

Principles of Economics

Twelfth Edition



Chapter 9

Long-Run Costs and
Output Decisions

Principles of Economics

TWELFTH EDITION

Karl E. Case • Ray C. Fair • Sharon E. Oster

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Chapter Outline and Learning Objectives

(1 of 2)

9.1 Short-Run Conditions and Long-Run Directions

- Discuss how short-run conditions affect a firm's short-run and long-run behavior.

9.2 Long-Run Costs: Economies and Diseconomies of Scale

- Explain the causes and effects of diseconomies of scale.

9.3 Long-Run Adjustments to Short-Run Conditions

- Describe long-run adjustments for short-run profits and losses.

Chapter Outline and Learning Objectives

(2 of 2)

Output Markets: A Final Word

Appendix: External Economies and Diseconomies and the Long-Run Industry Supply Curve

- Understand how external economies and diseconomies impact the slope of long-run industry supply curves.

Chapter 9 Long-Run Costs and Output Decisions

- Output decisions in the long run are less constrained than in the short run:
 - Firms can choose their scale of plant and change any or all of its inputs.
 - Firms are free to enter and leave the industry.
- Managers simultaneously make short-run and long-run decisions, making the best of the current constraints while planning for the future.

Short-Run Conditions and Long-Run Directions

- We begin our discussion of the long run by looking at firms in three short-run circumstances:
 - Firms that earn economic profits
 - Firms that suffer economic losses but continue to operate to reduce or minimize those losses
 - Firms that decide to shut down and bear losses just equal to fixed costs
- **breaking even** The situation in which a firm is earning exactly a normal rate of return.

Maximizing Profits *(1 of 2)*

Example: The Blue Velvet Car Wash

TABLE 9.1 Blue Velvet Car Wash Weekly Costs

<i>TFC</i> Total Fixed Cost			<i>TVC</i> Total Variable Cost (800 Washes)			<i>TC</i> Total Cost (800 Washes)	<i>TR</i> Total Revenue (<i>P</i> = \$5)
<i>TC = TFC + TVC</i>							
1.	Normal return to investors	\$1,000	1.	Labor	\$1,000	=\$2,000 + \$1,600 =\$3,600	<i>TR</i> = \$5 × 800 = \$4,000
			2.	Soap	600		
2.	Other fixed costs (maintenance contract)	\$1,000			\$1,600		<i>Profit = TR – TC</i> = \$400
		\$2,000					

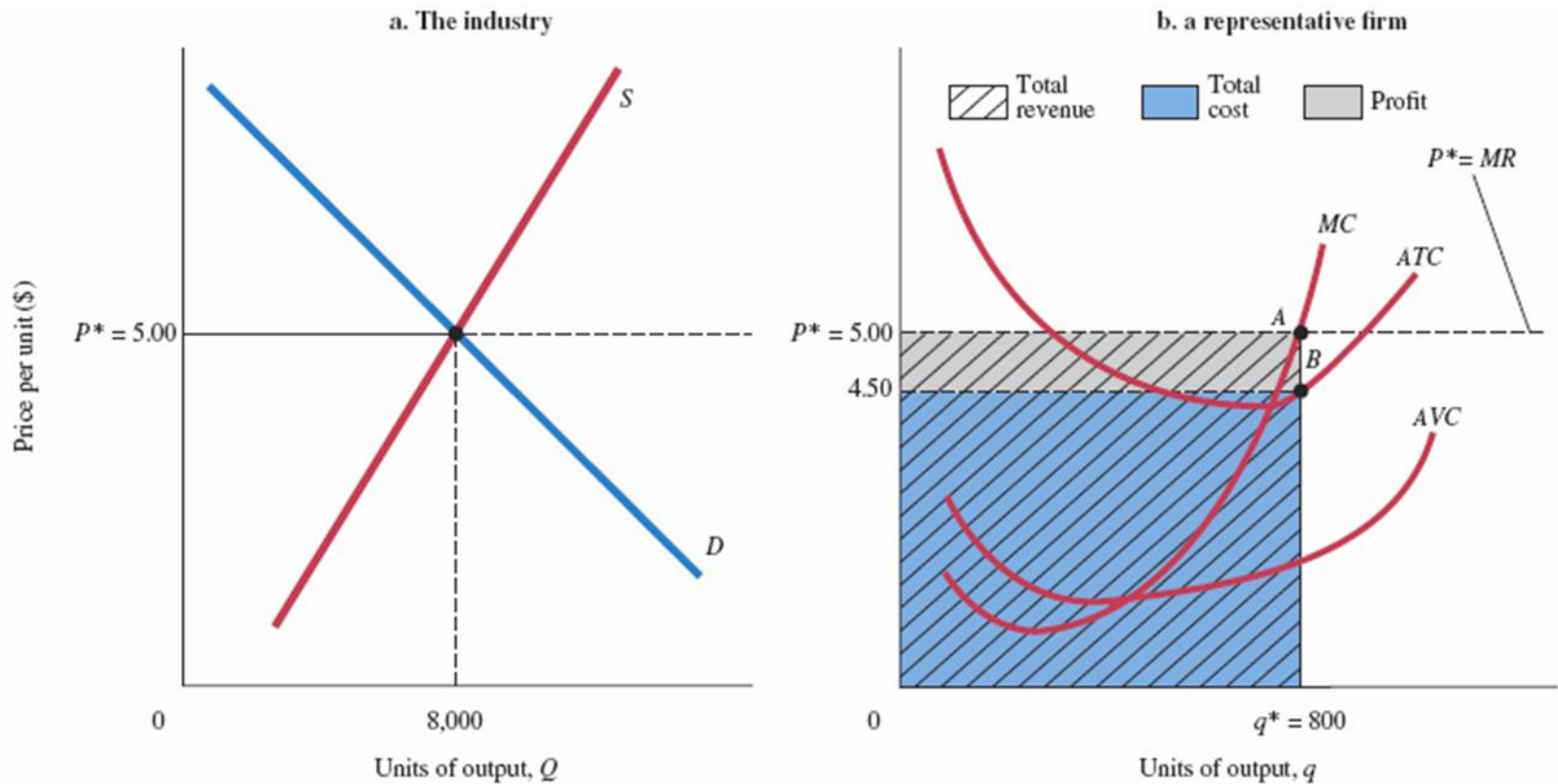
Maximizing Profits (2 of 2)

Graphic Presentation

- A profit-maximizing perfectly competitive firm will produce up to the point where $P^* = MC$.
- Profit is the difference between total revenue and total cost.
- Because average total cost is derived by dividing total cost by q , we can get back to total cost by *multiplying* average total cost by q .

$$ATC = \frac{TC}{q} \quad \text{and so} \quad TC = ATC \times q.$$

FIGURE 9.1 Firm Earning a Positive Profit in the Short Run



At $q^* = 800$, total revenue is $\$5 \times 800 = \$4,000$, total cost is $\$4.50 \times 800 = \$3,600$, and profit is $\$4,000 - \$3,600 = \$400$.

Minimizing Losses *(1 of 2)*

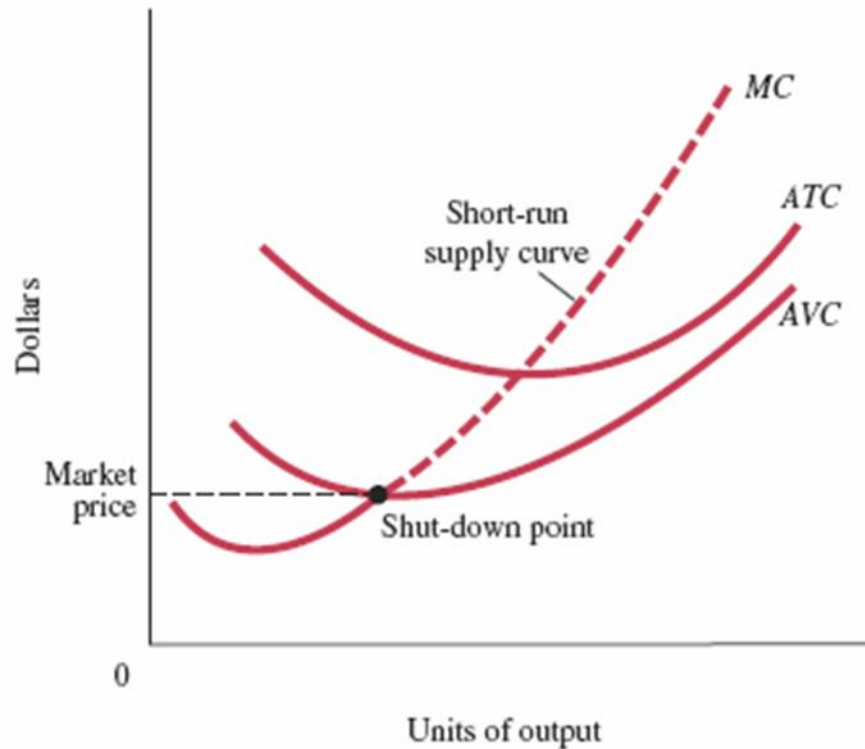
- If total revenue exceeds total variable cost, the excess revenue can be used to offset fixed costs and reduce losses, and it will pay the firm to keep operating.
- If total revenue is smaller than total variable cost, the firm that operates will suffer losses in excess of fixed costs. In this case, the firm can minimize its losses by shutting down.

Minimizing Losses *(2 of 2)*

Producing at a Loss to Offset Fixed Costs

- **shutdown point** The lowest point on the average variable cost curve. When price falls below the minimum point on *AVC*, total revenue is insufficient to cover variable costs, and the firm will shut down and bear losses equal to fixed costs.

FIGURE 9.2 Short-Run Supply Curve of a Perfectly Competitive Firm



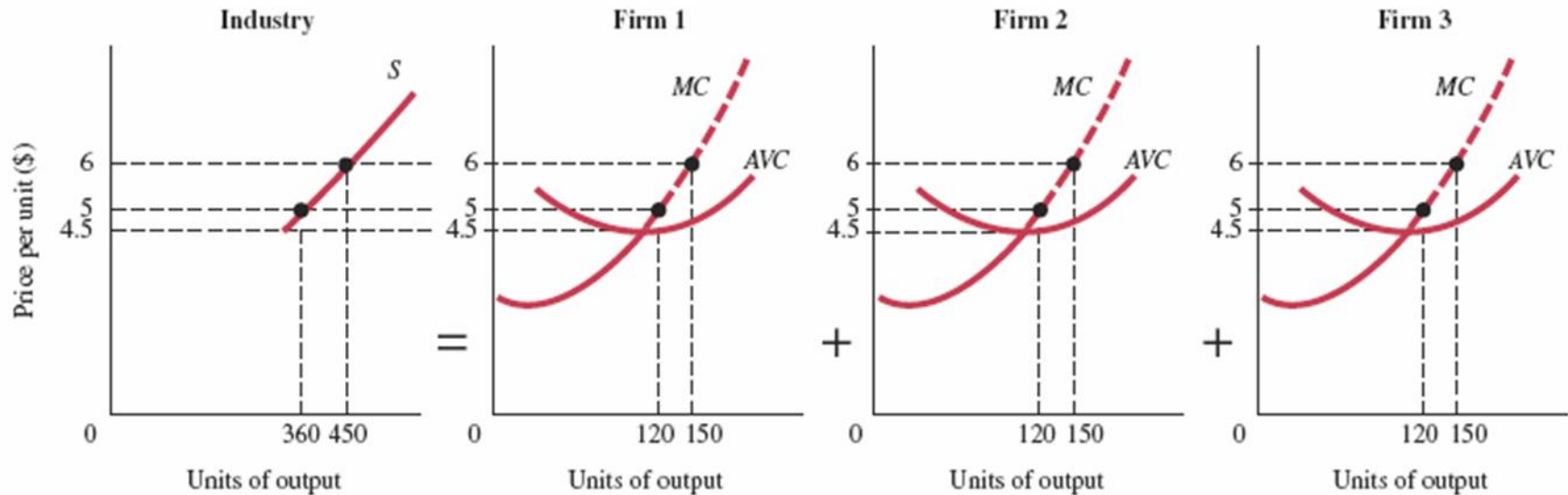
At prices below average variable cost, it pays a firm to shut down rather than continue operating.

Thus, the short-run supply curve of a competitive firm is the part of its marginal cost curve that lies *above* its average variable cost curve.

The Short-Run Industry Supply Curve

- **short-run industry supply curve** The sum of the marginal cost curves (above *AVC*) of all the firms in an industry.

FIGURE 9.3 The Industry Supply Curve in the Short Run Is the Horizontal Sum of the Marginal Cost Curves (above *AVC*) of All the Firms in an Industry



If there are only three firms in the industry, the industry supply curve is simply the sum of all the products supplied by the three firms at each price.

For example, at \$6 each firm supplies 150 units, for a total industry supply of 450.

Long-Run Directions: A Review

TABLE 9.2 Profits, Losses, and Perfectly Competitive Firm Decisions in the Long and Short Run

	Short-Run Condition	Short-Run Decision	Long-Run Decision
Profits	$TR > TC$	$P = MC$: operate	Expand: new firms enter
Losses	1. $TR \geq TVC$	$P = MC$: operate (loss < total fixed cost)	Contract: firms exit
	2. $TR < TVC$	Shut down: loss = total fixed cost	Contract: firms exit

Long-Run Costs: Economies and Diseconomies of Scale

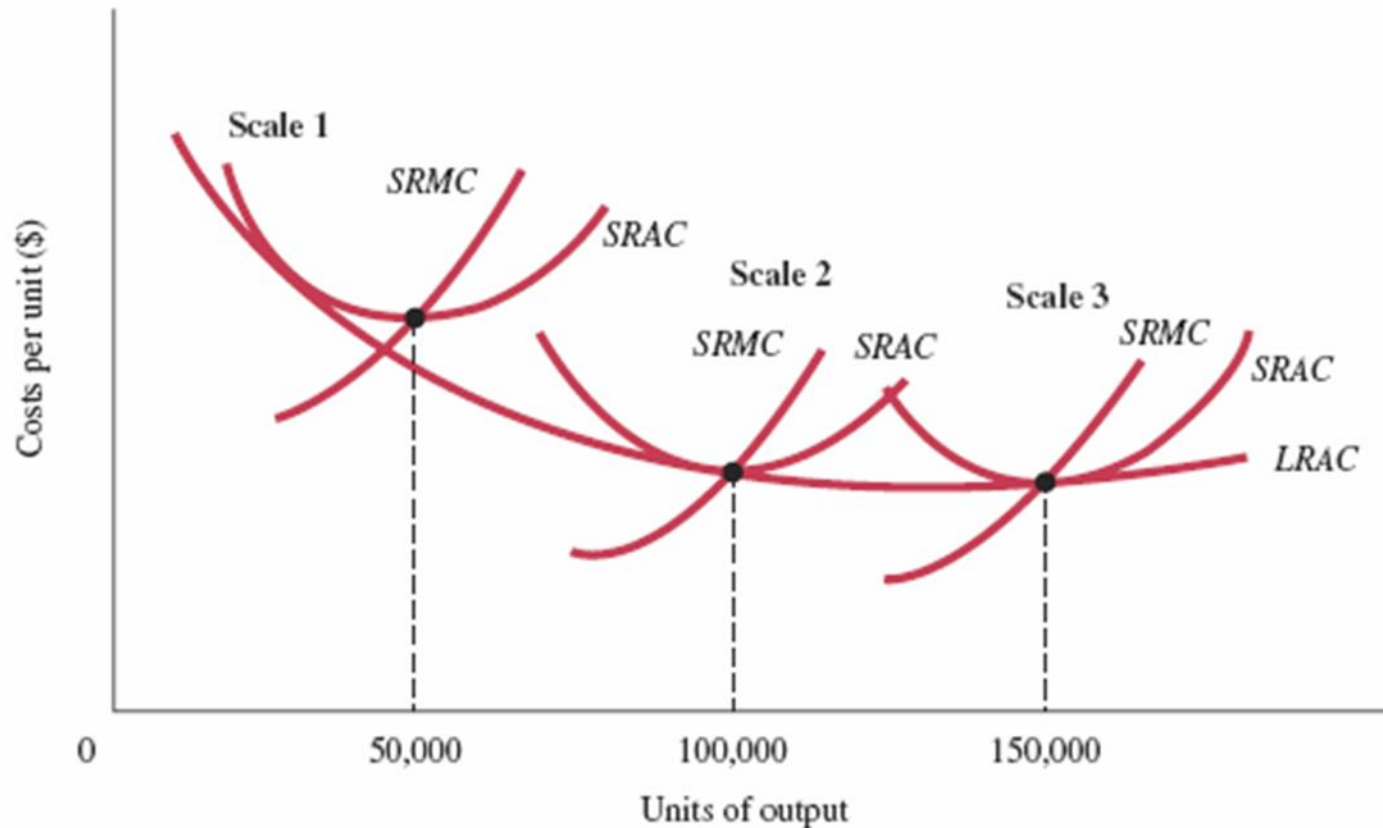
- **long-run average cost curve (*LRAC*)** Shows the way per-unit costs change with output in the long run.
- **increasing returns to scale** or **economies of scale** An increase in a firm's scale of production leads to lower costs per unit produced.
- **constant returns to scale** An increase in a firm's scale of production has no effect on costs per unit produced.
- **decreasing returns to scale** or **diseconomies of scale** An increase in a firm's scale of production leads to higher costs per unit produced.

Increasing Returns to Scale

The Sources of Economies of Scale

- Some economies of scale result not from technology but from firm-level efficiencies and bargaining power that can come with size.
- Economies of scale have come from advantages of larger firm size rather than gains from plant size.
- **minimum efficient scale (MES)** The smallest size at which the long-run average cost curve is at its minimum.

FIGURE 9.4 A Firm Exhibiting Economies of Scale



The long-run average cost curve of a firm shows the different scales on which the firm can choose to operate in the long run. Each scale of operation defines a different short run. Here we see a firm exhibiting economies of scale; moving from scale 1 to scale 3 reduces average cost.

ECONOMICS IN PRACTICE

Economies of Scale in the Search Business

Online search is a scale-driven business: The search behavior of one user can be used to improve the search of future users.

Google—the top search engine—has more than three times the searches of Microsoft’s Bing but employs only about twice as many engineers and spends less per search on its data centers.



THINKING PRACTICALLY

1. Google was an early pioneer in the search business. How did that early lead interact with the fact of scale economies in Google’s favor?

Constant Returns to Scale

- Technically, the term *constant returns* means that the quantitative relationship between input and output stays constant, or the same, when output is increased.
- Constant returns to scale means that the firm's long-run average cost curve remains flat.

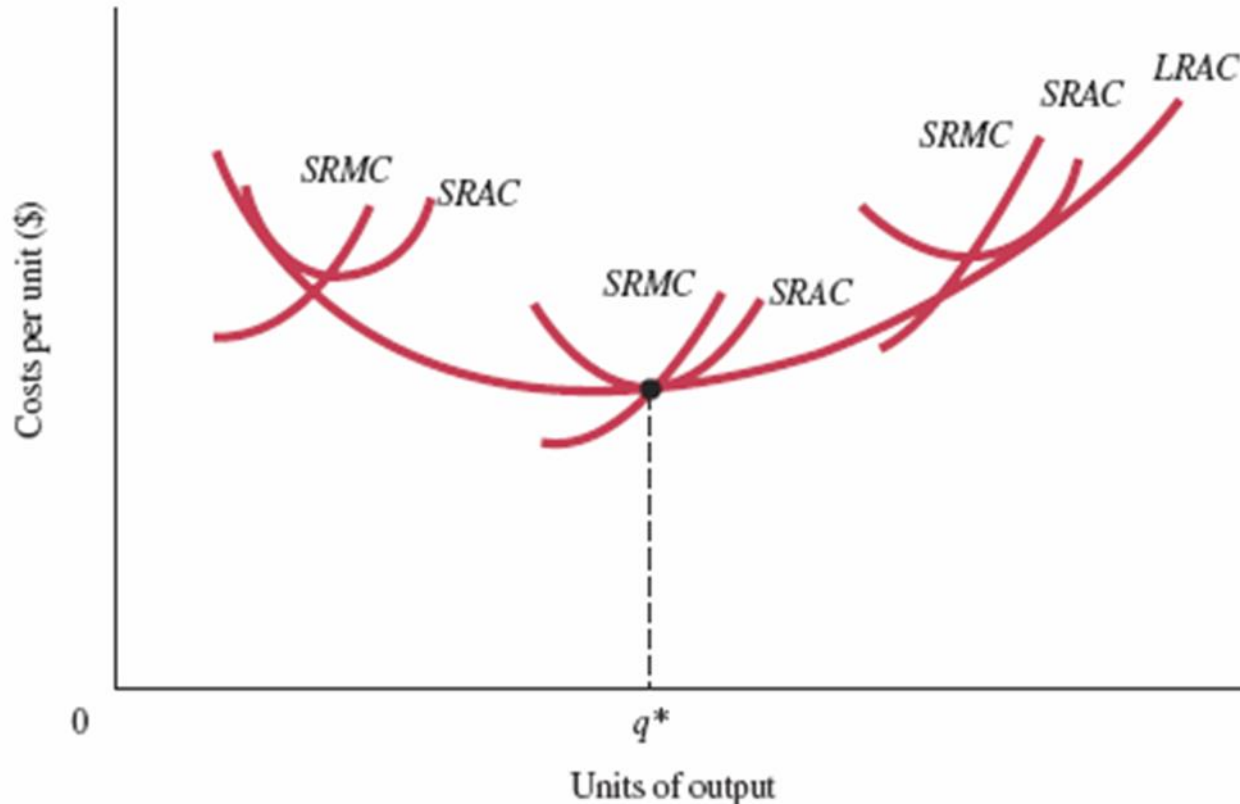
Diseconomies of Scale

- When average cost increases with scale of production, a firm faces *decreasing returns to scale*, or *diseconomies of scale*.

U-Shaped Long-Run Average Costs

- **optimal scale of plant** The scale of plant that minimizes long-run average cost.

FIGURE 9.5 A Firm Exhibiting Economies and Diseconomies of Scale



Economies of scale push this firm's average costs down to q^* .

Beyond q^* , the firm experiences diseconomies of scale; q^* is the level of production at lowest long-run average costs, using optimal scale.

ECONOMICS IN PRACTICE

The Long-Run Average Cost Curve: Flat or U-Shaped?

A long-run average cost curve was first drawn as the “envelope” of a series of short-run curves in 1931.

Jacob Viner drew the long-run curve through the minimum points of all the short-run average cost curves.

In 1986, Professor Herbert Simon of Carnegie-Mellon University explained that studies show that a firm’s cost curves are not U-shaped but instead slope down to the right and then level off.



THINKING PRACTICALLY

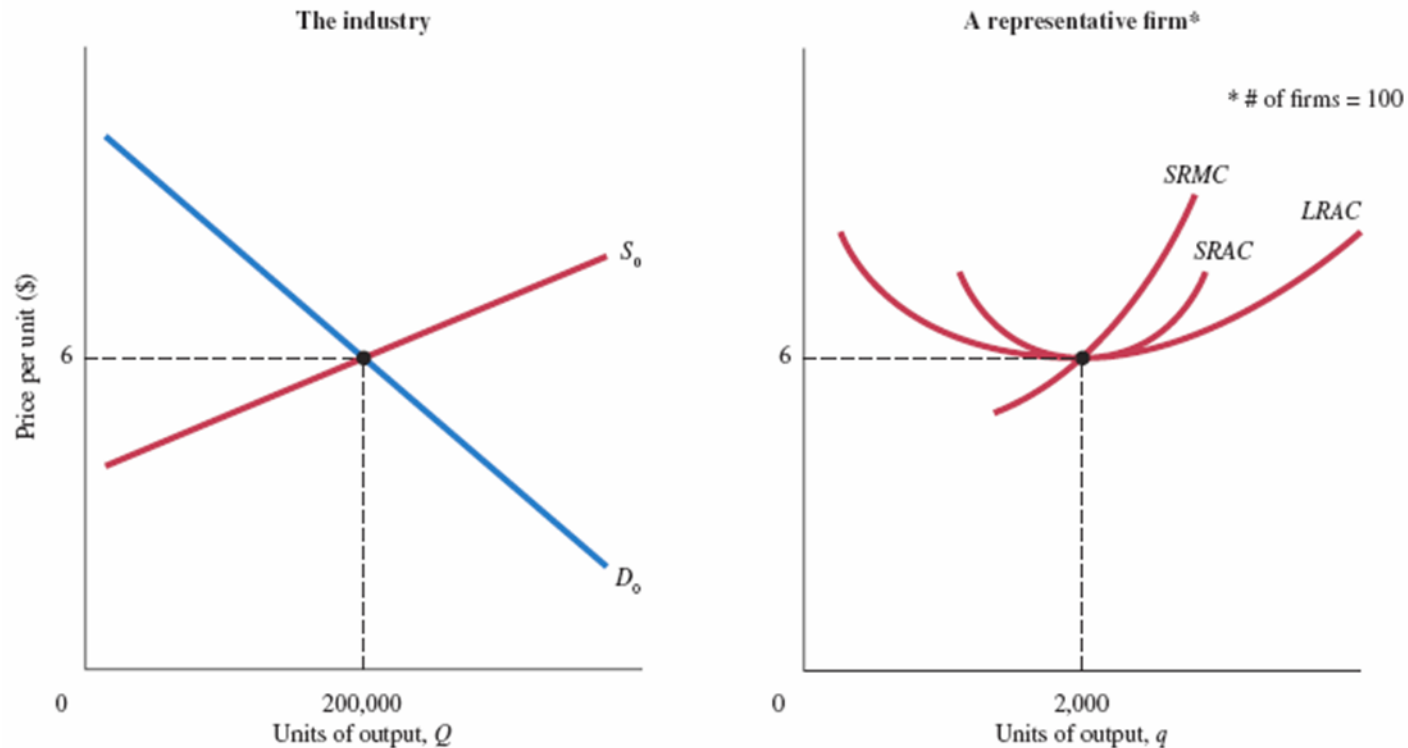
1. Some have argued that even if long-run AC curves do eventually slope up, we would not likely see many firms operating at this size. Why not?

Long-Run Adjustments to Short-Run Conditions

Short-Run Profits: Moves In and Out of Equilibrium

- Suppose demand increases when the industry is in long-run equilibrium. What will happen?

FIGURE 9.6 Equilibrium for an Industry with U-Shaped Cost Curves



The individual firm on the right is producing 2,000 units, and we also know that the industry consists of 100 firms.

All firms are identical, and all are producing at the uniquely best output level of 2,000 units.

FIGURE 9.7 Industry Response to an Increase in Demand

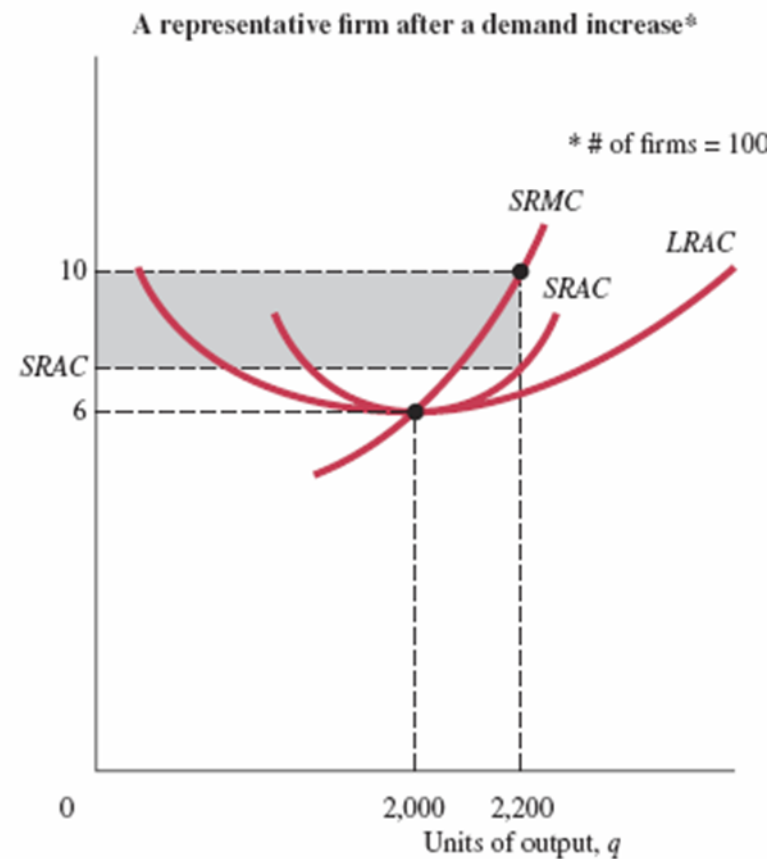
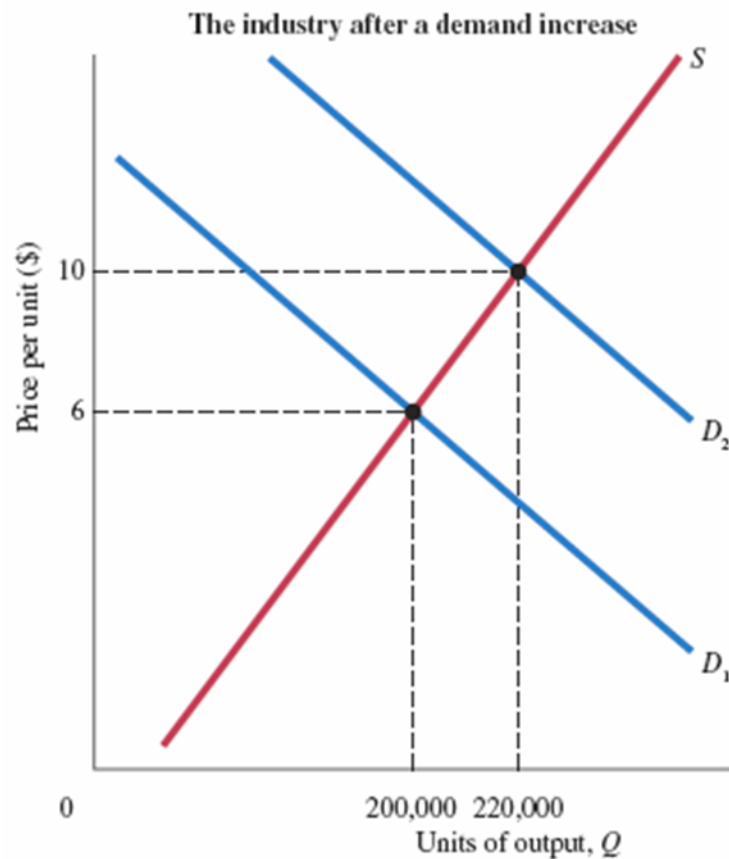
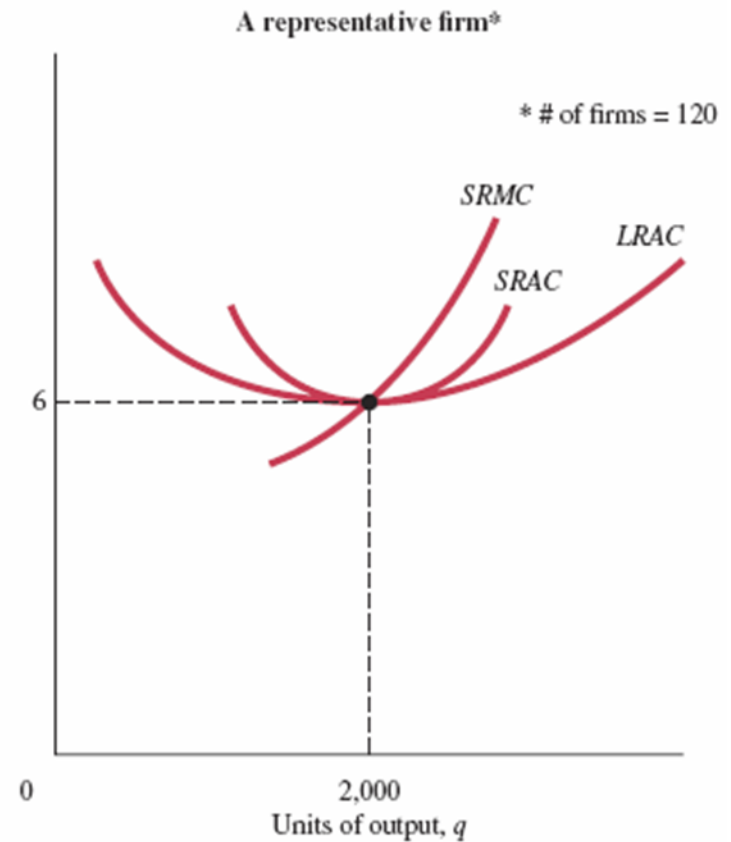
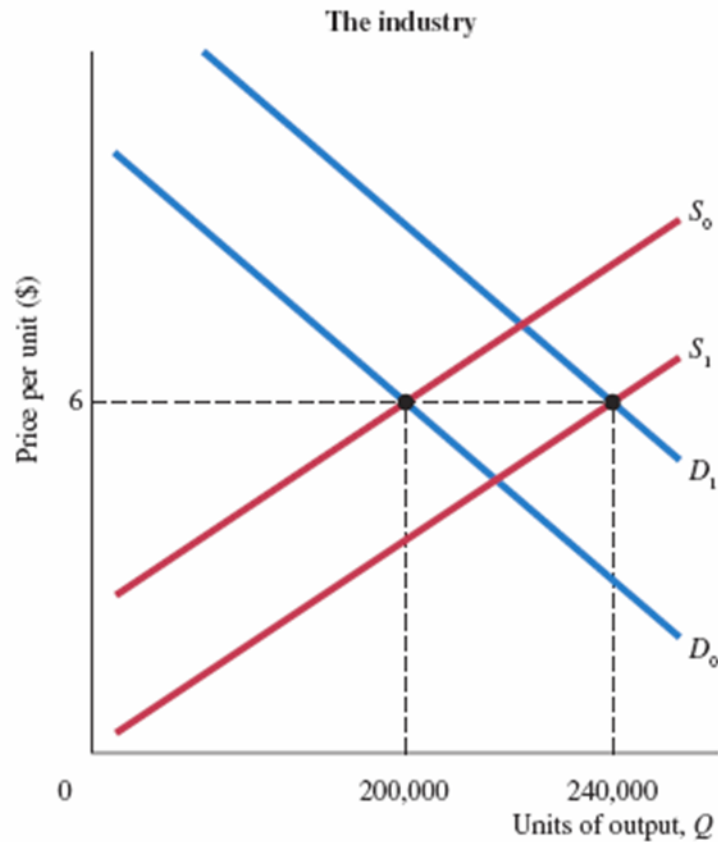


FIGURE 9.8 New Equilibrium with Higher Demand



Short-Run Profits: Moves In and Out of Equilibrium

- In equilibrium, each firm has:

$$SRMC = SRAC = LRAC$$

- Firms make no excess profits so that:

$$P = SRMC = SRAC = LRAC$$

and there are enough firms so that supply equals demand.

The Long-Run Adjustment Mechanism: Investment Flows toward Profit Opportunities

(1 of 2)

- The entry and exit of firms in response to profit opportunities usually involve the financial capital market.
- In capital markets, people are constantly looking for profits. When firms in an industry do well, capital is likely to flow into that industry in a variety of forms.
- **long-run competitive equilibrium** When
 $P = SRMC = SRAC = LRAC$ and profits are zero.

The Long-Run Adjustment Mechanism: Investment Flows toward Profit Opportunities

(2 of 2)

- Investment—in the form of new firms and expanding old firms—will over time tend to favor those industries in which profits are being made.
- Also, over time, industries in which firms are suffering losses will gradually contract from disinvestment.

ECONOMICS IN PRACTICE

Why is Food so Expensive at the Airport?

A sandwich or a latte at an airport is more expensive.

If airport A earns supernormal profits, free entry would lead to constructing another airport nearby, reducing the demand for everything in airport A, including the demand for food. Airport A would then have to charge a lower rent from food vendors, making food cheaper.

Research has shown that taking the costs and revenues of running an airport into account, that if no supernormal profit is earned by the airport, the food items cost just as much as they should.



THINKING PRACTICALLY

1. With the help of a graph, show how a higher rent increases the price of a café latte.

Output Markets: A Final Word *(1 of 2)*

- In the last four chapters, we have been building a model of a simple market system under the assumption of perfect competition.
- *Changes in market price and thus profits are the basic signal that leads to a reallocation of society's resources.*
- In the short run, producers are constrained by their scales of operation.

Output Markets: A Final Word *(2 of 2)*

- In the long run, however, we would expect to see resources flow in to compete for these profits. What starts as a shift in preferences thus ends up as a shift in resources.
- You have now seen what lies behind the demand curves and supply curves in competitive output markets.
- The next two chapters complete the picture by taking up competitive *input* markets.

REVIEW TERMS AND CONCEPTS

- breaking even
 - constant returns to scale
 - decreasing returns to scale or diseconomies of scale
 - increasing returns to scale or economies of scale
 - long-run average cost curve (*LRAC*)
 - long-run competitive equilibrium
 - minimum efficient scale (MES)
 - optimal scale of plant
 - short-run industry supply curve
 - shutdown point
- Equation:
- long-run competitive equilibrium,

$$P = SRMC = SRAC = LRAC$$

CHAPTER 9 APPENDIX: External Economies and Diseconomies

- When industry growth results in a decrease in long-run average costs, there are *external economies*.
- When industry growth results in an increase in long-run average costs, there are *external diseconomies*.

TABLE 9A.1 Construction of New Housing and Construction Materials Costs, 2000–2005

Year	House Prices % over the Previous Year	Housing Starts (Thousands)	Housing Starts % Change over the Previous Year	Construction Materials Prices % Change over the Previous Year	Consumer Prices % Change over the Previous Year
2000	—	1,573	—	—	—
2001	7.5	1,661	5.6%	0%	2.8%
2002	7.5	1,710	2.9%	1.5%	1.5%
2003	7.9	1,853	8.4%	1.6%	2.3%
2004	12.0	1,949	5.2%	8.3%	2.7%
2005	13.0	2,053	5.3%	5.4%	2.5%

Source: Based on Economy.com and the Office of Federal Housing Enterprise Oversight (OFHEO).

The Long-Run Industry Supply Curve

(1 of 2)

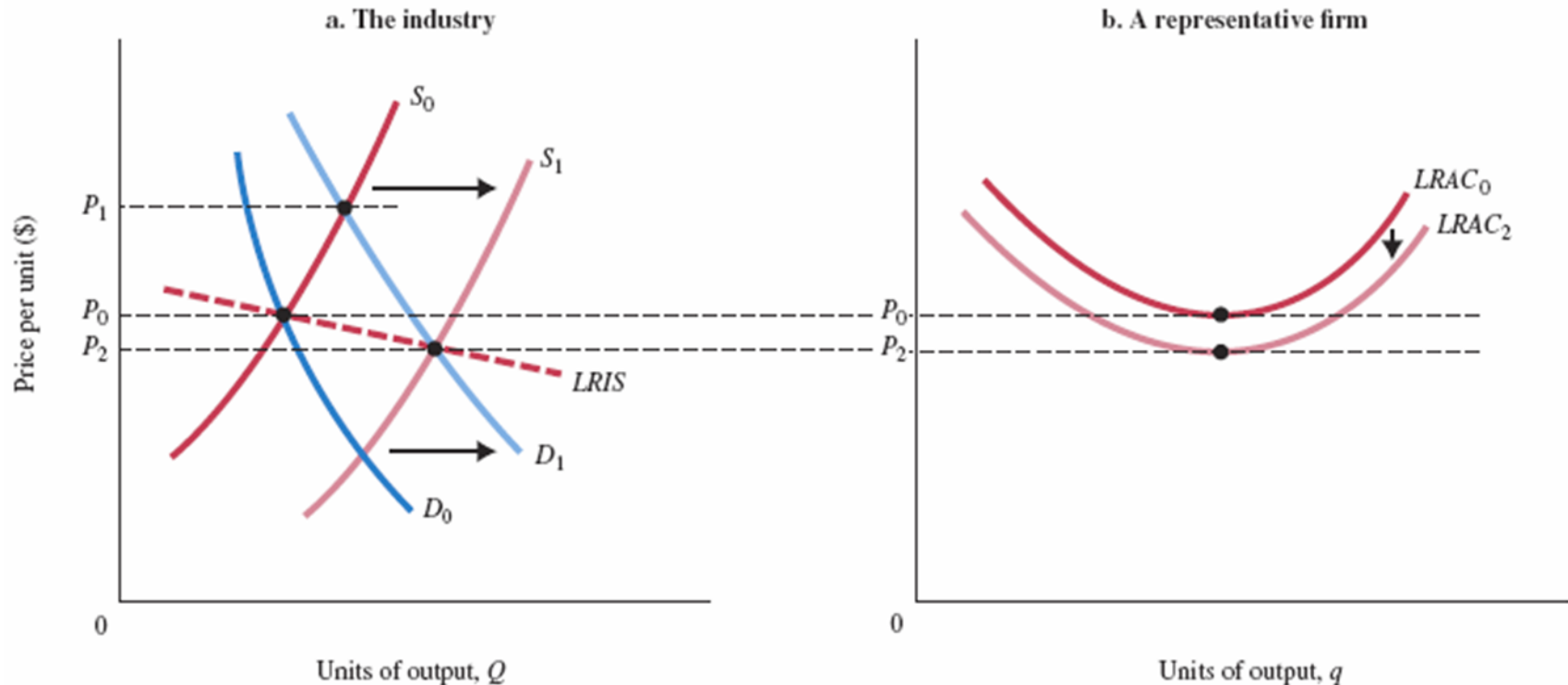
- **long-run industry supply curve (*LRIS*)** A graph that traces out price and total output over time as an industry expands.
- **decreasing-cost industry** An industry that realizes external economies—that is, average costs decrease as the industry grows. The long-run supply curve for such an industry has a negative slope.

The Long-Run Industry Supply Curve

(2 of 2)

- **increasing-cost industry** An industry that encounters external diseconomies—that is, average costs increase as the industry grows. The long-run supply curve for such an industry has a positive slope.
- **constant-cost industry** An industry that shows no economies or diseconomies of scale as the industry grows. Such industries have flat, or horizontal, long-run supply curves.

FIGURE 9A.1 A Decreasing-Cost Industry: External Economies



In a decreasing-cost industry, average cost declines as the industry expands.

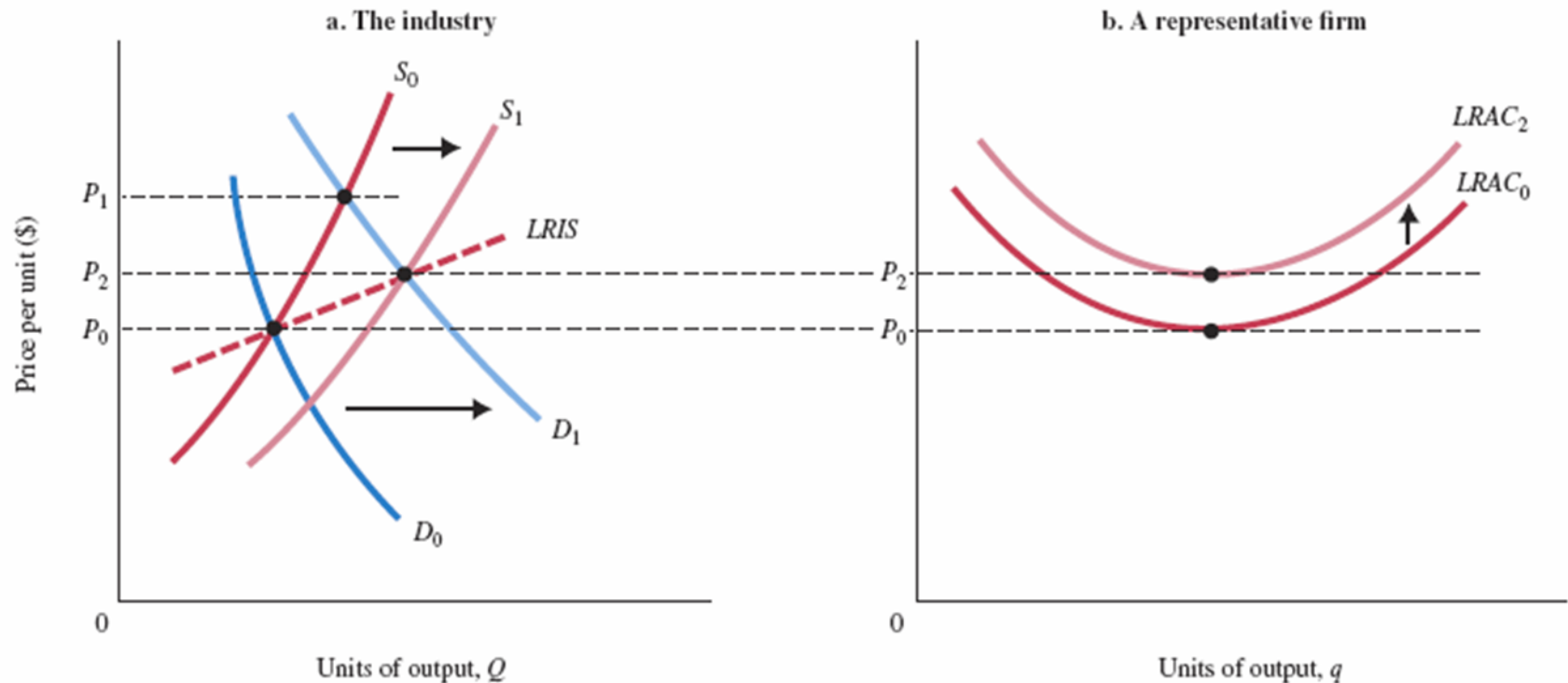
As demand expands from D_0 to D_1 , price rises from P_0 to P_1 .

As new firms enter and existing firms expand, supply shifts from S_0 to S_1 , driving price down.

If costs decline as a result of the expansion to $LRAC_2$, the final price will be below P_0 at P_2 .

The long-run industry supply curve ($LRIS$) slopes downward in a decreasing-cost industry.

FIGURE 9A.2 An Increasing-Cost Industry: External Diseconomies



In an increasing-cost industry, average cost increases as the industry expands.

As demand shifts from D_0 to D_1 , price rises from P_0 to P_1 .

As new firms enter and existing firms expand output, supply shifts from S_0 to S_1 , driving price down.

If long-run average costs rise, as a result, to $LRAC_2$, the final price will be P_2 .

The long-run industry supply curve ($LRIS$) slopes up in an increasing-cost industry.

APPENDIX REVIEW TERMS AND CONCEPTS

- constant-cost industry
- decreasing-cost industry
- external economies and diseconomies
- increasing-cost industry
- long-run industry supply curve (*LRIS*)