Economics

PRODUCTION, COSTS,

AND INDUSTRY STRUCTURE

Ch.7 OUTLINE

Amazon - Example of Economies of Scale

- Amazon is an American international electronic commerce company that sells books, among many other things, shipping them directly to the consumer. Until recently there were no brick-and-mortar Amazon stores.

- A major reason for the giant retailer's success is its production model and cost structure, which has enabled Amazon to undercut the competitors' prices even when factoring in the cost of shipping.

(Credit: modification of "Amazon Prime Delivery Van (50072389511)" by Tony Webster/Wikimedia Commons, CC BY 2.0)

Theory of the Firm

Firm (or producer or business) - an organization that combines inputs of labor, capital, land, and raw or finished component materials to produce outputs.

Private enterprise - the ownership of businesses by private individuals

Production - the process of combining inputs to produce outputs, ideally of a value greater than the value of the inputs.

The Spectrum of Competition

- Firms face different competitive situations.
- At one extreme—perfect competition—many firms are all trying to sell identical products.
- At the other extreme—monopoly—only one firm is selling the product, and this firm faces no competition.
- Monopolistic competition is a situation with many firms selling similar, but not identical products.
- Oligopoly is a situation with few firms that sell identical or similar products.

7.1 Explicit and Implicit Costs, and Accounting and Economic Profit

- Profit = Total Revenue – Total Cost

- **Revenue** - the income a firm generates from selling its products.

- Total Revenue = Price × Quantity Sold

- **Explicit costs** - out-of-pocket costs; actual payments.
  - Wages, rent, etc.

- **Implicit costs** - the opportunity cost of using resources that the firm already owns.
  - Depreciation of goods, materials, and equipment

Types of Profit

- **Accounting profit** - the difference between dollars brought in and dollars paid out.

Accounting Profit = Total Revenue – Explicit Costs

- **Economic profit** - includes both explicit and implicit costs.

Economic Profit = Total Revenue – Total Costs

Total Costs = Explicit Costs + Implicit Costs

7.2 Production in the Short Run

- The production process for pizza includes inputs such as ingredients, the efforts of the pizza maker, and tools and materials for cooking and serving.

(Credit: “Grilled gluten-free BBQ chicken pizza” by Keith McDuffee/Flickr, CC BY 2.0)

Production

- Categories of **factors of production (inputs)** - resources that firms use to produce their products,:
  - Natural Resources (Land and Raw Materials)
  - Labor
  - Capital
  - Technology
  - Entrepreneurship

- **Production function** - mathematical equation that tells how much output (Q) a firm can produce with given amounts of the inputs.

- $Q = f(NR, L, K, t, E)$

Inputs

- **Fixed inputs** (K) - factors of production that can't be easily increased or decreased in a short period of time
- **Variable inputs** (L) - factors of production that a firm can easily increase or decrease in a short period of time
- Short-hand form for the production function:
- $Q = f(L, K)$

Short and Long Run Production

- **Short run** - period of time during which at least some factors of production are fixed.

- **Long run** - period of time during which all factors are variable.

Example - Production in Short Run

- Production in the short run may be explored through the example of lumberjacks using a two-person saw.

$$Q = TP = f(L, K), \text{ or just}$$
$$Q = TP = f(L)$$

- Output (Q) is also called **Total Product** (TP).
- Since K is fixed in the short run, the amount of output (trees cut down per day) depends only on the amount of labor employed (number of lumberjacks working).

Marginal Product

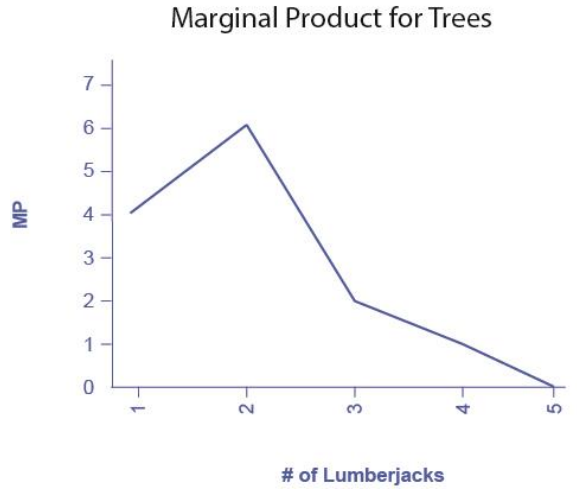
- **Marginal product (MP)** - the additional output of one more worker.

$$MP = \frac{\Delta TP}{\Delta L}$$

- **Law of Diminishing Marginal Productivity** - general rule that as a firm employs more labor, eventually the amount of additional output produced declines.

Short Run Production Function for Trees

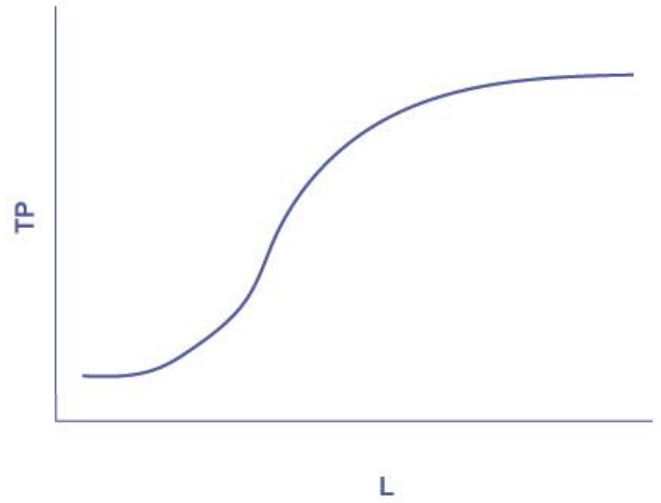
- The top graph shows the short run total product for trees.
- As the number of lumberjacks increase, the output also increases, until 5 lumberjacks are reached.
- The bottom graph shows that as workers are added, the MP increases at first, but sooner or later additional workers will have decreasing marginal product.

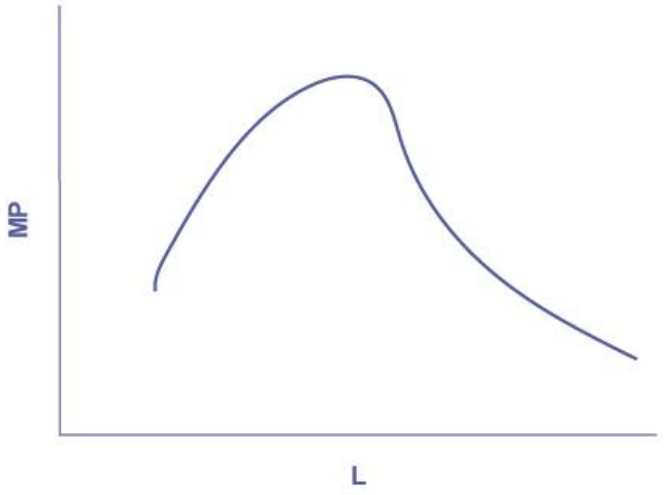


General Case of Total Product and Marginal Product Curves

- General case of total product curve.

- General case of marginal product curve.





7.3 Costs in the Short Run

- **Factor payments** - what the firm pays for the use of the factors of production (aka costs, from the firm's perspective).
  - Raw materials prices
  - Rent
  - Wages and salaries
  - Interest and dividends
  - Profit

- **Variable costs** - costs of the variable inputs, like labor.

- **Fixed costs** - costs of the fixed inputs, like rent.
  - Expenditure that a firm must make before production starts
  - Do not change in the short run
  - Do not change regardless of the level of production.

- **Total cost** - the sum of fixed and variable costs of production

Costs

- **Average total cost** (ATC) - total cost divided by the quantity of output produced.

$$ATC = \frac{TC}{Q}$$

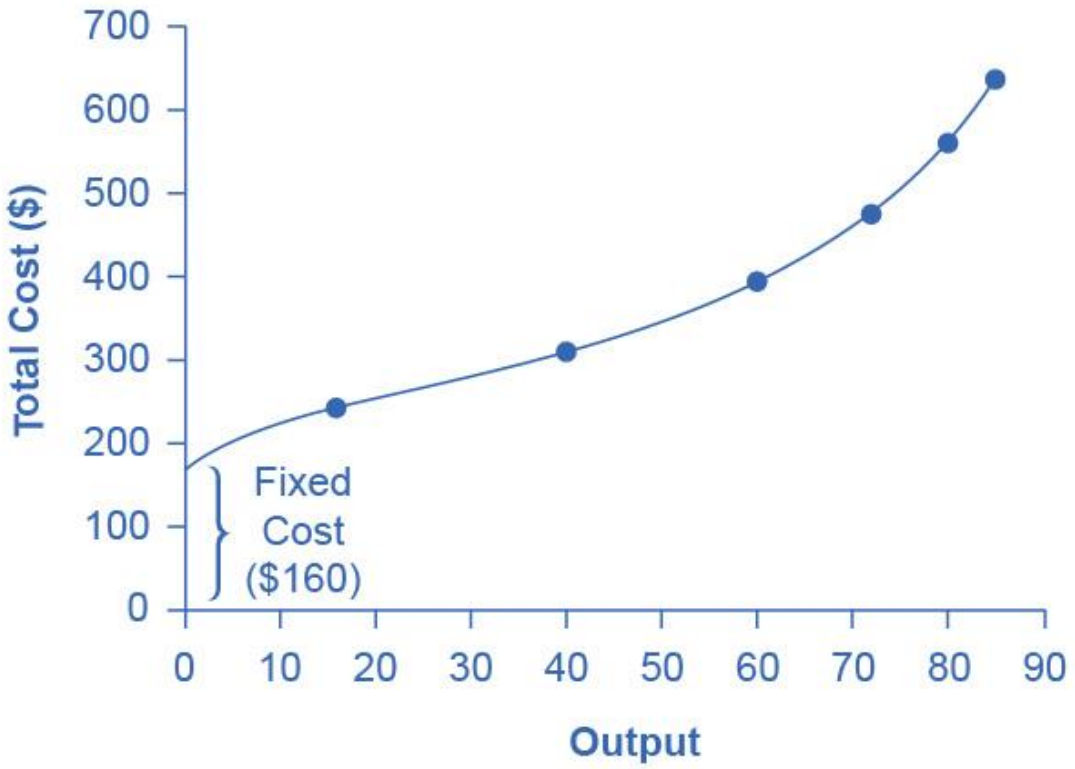
- **Marginal cost** (MC) - the additional cost of producing one more unit of output.

$$MC = \frac{\Delta TC}{\Delta Q}$$

- **Average variable cost** - variable cost divided by quantity of output.

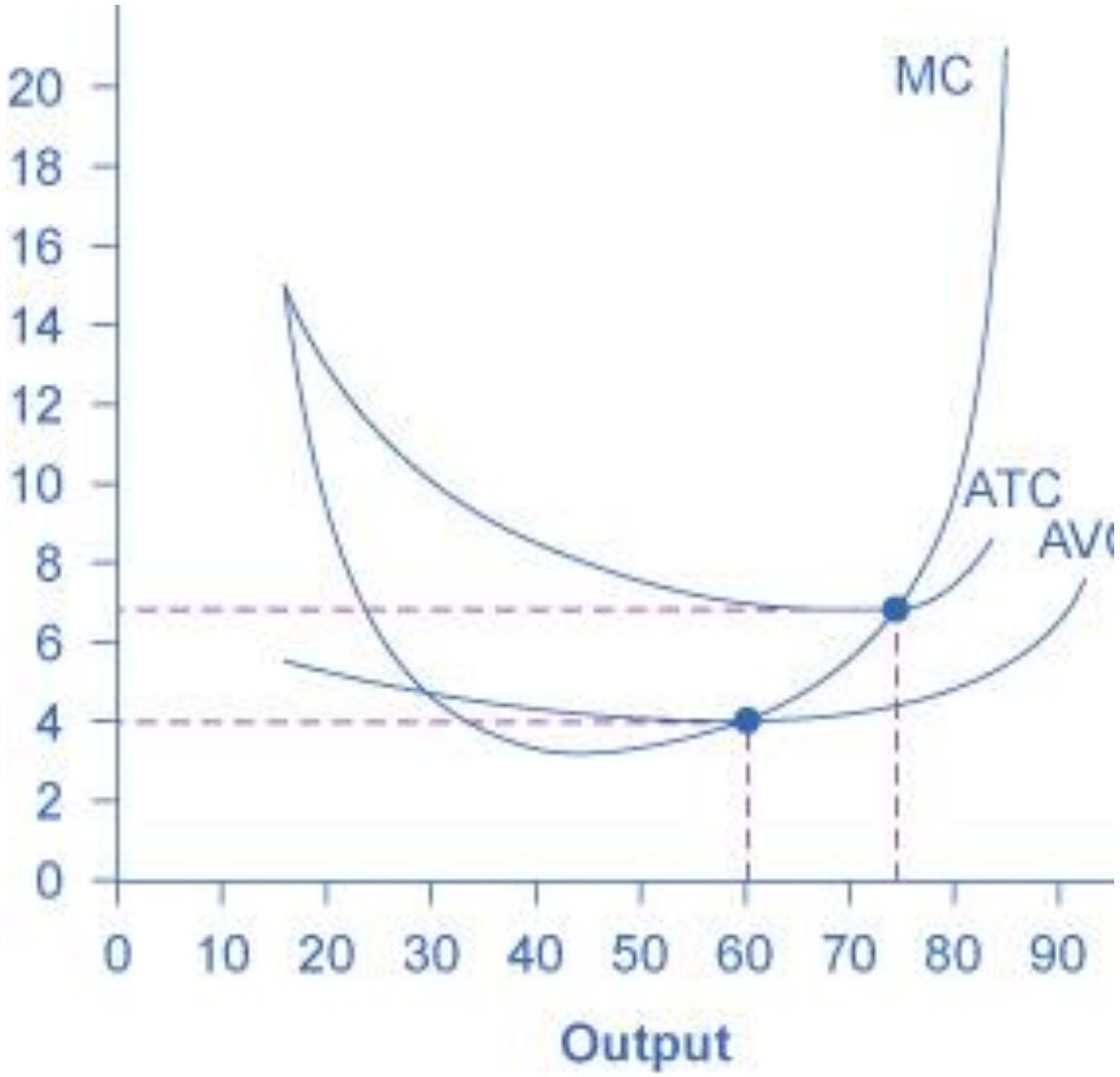
How Output Affects Total Costs

- At zero production, the fixed costs of $160 are still present.
- As production increases, variable costs are added to fixed costs, and the total cost is the sum of the two.



Cost Curves

- Average total cost (ATC)
  - Typically U-shaped
- Average variable cost (AVC)
  - Lies below the average total cost curve and
  - Typically U-shaped or upward-sloping.
- Marginal cost (MC)
  - Generally upward-sloping



Average Profit

- **Average Profit** or *profit margin* = price – average cost

- If the market price > average cost, then average profit will be positive.

- If price is < average cost, then profits will be negative.

7.4 Production in the Long Run

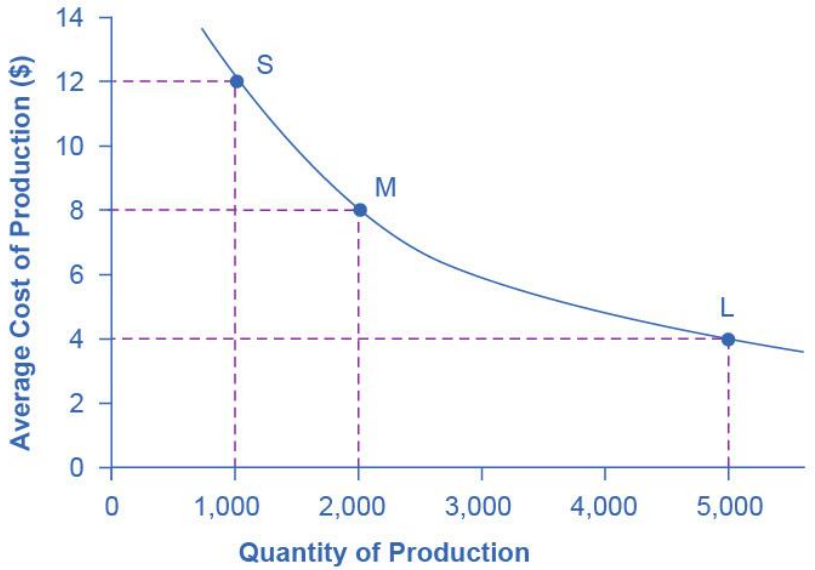
- In the long run, all factors (including capital) are variable.
- Production function is $Q = f\ [L, K]$
- Because all factors are variable, the long run production function shows the most efficient way of producing any level of output.

7.5 Costs in the Long Run

- The long run is the period of time when all costs are variable.
- **Production technologies** - alternative methods of combining inputs to produce output
- Economies of scale - the situation where, as the quantity of output goes up, the cost per unit goes down.

Economies of Scale

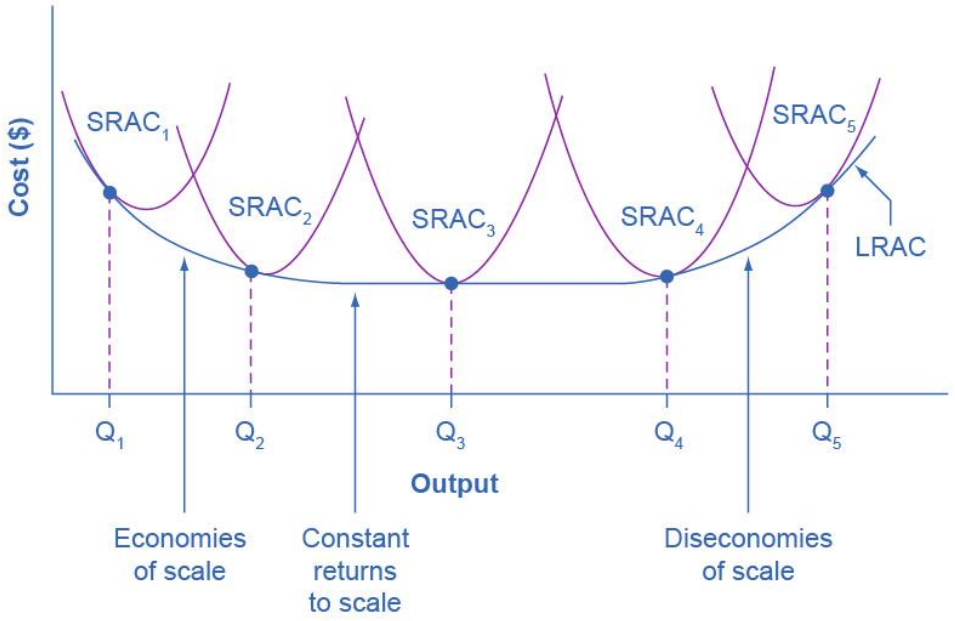
- A small factory like S produces 1,000 alarm clocks at an average cost of $12 per clock.
- A medium factory like M produces 2,000 alarm clocks at a cost of $8 per clock.
- A large factory like L produces 5,000 alarm clocks at a cost of $4 per clock.
- Economies of scale exist because the larger scale of production leads to lower average costs.



Shapes of Long-Run Average Cost Curves

- **Long-run average cost (LRAC) curve** - shows the lowest possible average cost of production, allowing all the inputs to production to vary so that the firm is choosing its production technology.

- **Short-run average cost (SRAC) curves** - the average total cost curve in the short term; shows the total of the average fixed costs and the average variable costs.



From Short-Run Average Cost Curves to Long-Run Average Cost Curves

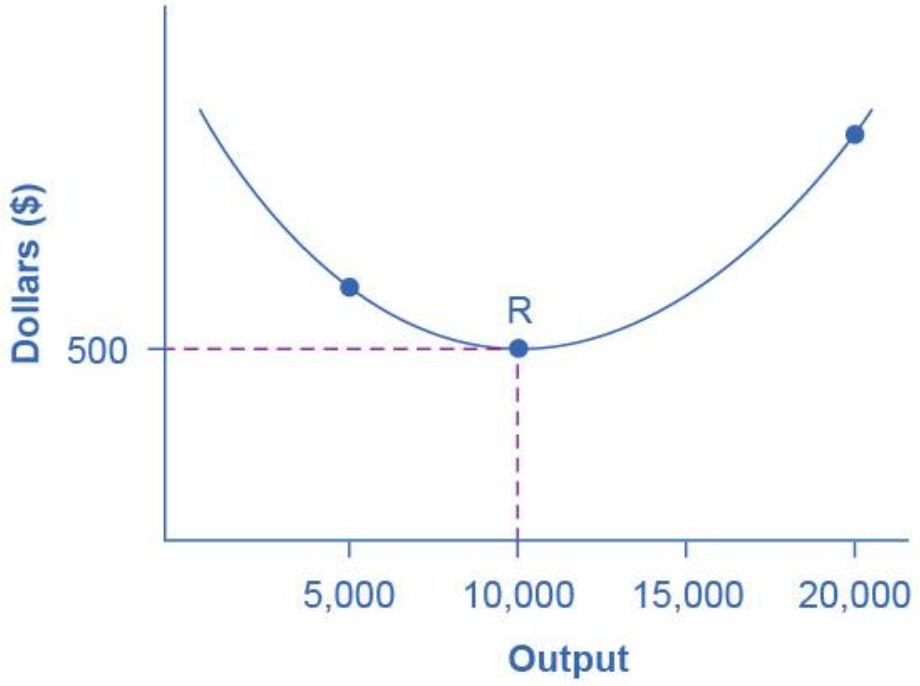
- The five different short-run average cost (SRAC) curves each represents a different level of fixed costs, from the low level of fixed costs at $SRAC_1$ to the high level of fixed costs at $SRAC_5$.
- Other SRAC curves, not in the diagram, lie between the ones that are here.
- The long-run average cost (LRAC) curve shows the lowest cost for producing each quantity of output when fixed costs can vary, and so it is formed by the bottom edge of the family of SRAC curves.
- If a firm wished to produce quantity Q_3, it would choose the fixed costs associated with $SRAC_3$.

Ranges on the Long-Run Average Cost Curve

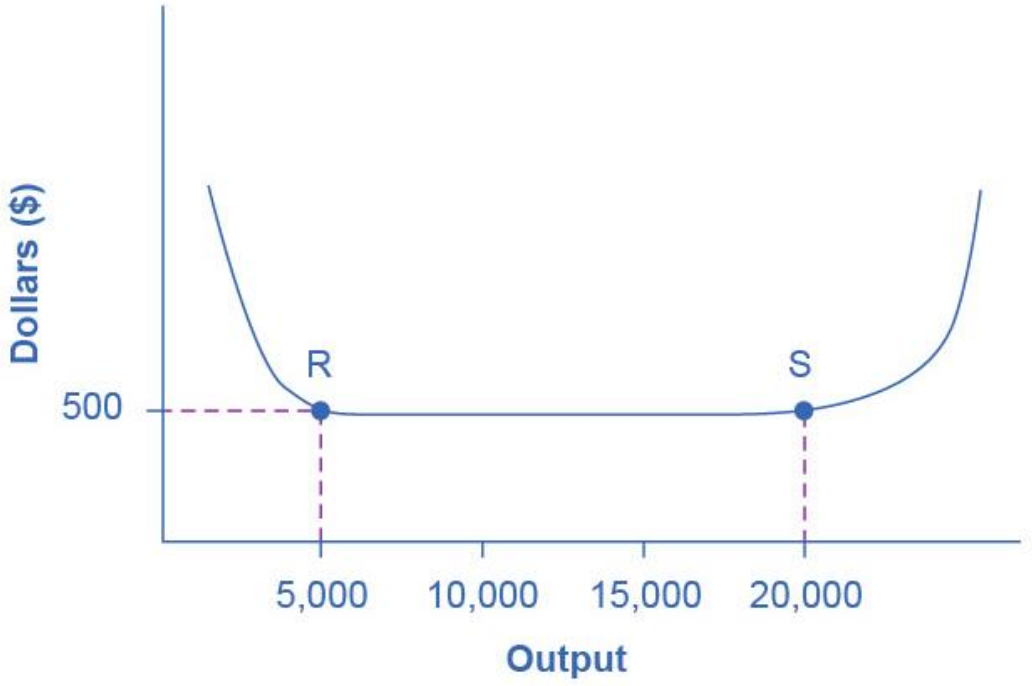
- **Constant returns to scale** - when expanding all inputs proportionately does not change the average cost of production.
- **Diseconomies of scale** - the long-run average cost of producing each individual unit increases as total output increases.
  - A firm or a factory can grow so large that it becomes very difficult to manage or run efficiently.

The Size and Number of Firms in an Industry

- The shape of the long-run average cost curve has implications for:
  - how many firms will compete in an industry
  - whether the firms in an industry have many different sizes
  - or if they will tend to be the same size.



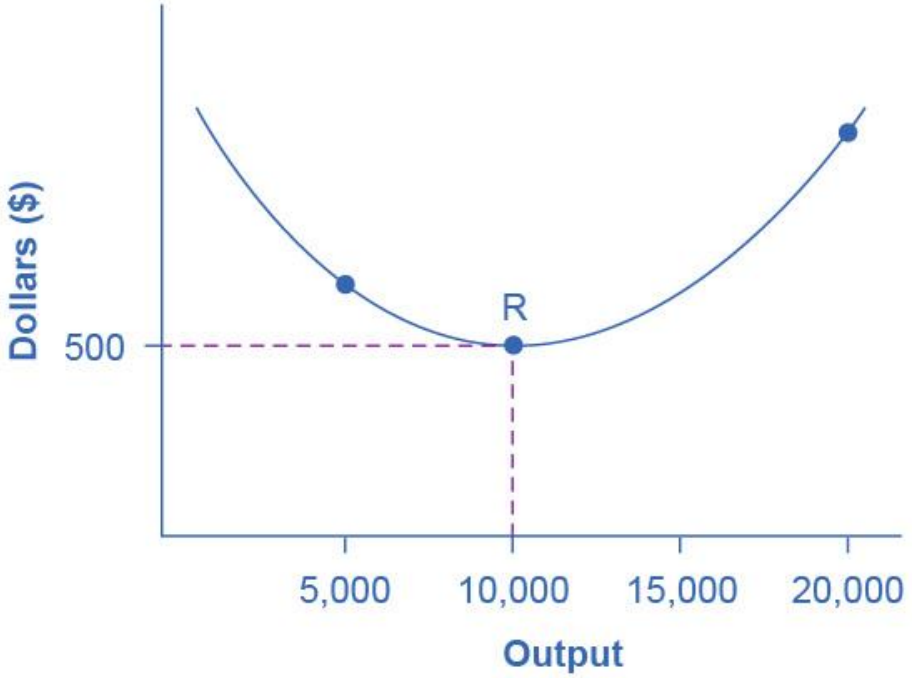
(a) LRAC curve with a clear minimum point



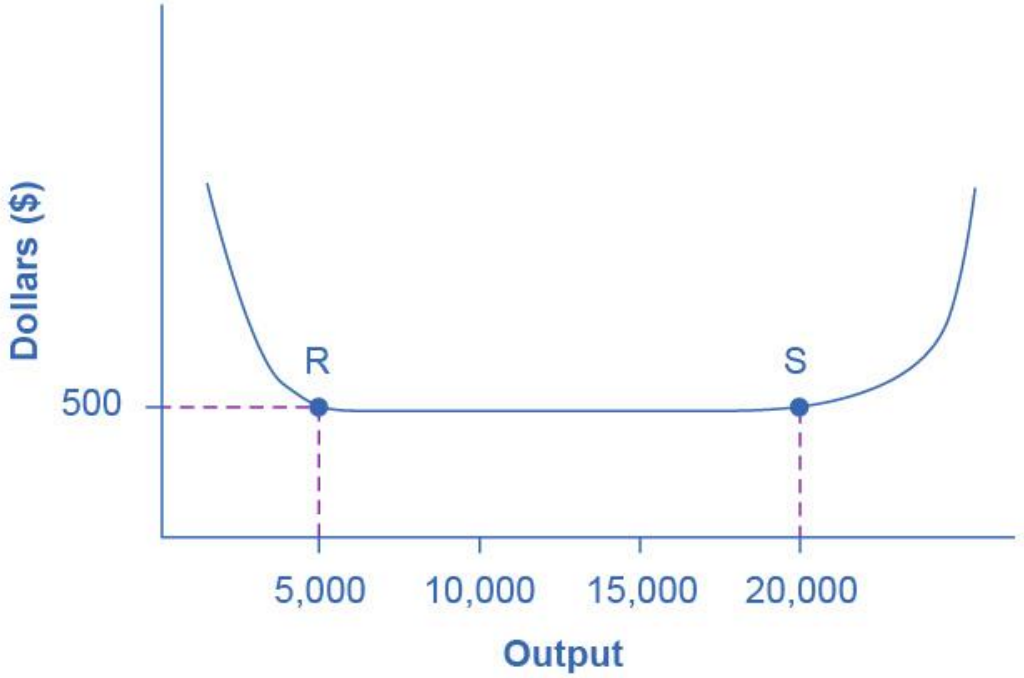
(b) A flat-bottomed LRAC curve

The LRAC Curve and the Size and Number of Firms

- For graph (a):
- Low-cost firms will produce at output level R.
- When the LRAC curve has a clear minimum point, then any firm producing a different quantity will have higher costs.
- In this case, a firm producing at a quantity of 10,000 will produce at a lower average cost than a firm producing 5,000 or 20,000 units.



(a) LRAC curve with a clear minimum point



(b) A flat-bottomed LRAC curve

The LRAC Curve and the Size and Number of Firms, Continued

- For graph (b):
- Low-cost firms will produce between output levels R and S.
- When the LRAC curve has a flat bottom, then firms producing at any quantity along this flat bottom can compete.
- In this case, any firm producing a quantity between 5,000 and 20,000 can compete effectively,
- Firms producing less than 5,000 or more than 20,000 would face higher average costs and be unable to compete.

Credits: Greenlaw, S. A., Shapiro, D., & MacDonald, D. (2022). *Principles of economics* (3rd ed.). OpenStax. https://openstax.org/books/principles-economics-3e