EC2101: Microeconomic Analysis I

Lecture 11

Perfect Competition

- Perfect Competition in the Long Run
  - LR Supply Curve
  - LR Market Equilibrium
  - LR Market Supply Curve
  - Economic Rent

Long-Run Supply Curve

Long-Run Decisions

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

Profit-Maximizing Condition

- The firm's long-run profit-maximizing output choice is:

$$MR = LRMC$$

- In a perfectly competitive market, since $MR = p$,

$$p = LRMC$$

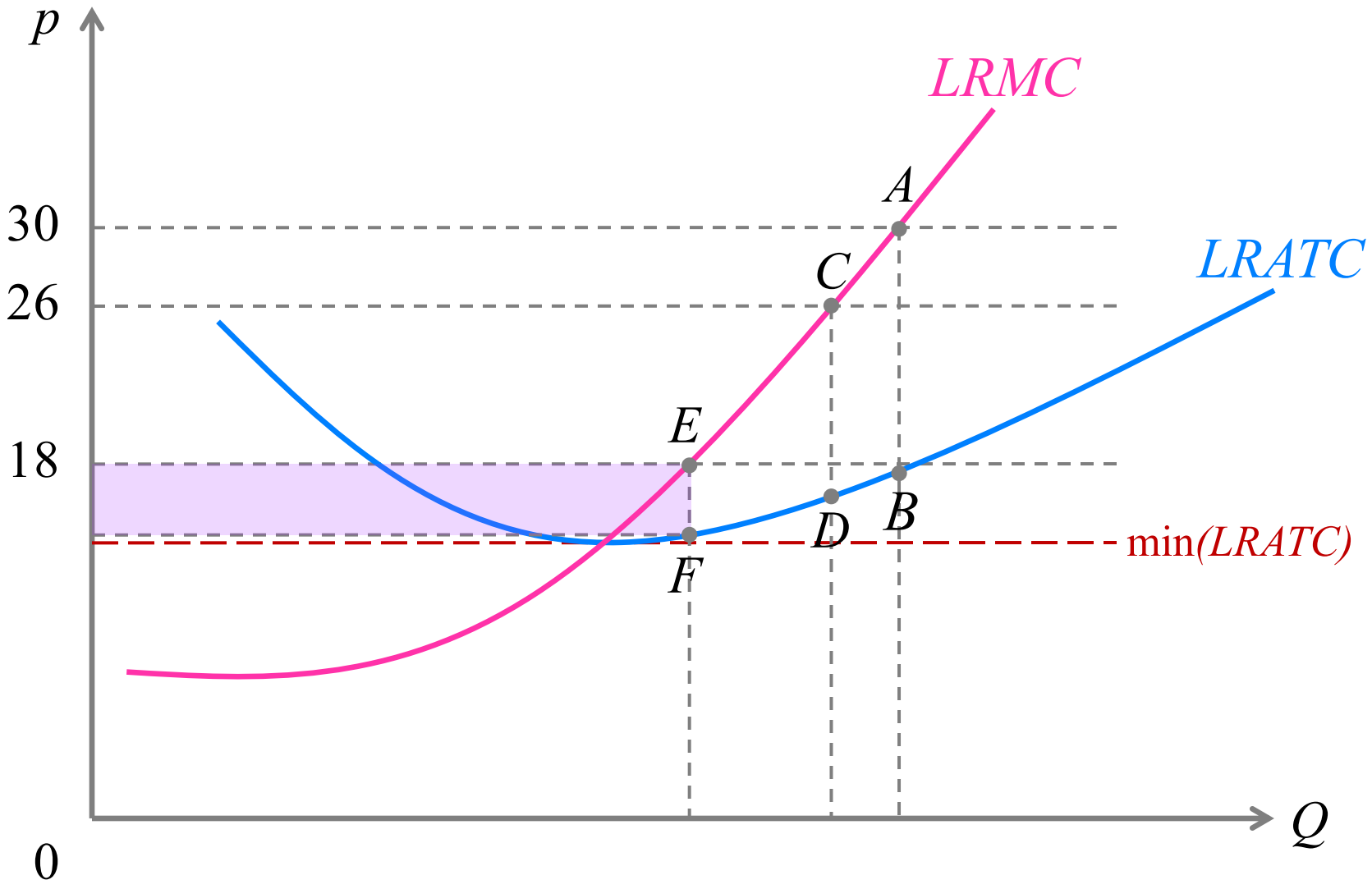
Profit-Maximizing Condition

- If $p > LRMC$:
  - Marginal revenue is greater than marginal cost.
  - The firm should increase Q by adjusting L and K.
- If $p < LRMC$:
  - Marginal cost is greater than marginal revenue.
  - The firm should decrease Q by adjusting L and K.

Individual Firm: Incentive for Entry

- Suppose the market price is such that a firm that enters the market can make positive profit.
  - Then there is incentive for entry.
- When are firms making positive profit?
  - When $TR > LRTC$.
  - Or equivalently when $p > LRATC$.
  - But can we say more?

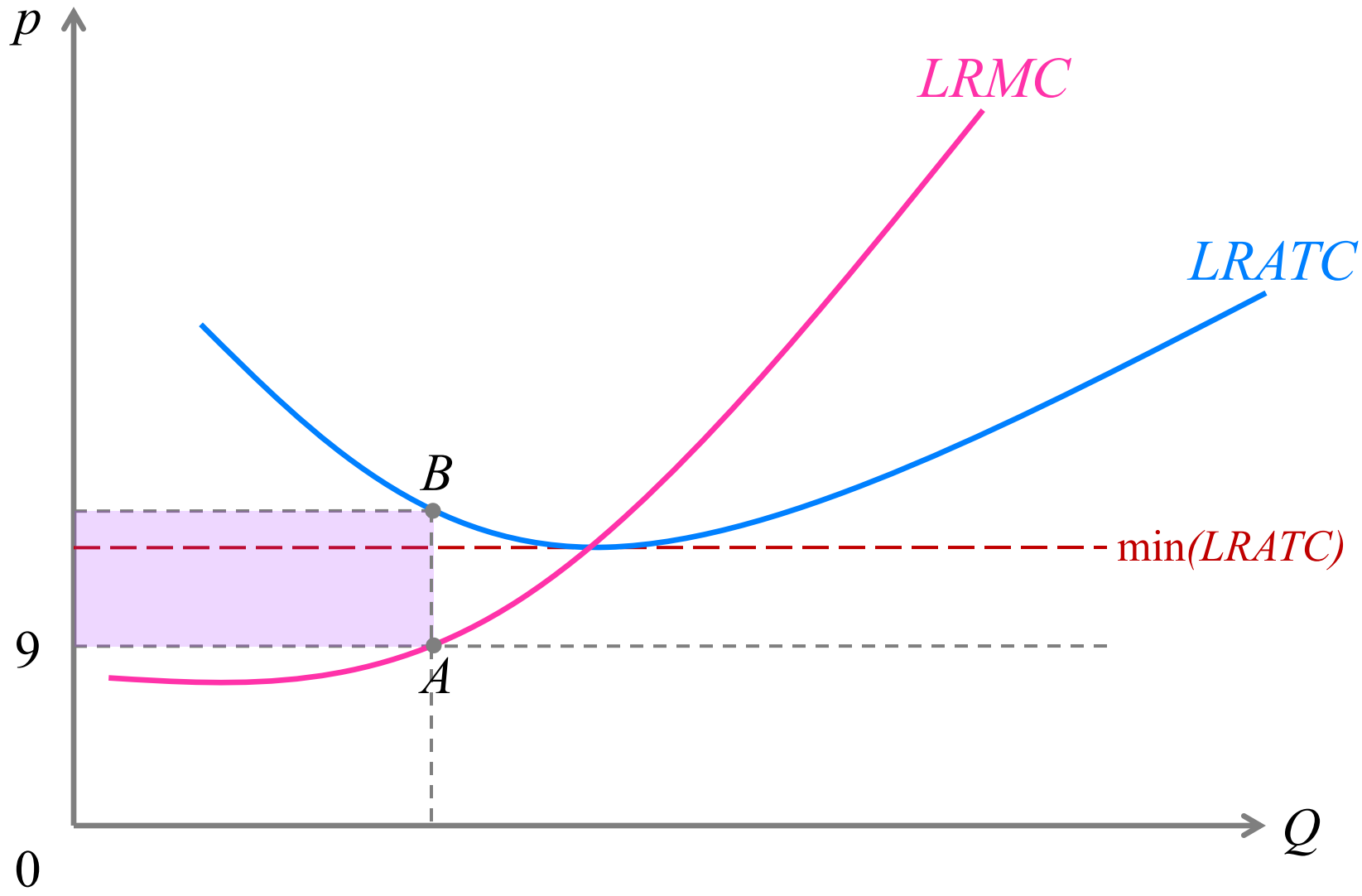
Incentive for Entry: $p > \min(LRATC)$



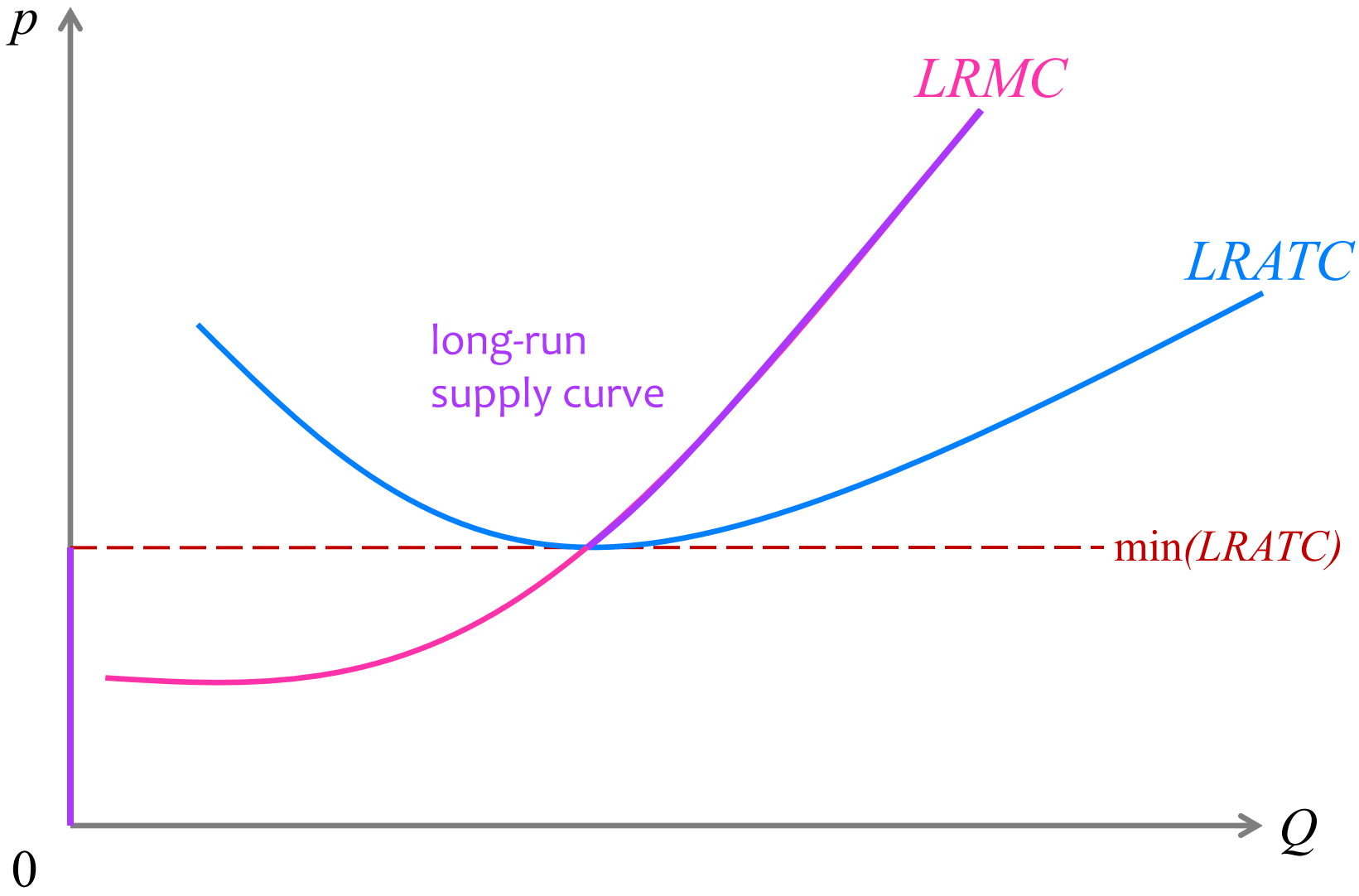
Individual Firm: Incentive for Exit

- Suppose the market price is such that existing firms are making negative profit.
  - Then there is incentive for exit.
- When are firms making negative profit?
  - When $TR < LRTC$.
  - Or equivalently when $p < LRATC$.
  - But can we say more?

Incentive for Exit: $p < \min(LRATC)$



The Individual Firm's Long-Run Supply Curve



The Individual Firm's Long-Run Supply Curve

- 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.
  - $Q_f(p)$
- When $p < \min(LRATC)$:
  - The firm chooses $Q = 0$.
  - The supply curve is the vertical axis.
- When $p \geq \min(LRATC)$:
  - The firm chooses Q such that $p = LRMC(Q)$.
  - The supply curve is the marginal cost curve.

Exercise 11.1

Short-Run vs. Long-Run Supply Curve

What is the difference between the firm's short-run supply curve and the firm's long-run supply curve?

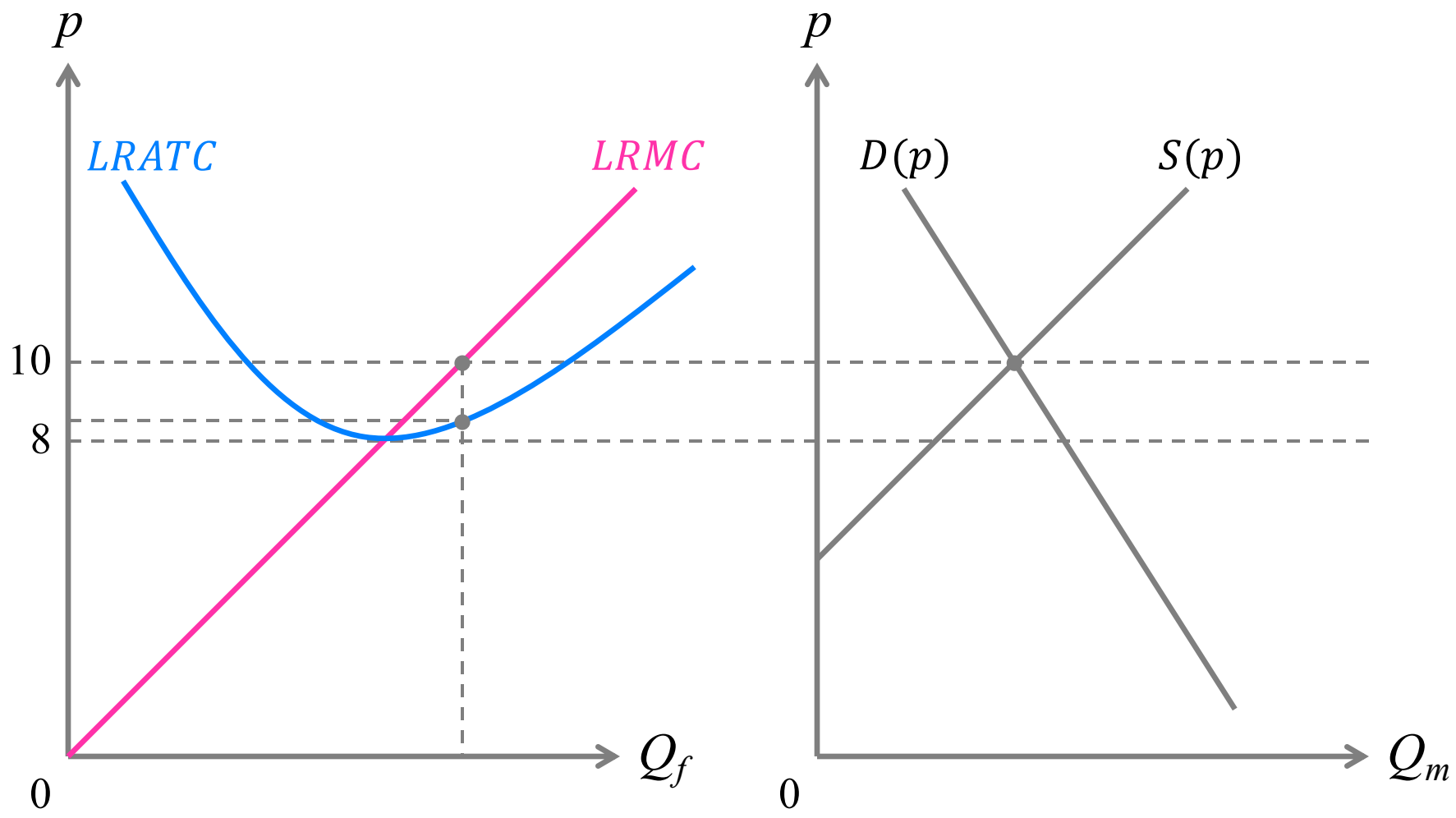
When does the firm stop producing in the short run, and when does the firm stop producing in the long run?

Long-Run Market Equilibrium

Market: Entry, Supply Curve, and Price

- Assume all firms are identical.
- Suppose new firms enter the market.
  - The number of firms in the market increases.
  - The short-run market supply curve shifts to the right.
  - The market price will fall.

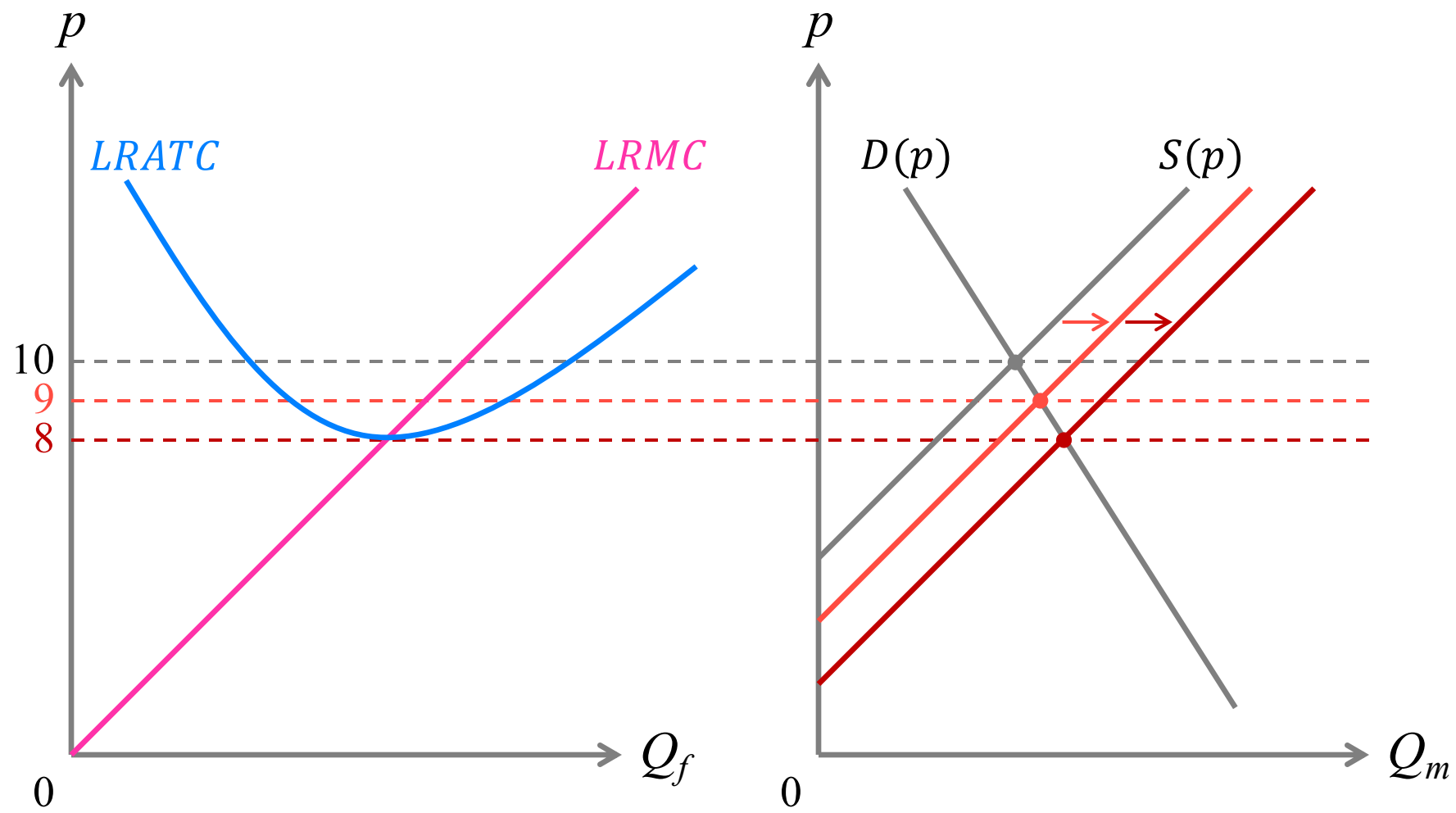
Short-Run Equilibrium at $p = 10$



Typical firm's cost and supply

Market supply and demand

Entry stops when $p = \min(LRATC)$



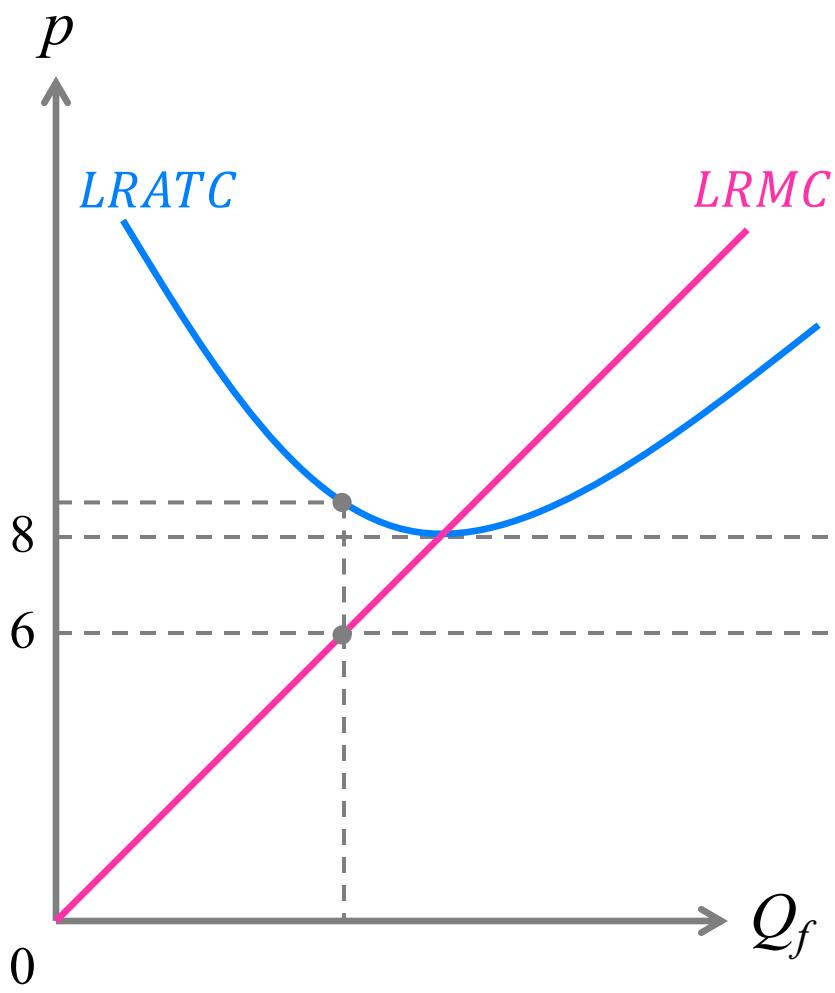
Typical firm's cost and supply

Market supply and demand

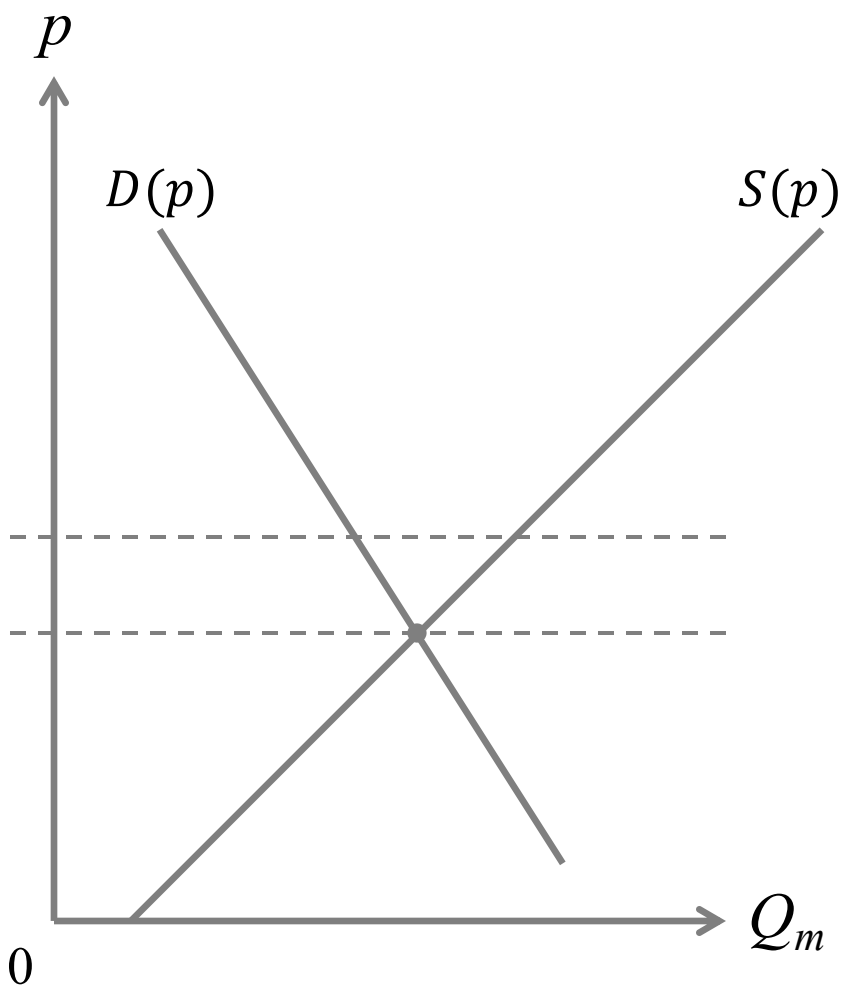
Market: Exit, Supply Curve, and Price

- Assume all firms are identical.
- Suppose existing firms exit the market.
  - The number of firms in the market decreases.
  - The short-run market supply curve shifts to the left.
  - The market price will rise.

Short-Run Equilibrium at $p = 6$

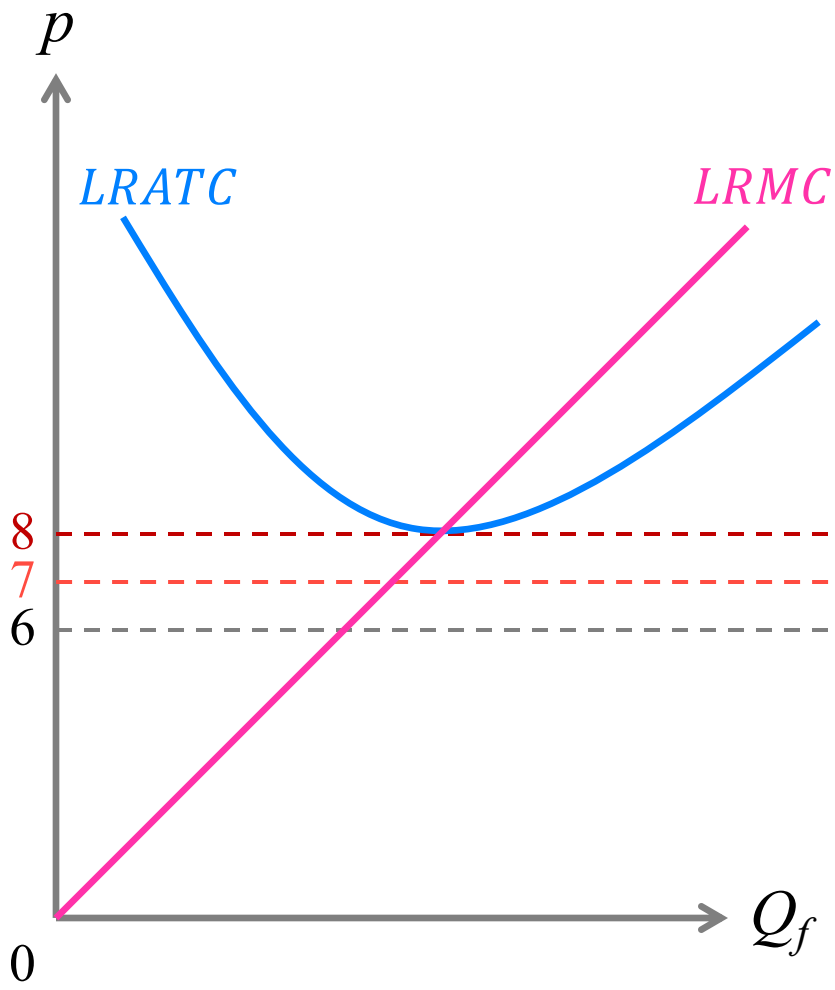


Typical firm's
cost and supply

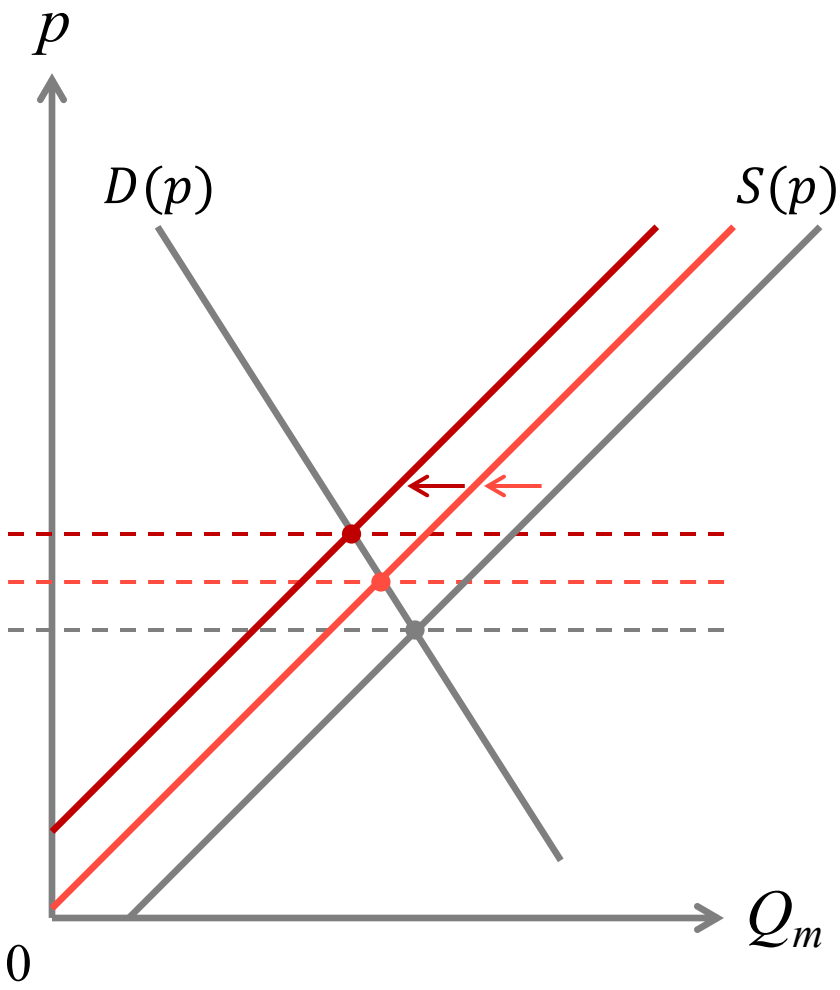


Market supply
and demand

Exit stops when $p = \min(LRATC)$



Typical firm's
cost and supply



Market supply
and demand

Long-Run Market Equilibrium

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

Long-Run Market Equilibrium: Implications

- No potential entrant has an incentive to enter the market.
  - $p \leq \min(LRATC)$
- No existing firm has an incentive to exit the market.
  - $p \geq \min(LRATC)$
- Therefore, the long-run equilibrium price is:

$$p^* = \min(LRATC)$$

Long-Run Market Equilibrium: Implications

- The long-run equilibrium price is:

$$p^* = \min(LRATC)$$

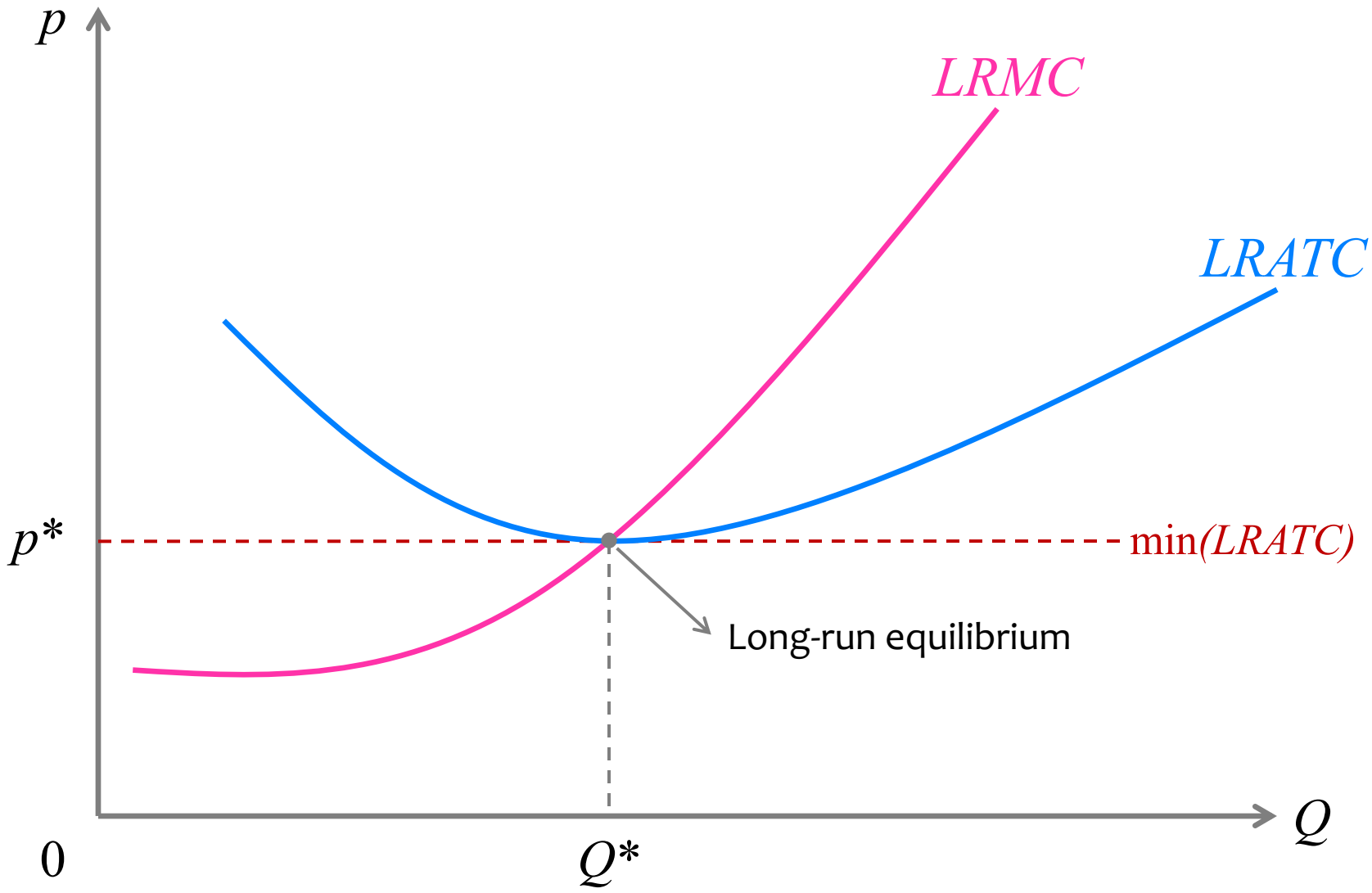
- The long-run equilibrium level of output is:

$$\begin{aligned} p^* &= LRMC(Q^*) \\ &= \min(LRATC) \\ &= LRATC(Q^*) \end{aligned}$$

- The long-run equilibrium profit is:

$$\begin{aligned} \pi^* &= p^*Q^* - LRTC(Q^*) \\ &= (p^* - LRATC(Q^*))Q^* \\ &= 0 \end{aligned}$$

Long-Run Market Equilibrium



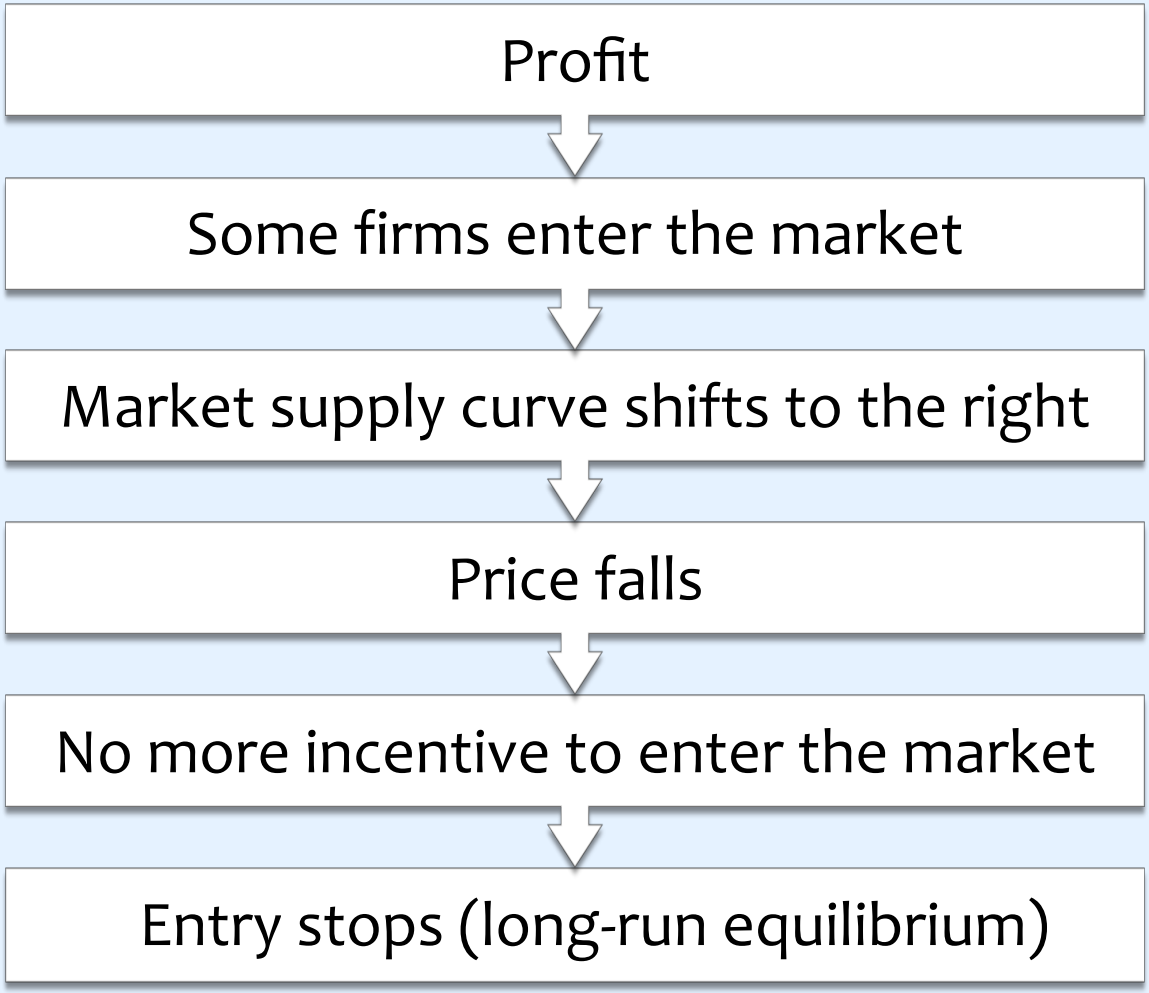
Long-Run Market Equilibrium: Profit

- In the long-run equilibrium, all firms earn zero economic profit.
- Free entry and exit eventually drives economic profit down to zero.
  - Positive economic profit will not persist in perfectly competitive markets.
- But the market is not always in a long-run equilibrium.
  - Positive economic profit is possible in the short run.

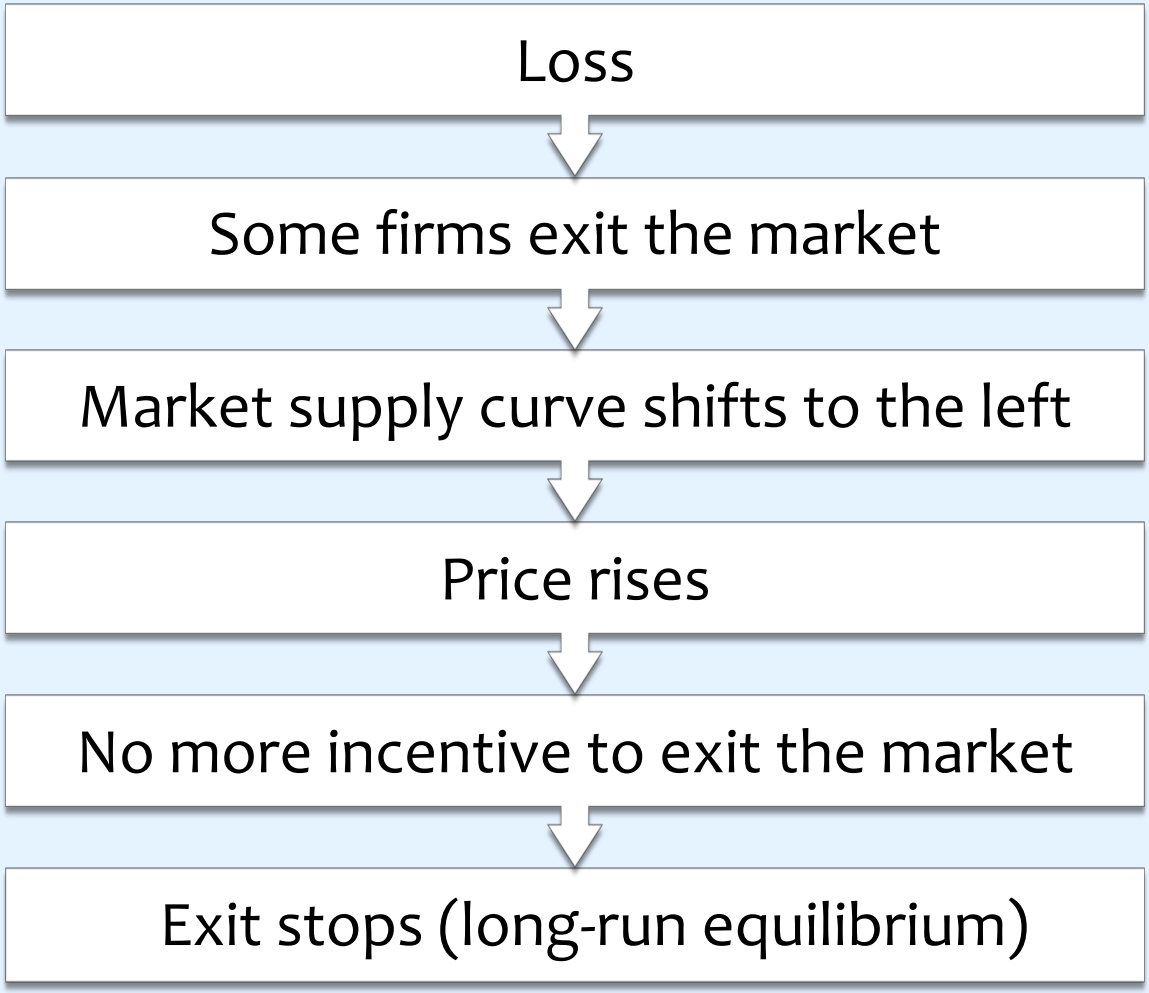
Long-Run Market Equilibrium: Number of Firms

- The number of firms is not fixed in the long run.
  - Entry and exit are possible.
- The number of firms in the long-run equilibrium can be determined, e.g.,
  - Suppose the long-run equilibrium price is $p^* = 10.$
  - Given this price,
    - Each firm produces $Q^* = 5.$
    - The total quantity demanded in the market is $80.$
  - Thus there are $\frac{80}{5} = 16$ firms in the long-run equilibrium.

Long-Run Dynamics: Entry



Long-Run Dynamics: Exit



Exercise 11.2

Long-Run Profit-Maximizing Output Choice

Suppose a firm in a perfectly competitive market has a long-run total cost curve of $LRTC(Q) = \frac{1}{2}Q^2 - 10Q + 800.$

(a) What is the firm's optimal level of output in the long run?

(b) What is the market price of the output in the long run?

(c) Calculate the firm's profit.

Exercise 11.2(a)

Long-Run Profit-Maximizing Output Choice

Exercise 11.2(b)

Long-Run Profit-Maximizing Output Choice

Exercise 11.2(c)

Short-Run Profit-Maximizing Output Choice

Long-Run Market Supply Curve

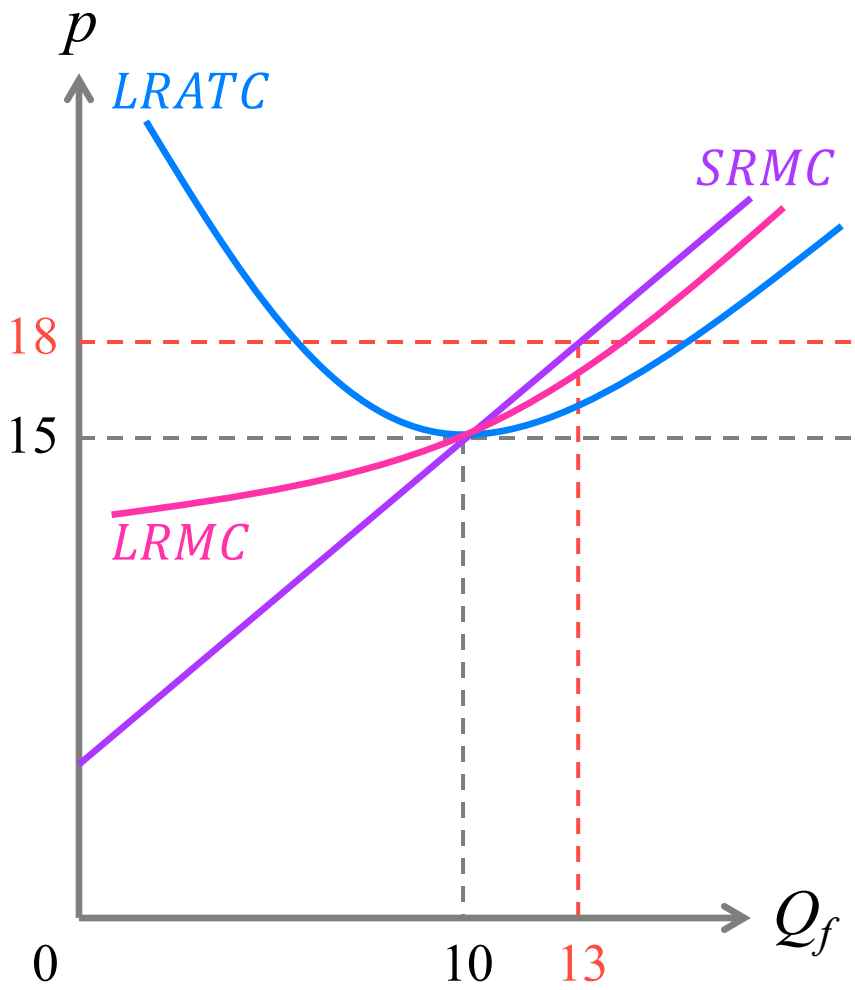
Input Prices in the Long Run

- Constant-cost industry
  - Changes in the industry output
    do not affect the prices of inputs in the long run.

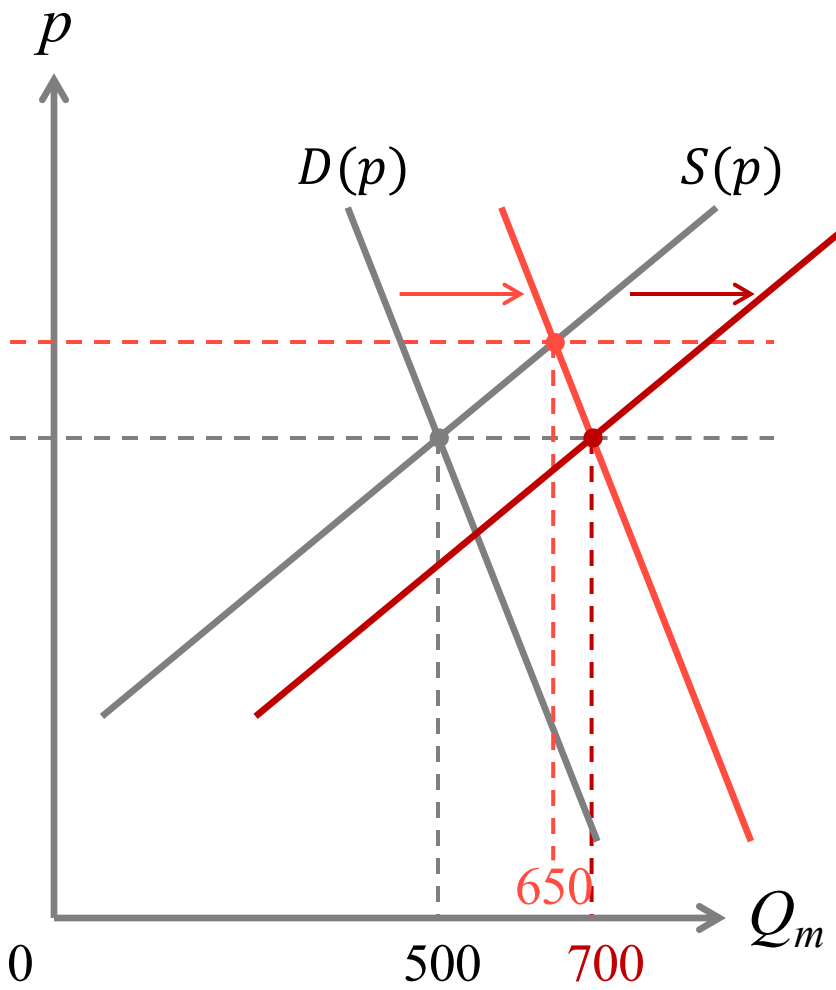
Input Prices in the Long Run

- Increasing-cost industry
  - An increase in the industry output causes the prices of inputs to rise in the long run.
  - A decrease in the industry output causes the prices of inputs to fall in the long run.
- Decreasing-cost industry
  - An increase in the industry output causes the prices of inputs to fall in the long run.
  - A decrease in the industry output causes the prices of inputs to rise in the long run.

Constant-Cost Industry: Increase in Demand



Typical firm's
cost and supply



Market equilibrium
with 50 identical firms
at the initial equilibrium

Constant-Cost Industry: Following a Permanent Increase in Demand

	Before increase in demand	*After increase in demand*	
	Long-run equilibrium	**Short-run equilibrium**	**Long-run equilibrium**
Price	15	18	15
Market Quantity	500	650	700
Each Firm's Output	10	13	10
Number of Firms	50	50	70

Exercise 11.3

Increase in Demand

How do we explain the change in total quantity:

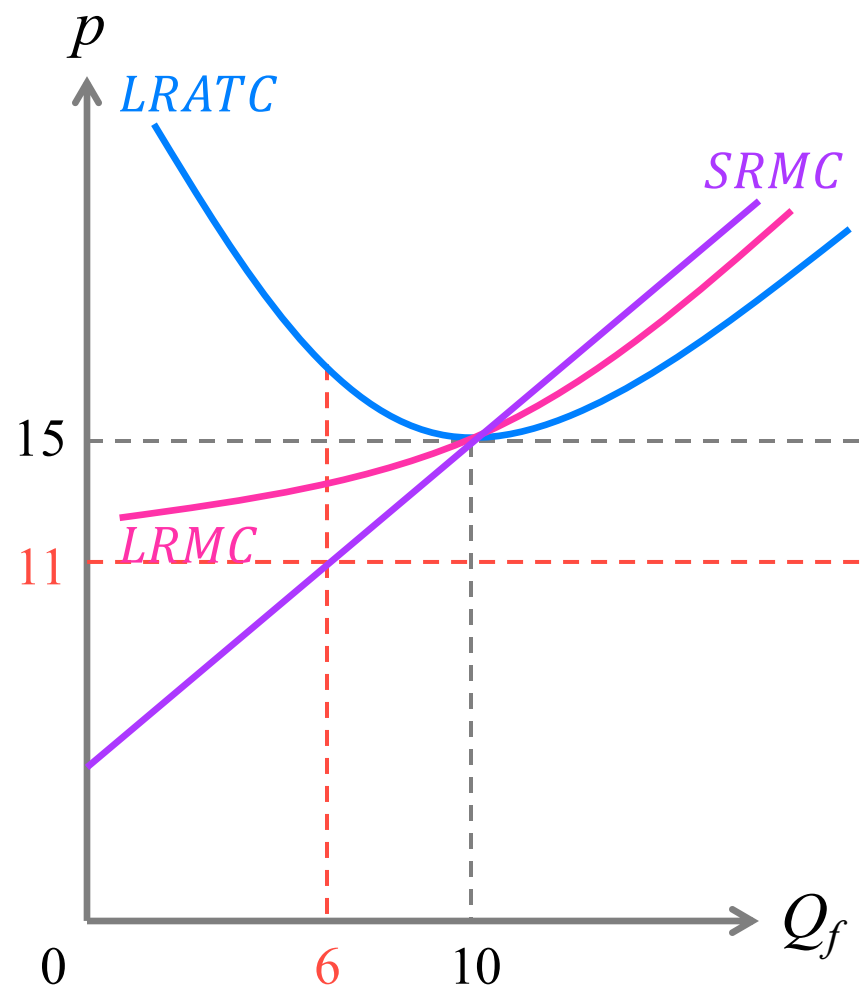
(a) From 500 in the initial long-run equilibrium
to 650 in the short-run equilibrium
following the increase in demand

(b) From 650 in the short-run equilibrium
to 700 in the long-run equilibrium

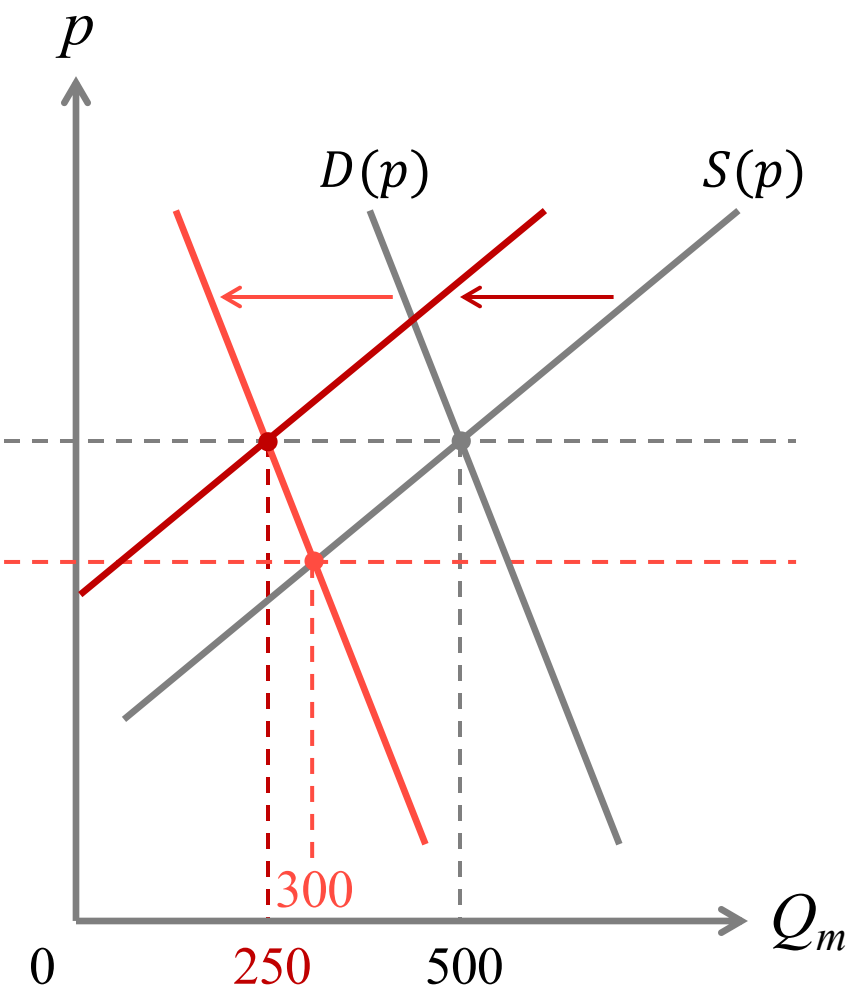
Exercise 11.3

Increase in Demand

Constant-Cost Industry: Decrease in Demand



Typical firm's
cost and supply



Market equilibrium
with 50 identical firms
at the initial equilibrium

Constant-Cost Industry: Following a Permanent Decrease in Demand

	Before decrease in demand	*After decrease in demand*	
	Long-run equilibrium	**Short-run equilibrium**	**Long-run equilibrium**
Price	15	11	15
Market Quantity	500	300	250
Each Firm's Output	10	6	10
Number of Firms	50	50	25

Exercise 11.4

Decrease in Demand

How do we explain the change in total quantity:

(a) From 500 in the initial long-run equilibrium
to 300 in the short-run equilibrium
following the decrease in demand

(b) From 300 in the short-run equilibrium
to 250 in the long-run equilibrium

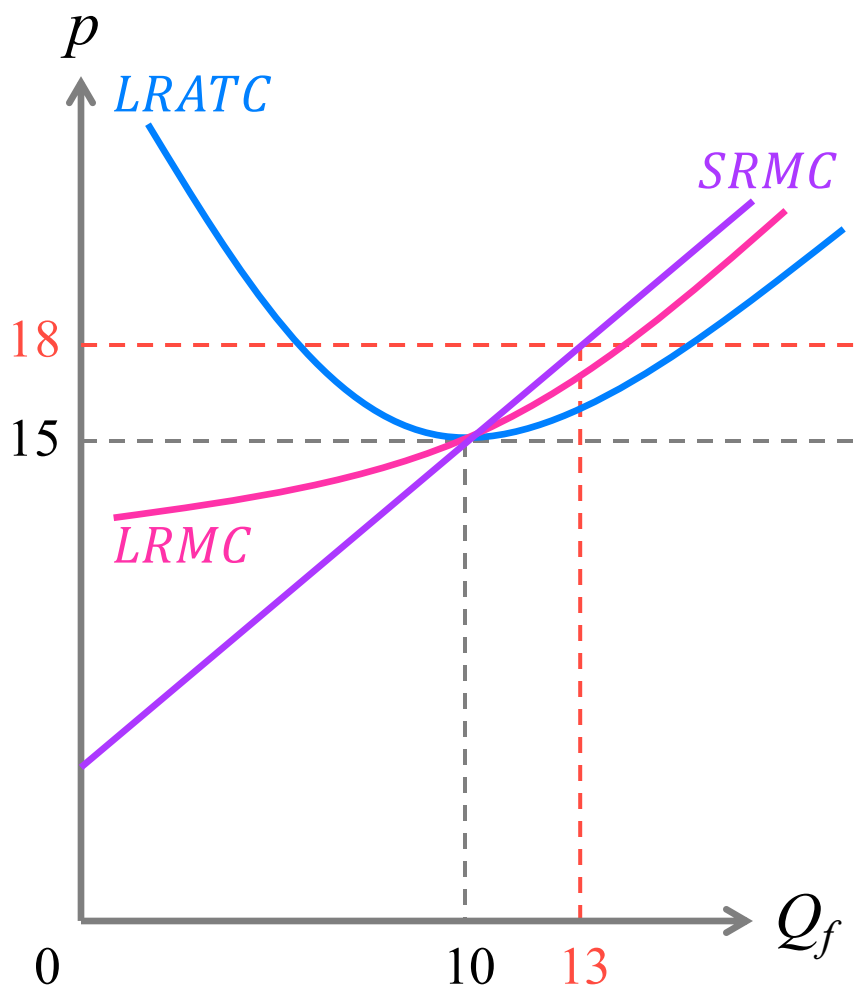
Exercise 11.4

Decrease in Demand

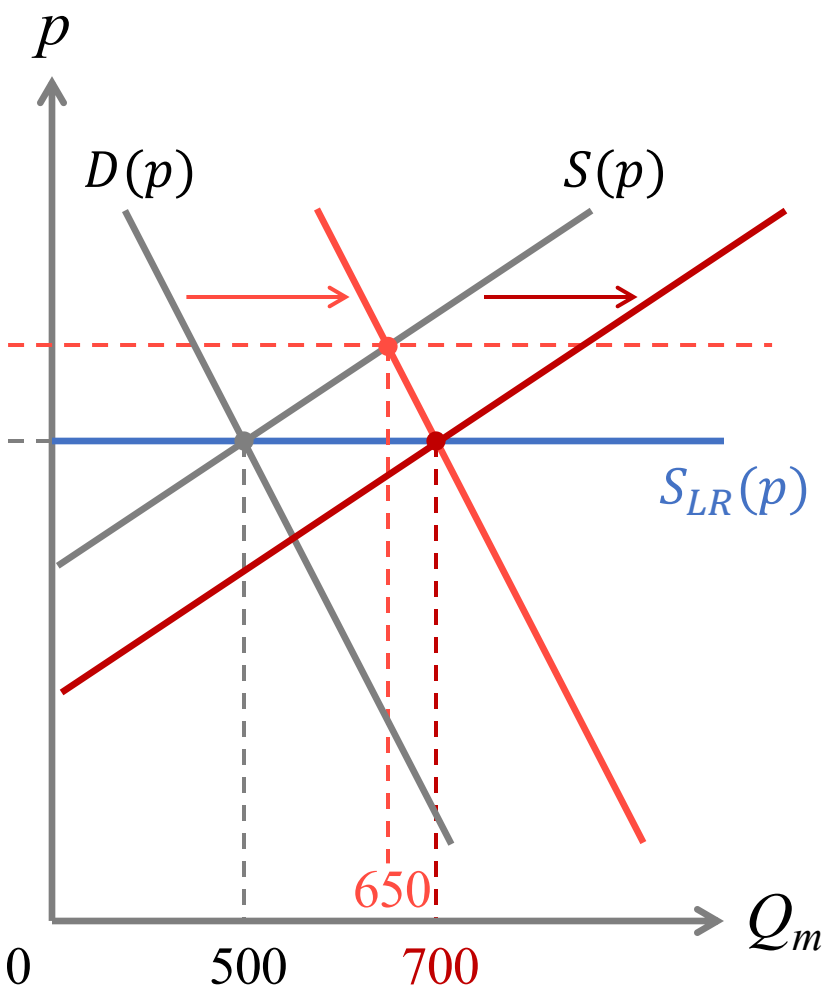
Long-Run Market Supply Curve

- How do we obtain the long-run market supply curve?
  - The set of firms in the market is not fixed in the long run.
  - The number of firms can only be determined in the long-run equilibrium.
- Long-run market supply curve
  - Total quantity supplied in the long-run equilibrium as a function of the long-run equilibrium price.
  - $S^*(p^*)$

LR Market Supply Curve: Constant-Cost Industry

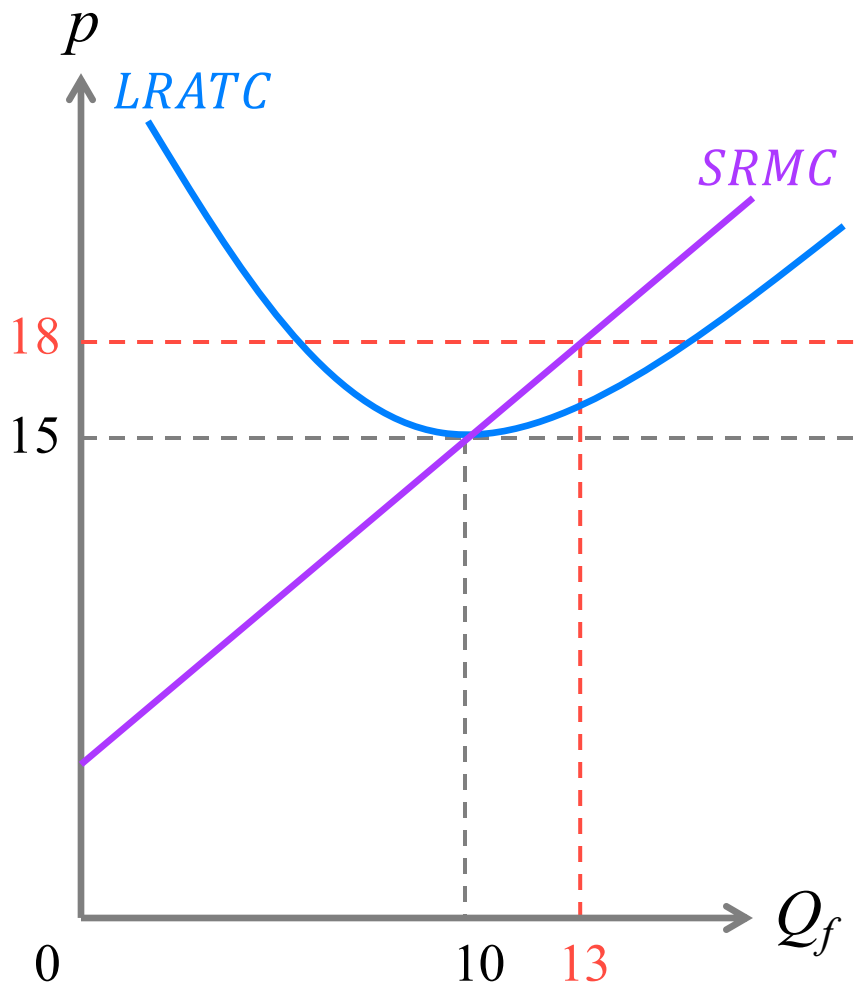


Typical firm's cost and supply

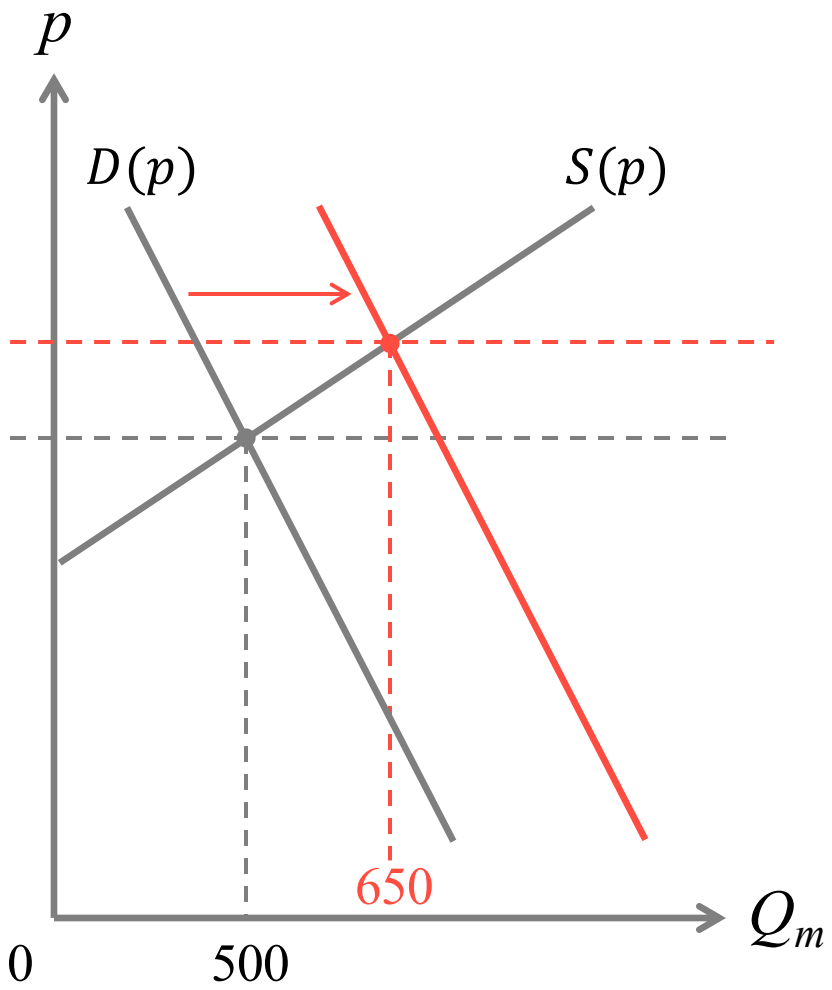


Market equilibrium with 50 identical firms at the initial equilibrium

LR Market Supply Curve: Increasing-Cost Industry

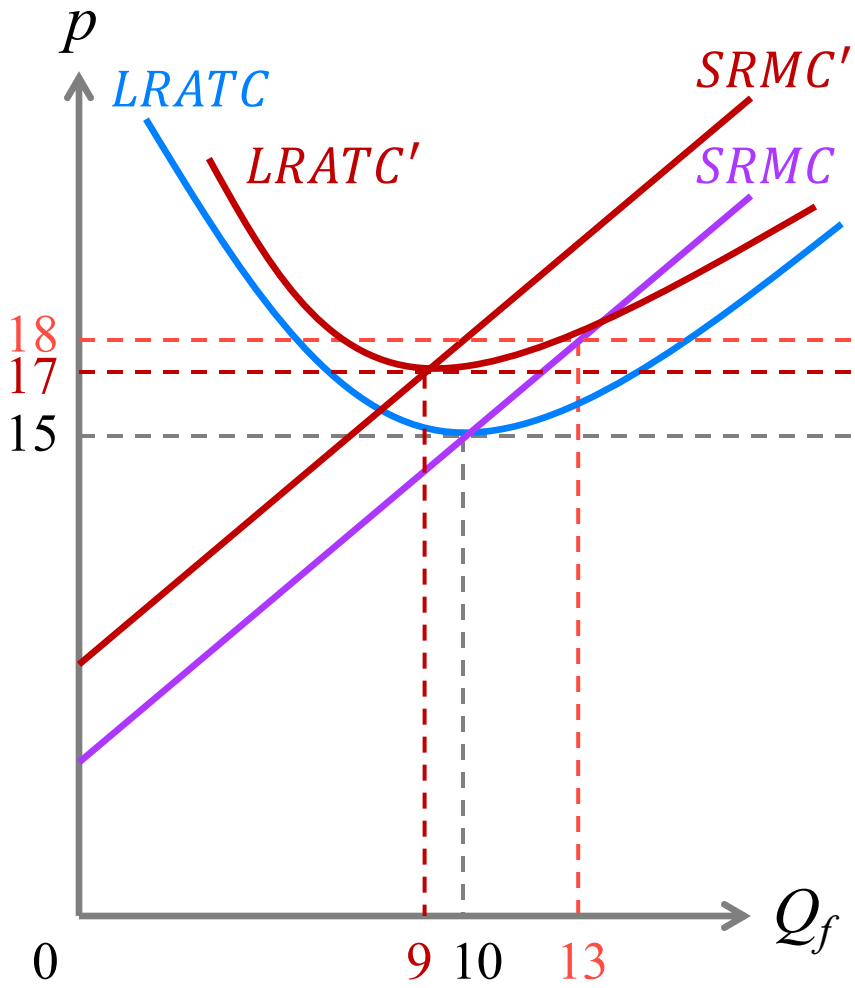


Typical firm's
cost and supply

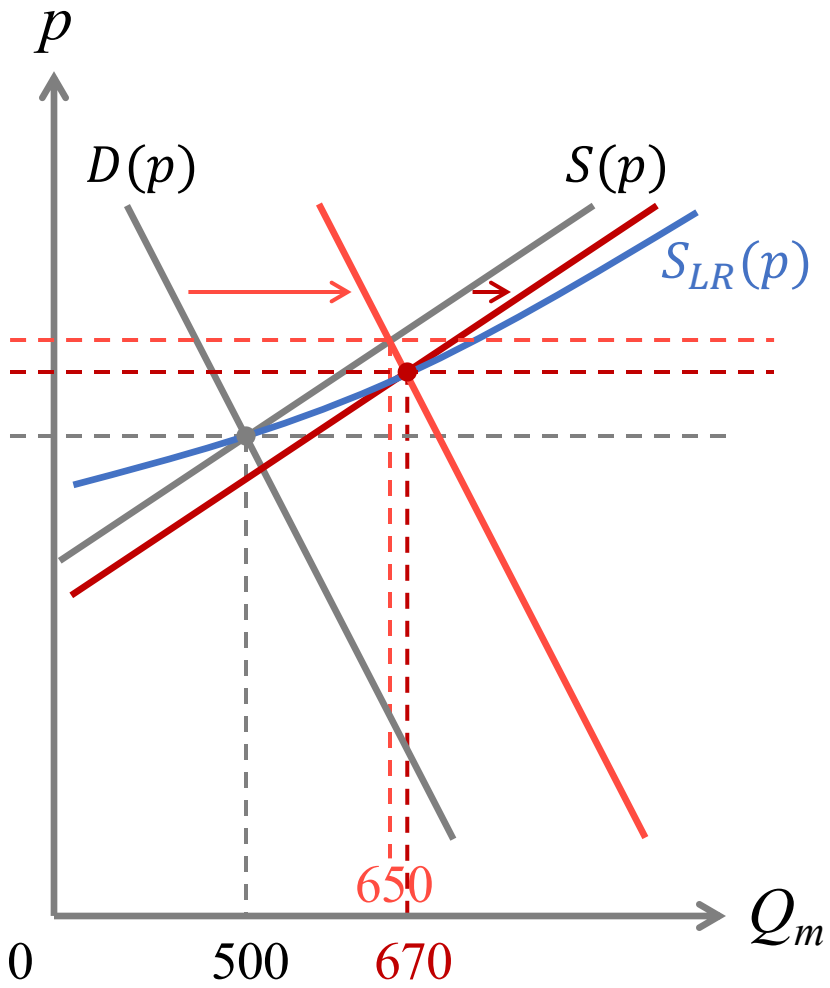


Market equilibrium
with 50 identical firms
at the initial equilibrium

LR Market Supply Curve: Increasing-Cost Industry

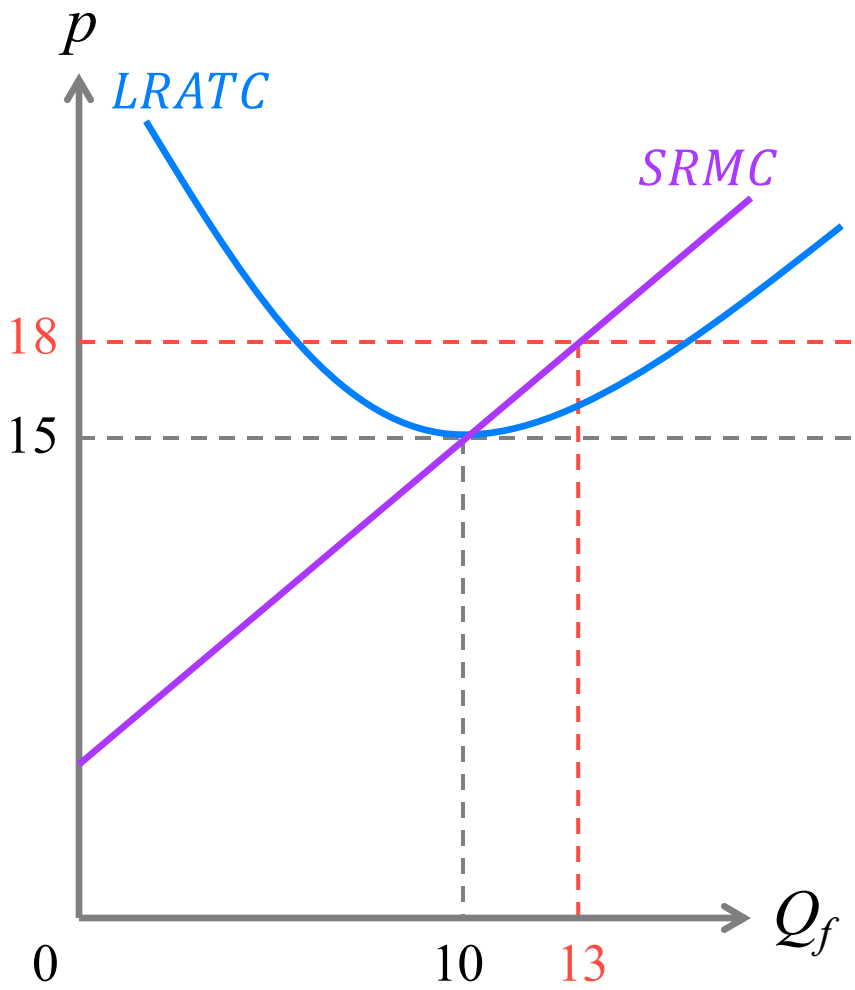


Typical firm's cost and supply

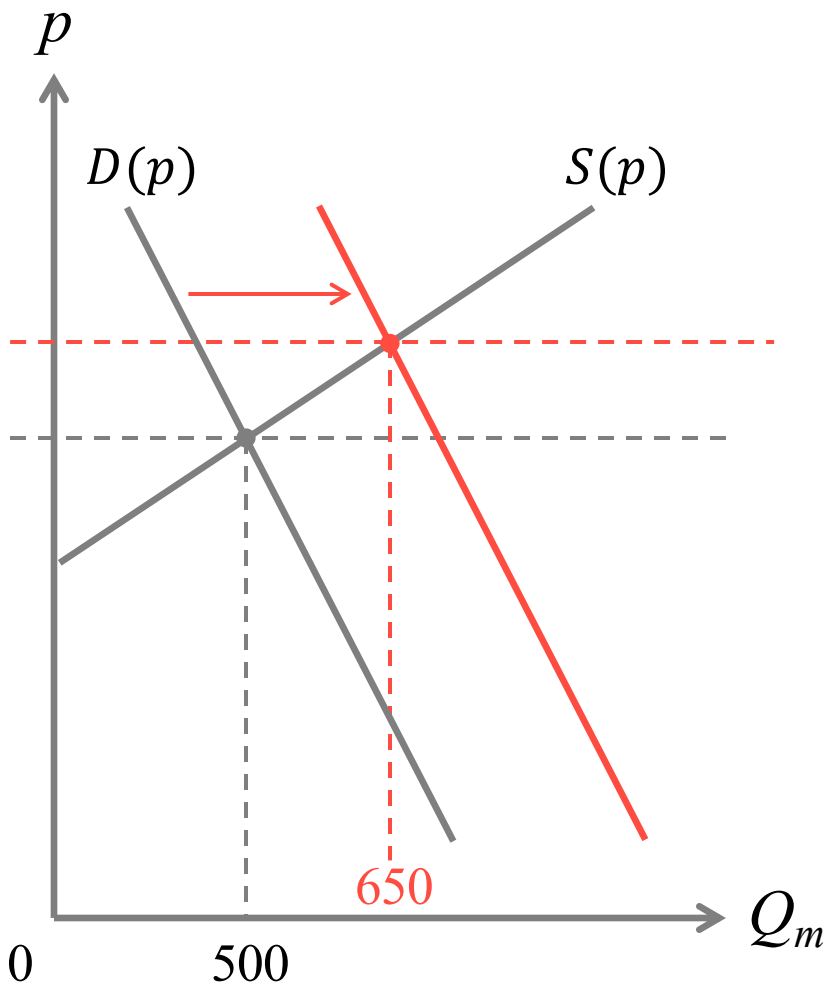


Market equilibrium with 50 identical firms at the initial equilibrium

LR Market Supply Curve: Decreasing-Cost Industry

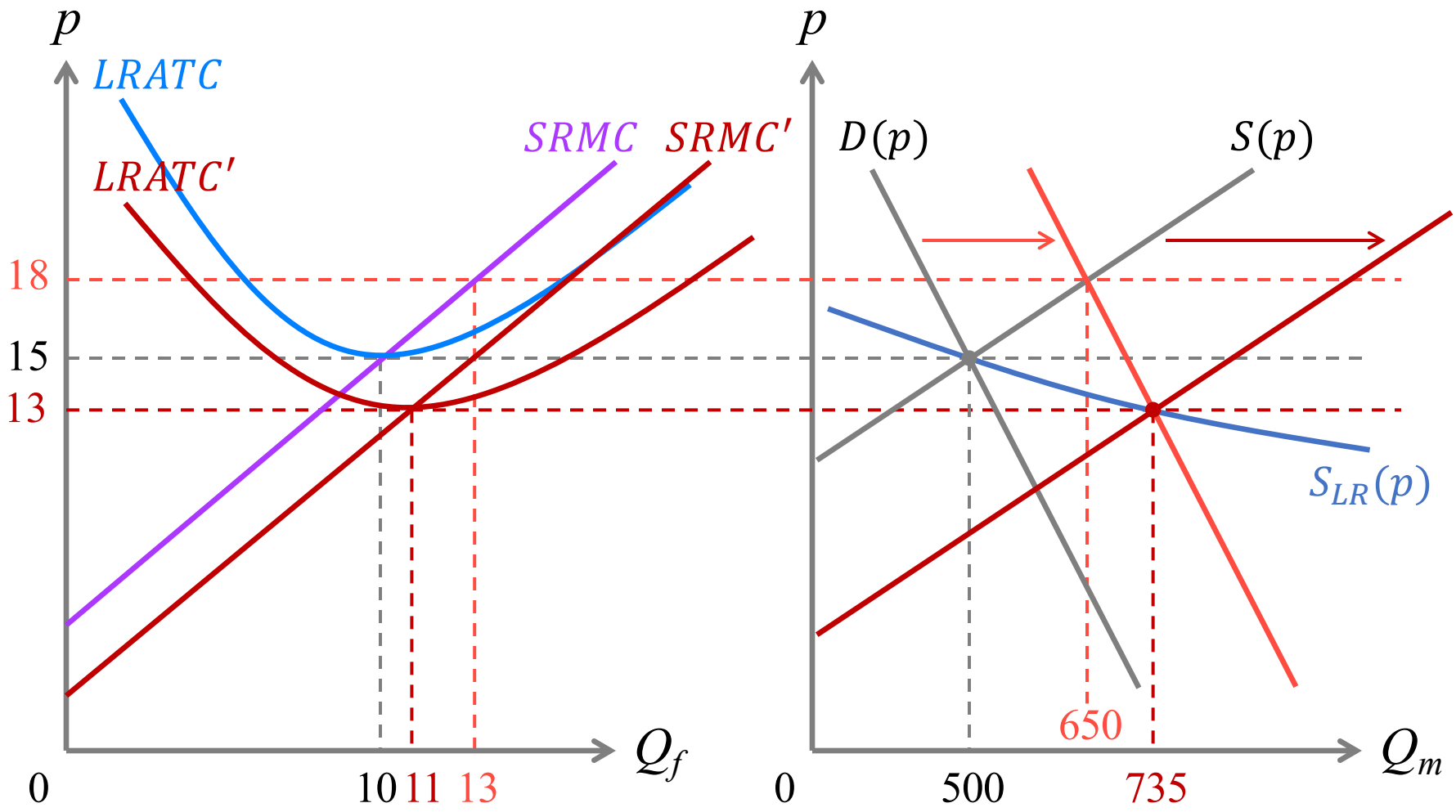


Typical firm's cost and supply



Market equilibrium with 50 identical firms at the initial equilibrium

LR Market Supply Curve: Decreasing-Cost Industry



Typical firm's cost and supply

Market equilibrium with 50 identical firms at the initial equilibrium

Long-Run Market Supply Curve of Different Industries

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

Summary

Short-Run Equilibrium vs. Long-Run Equilibrium

	Short-Run Equilibrium	**Long-Run Equilibrium**
Equilibrium Price		
Each Firm's Output		
Number of Firms		
Each Firm's Economic Profit		

Increase in demand	**Short-Run Equilibrium**	**Long-Run Equilibrium**		
		Constant Cost	**Increasing Cost**	**Decreasing Cost**
Number of Firms				
Price				
Market Quantity				
Each Firm's Output				
Each Firm's Profit				
Market supply curve				

Decrease in demand	**Short-Run Equilibrium**	**Long-Run Equilibrium**		
		Constant Cost	**Increasing Cost**	**Decreasing Cost**
Number of Firms				
Price				
Market Quantity				
Each Firm's Output				
Each Firm's Profit				
Market supply curve				

Economic Rent

Economic Rent

- Thus far we have assumed that
  all firms have equal access to resources.
  - Firms have identical costs.

- What if some firms have access to superior inputs
  that are not available to other firms?
  - E.g., amazing chef, managerial talent,
    control of higher-quality land, better veins of ore.

- These superior inputs could generate economic rent.
  - Economic rent is the difference between
    the maximum amount a firm is willing to pay for the input
    and the reservation value of the input.

Economic Rent: Example

- Suppose there are two types of chefs:
  - Amazing chefs
  - Average chefs
- Suppose there is only one amazing chef but infinitely many average chefs.
- Suppose the reservation wage for any chef is $\$50{,}000$.

Economic Rent: Example

- Suppose every chef is paid the reservation wage.
- Relative to the firms with the average chefs:
  - The firm with the amazing chef has a lower $LRATC$.
  - The firm with the amazing chef has a lower $\min(LRATC)$.
- The long-run equilibrium price is the $\min(LRATC)$ of the firms with the average chefs.
  - At this long-run equilibrium price, no potential entrant wants to enter the market, and no existing firm wants to exit the market.

Economic Rent: Example

- The firms with the average chefs earn zero economic profit.
- The firm with the amazing chef earns positive economic profit because it has lower average total costs.
  - Suppose the firm with the amazing chef earns a profit of $\$20{,}000$.

Economic Rent: Example

- What is the maximum amount that a firm is willing to pay the amazing chef?
  - $\$50{,}000 + \$20{,}000 = \$70{,}000$
- What is the reservation value of the amazing chef?
  - The reservation wage of $\$50{,}000.$
- Economic rent
  = Maximum amount a firm is willing to pay for the input – Reservation value of the input
  $= \$70{,}000 - \$50{,}000 = \$20{,}000$

Economic Rent: Example

- What is the difference between economic rent and profit?
- Suppose firms need to compete with one another to hire the amazing chef.
- The wage of the amazing chef can be bid up to $70,000.
  - The economic rent of $20,000 now goes to the amazing chef.
  - The firm with the amazing chef earns zero economic profit.
  - The economic rent of $20,000 is still there.

Economic Rent: Example

- In general, the economic rent is split between the firm and the amazing chef.
  - The amount that goes to the firm is the firm's profit.
  - The amount that goes to the amazing chef is the amazing chef's wage.

Exercise 11.5

Long-Run Equilibrium with Two Types of Firms

- Suppose every chef is paid the reservation wage of $\$50{,}000$.
- Suppose a firm with an average chef (high-cost firm) has $\min(LRATC) = 20$.
- Suppose the firm with the amazing chef (low-cost firm) has $\min(LRATC) = 16$.
- What happens when $p = 16$?
  - Can $p = 16$ be the long-run equilibrium price?

Exercise 11.5

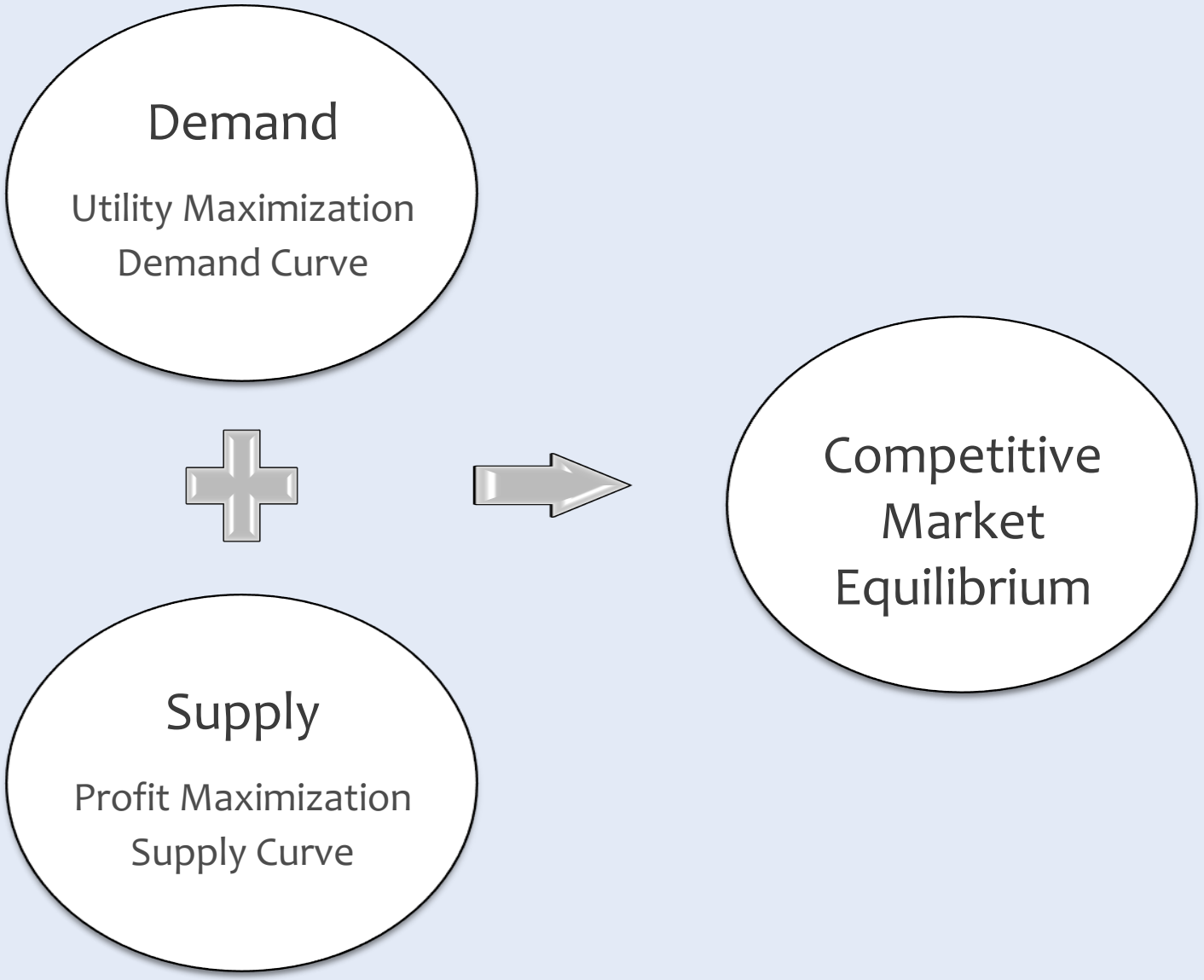
Long-Run Equilibrium with Two Types of Firms

Application

Perfect Competition vs. Imperfect Competition

- What examples of perfect competition do you see around you?
- What examples of imperfect competition do you see around you?
- What are some conditions that increase the likelihood of competition?

Where are we?


Demand
Utility Maximization
Demand Curve
Supply
Profit Maximization
Supply Curve
Competitive
Market
Equilibrium