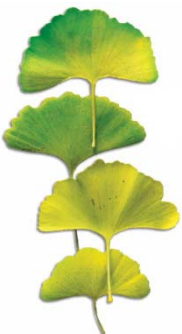


Chapter 9

Costs

Chapter Outline

- Costs In The Short Run
- Graphing the Total, Variable, and Fixed Cost Curves
- Average Fixed, Average Variable, Average Total and Marginal Costs
- Allocating Production Between Two Processes
- The Relationship Among MP, AP, MC, And AVC
- Costs In The Long Run
- Long-Run Costs And The Structure Of Industry
- The Relationship Between Long-run And Short-run Cost Curves



Costs In the Short Run

- ***Fixed cost (FC)***: cost that does not vary with the level of output in the short run (the cost of all fixed factors of production).
- ***Variable cost (VC)***: cost that varies with the level of output in the short run (the cost of all variable factors of production).
- ***Total cost (TC)***: all costs of production: the sum of variable cost and fixed cost.

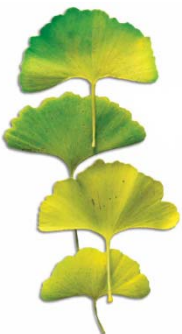


Figure 9.1: Output as a Function of One Variable Input

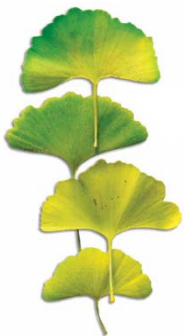
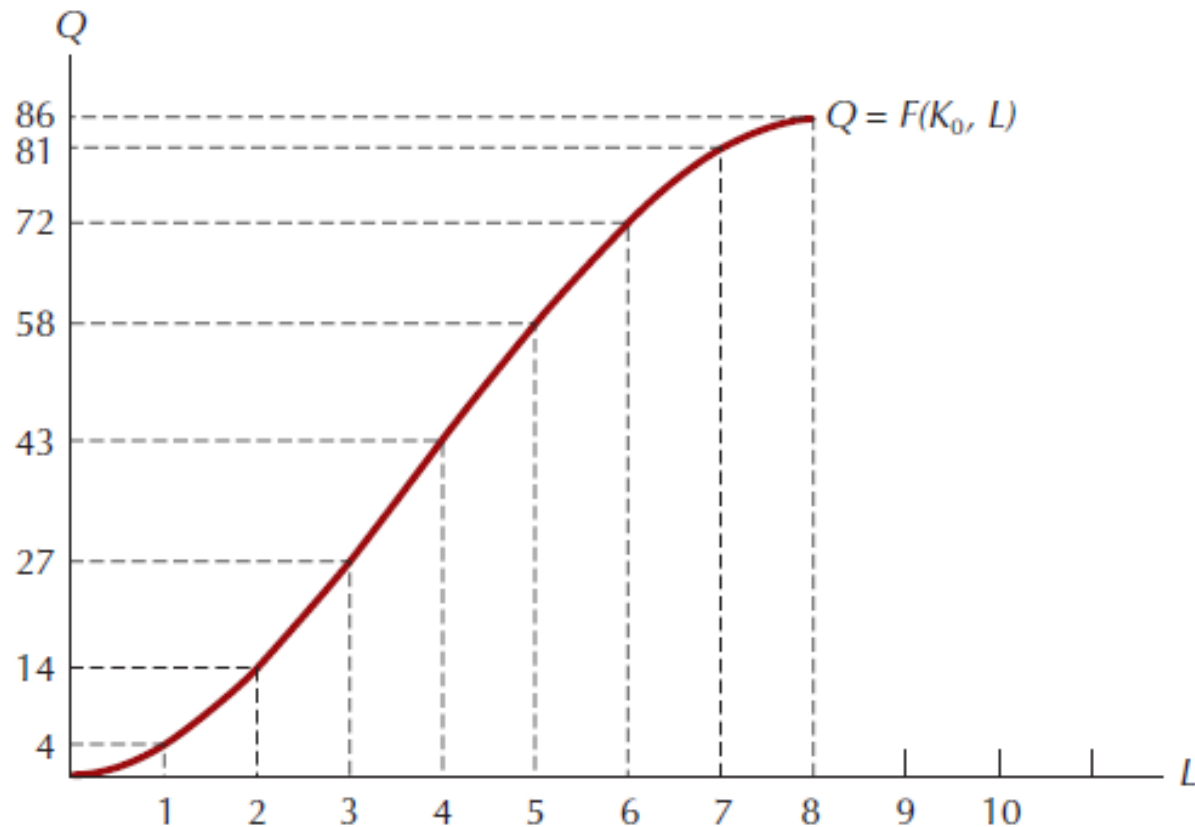


Figure 9.2: The Total, Variable, and Fixed Cost Curves

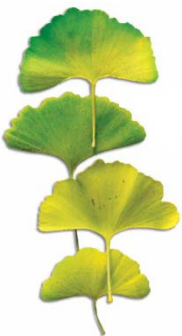
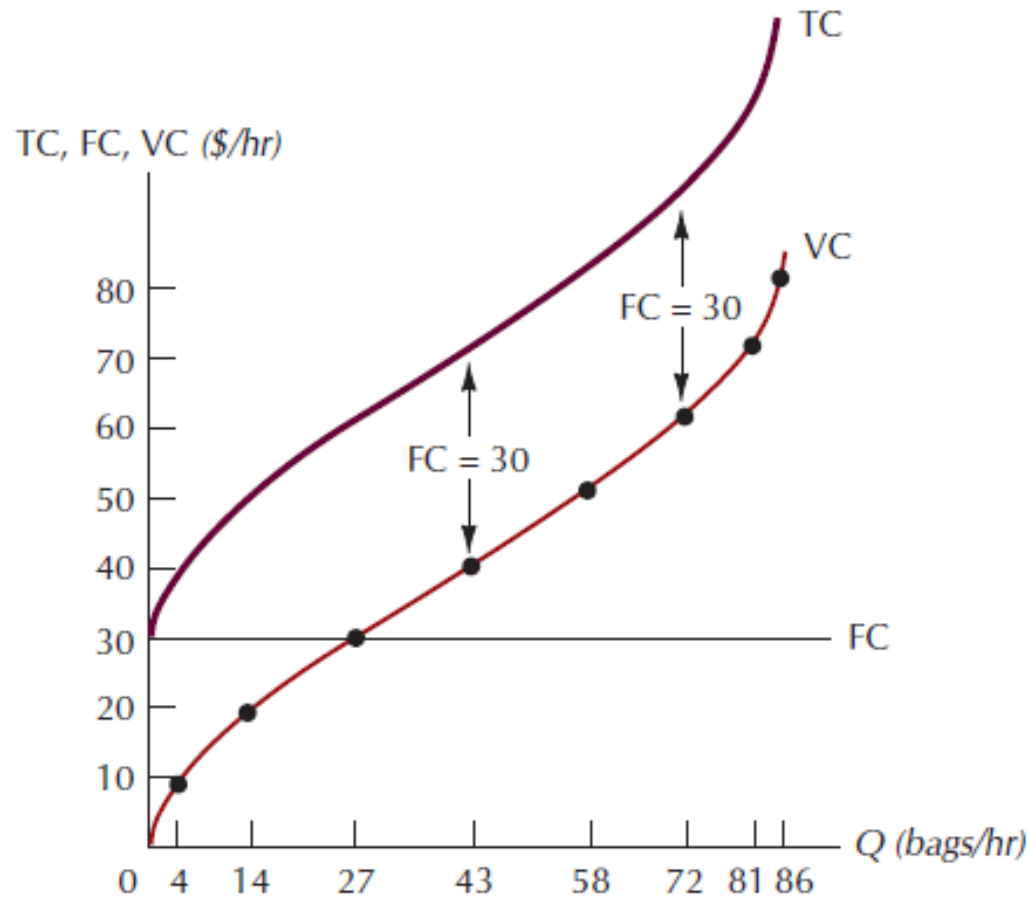


Figure 9.3: The Production Function

$Q = 3KL$, with $K = 4$

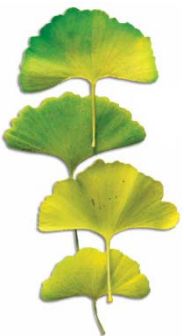
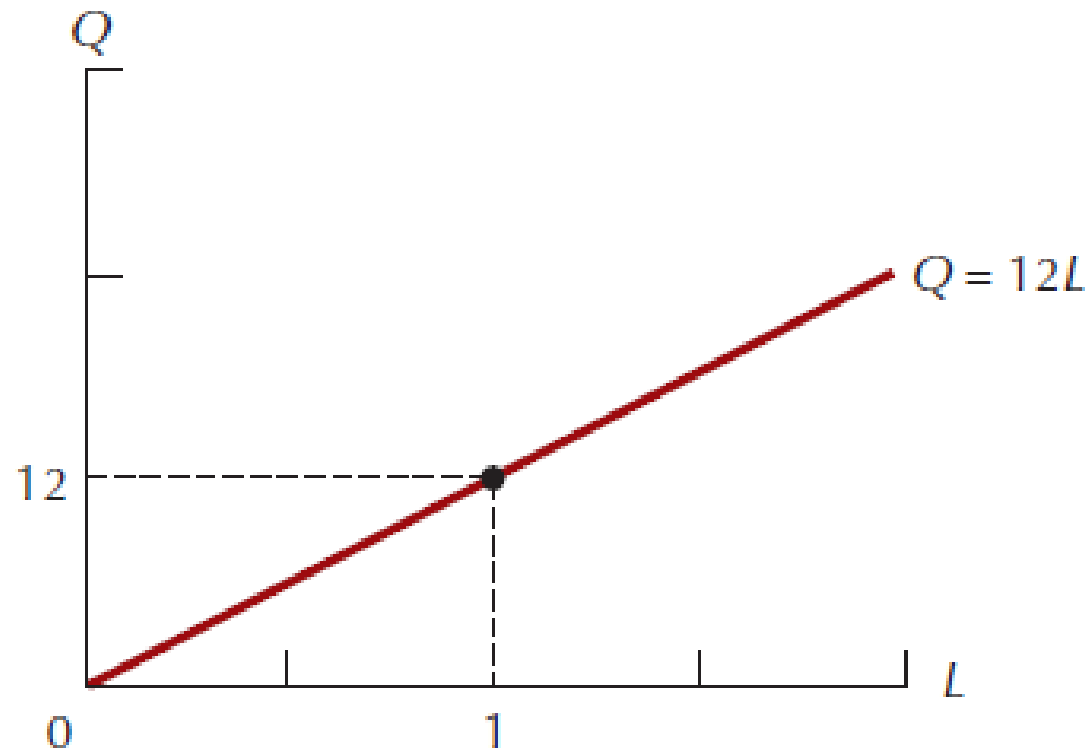
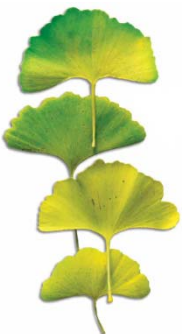
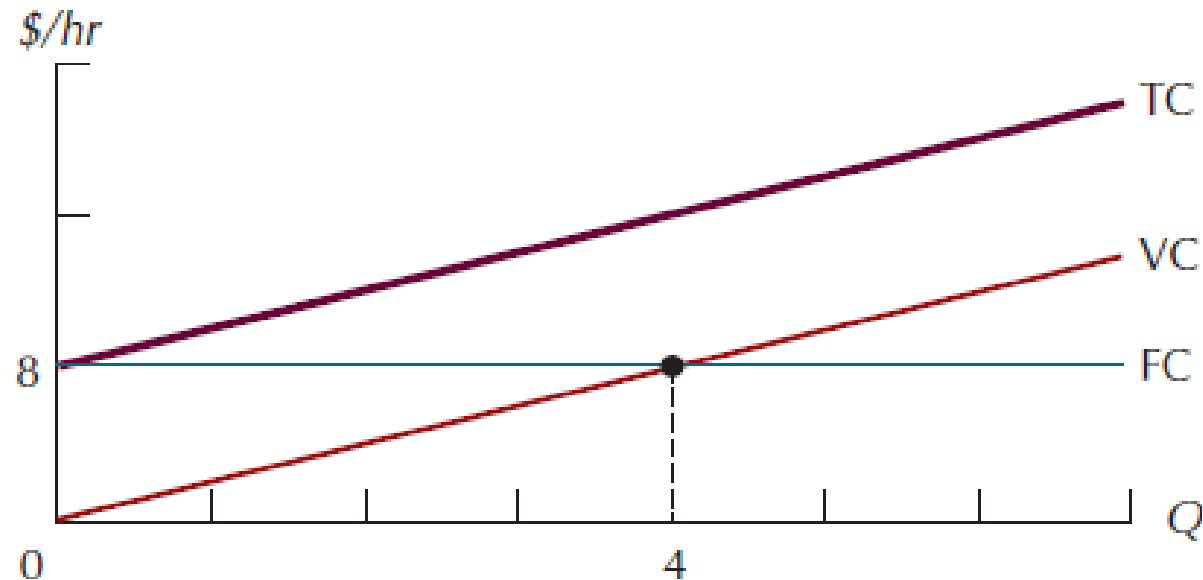
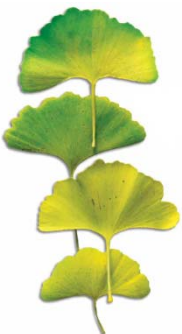


Figure 9.4: The Total, Variable, and Fixed Cost Curves for the Production Function $Q = 3KL$



Other Short-Run Costs

- ***Average fixed cost (AFC)***: fixed cost divided by the quantity of output.
- ***Average variable cost (AVC)***: variable cost divided by the quantity of output.
- ***Average total cost (ATC)***: total cost divided by the quantity of output.
- ***Marginal cost (MC)***: change in total cost that results from a 1-unit change in output.



Graphing the Short-run Average and Marginal Cost Curves

- Geometrically, average variable cost at any level of output Q may be interpreted as the slope of a ray from the origin to the variable cost curve at Q .
- Geometrically, marginal cost at any level of output may be interpreted as the slope of the total cost curve at that level of output.
 - And since the total cost and variable cost curves are parallel, is also equal to the slope of the variable cost curve.
 - Marginal cost is the most important of the cost curves.

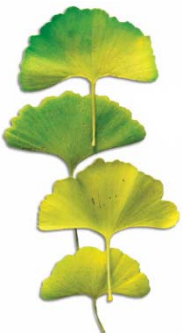
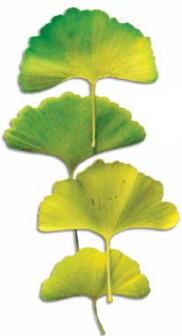
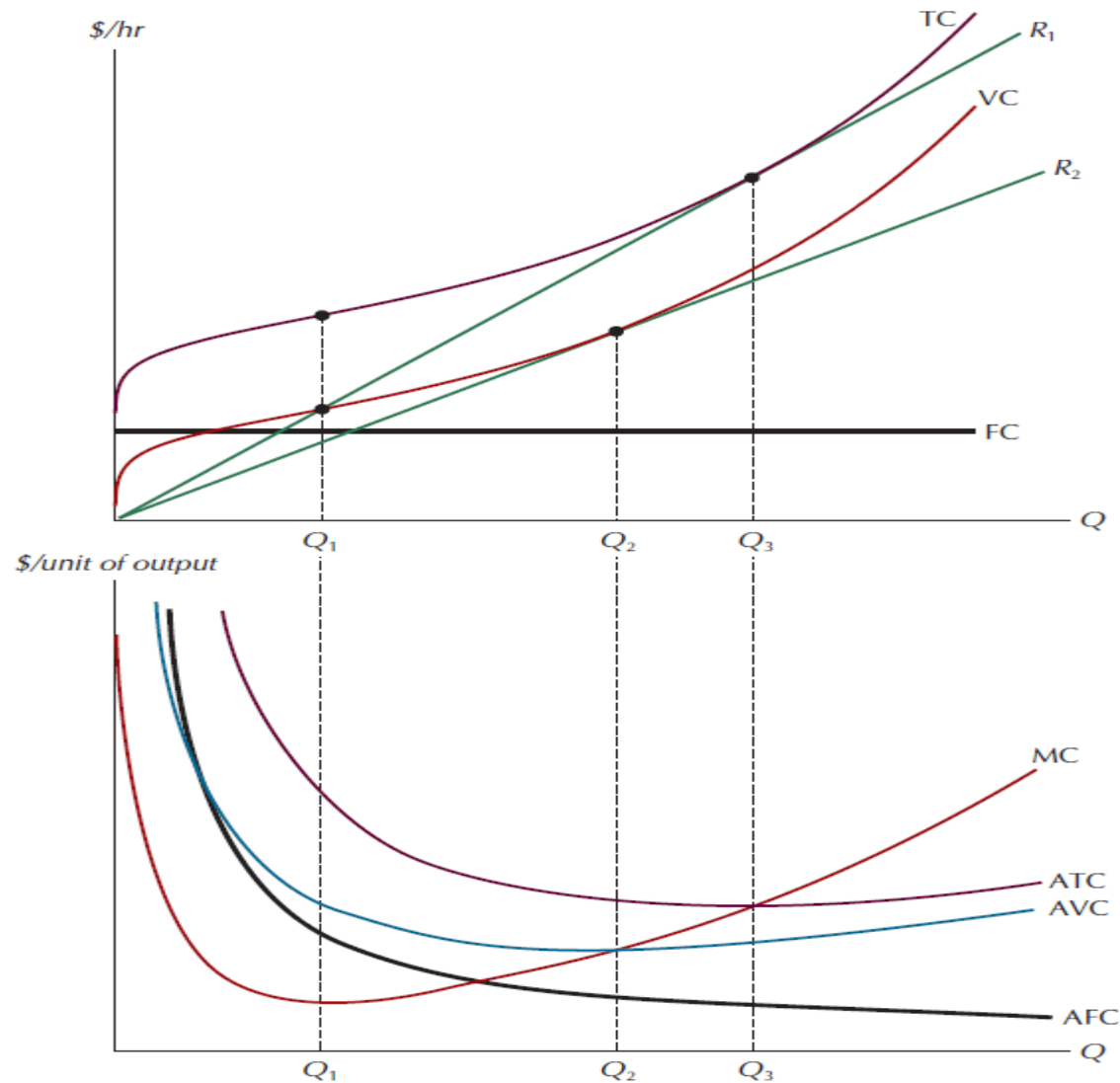


Figure 9.5: The Marginal, Average Total, Average Variable, and Average Fixed Cost Curves



Marginal and Average Costs

- *When MC is less than average cost (either ATC or AVC), the average cost curve must be decreasing with output; and when MC is greater than average cost, average cost must be increasing with output.*

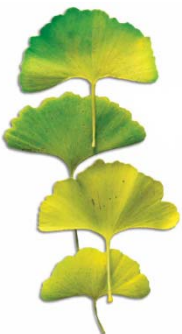


Figure 9.6: Quantity vs. Average Costs

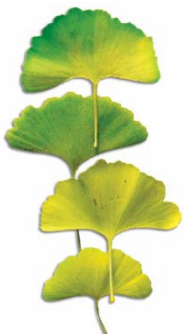
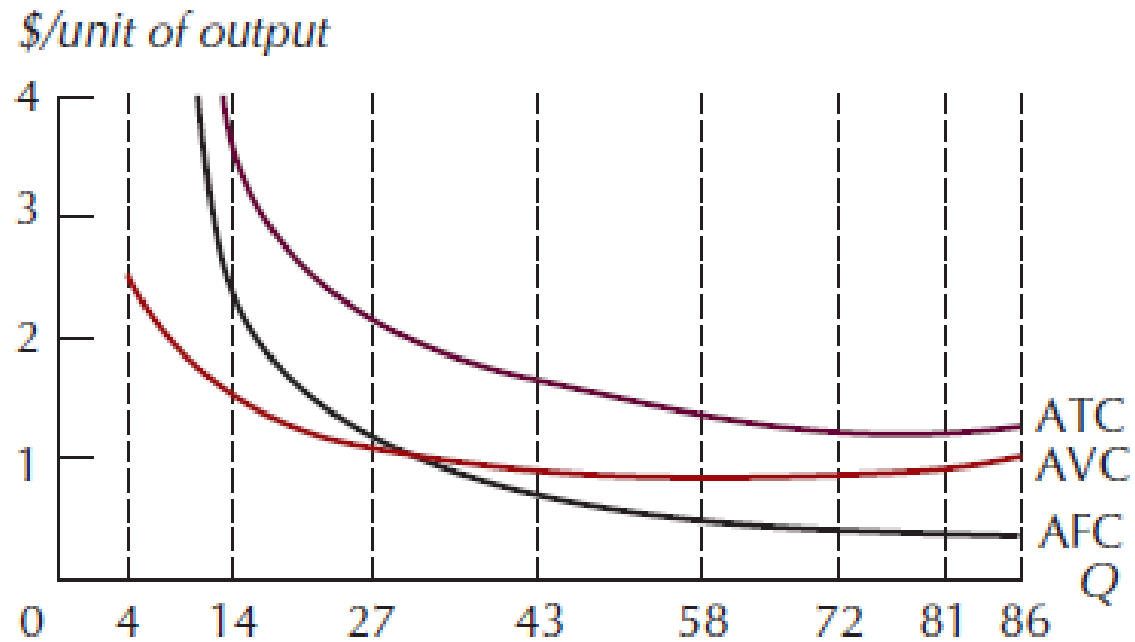
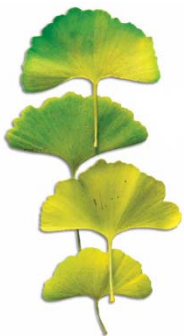
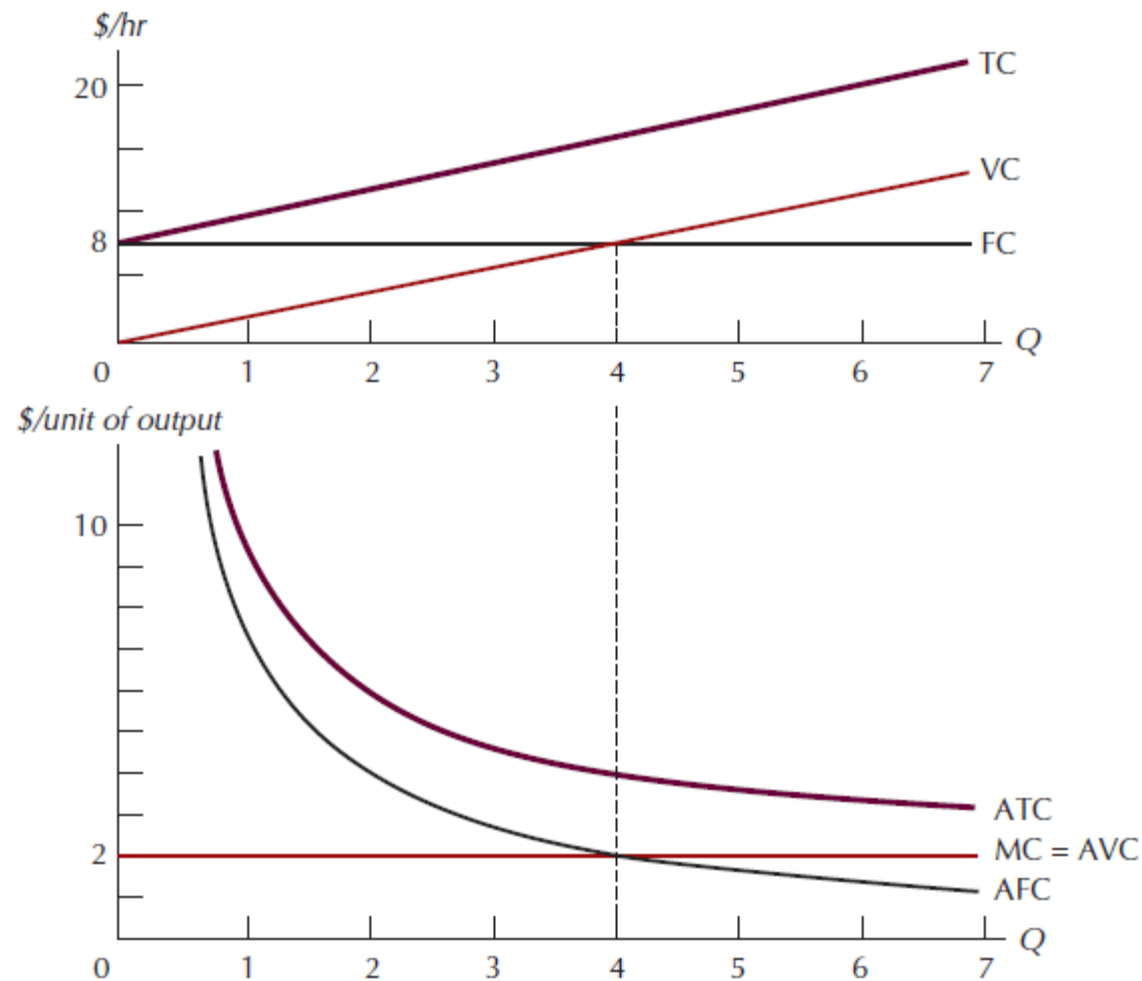


Figure 9.7: Cost Curves for a Specific Production Process



Allocating Production Between Two Processes

- Let Q_T be the total amount to be produced, and let Q_1 and Q_2 be the amounts produced in the first and second processes, respectively. And suppose the marginal cost in either process at very low levels of output is lower than the marginal cost at Q_T units of output in the other (which ensures that both processes will be used).
- The values of Q_1 and Q_2 that solve this problem will then be the ones that result in equal marginal costs for the two processes.

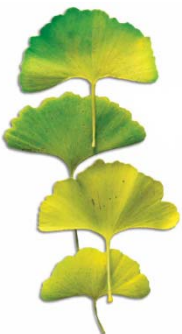


Figure 9.8: The Minimum Cost Production Allocation

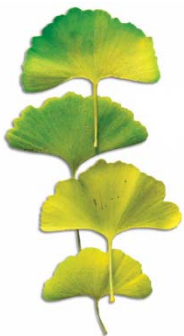
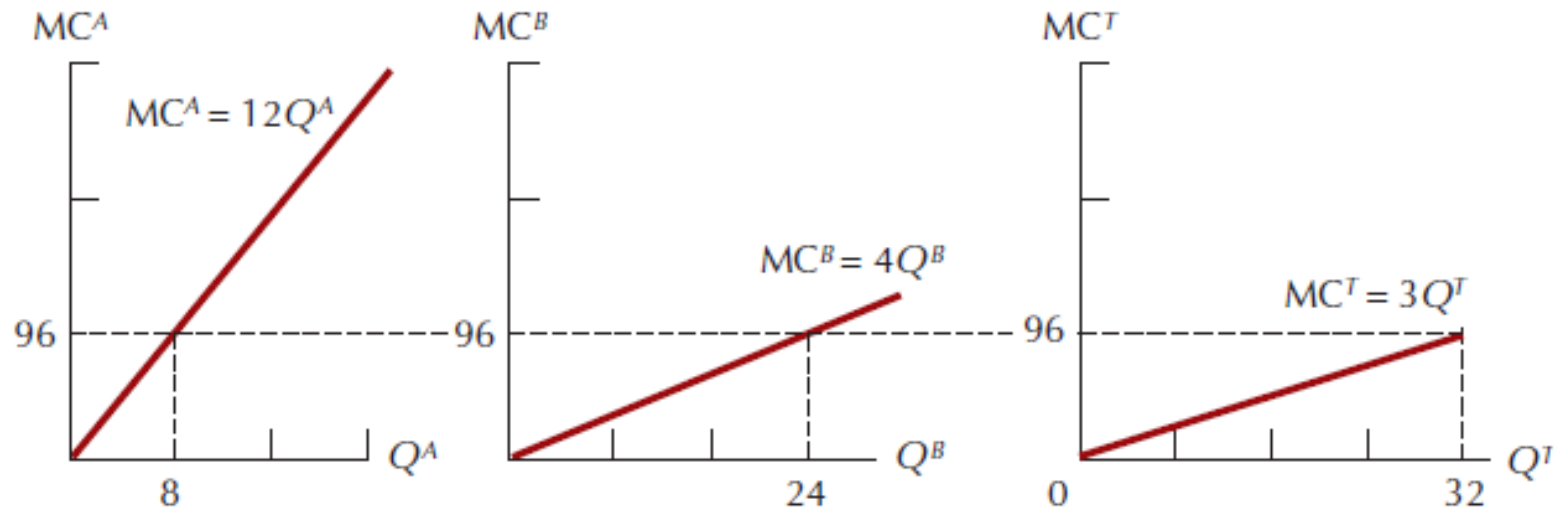
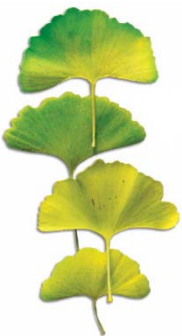
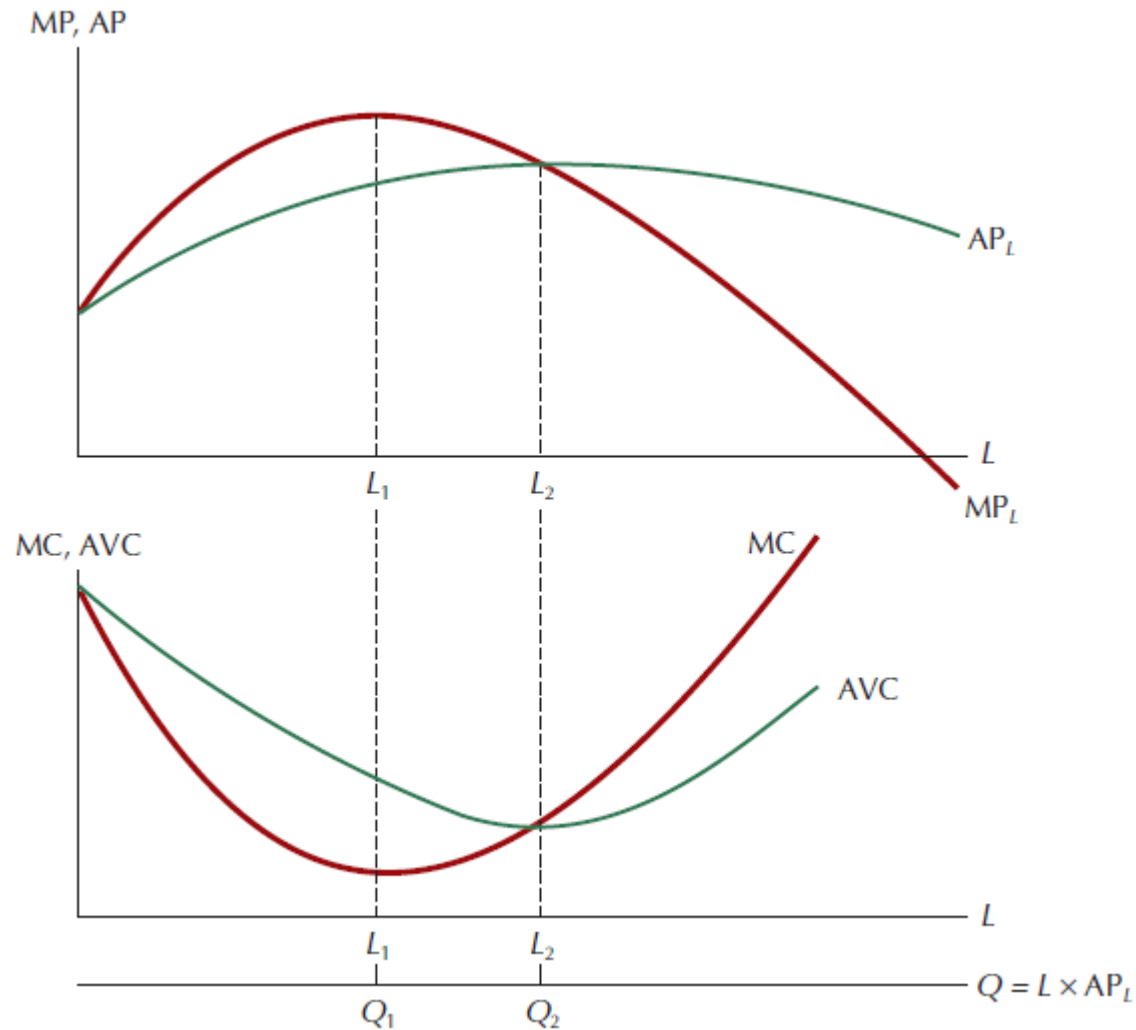


Figure 9.9: The Relationship Among MP, AP, MC, and AVC



Costs in the Long Run

- ***Isocost line:*** a set of input bundles each of which costs the same amount.
- To find the minimum cost point we begin with a specific isoquant then superimpose a map of isocost lines, each corresponding to a different cost level.
 - The least-cost input bundle corresponds to the point of tangency between an isocost line and the specified isoquant.

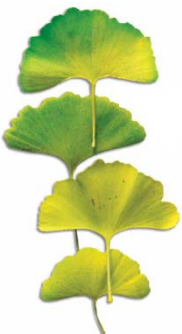


Figure 9.10: The Isocost Line

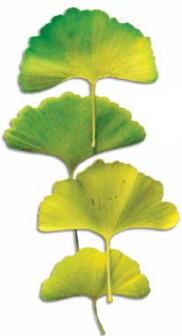
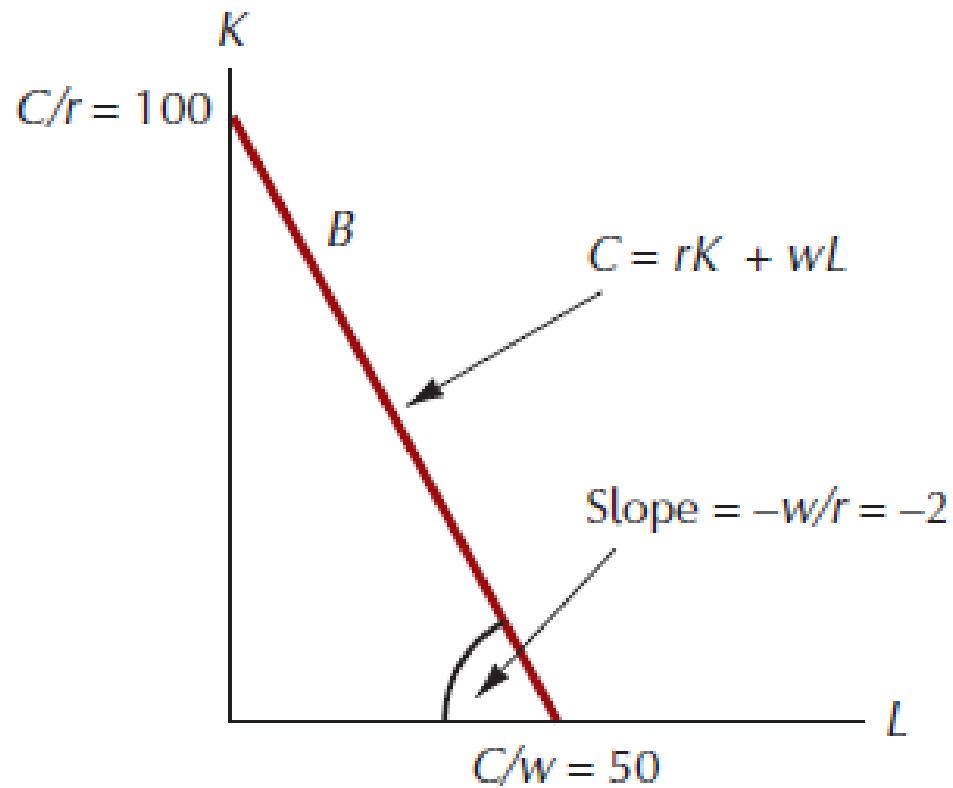


Figure 9.11: The Maximum Output for a Given Expenditure

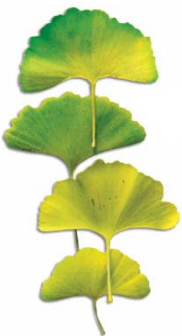
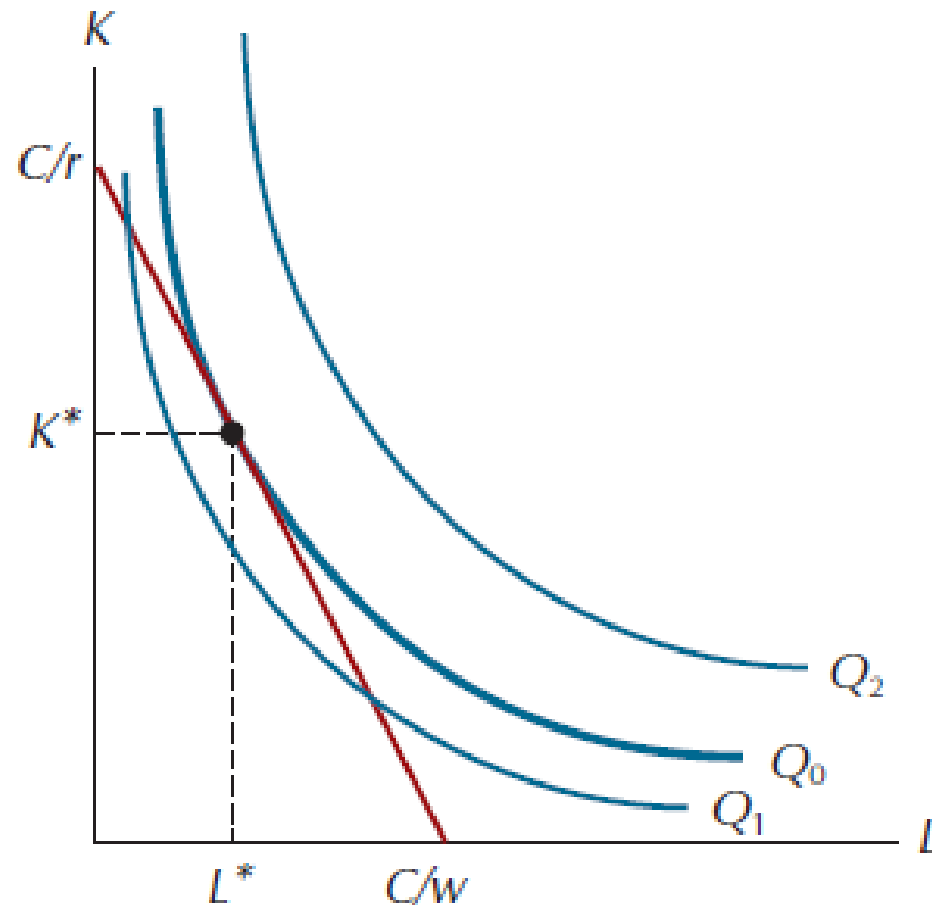


Figure 9.12: The Minimum Cost for a Given Level of Output

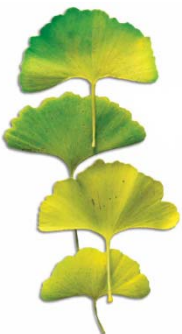
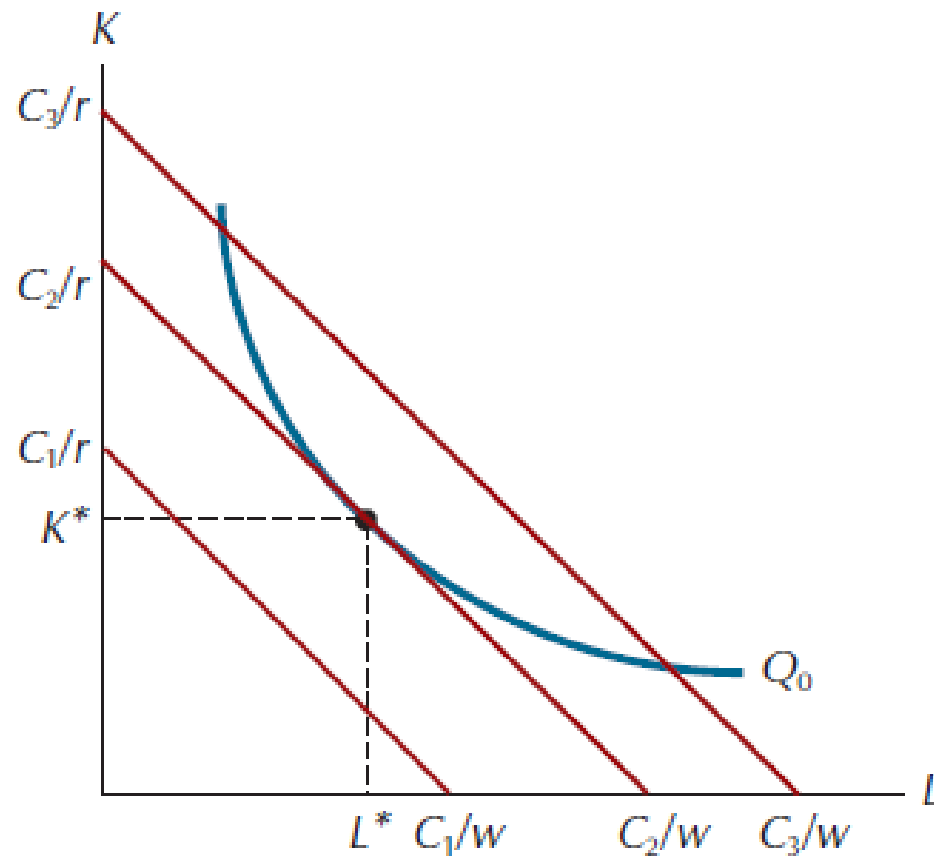


Figure 9.13: Different Ways of Producing 1 Ton of Gravel

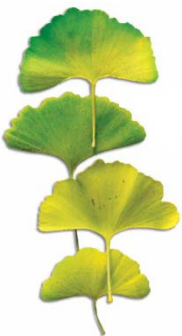
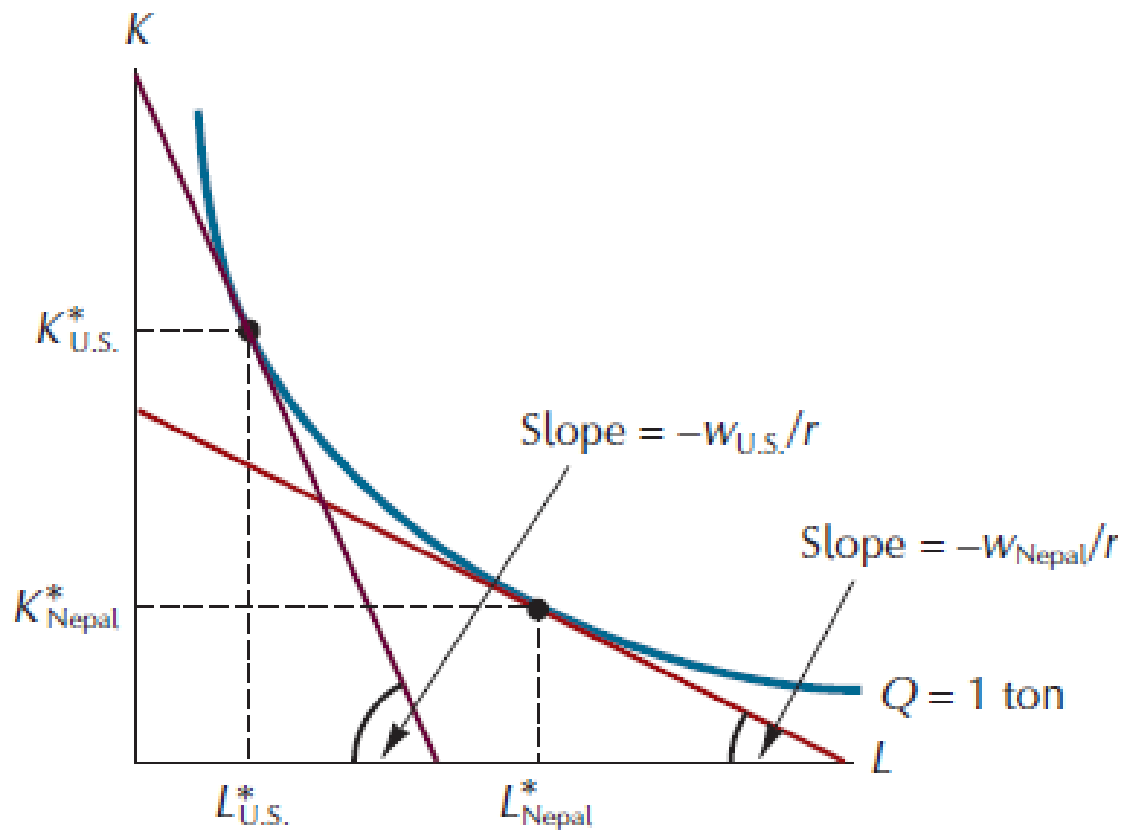
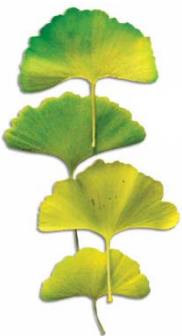
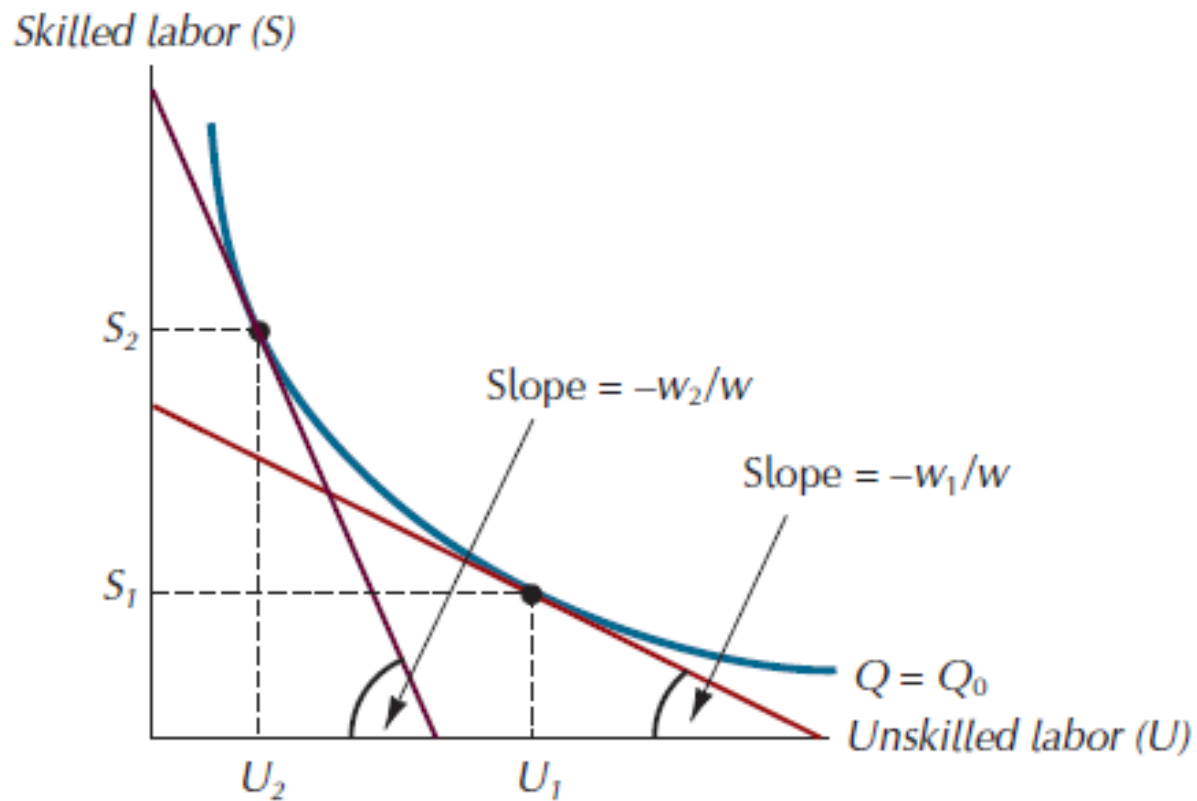


Figure 9.14: The Effect of a Minimum Wage Law on Unemployment of Skilled Labor



The Relationship Between Optimal Input Choice and Long-Run Costs

- ***Output expansion path:*** the locus of tangencies (minimumcost input combinations) traced out by an isocost line of given slope as it shifts outward into the isoquant map for a production process.

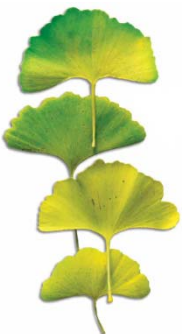


Figure 9.15: The Long-Run Expansion Path

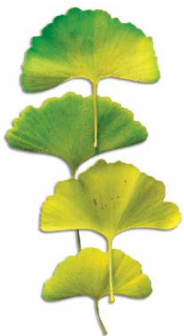
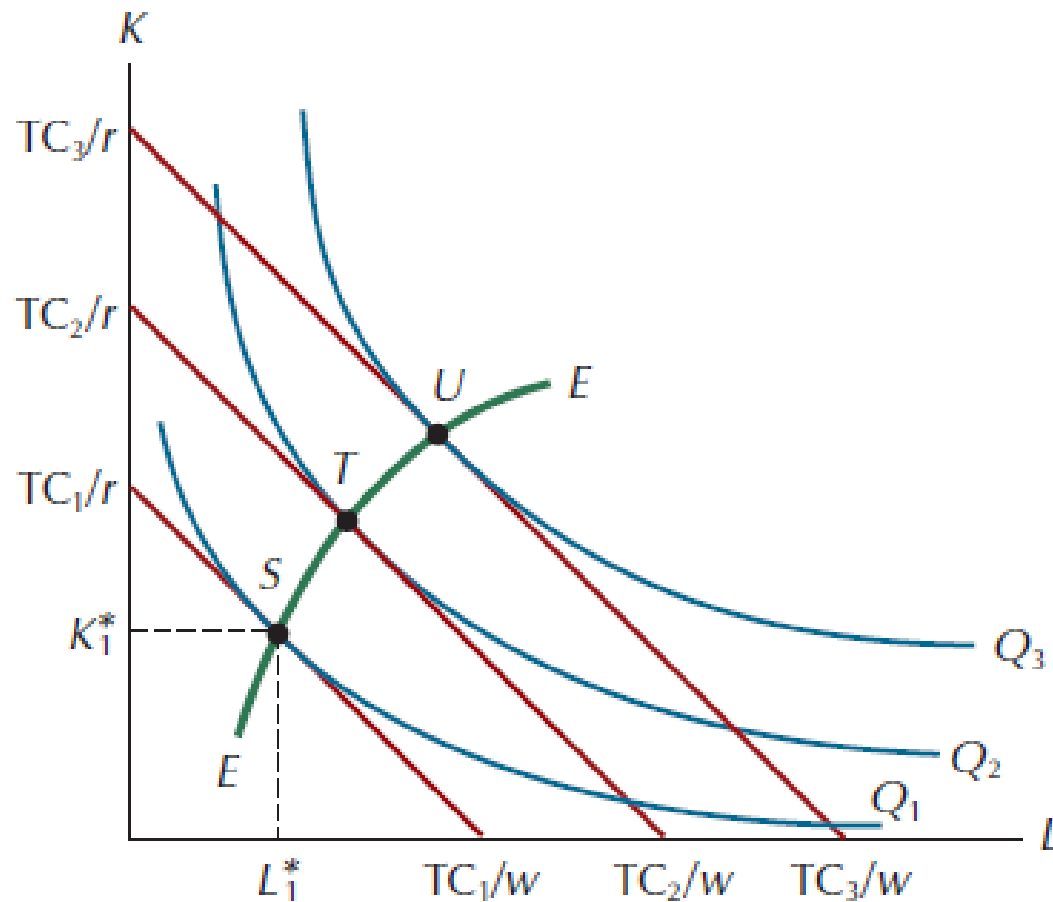
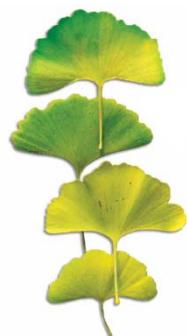
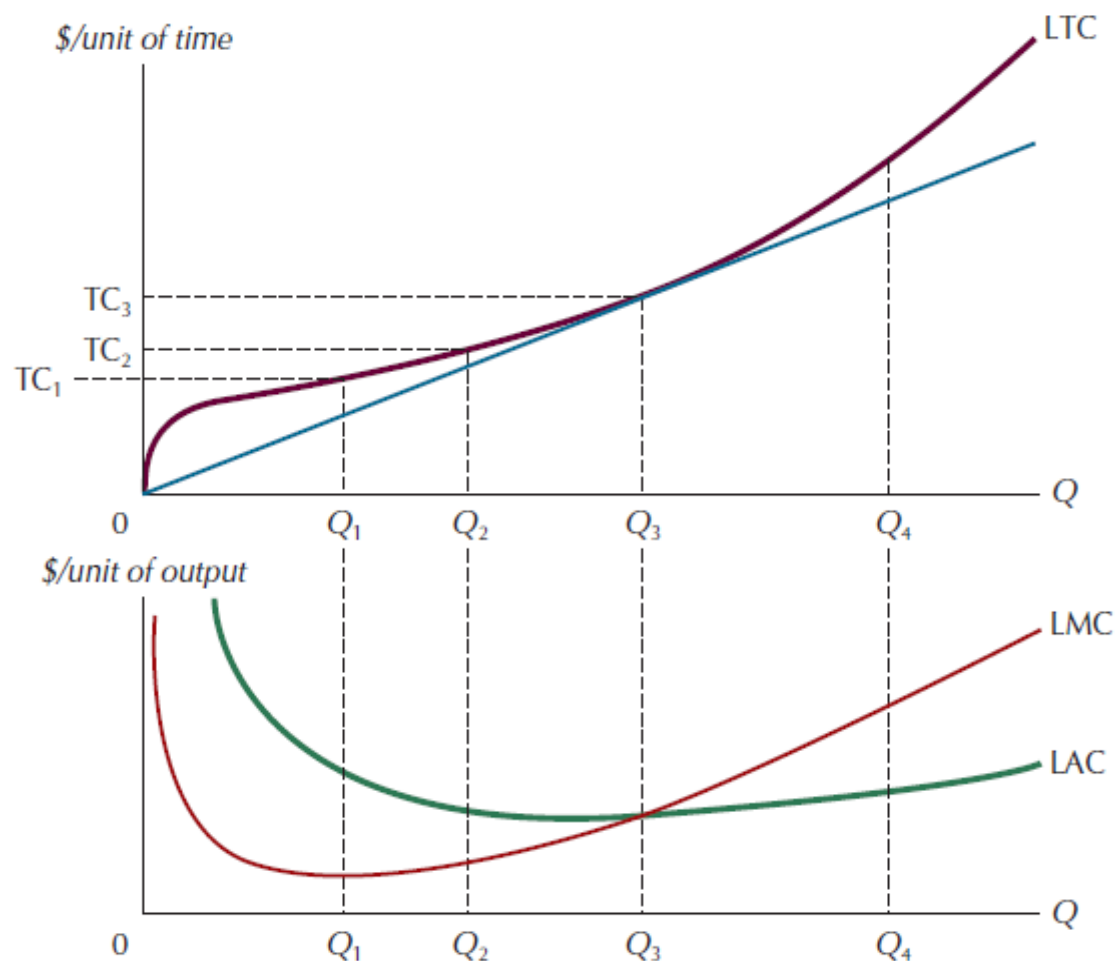


Figure 9.16: The Long-Run Total, Average, and Marginal Cost Curves



The Relationship Between Optimal Input Choice and Long-Run Costs

- Constant returns to scale - long-run total costs are thus exactly proportional to output.
- Decreasing returns to scale - a given proportional increase in output requires a greater proportional increase in all inputs and hence a greater proportional increase in costs.
- Increasing returns to scale - long-run total cost rises less than in proportion to increases in output.

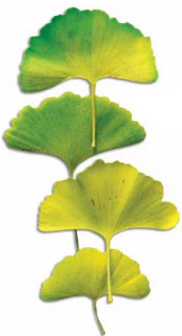


Figure 9.17: The LTC, LMC and LAC Curves with Constant Returns to Scale

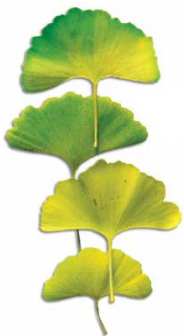
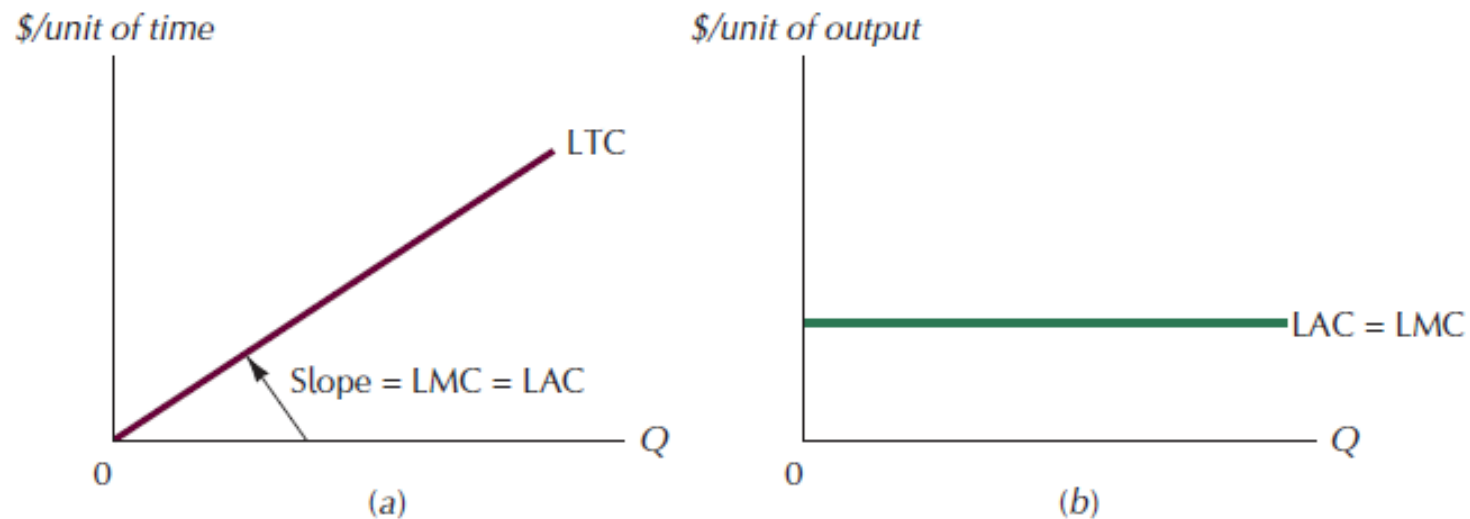


Figure 9.18: The LTC, LAC and LMC Curves for a Production Process with Decreasing Returns to Scale

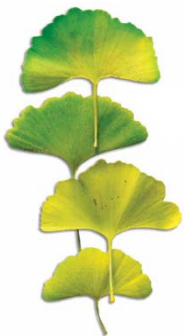
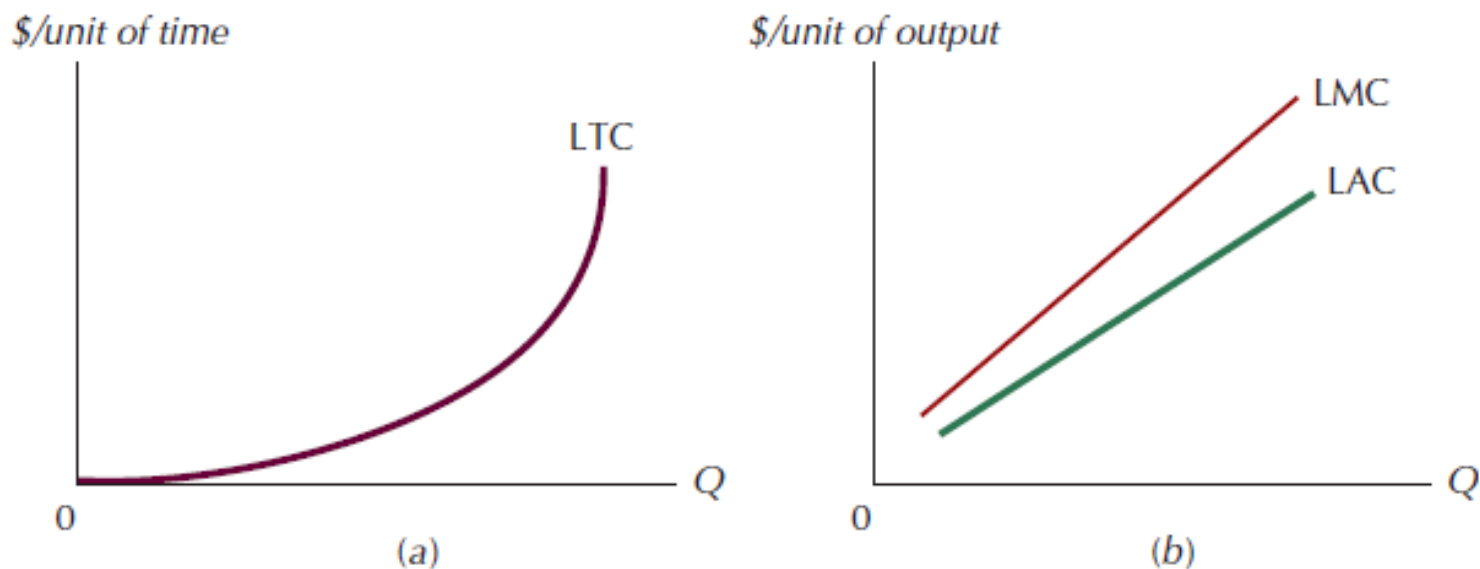
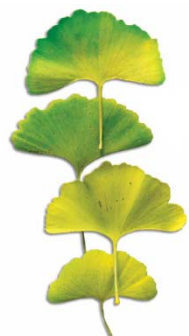
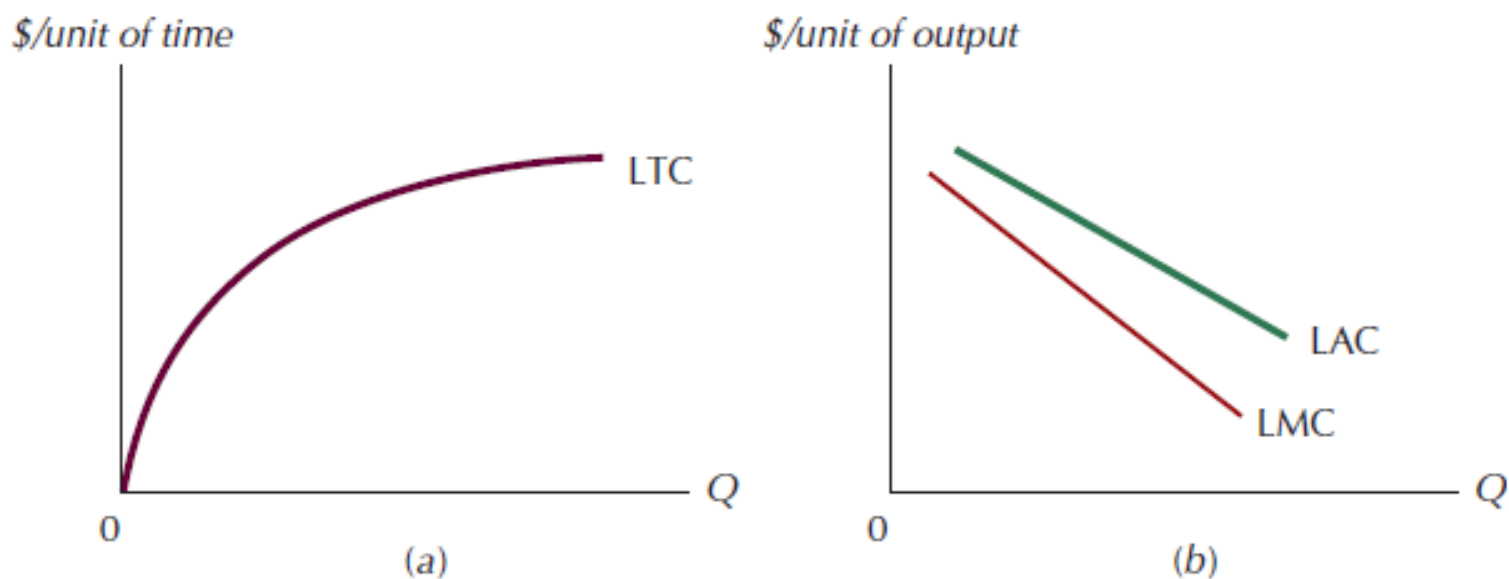


Figure 9.19: The LTC, LAC and LMC Curves for a Production Process with Increasing Returns to Scale



Long-Run Costs and the Structure of Industry

- ***Natural monopoly***: an industry whose market output is produced at the lowest cost when production is concentrated in the hands of a single firm.
- ***Minimum efficient scale***: the level of production required for LAC to reach its minimum level.

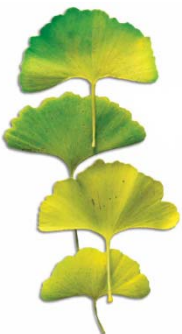


Figure 9.20: LAC Curves Characteristic of Highly Concentrated Industrial Structures

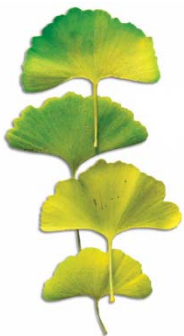
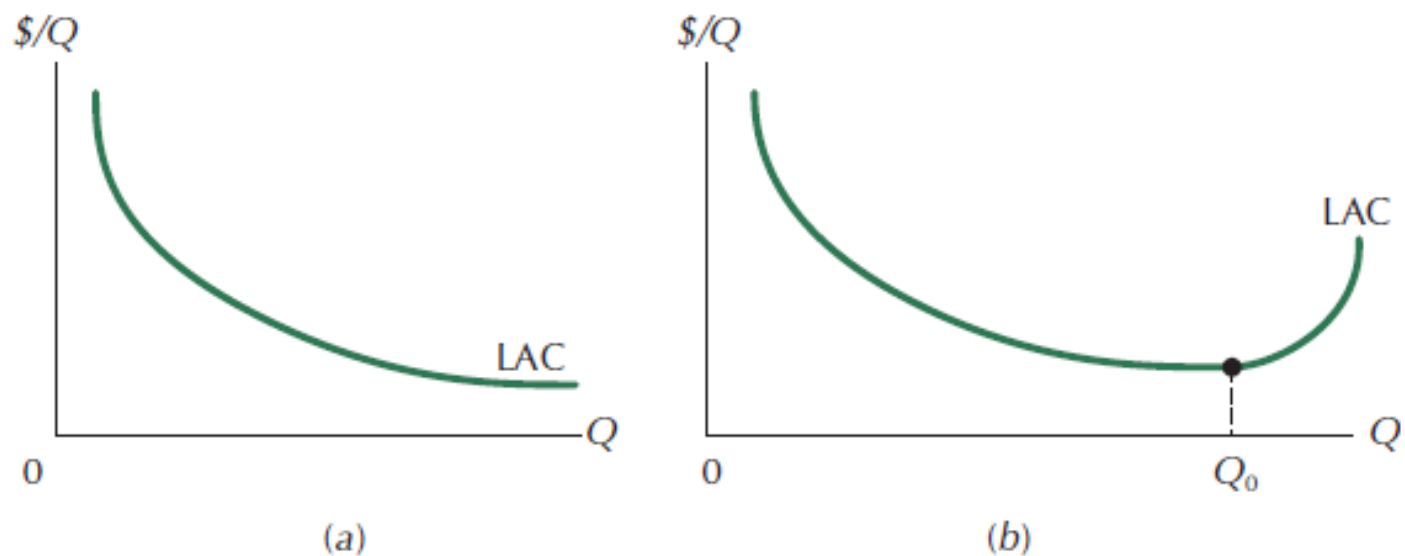


Figure 9.21: LAC Curves Characteristic of Unconcentrated Industry Structures

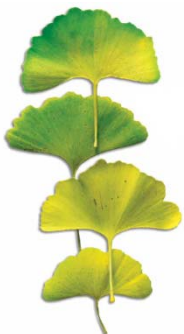
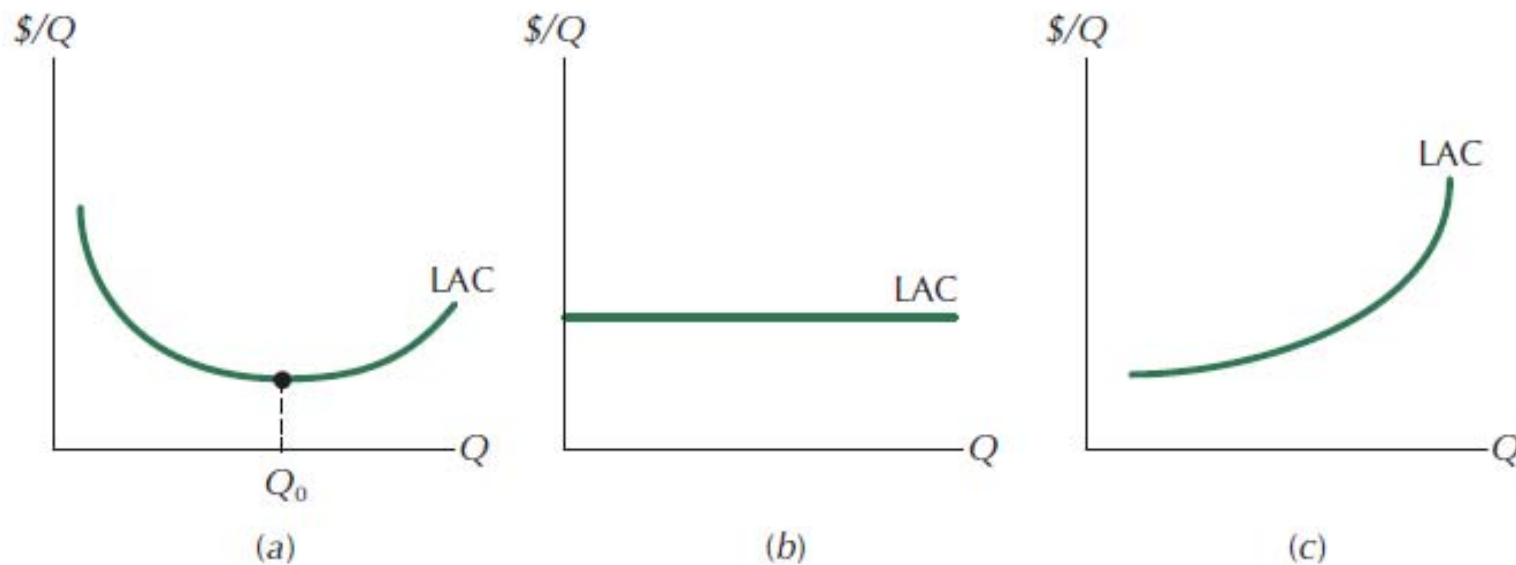


Figure 9.22: The Family of Cost Curves Associated with a U-Shaped LAC

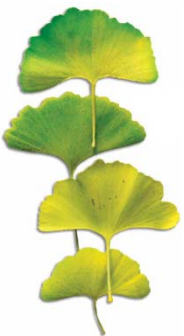
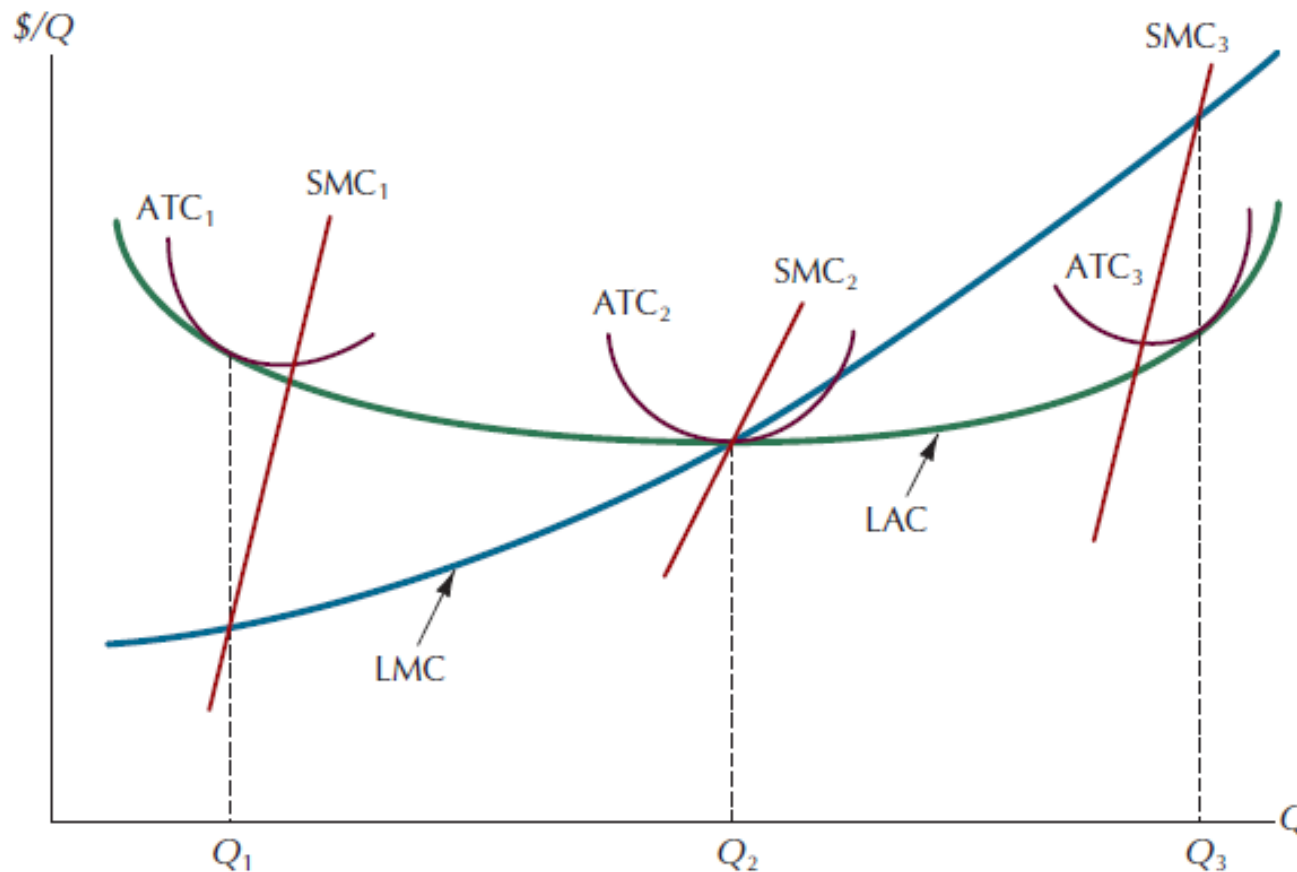


Figure A9.1: The Short-run and Long-Run Expansion Paths

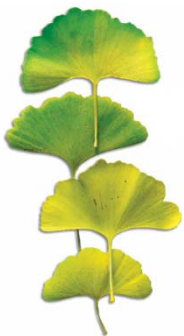
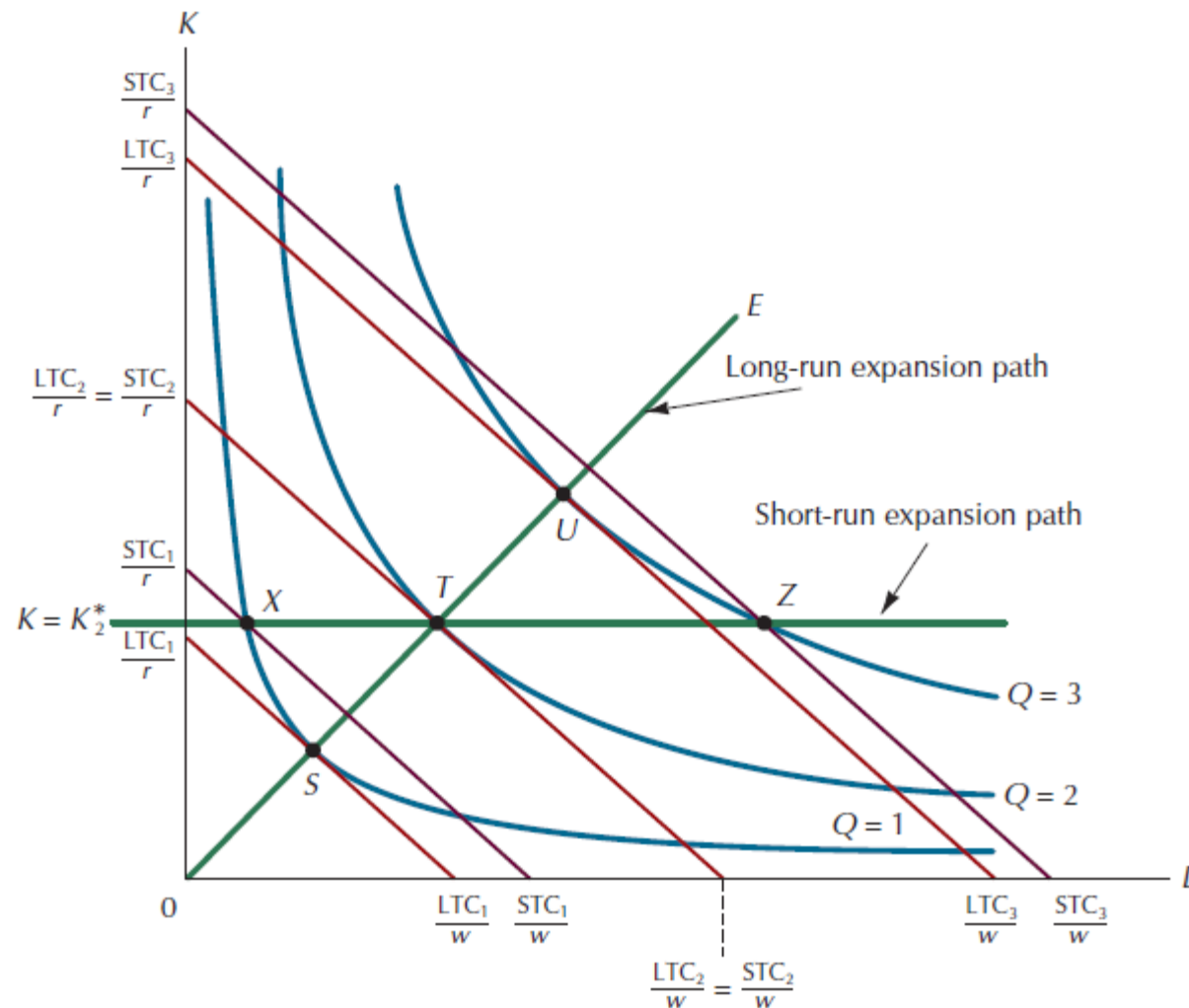


Figure A9.2: The LTC and STC Curves Associated with the Isoquant Map in Figure A.9.1

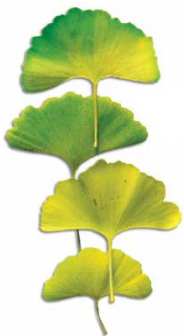
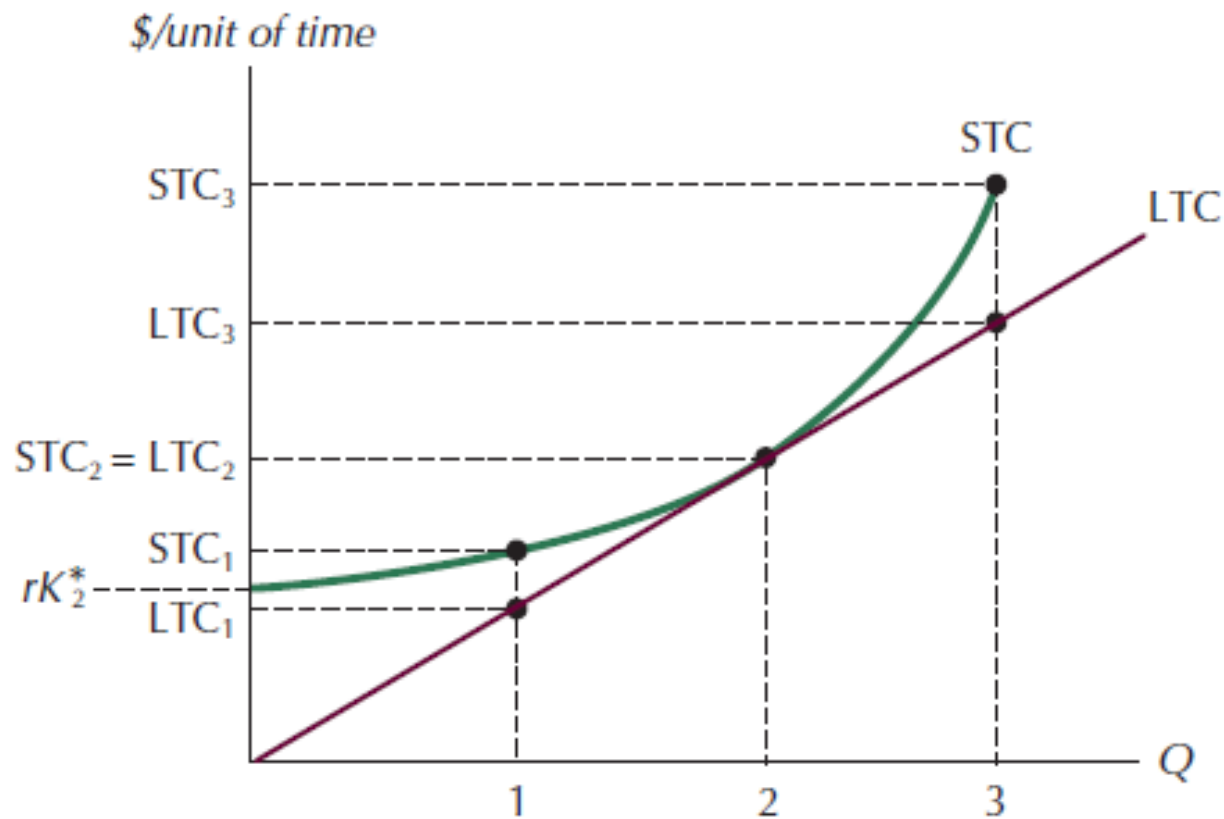


Figure A9.3: The LAC, LMC, and Two ATC Curves Associated with the Cost Curves from Figure A.9.2

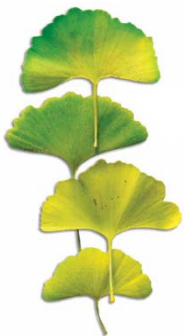
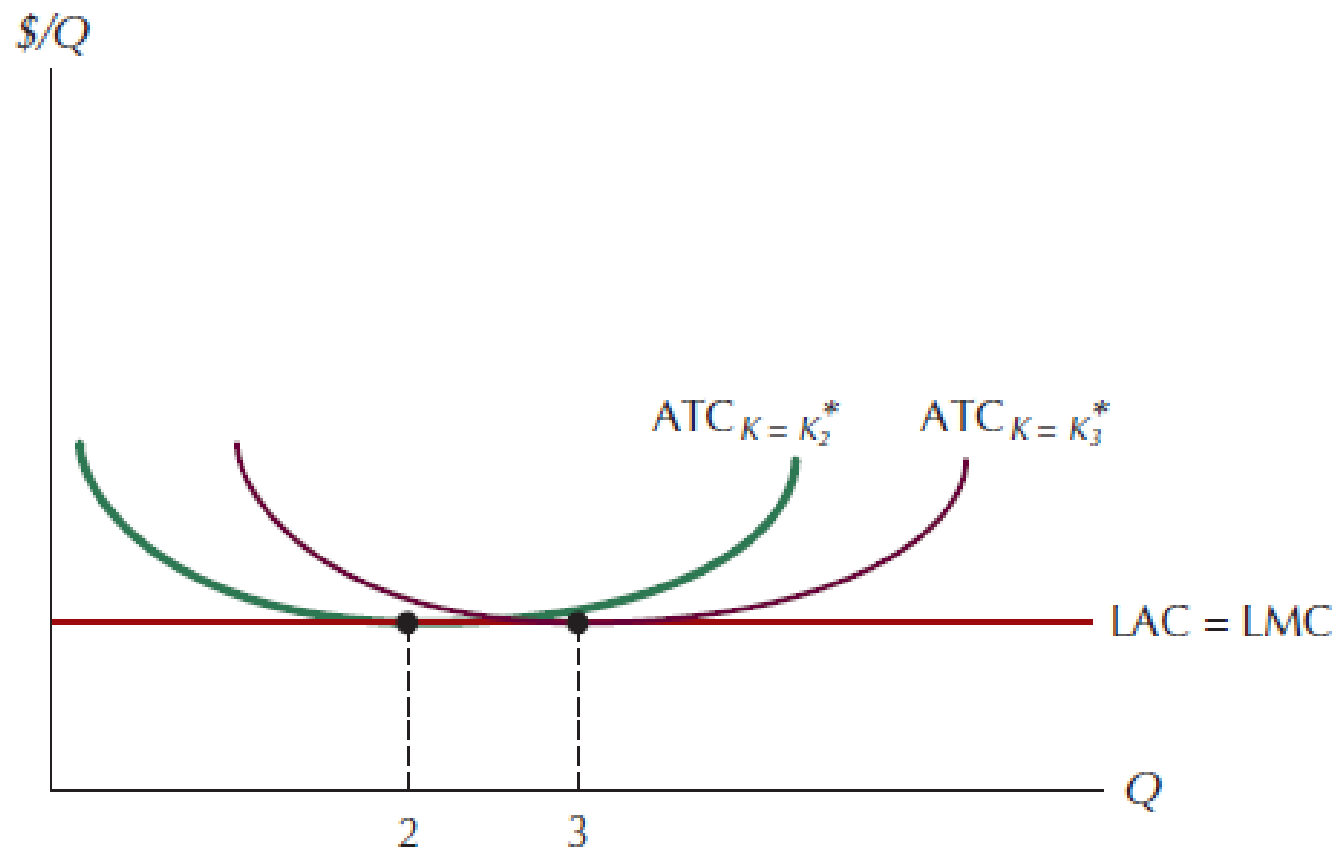


Figure A9.4: The Family of Cost Curves Associated with a U-Shaped LAC

