

# Lecture 7. Competitive Markets and Supply Curves

BTM210, KAIST

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# Topics Covered in This Lecture

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Competitive Markets

Profit Maximization

Short-Run Supply Curves

Long-Run Supply Curves

## Competitive Markets

Profit Maximization

Short-Run Supply Curves

Long-Run Supply Curves

# Competitive Markets

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- Given the assumption that markets are perfectly competitive,
  - The equilibrium price and quantity of each product are determined
  - By the intersection of the market demand and market supply curves
- Three characteristics or assumptions of a perfectly competitive market
  - Price takers: Each firm is so small that its production decisions have no effect on market price.
  - Free entry and exit: New firms can easily enter the industry if they perceive a potential for profit, and existing firms can exit if they start losing money.
  - Product homogeneity: All firms produce an identical product.
- A good starting point or a benchmark for examining a real-world economy
  - Ideal gas law ( $PV = nRT$ ), Free fall without frictions ( $V = gt \rightarrow S = \frac{1}{2}gt^2$ )

## Assumption 1. Price Takers

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- Each firm takes the market price as given. Why?
  - Many firms compete in the market.
  - Each firm faces a significant number of direct competitors for its products.
  - Each individual firm sells a sufficiently small proportion of total market output.
  - Thus, its decisions have no impact on market price.
- The price taking assumption applies to consumers too.
- Note that
  - Firms and consumers believe correctly that their decisions will not affect prices in a perfectly competitive market.
  - A Price taking firm faces perfectly elastic or demand curve.

## Assumption 2. Free Entry and Exit

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- Suppliers can easily enter or exit a market.
  - There is no economic barrier to entry, which is a fixed cost that must be incurred by a new entrant, regardless of production or sales activities, into a market that incumbents do not have to incur.
  - Suppliers can easily enter or exit a market.
  - Buyers can easily switch from one supplier to another.
- Note that
  - The free entry and exit assumption is important for competition to be effective.
  - A firm can freely enter an industry if it sees a profit opportunity, and exit if it is losing money.

## Assumption 3. Product Homogeneity

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- The products of all firms in a market are perfectly substitutable with one another.
  - e.g., oil, gasoline, raw materials, grains
- Note that
  - Price-taking behavior typically occurs in markets where firms produce identical, or nearly identical, products.
  - No firm can raise the price of its product above the price of other firms without losing most or all of its business.
  - The product homogeneity assumption ensures that there is a single market price.

## Some Remarks

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- In a perfectly competitive market, (1) each firm faces a perfectly horizontal demand curve (2) for a homogeneous product (3) in an industry that it can freely enter or exit.
- Few real-world markets are "perfectly" competitive, but many markets are "highly" competitive.
  - Highly elastic demand curves for similar, substitutable products
  - Relatively easy entry and exit (low barrier to entry)
- Which market is competitive?
  - Many firms colluding vs. A handful of firms facing highly elastic demand
  - Café or Chicken place in South Korea



Competitive Markets

Profit Maximization

Short-Run Supply Curves

Long-Run Supply Curves

- Do firms maximize profit?
  - Manager's vs. owner's profit maximization
  - Profit vs. revenue maximization
  - Short-run vs. long-run profit maximization
  - Firms that have been in business for a long time are likely to care a lot about profit.
  - Thus, the profit maximization assumption predicts business behavior reasonably accurately and avoids unnecessary analytical complications.
- Firm's problem:

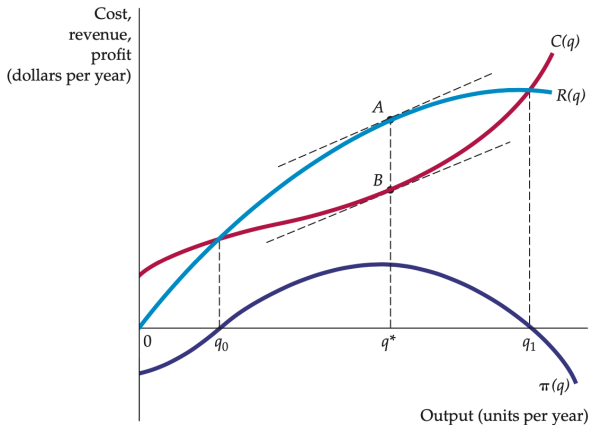
$$\max_q \underbrace{\Pi(q)}_{\text{Profit}} = \underbrace{Pq}_{\text{Revenue}} - \underbrace{(rK^*(q) + wL^*(q))}_{\text{Cost}}$$

- FOC:

$$MR(q) = MC(q) \quad \text{in general}$$

$$P = MC(q) \quad \text{in a competitive market}$$

# Profit Maximization = Maximizing the Distance b/w $R(q)$ and $C(q)$



**FIGURE 8.1**  
**PROFIT MAXIMIZATION IN**  
**THE SHORT RUN**

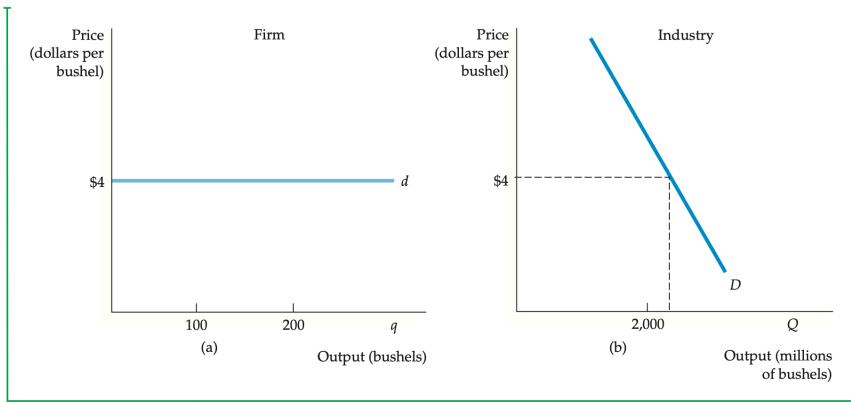
A firm chooses output  $q^*$ , so that profit, the difference  $AB$  between revenue  $R$  and cost  $C$ , is maximized. At that output, marginal revenue (the slope of the revenue curve) is equal to marginal cost (the slope of the cost curve).

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.1

## Demand for a Competitive Firm

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- A competitive firm's demand curve "d" is given by a horizontal line.
  - Each firm sells only a small fraction of the entire industry output.
  - How much output the firm decides to sell will have no effect on the market price of the product.
  - Thus, in a competitive industry, a firm is a price taker.
- The market demand curve "D" is downward sloping.
  - We derived a downward-sloping aggregate demand curve from consumers' utility maximization problem: consumers buy more outputs at a lower price.
  - "D" shows how many outputs all consumers will buy at each possible price.



**FIGURE 8.2**  
**DEMAND CURVE FACED BY A COMPETITIVE FIRM**

A competitive firm supplies only a small portion of the total output of all the firms in an industry. Therefore, the firm takes the market price of the product as given, choosing its output on the assumption that the price will be unaffected by the output choice. In (a) the demand curve facing the firm is perfectly elastic, even though the market demand curve in (b) is downward sloping.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.2

## Short-Run Profit Maximization by a Competitive Firm

- In the short run, a firm operates with a fixed amount of capital and must choose the levels of its variable inputs (labor and materials) to maximize profit.

$$\max_q \underbrace{\Pi(q)}_{\text{Profit}} = \underbrace{Pq}_{\text{Revenue}} - \underbrace{(rK + wL^*(q))}_{\text{Cost}}$$

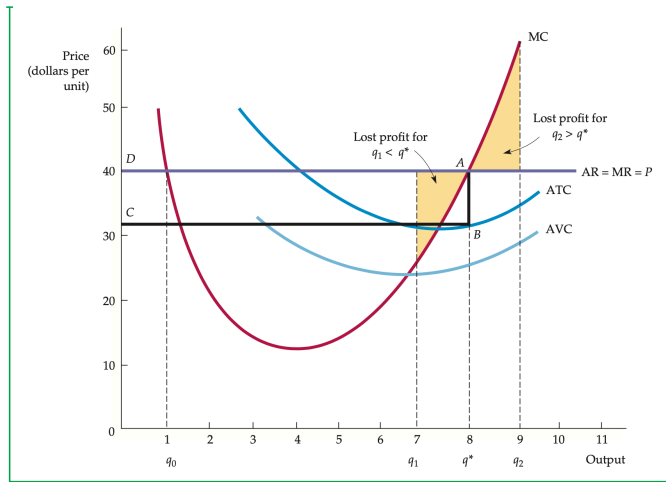
- FOC:

$$MR(q) = MC(q)$$

$$P = MC(q) = w \frac{dL^*(q)}{dq} = \frac{w}{MP_L}$$

- Profit:

$$\Pi(q) = (P - ATC(q)) * q$$



**FIGURE 8.3**  
**A COMPETITIVE FIRM MAKING A POSITIVE PROFIT**

In the short run, the competitive firm maximizes its profit by choosing an output  $q^*$  at which its marginal cost  $MC$  is equal to the price  $P$  (or marginal revenue  $MR$ ) of its product. The profit of the firm is measured by the rectangle  $ABCD$ . Any change in output, whether lower at  $q_1$  or higher at  $q_2$ , will lead to lower profit.

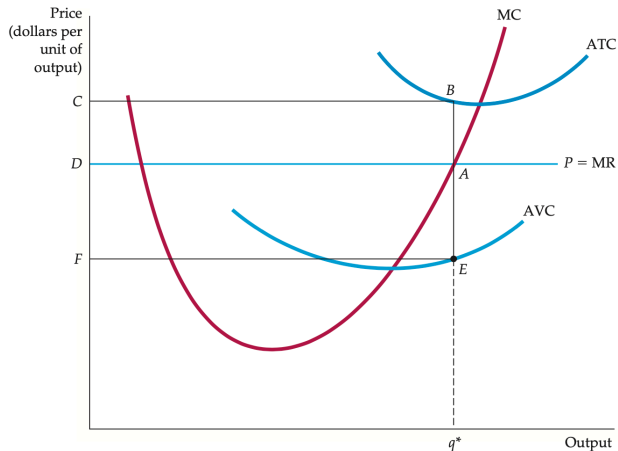
Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.3

## When Should the Firm Shut Down?

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- Suppose a firm is losing money such that  $AVC(q^*) < P < ATC(q^*)$ . Should it shut down and leave the industry?
- Exit if
  - There is little chance that conditions will improve.
  - The firm is losing money due to fixed costs even though  $P > AVC(q^*)$ .
  - Fixed costs do not change with the level of output, but they can be eliminated if the firm shuts down.
- Keep running if
  - The firm expects to become profitable again in the future.
  - It can change the amount of capital and reduce its average fixed and total cost in the future.





**FIGURE 8.4**

**A COMPETITIVE FIRM INCURRING LOSSES**

A competitive firm should shut down if price is below AVC. The firm may produce in the short run if price is greater than average variable cost.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.4

Competitive Markets

Profit Maximization

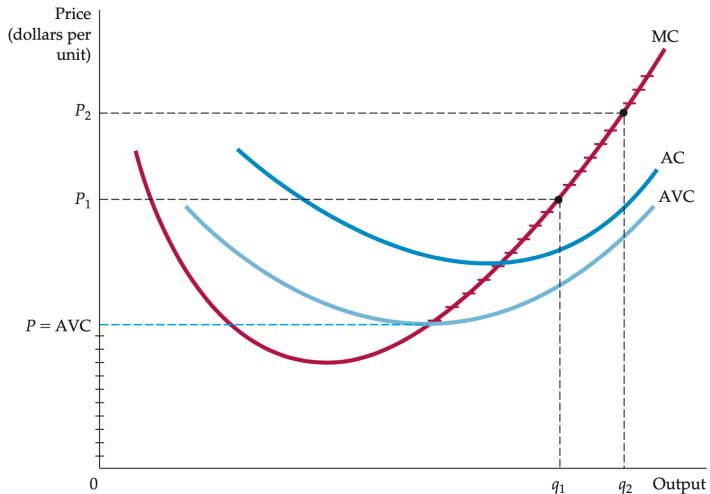
Short-Run Supply Curves

Long-Run Supply Curves

## The Competitive Firm's Short-Run Supply Curve

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- Competitive firms will increase output to the point at which price is equal to marginal cost.
- They will shut down if price is below average variable cost ( $P < AVC(q^*)$ ).
- A short-run supply curve for a firm
  - Is the portion of the marginal cost curve for which marginal cost is greater than average variable cost.
  - Tells us how much output it will produce at every possible price.
  - Slopes upward because marginal cost increases.



**FIGURE 8.6**  
**THE SHORT-RUN**  
**SUPPLY CURVE FOR**  
**A COMPETITIVE**  
**FIRM**

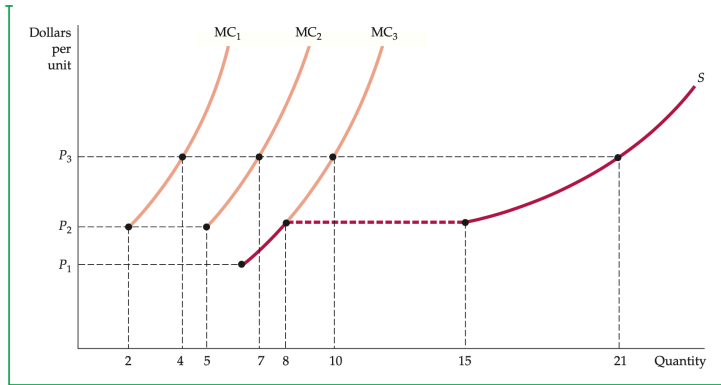
In the short run, the firm chooses its output so that marginal cost  $MC$  is equal to price as long as the firm covers its average variable cost. The short-run supply curve is given by the crosshatched portion of the marginal cost curve.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.6

# The Short-Run Market Supply Curve

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- The short-run market supply curve
  - Can be obtained by adding up the supply curves of each of these firms.
  - Slopes upward because each firm's supply curve is upward sloping.
  - Shows the amount of output that the industry will produce in the short run for every possible price.
- Note that in the short run
  - An increase in the market price will induce firms already in the market to increase the quantities they produce.



**FIGURE 8.9**  
**INDUSTRY SUPPLY IN THE SHORT RUN**

The short-run industry supply curve is the summation of the supply curves of the individual firms. Because the third firm has a lower average variable cost curve than the first two firms, the market supply curve  $S$  begins at price  $P_1$  and follows the marginal cost curve of the third firm  $MC_3$  until price equals  $P_2$ , when there is a kink. For  $P_2$  and all prices above it, the industry quantity supplied is the sum of the quantities supplied by each of the three firms.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.9

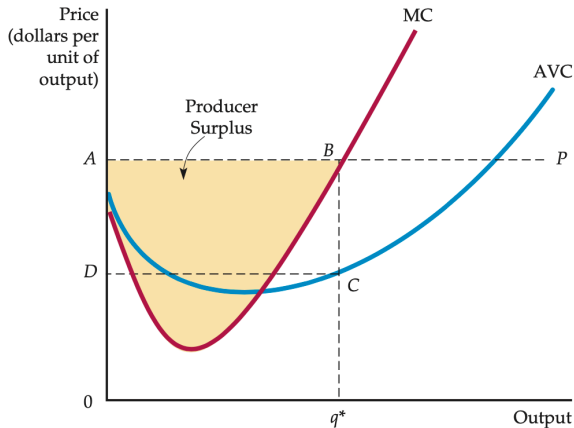
# Producer Surplus

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- The producer surplus of a firm
  - Measures the area above a producer's supply curve and below the market price.
- Note that
  - Because fixed cost does not vary with output, the sum of all marginal costs must equal the sum of the firm's variable costs.
  - Producer surplus can alternatively be defined as the difference between the firm's revenue and its total variable cost.
  - In the short run, when fixed cost is positive, producer surplus is greater than profit.

$$\text{Producer surplus} = R - VC$$

$$\text{Profit} = R - VC - FC$$



**FIGURE 8.11**  
**PRODUCER SURPLUS FOR A FIRM**

The producer surplus for a firm is measured by the yellow area below the market price and above the marginal cost curve, between outputs 0 and  $q^*$ , the profit-maximizing output. Alternatively, it is equal to rectangle  $ABCD$  because the sum of all marginal costs up to  $q^*$  is equal to the variable costs of producing  $q^*$ .

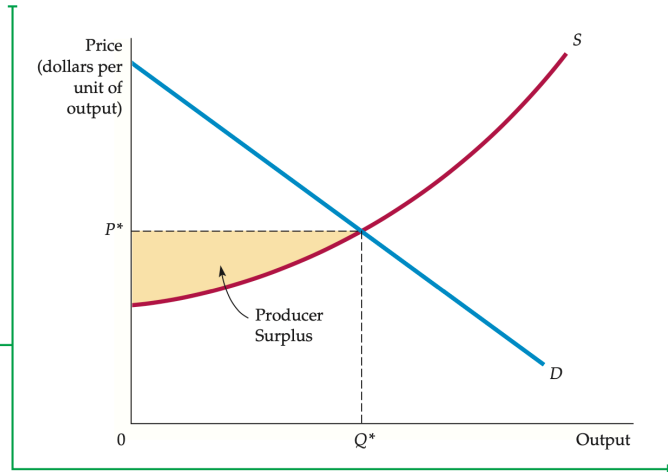
Source: *Microeconomics*, 9th ed. (Pindyck and Rubinfeld, 2018), Figure 8.11



- The producer surplus for a market can be determined by adding up the producer surpluses of all firms.

### FIGURE 8.12 PRODUCER SURPLUS FOR A MARKET

The producer surplus for a market is the area below the market price and above the market supply curve, between 0 and output  $Q^*$ .



Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.12

Competitive Markets

Profit Maximization

Short-Run Supply Curves

Long-Run Supply Curves

## Choosing Output in the Long Run

- In the long run,
  - A firm can alter all its inputs, including plant size.
  - It can decide to shut down (i.e., to exit the industry) or to begin producing a product for the first time (i.e., to enter an industry).
  - In a competitive market, there are no economic barriers to entry and exit.
- Firm's problem:

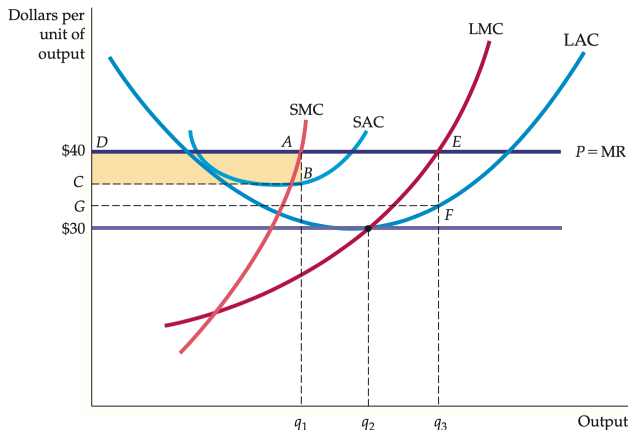
$$\max_q \underbrace{\Pi(q)}_{\text{Profit}} = \underbrace{Pq}_{\text{Revenue}} - \underbrace{(rK^*(q) + wL^*(q))}_{\text{Cost}}$$

- FOC:

$$MR(q) = LMC(q) \quad \text{in general}$$

$$P = LMC(q) \quad \text{in a competitive market}$$

- Long-run supply curve:  $P = LMC(q)$ ,  $q \in \{q | LAC(q) \leq LMC(q)\}$ .



**FIGURE 8.13**  
**OUTPUT CHOICE IN**  
**THE LONG RUN**

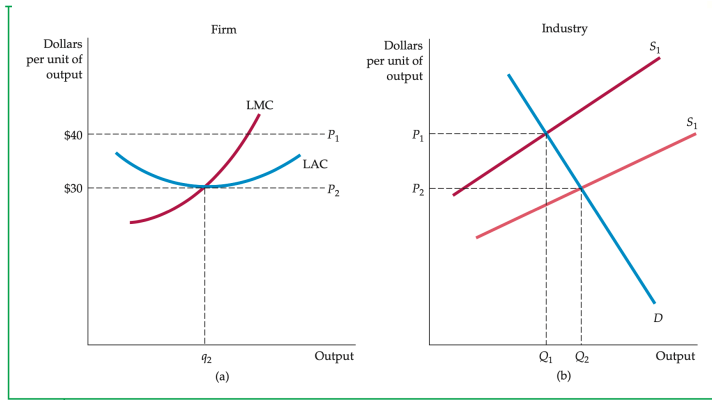
The firm maximizes its profit by choosing the output at which price equals long-run marginal cost LMC. In the diagram, the firm increases its profit from ABCD to EFGD by increasing its output in the long run.

Source: *Microeconomics*, 9th ed. (Pindyck and Rubinfeld, 2018), Figure 8.13

# Zero Economic Profit

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- A zero economic profit
  - Means that the firm is earning a normal return, which is the firm's opportunity cost
  - Shows that the industry is competitive, not that firms are performing poorly.
  - The firm has no incentive to go elsewhere because it cannot do better financially.
- In competitive markets, economic profit becomes zero in the long run because of free entry and exit.
  - A firm enters when it can earn a positive long-run profit and exits when it faces the prospect of a long-run loss.
  - If there is a room to earn positive economic profit, new firms enter the market, the supply curve shifts to the right, and the equilibrium price decreases in the long run.
  - Thus, positive economic profits converges to zero in the long run.



### FIGURE 8.14 LONG-RUN COMPETITIVE EQUILIBRIUM

Initially the long-run equilibrium price of a product is \$40 per unit, shown in **(b)** as the intersection of demand curve  $D$  and supply curve  $S_1$ . In **(a)** we see that firms earn positive profits because long-run average cost reaches a minimum of \$30 (at  $q_2$ ). Positive profit encourages entry of new firms and causes a shift to the right in the supply curve to  $S_2$ , as shown in **(b)**. The long-run equilibrium occurs at a price of \$30, as shown in **(a)**, where each firm earns zero profit and there is no incentive to enter or exit the industry.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.14

# A Long-Run Competitive Equilibrium

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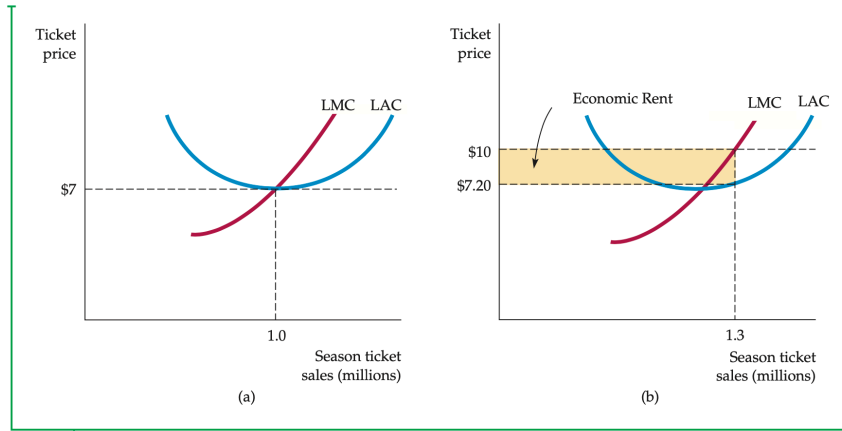
- In a long-run competitive equilibrium,
  - All firms in the industry are maximizing profit.
  - No firm has an incentive either to enter or exit the industry because all firms are earning zero economic profit.
  - The price of the product is such that the quantity supplied by the industry is equal to the quantity demanded by consumers.
- Note that
  - Zero economic profit is essential for the market to be in long-run equilibrium.
  - By definition, positive economic profit represents an opportunity for investors and an incentive to enter an industry.
  - Positive accounting profit, however, will not necessarily encourage entry.

# Economic Rent

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- Economic rent is what firms are willing to pay for an input less the minimum amount necessary to obtain it.
  - Some firms earn "higher accounting profit" than others because they have "access to scarce factors of production that are in limited supply" such as land, skill, or talent.
  - The "positive accounting profits are therefore translated into economic rent" that is earned by the scarce factors.
  - The presence of economic rent explains why there are some markets in which firms cannot enter in response to profit opportunities.
  - In these situations, what makes "economic profit zero" in the long run is the willingness of other firms to use the factors of production that are in limited supply.
- In the long run, in a competitive market, the producer surplus consists of the economic rent that it enjoys from all its scarce inputs.





**FIGURE 8.15**  
**FIRMS EARN ZERO PROFIT IN LONG-RUN EQUILIBRIUM**

In long-run equilibrium, all firms earn zero economic profit. In (a), a baseball team in a moderate-sized city sells enough tickets so that price (\$7) is equal to marginal and average cost. In (b), the demand is greater, so a \$10 price can be charged. The team increases sales to the point at which the average cost of production plus the average economic rent is equal to the ticket price. When the opportunity cost associated with owning the franchise is taken into account, the team earns zero economic profit.

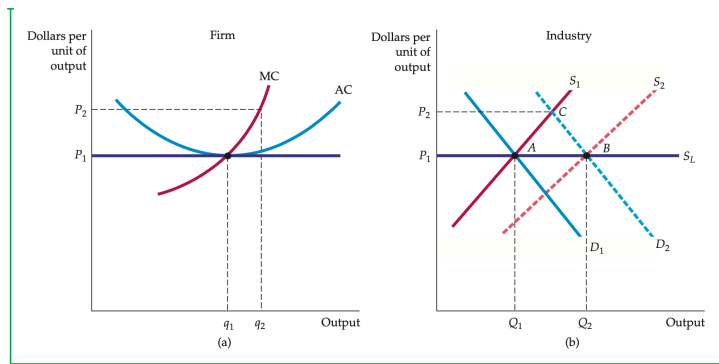
Source: *Microeconomics*, 9th ed. (Pindyck and Rubinfeld, 2018), Figure 8.15

# The Long-Run Supply Curve

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- The shape of the long-run supply curve depends on the (long-run average) cost structure of the industry.
  - Constant-cost industry  $\Rightarrow$  A horizontal long-run supply curve
  - Increasing-cost industry  $\Rightarrow$  An upward-sloping long-run supply curve
  - Decreasing-cost industry  $\Rightarrow$  A downward-sloping long-run supply curve
- Note that
  - In the long run, firms enter and exit markets as the market price changes.
  - This makes it impossible to sum up supply curves.
  - We do not know which firms' supplies to add up in order to get market totals.

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

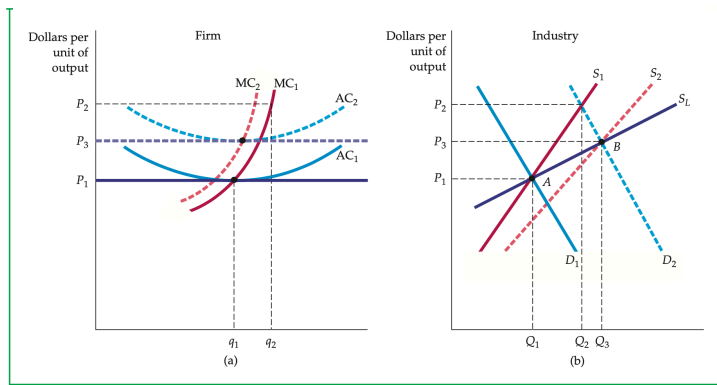


**FIGURE 8.16**  
**LONG-RUN SUPPLY IN A CONSTANT-COST INDUSTRY**

In (b), the long-run supply curve in a constant-cost industry is a horizontal line  $S_L$ . When demand increases, initially causing a price rise (represented by a move from point A to point C), the firm initially increases its output from  $q_1$  to  $q_2$ , as shown in (a). But the entry of new firms causes a shift to the right in industry supply. Because input prices are unaffected by the increased output of the industry, entry occurs until the original price is obtained (at point B in (b)).

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.16

# Long-Run Supply Curve in a Increasing-Cost Industry



**FIGURE 8.17**

## LONG-RUN SUPPLY IN AN INCREASING-COST INDUSTRY

In (b), the long-run supply curve in an increasing-cost industry is an upward-sloping curve  $S_L$ . When demand increases, initially causing a price rise, the firms increase their output from  $q_1$  to  $q_2$  in (a). In that case, the entry of new firms causes a shift to the right in supply from  $S_1$  to  $S_2$ . Because input prices increase as a result, the new long-run equilibrium occurs at a higher price than the initial equilibrium.

Source: *Microeconomics, 9th ed.* (Pindyck and Rubinfeld, 2018), Figure 8.17