LECTURE 11
PERFECT COMPETITION IN THE LONG RUN

Where are we?

- Firm's supply curve in the short run
  - Profit-maximizing *Q* in the short run as a function of market price
- Short-run market supply curve
- Short-run equilibrium
- Firm's supply curve in the long run
  - Profit-maximizing *Q* in the long run as a function of market price
- Long-run equilibrium
- Long-run market supply curve

Part 1

Long-Run Equilibrium

Long-Run Decisions

- Production
  - If the firm stays in the industry or if the potential entrant enters the industry, what is the optimal output level?
- Entry
  - Potential entrants decide whether to enter the market by starting new firms
- Exit
  - Existing firms decide whether to completely withdraw capacity

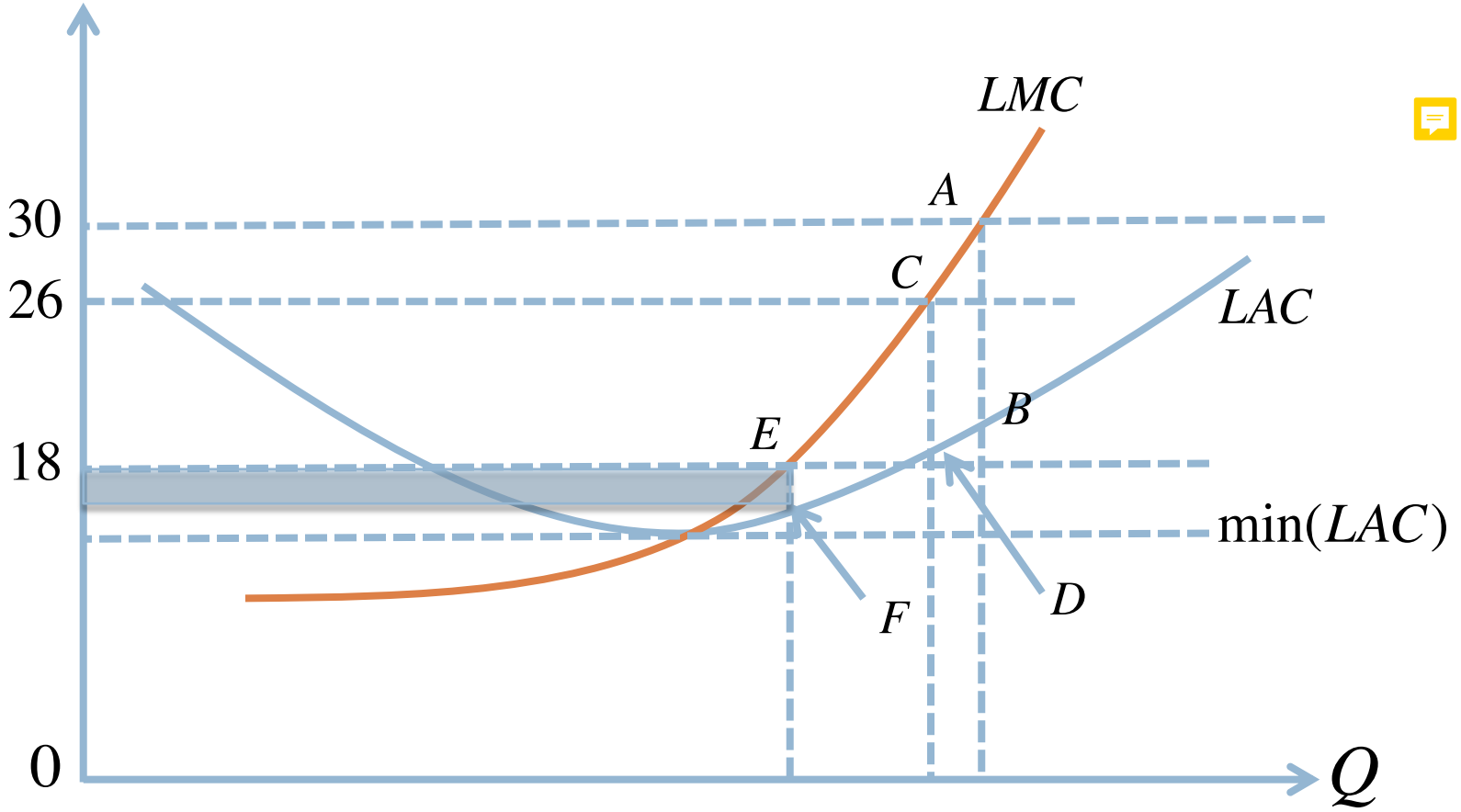
Profit-Maximizing Condition: Marginal Revenue Equals Long-Run Marginal Cost

- Long-run profit maximizing output choice is
  - $MR=P=LMC$
- If $P>LMC$
  - Producing too little
  - Adjust both K and L to increase Q
- If $P<LMC$
  - Producing too much
  - Adjust both K and L to decrease Q

Individual Firm: Incentive for Entry

- If market price is such that
  - If enters, the firm can make positive profit
  - There is incentive for entry
- When are firms making positive profit?
  - When *TR>LTC*
  - Or equivalently when *P>LAC*
  - But can we say more?

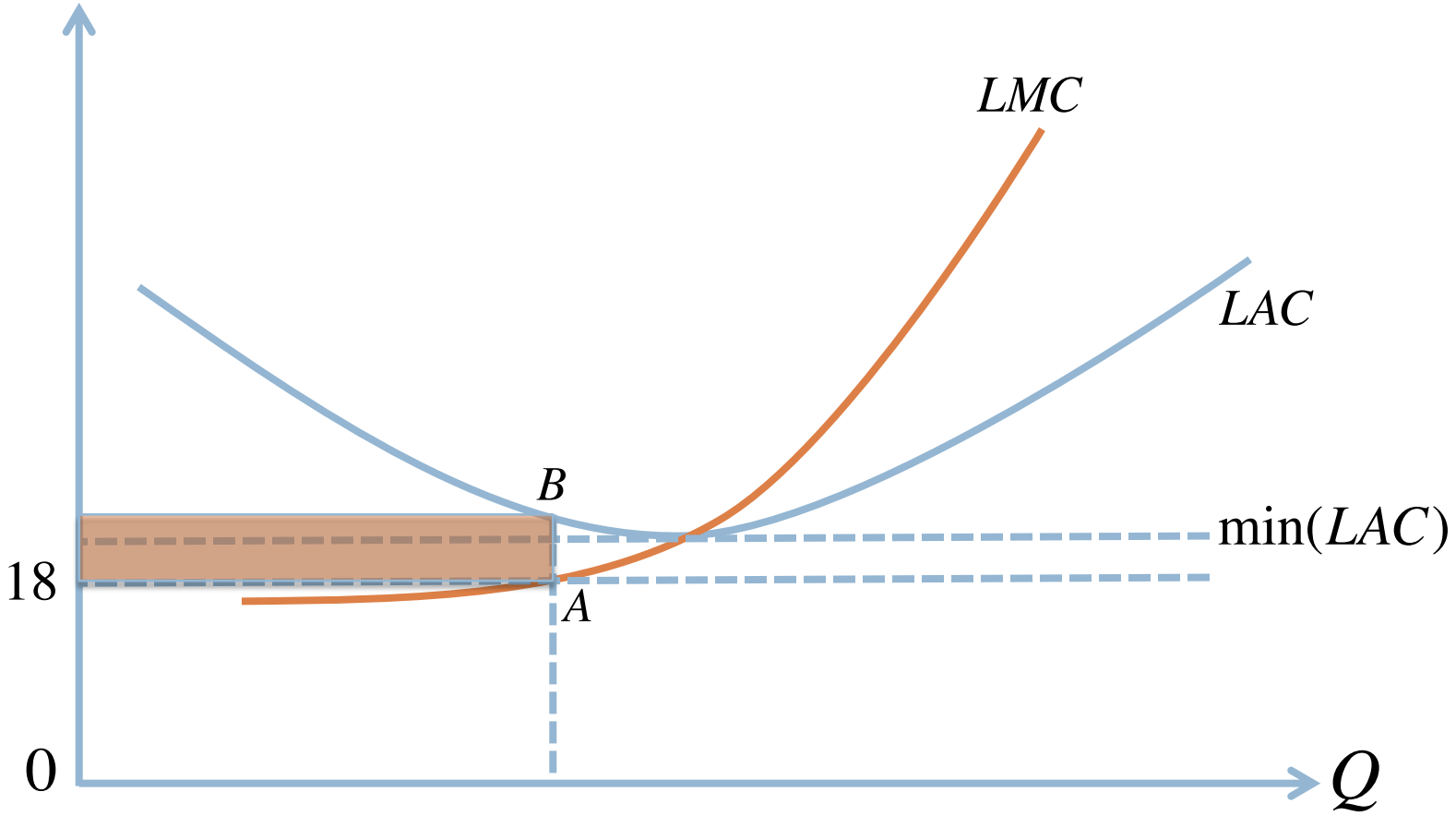
Incentive for Entry: *P*>min(*LAC*)



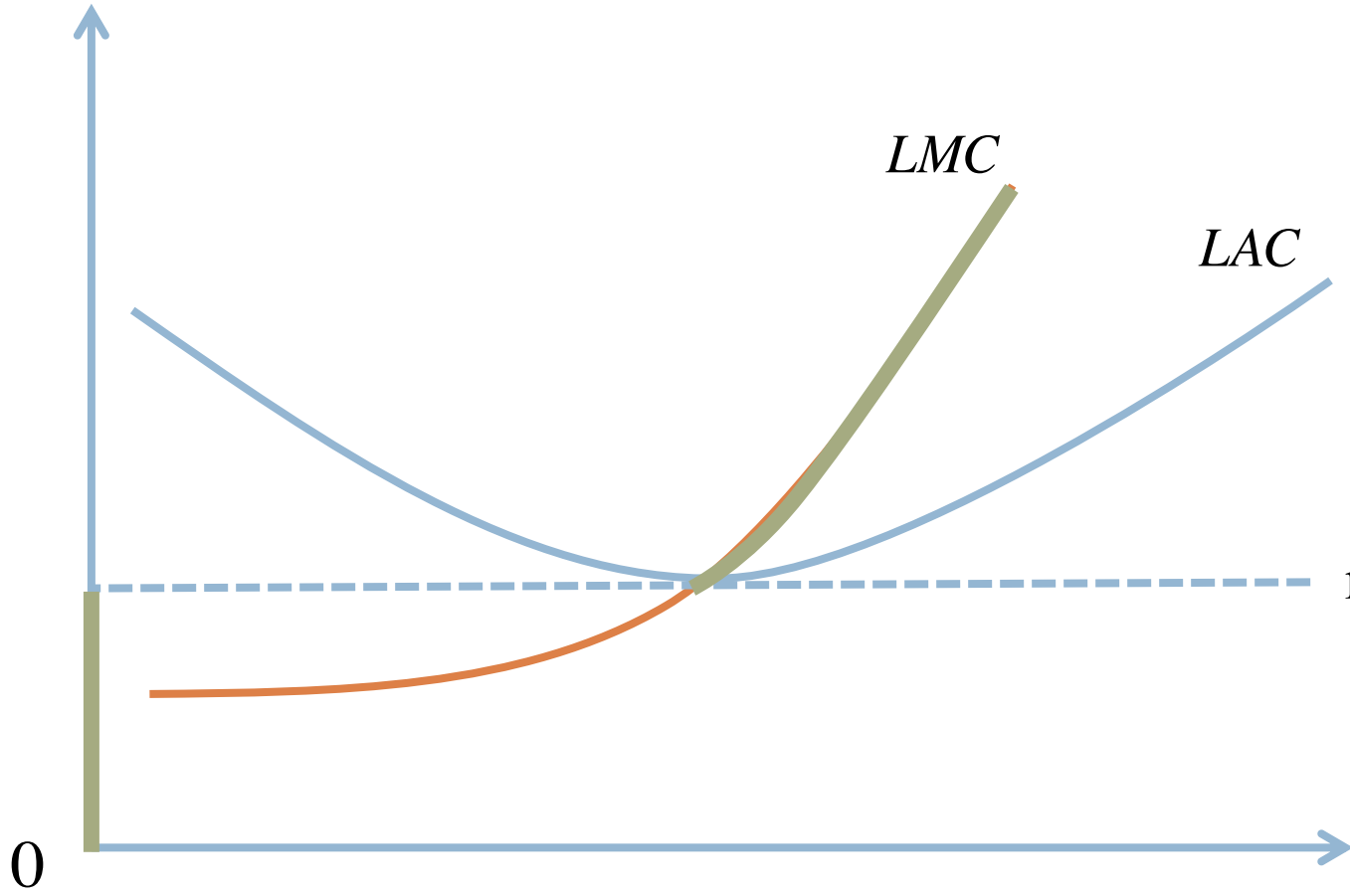
Individual Firm: Incentive for Exit

- If market price is such that
  - Existing firms are making negative profit
  - There is incentive for exit
- When are existing firms making negative profit?

Incentive for Exit: *P*<min(*LAC*)



Individual Firm's Long-Run Supply Curve



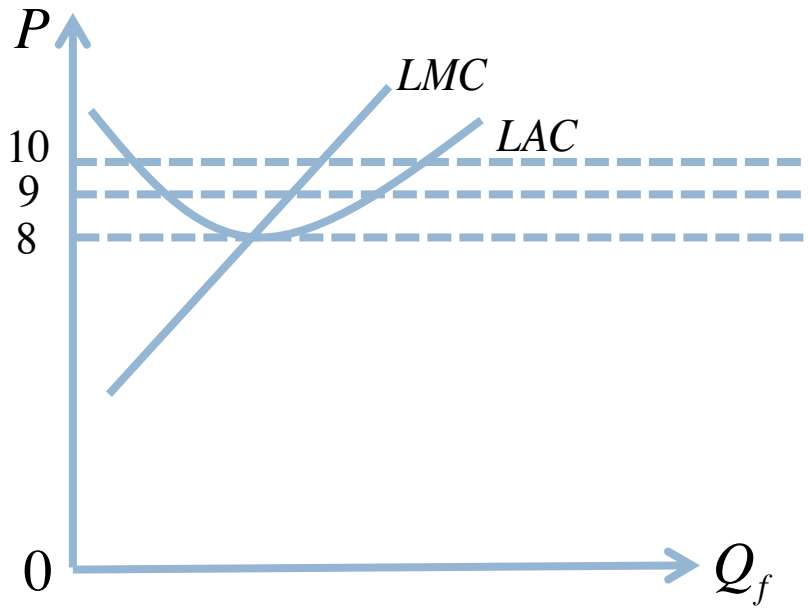
Definition 11.1 The *long-run supply curve for an individual firm* is the profit-maximizing quantity for the firm in the long run as a function of the market price

Market: Entry, Supply Curve, and Price

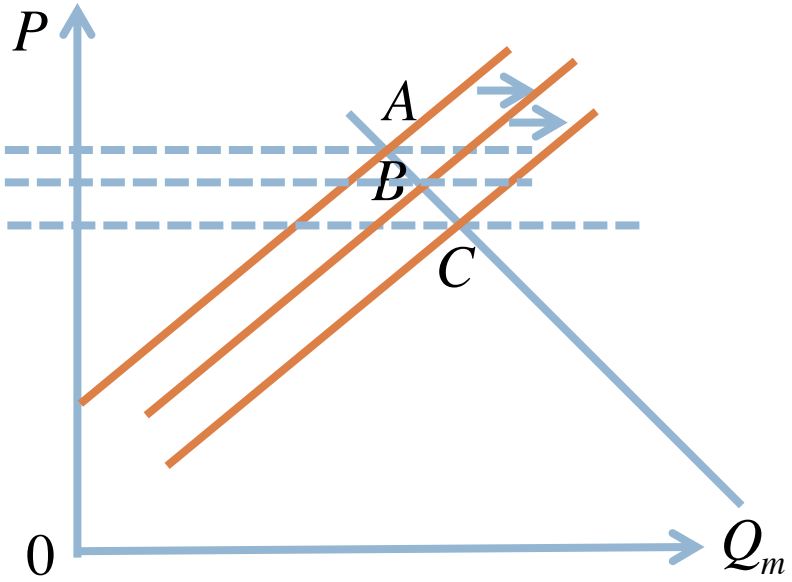
- Assume all firms are identical
- What happens when new firms start to enter the market?
- More firms in the market
- Short-run market supply curve will shift to the right
- Market price will

Entry stops when *P*=min(*LAC*)

Typical Firm's Cost and Supply



Market Supply and Demand

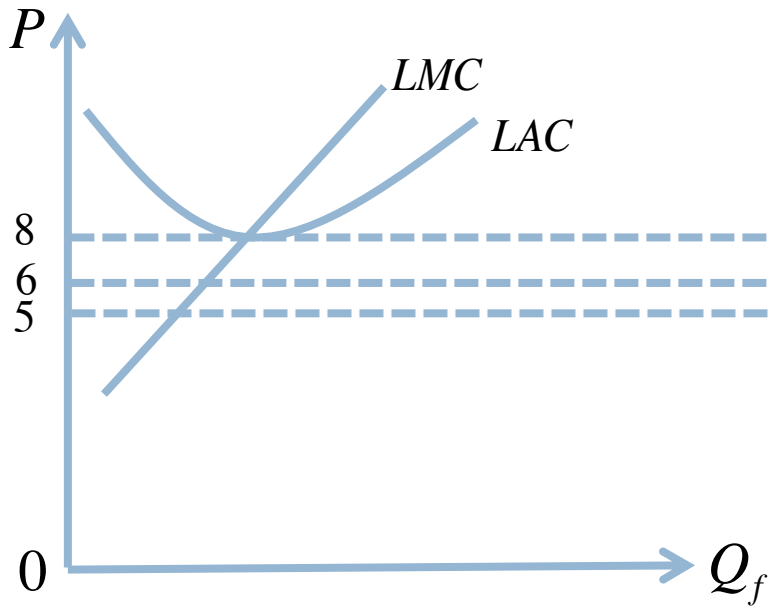


Market: Exit, Supply Curve, and Price

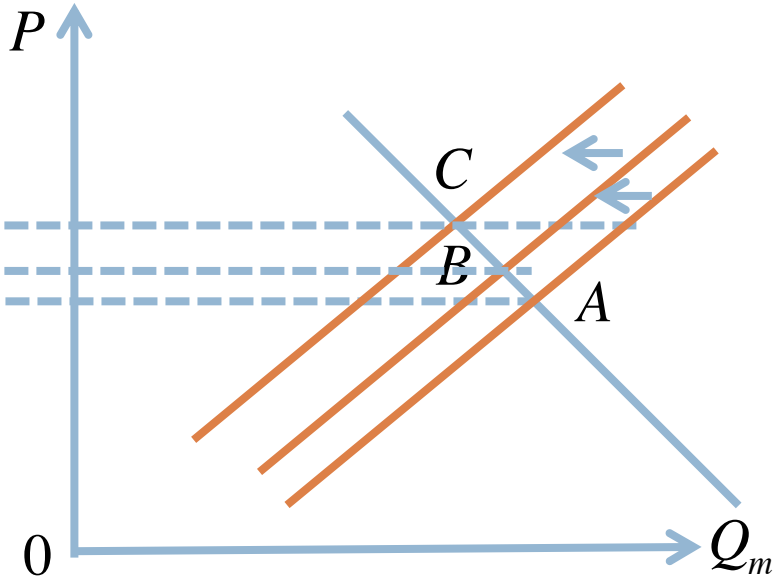
- What happens when existing firms start to exit the market?
- Fewer firms in the market
- Short-run market supply curve will shift to the left
- Market price will

Exit stops when *P*=min(*LAC*)

Typical Firm's Cost and Supply



Market Supply and Demand



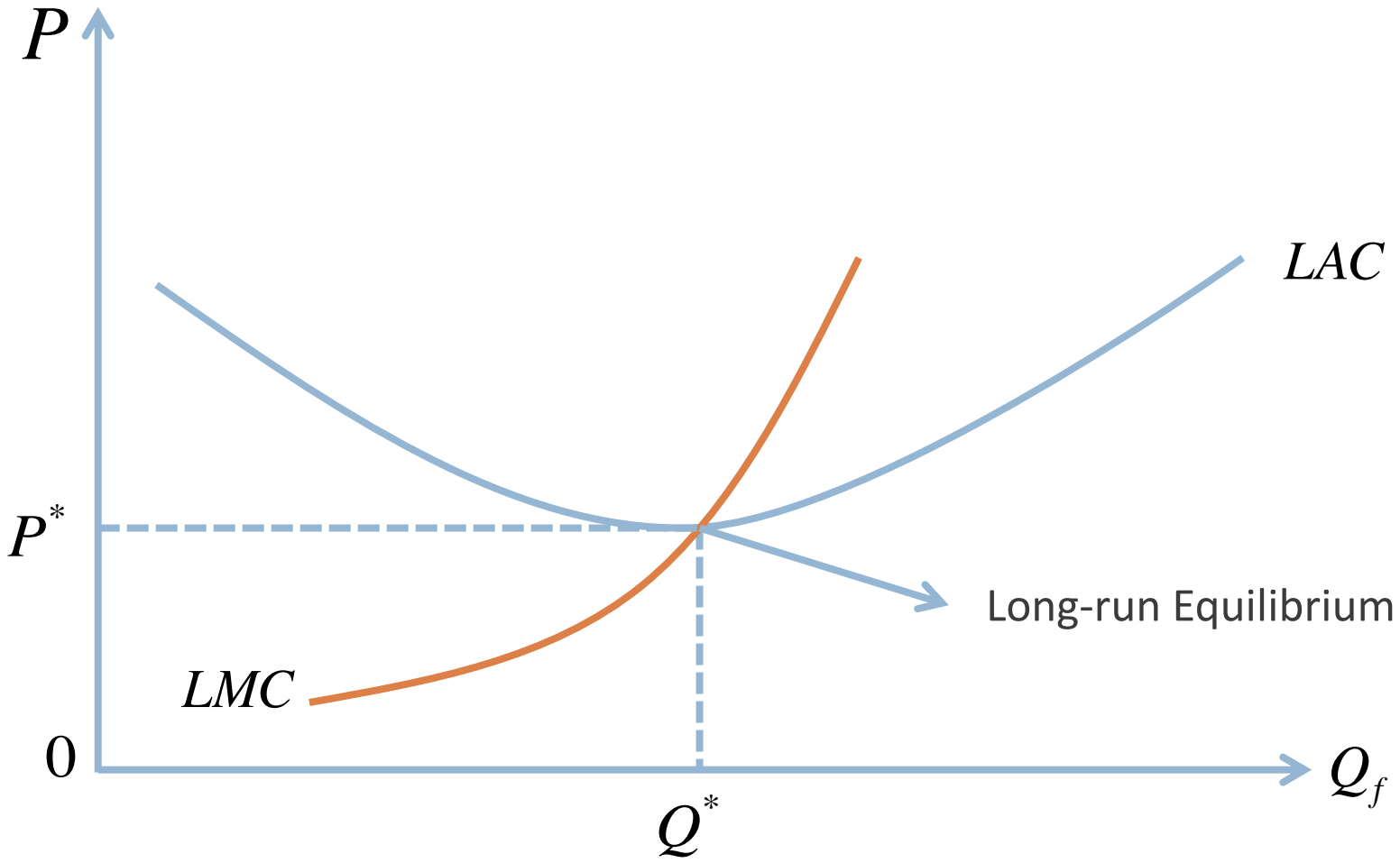
Long Run Market Equilibrium

- Definition 11.2 At the *long-run market equilibrium* in a competitive market
  - No existing firm has an incentive to exit the market
  - No potential entrant has an incentive to enter the market
  - Total quantity demanded equals total quantity supplied
  - Each firm produces at the profit-maximizing output level given the equilibrium price
  - Each consumer buys the utility-maximizing quantity given the equilibrium price

Implication of Long-Run Equilibrium

- No incentive to enter
  - $P <= \min(LAC)$
- No incentive to exit
  - $P >= \min(LAC)$
- Long-run equilibrium price
  - $P^* = \min(LAC)$
- Long-run equilibrium output for each firm
  - $P^* = LMC(Q^*) = \min(LAC) = LAC(Q^*)$
- Long-run equilibrium profit for each firm
  - $[P^* - LAC(Q^*)]Q^* = 0$!

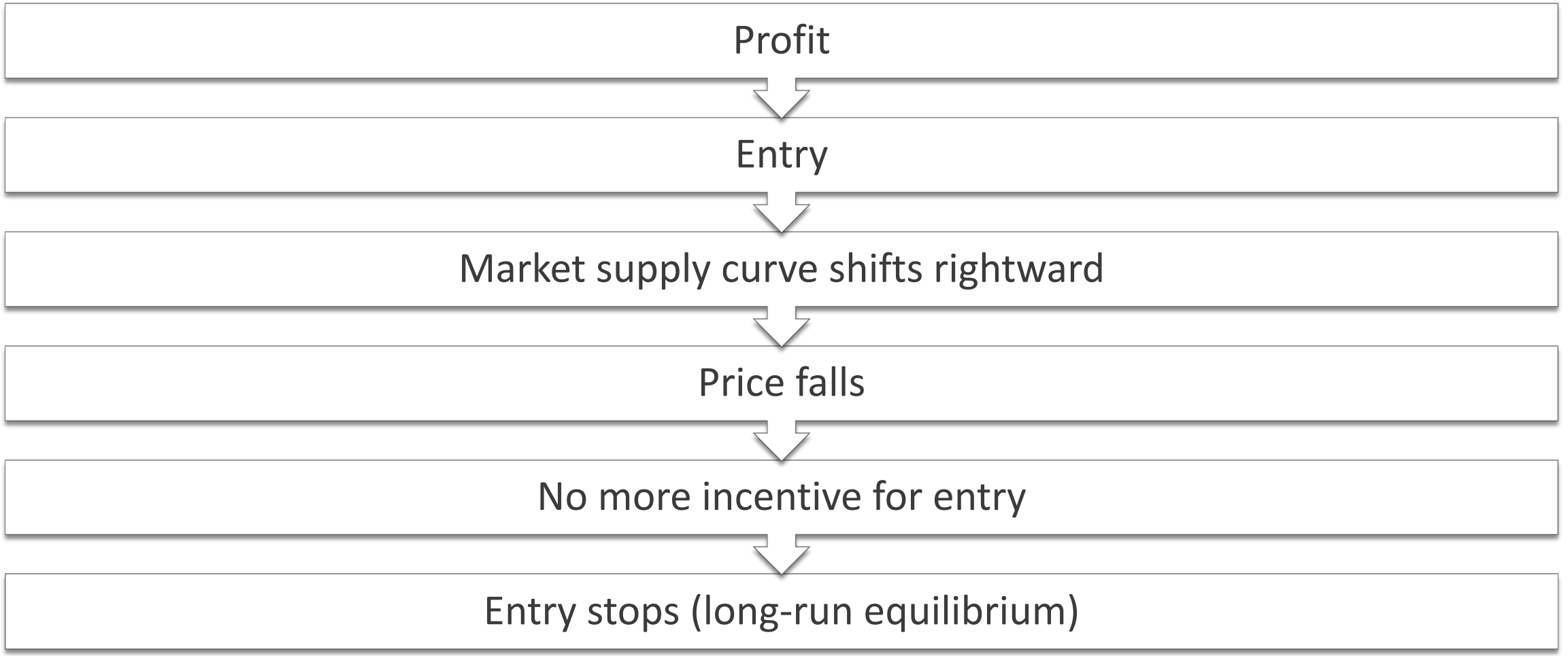
Long-run Equilibrium in Graph



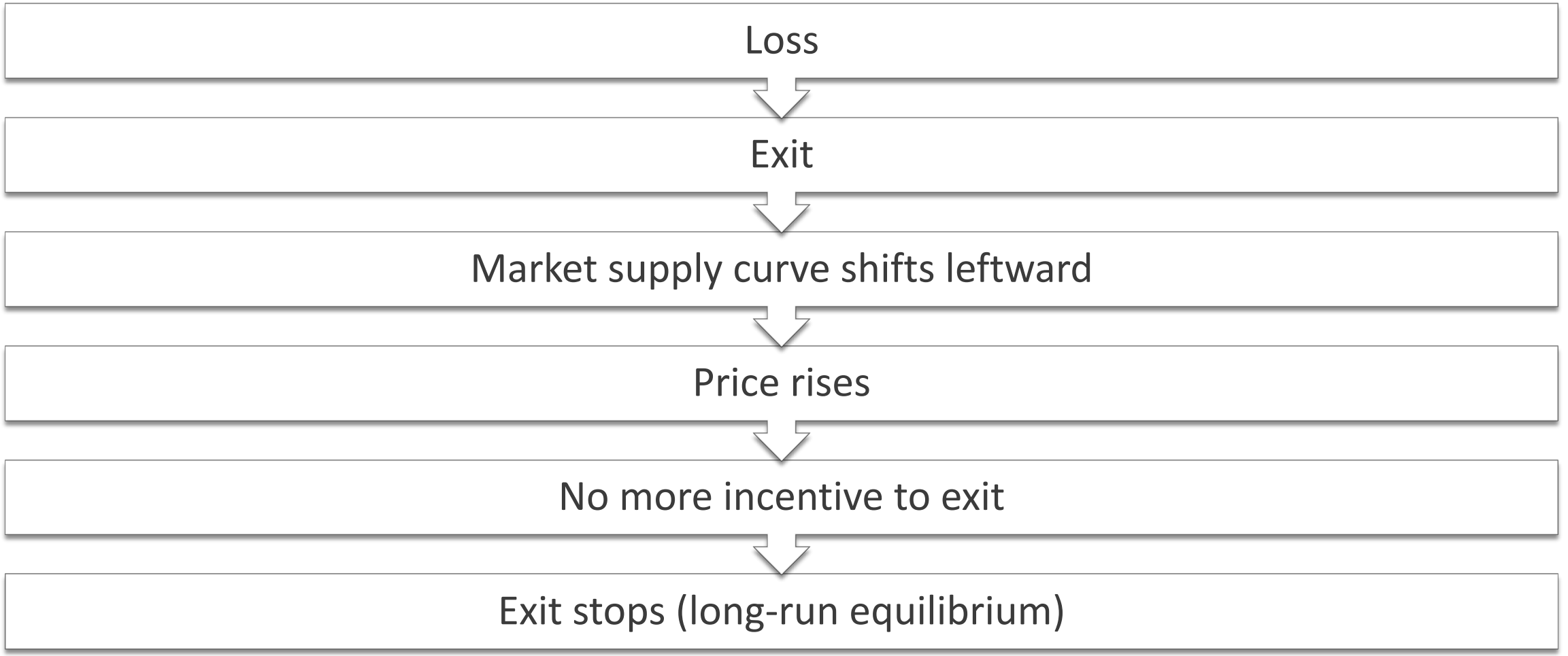
Number of Firms in Equilibrium

- Number of firms is not fixed in the long run
  - Entry and exit are possible
- Number of firms in the long-run equilibrium can be determined
  - Suppose the long-run equilibrium price is 10
  - Given this price, each firm produces 5 units
  - Given this price, the total quantity demanded in the market is 80
  - There are 80/5=16 firms in the long-run equilibrium

Long-Run Dynamic: Entry



Long-Run Dynamic: Exit



Economic Profit: An Example

- Suppose you own and run a small software development firm
- In 2019 your total revenue=$400,000
- Your incurred a cost of $250,000 for
  - wages paid to workers, supplies, rents, utilities, and etc.
- The amount of money you made is
  - $400,000-$250,00=$150,000

Economic Profit: An Example Cont'

- Your best alternative is to work for Google for $150,000 per year
- Your total economic cost is
  - $250,000+$150,000=$400,000
- Your economic profit is
  - $400,000-$400,000=$0
- By operating your own firm, you are making the same amount of money as you could have made had you worked for Google

How to interpret economic profit?

- Zero economic profit
  - All resources (entrepreneur's time, assets, capital) are getting a return equivalent to the best returns they could get elsewhere
- Positive economic profit
  - The business is delivering returns above and beyond the returns from the best alternative
- Negative economic profit
  - The resources could be used somewhere else to generate higher returns

What does long-run equilibrium tell us?

- In long-run equilibrium all firms earn zero profit
- Free entry and exit eventually drives profit down to 0
  - Economic profit will not last in perfectly competitive market
- But market is not always in long-run equilibrium!
  - Positive profit is possible in the short run

Part 2

Long-Run Market Supply Curve

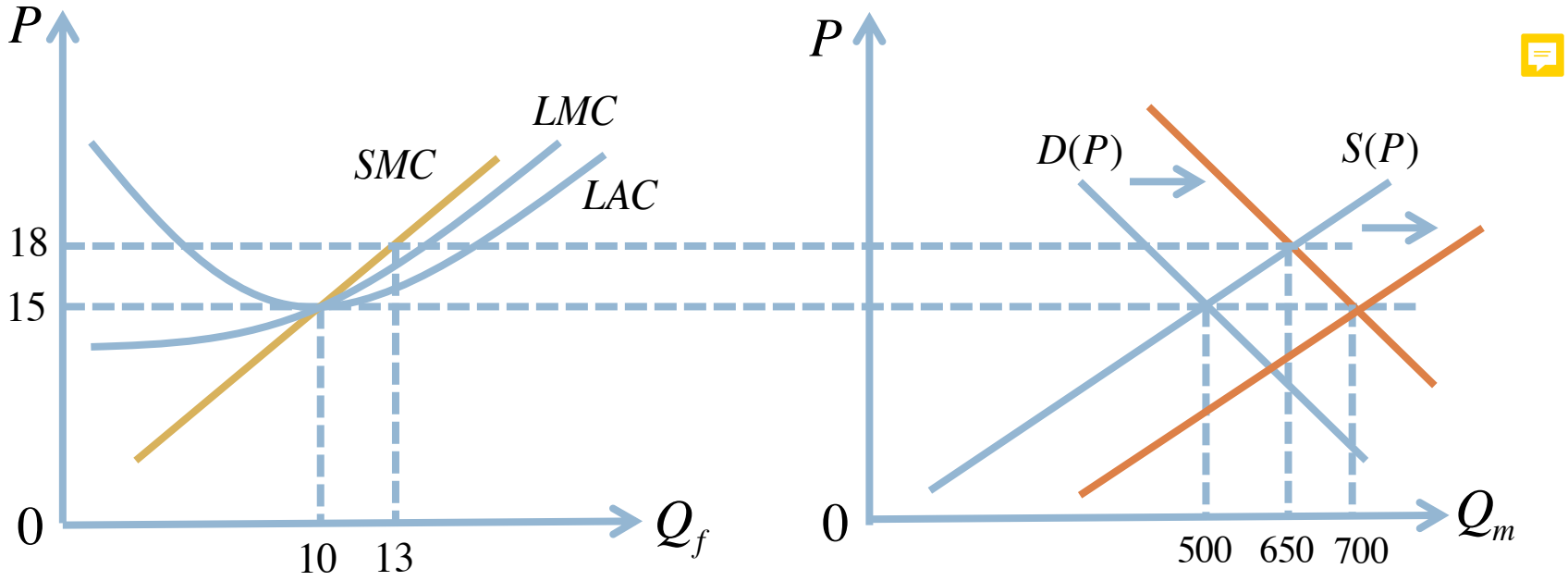
Input Prices in the Long Run

- Definition 11.3 *Constant-cost industry*
  - Changes in industry output does not affect input prices in the long run
- Definition 11.4 *Increasing-cost industry*
  - Increase in industry output causes the prices of inputs to rise in the long run
  - Decrease in industry output causes the prices of inputs to drop in the long run
- Definition 11.5 *Decreasing-cost industry*
  - Increase in industry output causes the prices of inputs to drop in the long run
  - Decrease in industry output causes the prices of inputs to rise in the long run

Constant-Cost Industry: What happens when demand increases?

Typical Firm's Cost and Supply

Market Equilibrium with 50 identical firms at the initial equilibrium



Equilibrium price increases in the short run but goes back to the same level in the long run

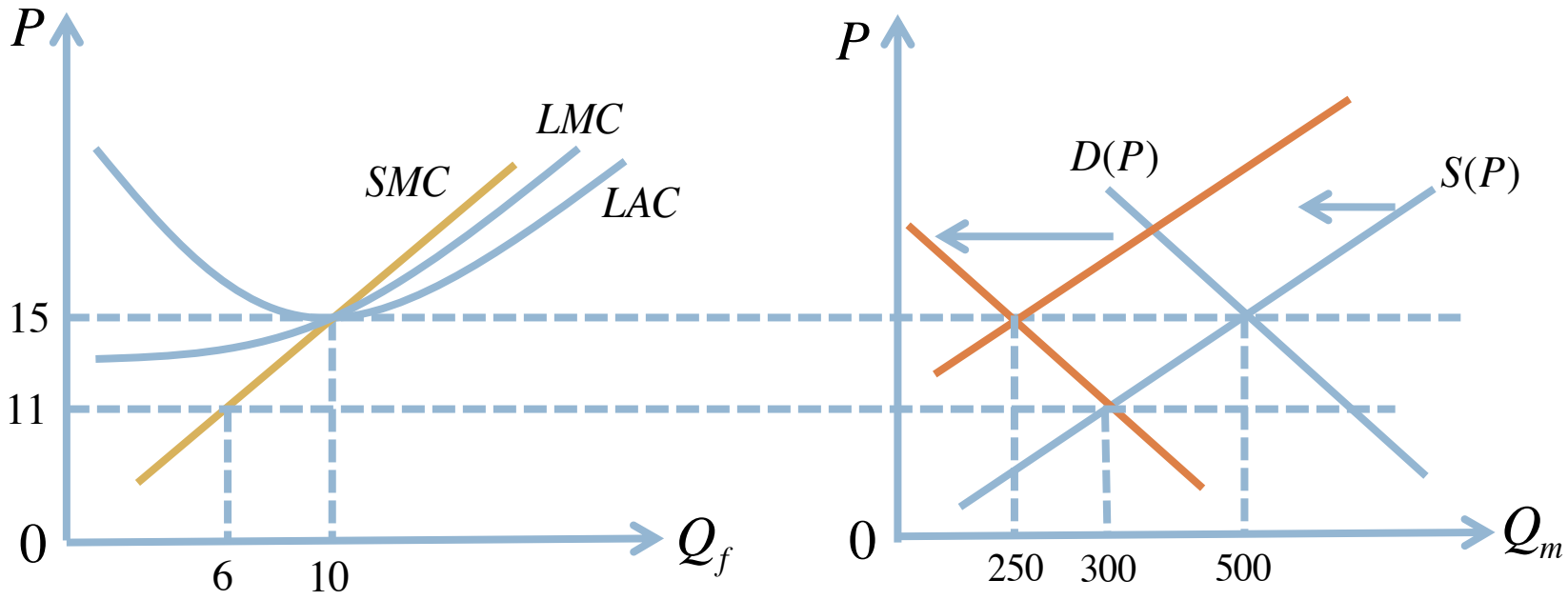
Constant-Cost Industry: Price and Quantity Dynamics after Permanent Increase in Demand

	Before demand increase	After demand increase	
	Long-run equilibrium	Short-run equilibrium	Long-run equilibrium
Price	15	18	15
Total quantity	500	650	700
Each firm's output	10	13	10
Number of firms	50	50	70

Constant-Cost Industry: What happens when demand decreases?

Typical Firm's Cost and Supply

Market Equilibrium with 50 identical firms at the initial equilibrium



Equilibrium price decreases in the short run but goes back to the same level in the long run

Constant-Cost Industry: Price and Quantity Dynamics after Permanent Decrease in Demand

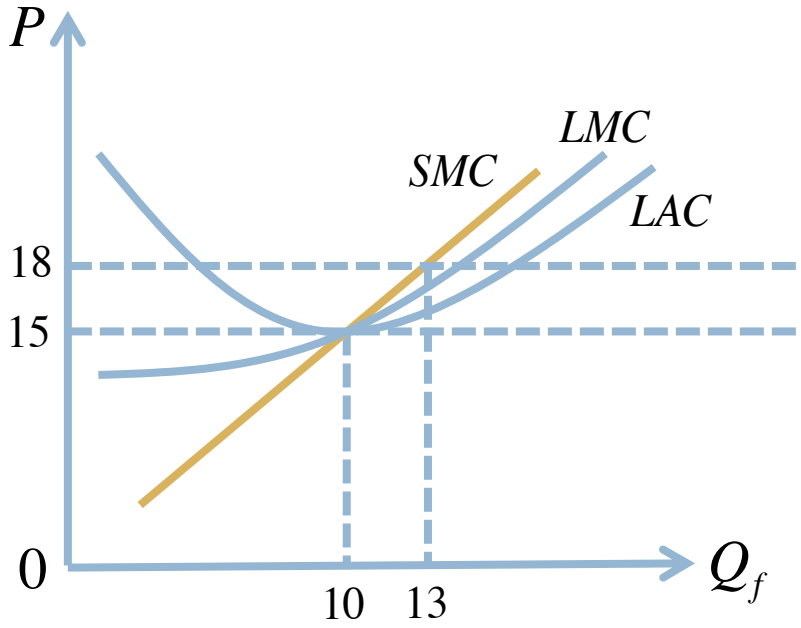
	Before demand decrease	After demand decrease	
	Long-run equilibrium	Short-run equilibrium	Long-run equilibrium
Price	15	11	15
Total quantity	500	300	250
Each firm's output	10	6	10
Number of firms	50	50	25

What is the long-run market supply curve?

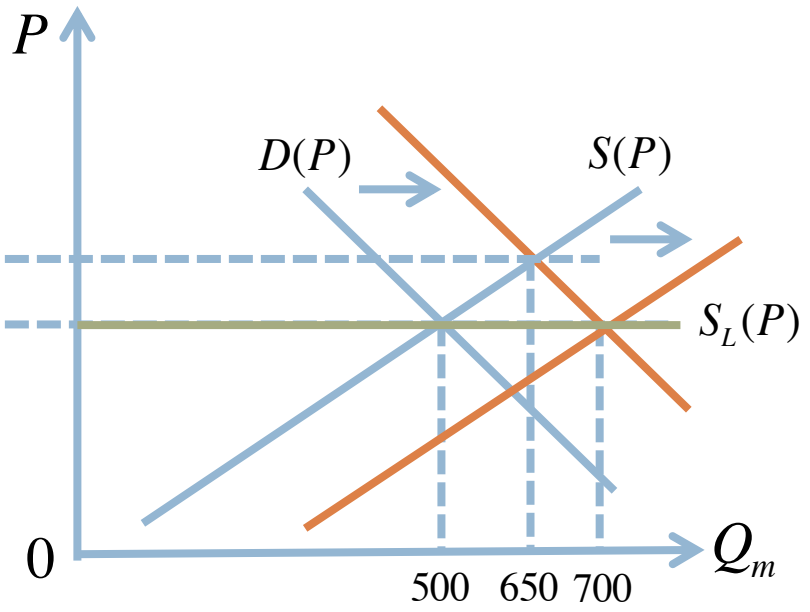
- How to get long-run market supply curve?
  - Set of firms in the market is not fixed in the long run
  - Number of firms can only be determined in long-run equilibrium
- Long-run market supply curve describes the relationship between price and total quantity in long-run equilibrium
- Definition 11.6 *Long-run market supply curve*
  - Total quantity supplied in long-run equilibrium as a function of long-run equilibrium price

Long-Run Market Supply Curve in a Constant-Cost Industry

Typical Firm's Cost and Supply

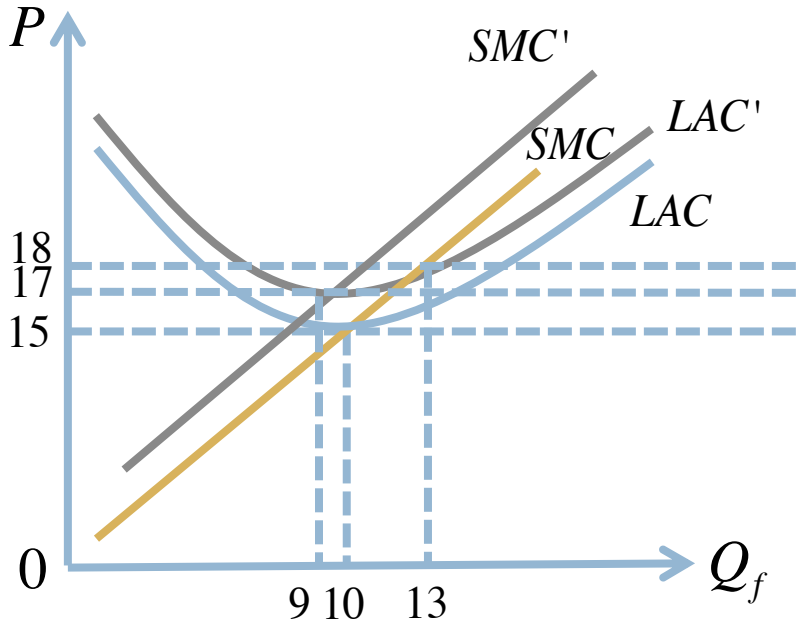


Market Equilibrium with 50 identical firms at the initial equilibrium

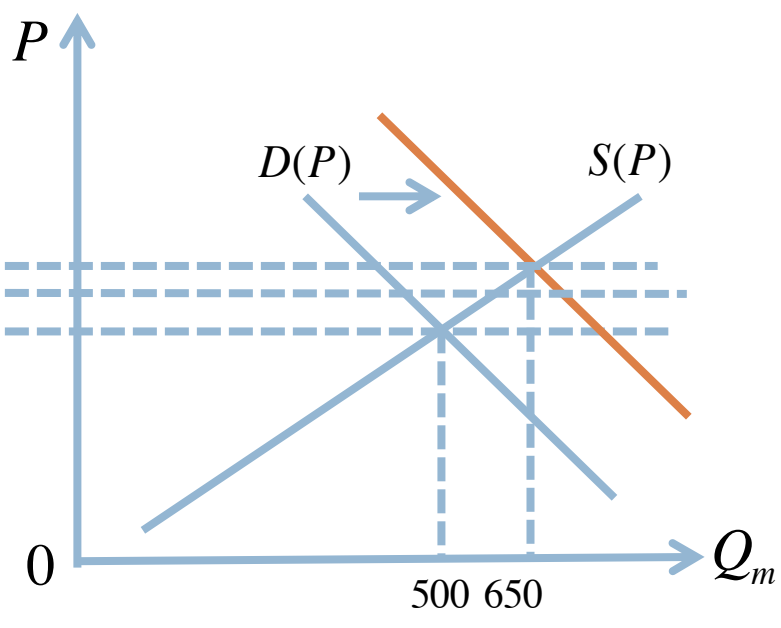


Long-Run Market Supply Curve in an Increasing-Cost Industry

Typical Firm's Cost and Supply

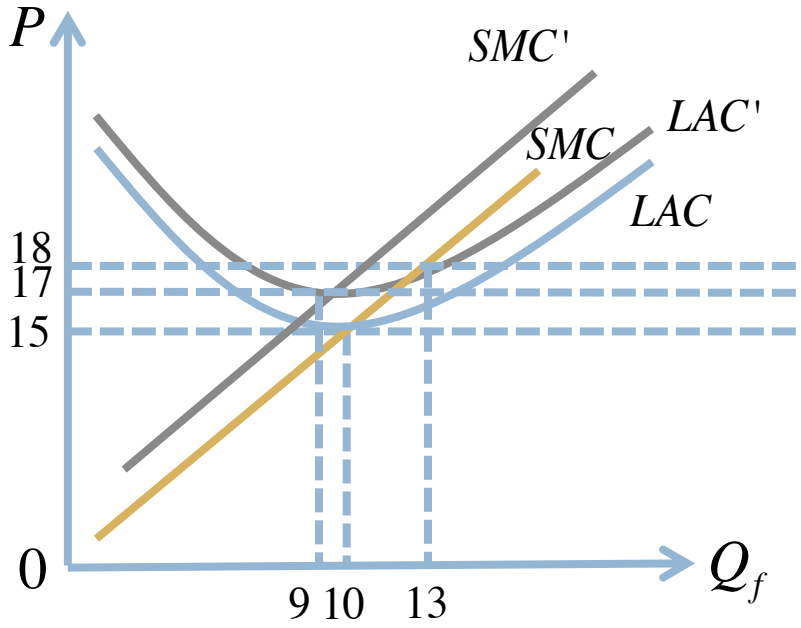


Market Equilibrium with 50 identical firms at the initial equilibrium

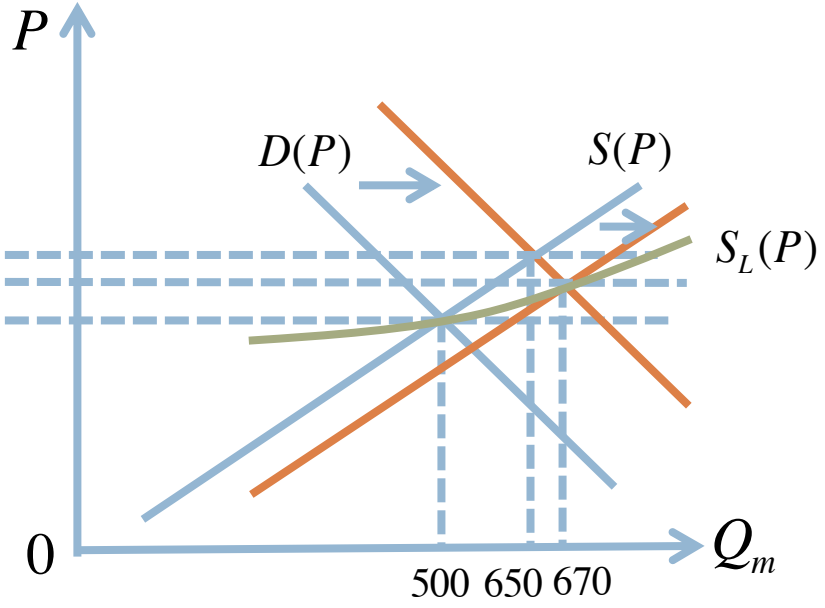


Long-Run Market Supply Curve in an Increasing-Cost Industry Cont'

Typical Firm's Cost and Supply

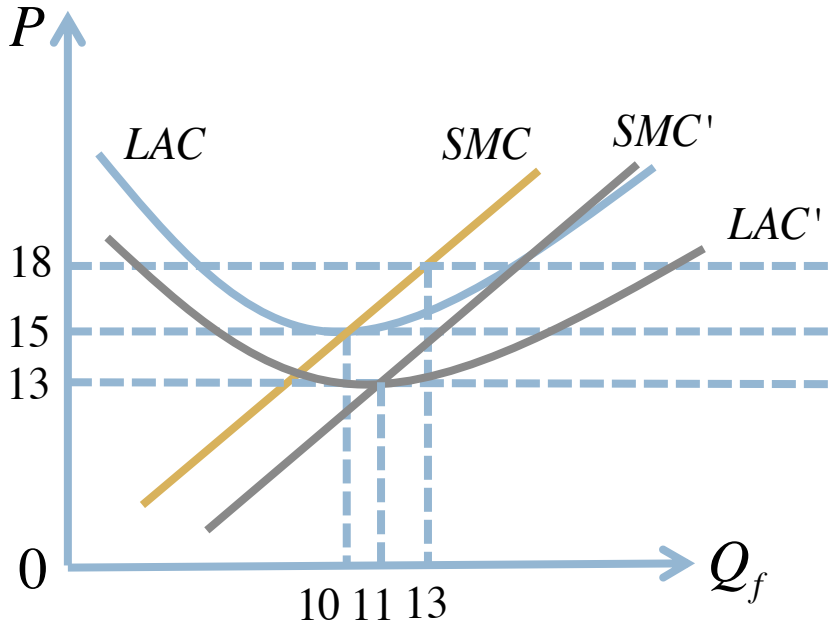


Market Equilibrium with 50 identical firms at the initial equilibrium

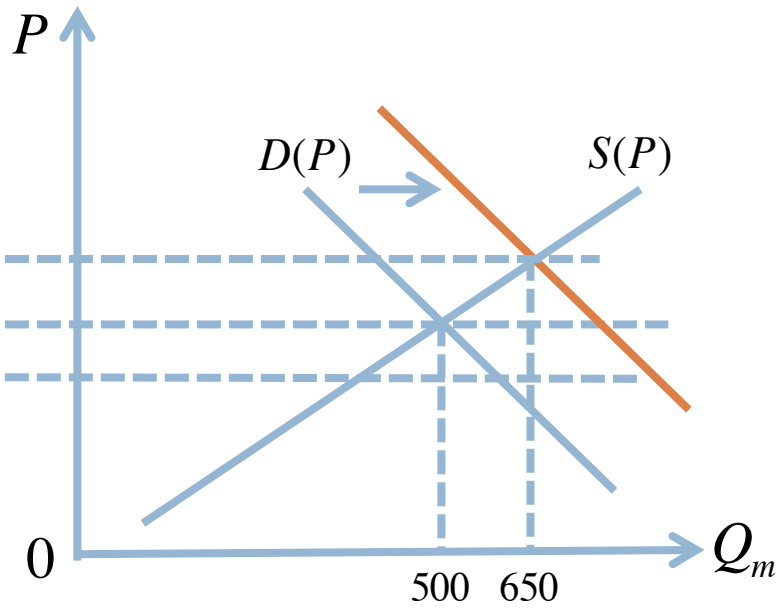


Long-Run Market Supply Curve in a Decreasing-Cost Industry

Typical Firm's Cost and Supply

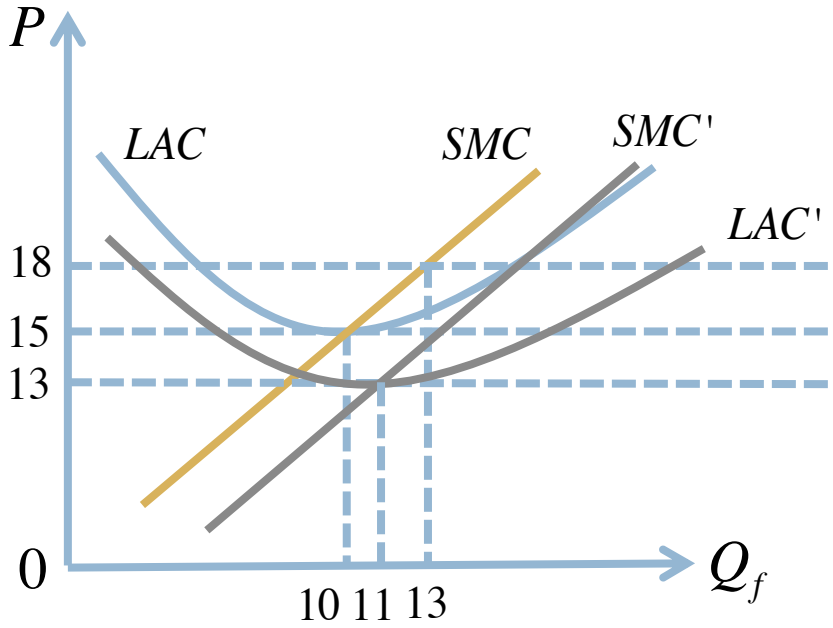


Market Equilibrium with 50 identical firms at the initial equilibrium

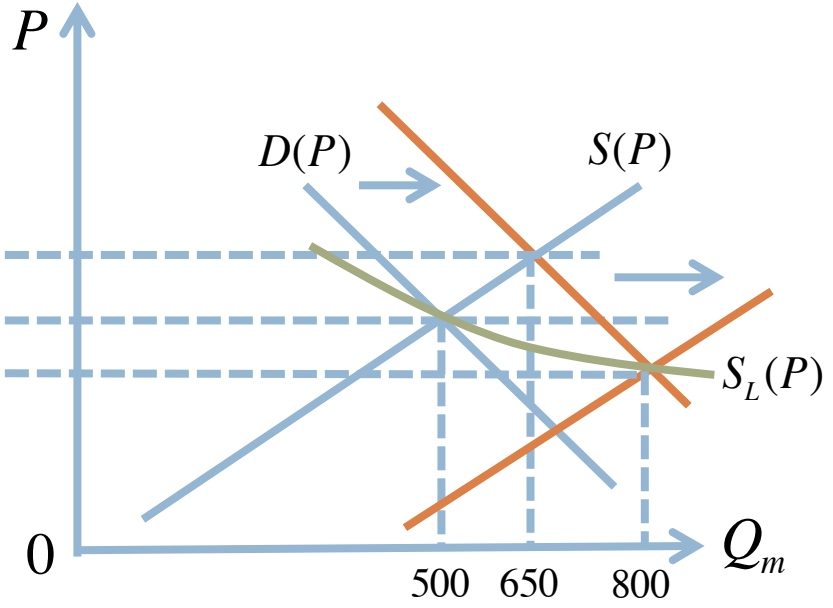


Long-Run Market Supply Curve in a Decreasing-Cost Industry Cont'

Typical Firm's Cost and Supply



Market Equilibrium with 50 identical firms at the initial equilibrium



Types of Industry and Long-Run Market Supply Curve

- Constant-cost industry
  - An industry in which long-run market supply curve is horizontal
- Increasing-cost industry
  - An industry in which long-run market supply curve is upward sloping
- Decreasing-cost industry
  - An industry in which long-run market supply curve is downward sloping

Short Run vs. Long Run

	In Short-run Equilibrium	In Long-run Equilibrium
Equilibrium price	Determined by $D(P^*)=S(P^*)$	$P^*=\min(LAC)$
Firm's supply	$P^*=SMC(Q_f^*)$	$P^*=LMC(Q_f^*)$
Number of firms	Fixed	Determined by $D(P^*)/Q_f^*$
Profit	Could be positive, negative, or 0	0