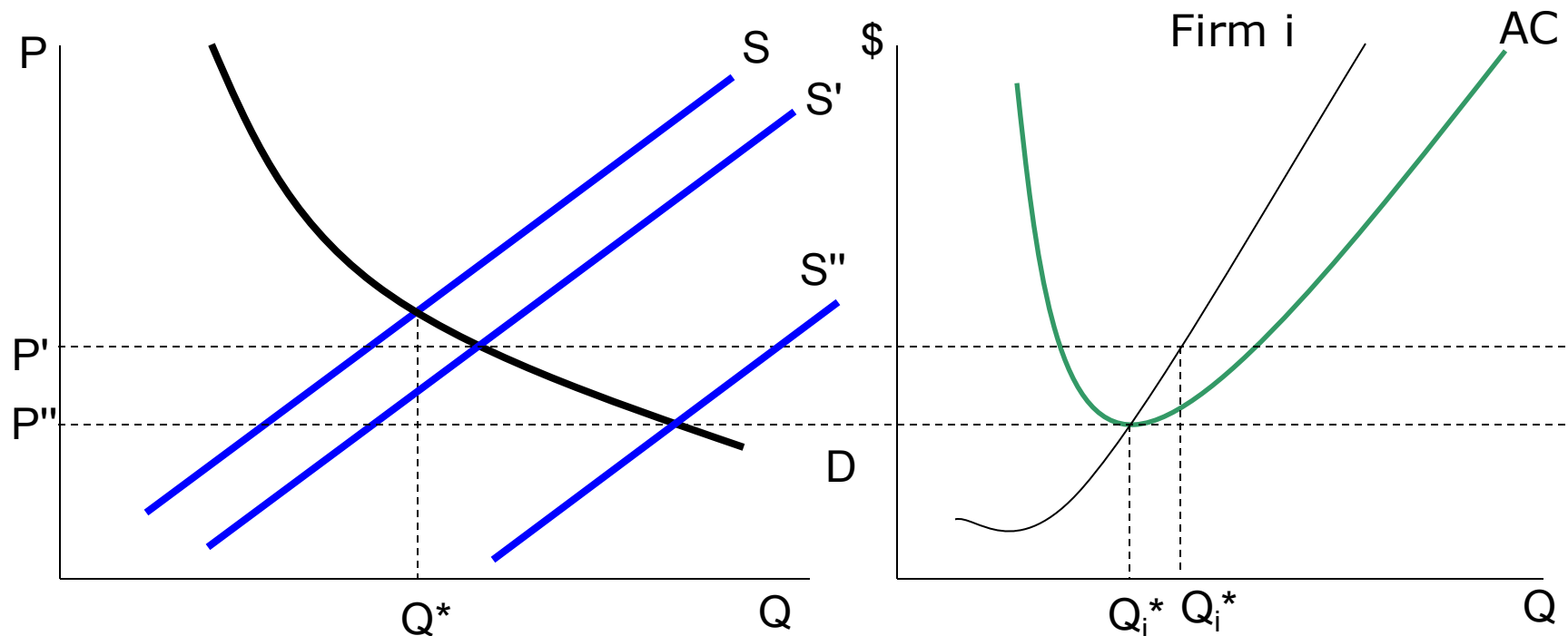
Entry and Profit

- Entry shifts the supply curve to the right.
- SR equilibrium price falls.
- Profit decreases.



Entry and Profit

- Entry continues until profit is zero.
- Profit is zero when $P = \min AC$.



Long Run Equilibrium

- If all firms are identical, a long run equilibrium is a point where
 - Market price $P^* = \min AC$
 - There are N firms on the market, such that $Q_S(P^*) = Q_D(P^*) = Q^*$
- Note that because $P^* = \min AC$, every firm in the long run equilibrium is earning **zero profit**
 - This is because we assumed identical firms (same cost function)
- In reality, when firms differ by their cost functions, then the long run equilibrium is such that the “marginal” firm earns zero profit
 - That is, firms keep entering the market until price falls to a point where it makes no sense for one more firm to enter the market
 - In such a long-run equilibrium, some firms (low-cost ones) are earning positive profits

Long Run Equilibrium - Example

- Suppose that firms have cost function:

$$C(Q) = 108 + 10Q + \frac{1}{3} Q^2.$$

- Initially, there are 10 firms in the market.
- Market demand is given by $Q = 1450 - P$.

Questions:

1. What is the short-run equilibrium?
 1. Equilibrium price=? Quantity=?
 2. each firm's profit=?
2. What is the long-run equilibrium?
 1. Each firm's supply=? Price=?
 2. Long-run number of firms in the market=?

$$Q_D = 1450 - P$$
$$C(Q) = 108 + 10Q + \frac{1}{3} Q^2$$

Long Run Equilibrium - Example

- **What is the short run equilibrium?**
- **Follow the steps:**
 - First, find each firm's supply function:
 - Then, find aggregate supply.

If there are 10 firms, at a price of P , total supply is $10 \cdot Q_i$.
 - In the short run, equilibrium is where quantity supplied = quantity demanded.
 - In the short run, firms earn positive profits = ?
 - So, there will be entry in the long run.

$$Q_D = 1450 - P$$
$$C(Q) = 108 + 10Q + \frac{1}{3} Q^2$$

Long Run Equilibrium - Example

- ☐ **What is the long run equilibrium?**
- ☐ In the long-run equilibrium, $P = \min AC$. Compute min AC:
- ☐ What is total quantity demanded?
- ☐ How many firms are there in the market?