Producer Theory

EC 201: Principles of Microeconomics

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Prologue

Housekeeping

Midterm 2: Grades posted.

- You should have received an email with your score, an approximate grade, and an attachment with your answer choices.

Discussions

- Upcoming worksheets important for final exam preparation.

Optional Short Essays

- One percentage point of extra credit per essay (up to four total).
- Submit on Canvas.
- Due by 10:00 on Monday of Week 10 (before lecture).
- See guidelines in the syllabus.

Agenda

Goal: Understand the tradeoffs that producers face.

- How do producers make decisions?
- Where does the supply curve come from?

Q: Why should you care?

- **A:** Useful insights for entrepreneurs, managers, and policymakers.

Outline

1. Costs of production (today).
2. Firms in competitive markets (Wednesday).
3. Monopoly (next week).

Profit

Assumption: Firms seek to maximize profit.

- Profit = total revenue − total cost

Q: Do all businesses try to maximize profit?

- Publicly-traded firms?
- Family businesses?
- Non-profit organizations?

Profit Maximization

To maximize profit, a producer must answer several interrelated questions:

- How much should I produce?
- What price should I set?
- How much labor should I hire? How much capital should I purchase?
- Should I shut down or keep producing?

Profit Maximization

Answers to those questions depend on

1. Production technology $\longrightarrow$ cost structure.
2. Market structure $\longrightarrow$ ability to set prices.
3. Short-run *vs.* long-run.

Costs of Production

Costs

Total cost = explicit cost + implicit cost

Explicit cost

> Tangible, out-of-pocket expenses.

- *e.g.*, wages, rent, raw materials, maintenance, taxes, *etc.*

Costs

Total cost = explicit cost + implicit cost

Implicit cost

> Opportunity cost of already-owned resources.

- Forgone value of the next-best investment
  $\longrightarrow$ no out-of-pocket payments.
- *e.g.*, starting a different business, investing in the stock market, *etc.*

Example

Need $100,000 to start a business and the interest rate is 5%.

Option 1: Borrow $100,000.

- Explicit cost = $5,000.

Option 2: Use $40,000 from savings and borrow $60,000.

- Explicit cost = $3,000 $\longrightarrow$ 5% interest on the loan.
- Implicit cost = $2,000 $\longrightarrow$ 5% forgone interest on the $40,000 from savings.

Total cost = $5,000 for either option.

Accounting *vs.* Economic Profits

Accounting profit

= total revenue – explicit cost

Economic profit

= total revenue – (explicit cost + implicit cost)

Q: Which of the following is true?

> **A.** Accounting profit > economic profit.
>
> **B.** Accounting profit < economic profit.

Accounting *vs.* Economic Profits

Positive accounting profit doesn't always mean that a firm is doing well.

1. Economic profit < 0
   $\Longrightarrow$ Current business is less profitable than the next-best option.

2. Economic profit = 0
   $\Longrightarrow$ Current business is just as profitable as the next-best option.

3. Economic profit > 0
   $\Longrightarrow$ Current business is more profitable than the next-best option.

Production Technology

Output: The product that a firm produces.

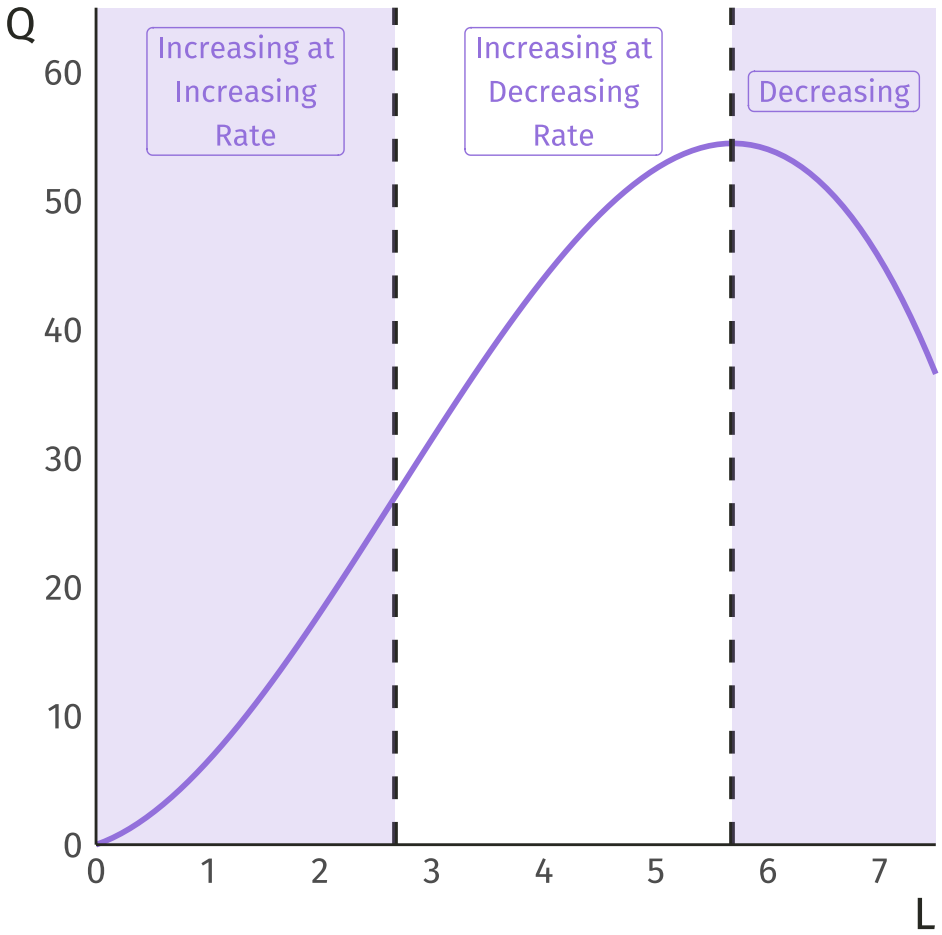
Inputs: Resources used in a firm's production process to produce output.

- Land: natural resources, site of business, *etc.*
- Labor: workers, managers, *etc.*
- Capital: machinery, computers, vehicles, *etc.*

Production function: Mathematical description of the relationship between inputs and output in a firm's production process.

$$\text{Inputs} \longrightarrow \text{production technology} \longrightarrow \text{output}$$

Total Product

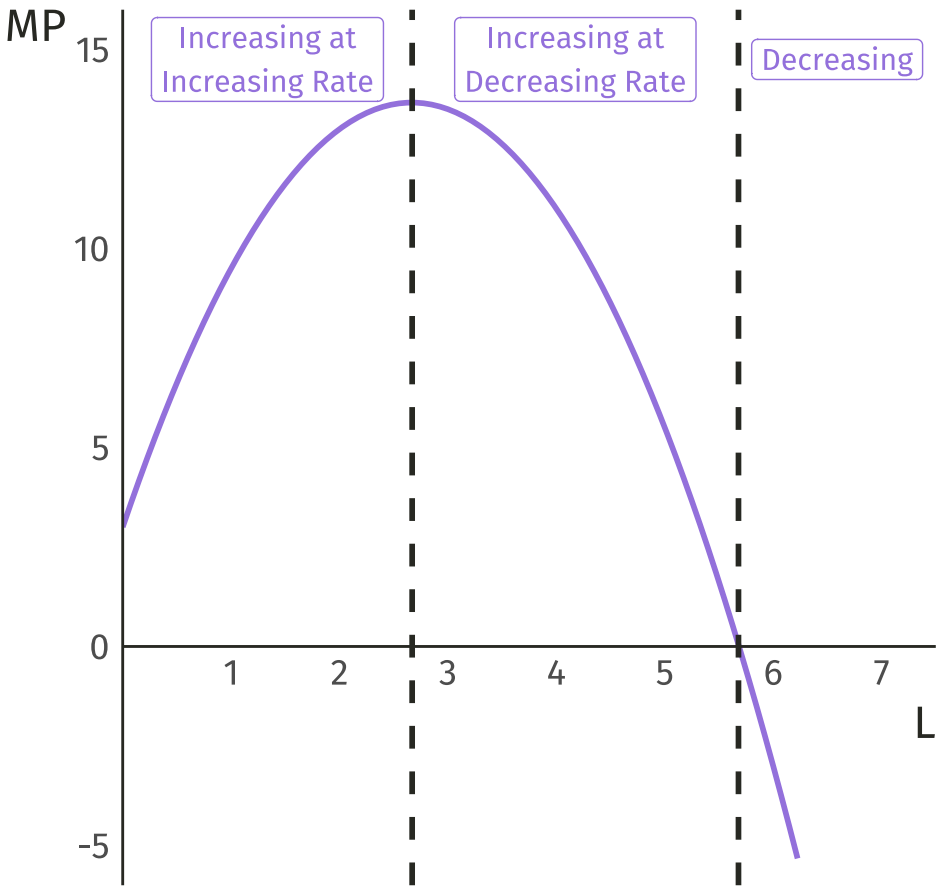


Definition

> Total amount of output from a given quantity of input.

Example: Labor (L), holding other inputs constant.

Marginal Product

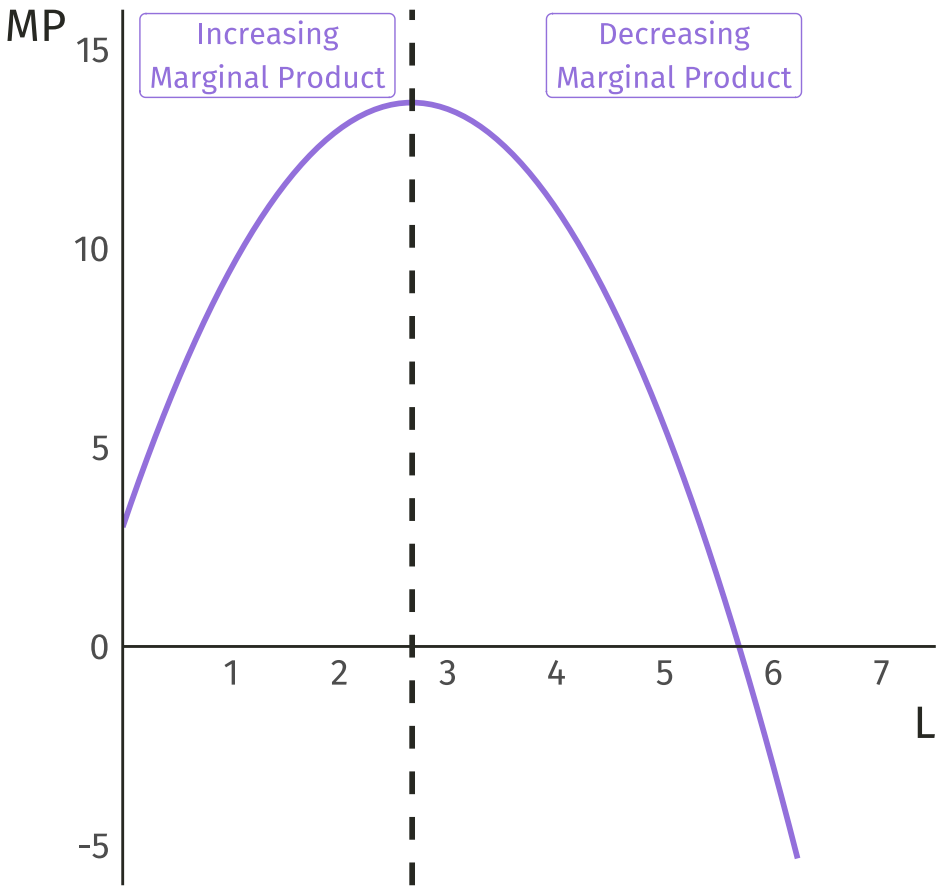


Definition

> Change in total product from a one-unit increase in an input.

Example: Labor (L), holding other inputs constant.

Diminishing Marginal Product



Idea

Marginal product eventually decreases as more of one input is used with a fixed quantity of other inputs.

Q: Suppose you are a watermelon farmer. If the price of a watermelon is $5 and the market wage is $2000 per month, how many workers should you hire?

Workers (L)	Watermelons (Q)	Marginal Product	Marginal Product × P	Wage
0	0	—	—	$2000
1	1000	1000	$5000	$2000
2	1800	800	$4000	$2000
3	2400	600	$3000	$2000
4	2800	400	$2000	$2000
5	3000	200	$1000	$2000

Think at the margin: Keep hiring as long as Marginal Product × P $\geq$ Wage.

A: You should hire 4 workers.

Input: Land $\longrightarrow$ must pay \$1000 per month in rent, regardless of the number of watermelons grown.

Input: Labor $\longrightarrow$ market wage is \$2000 per month.

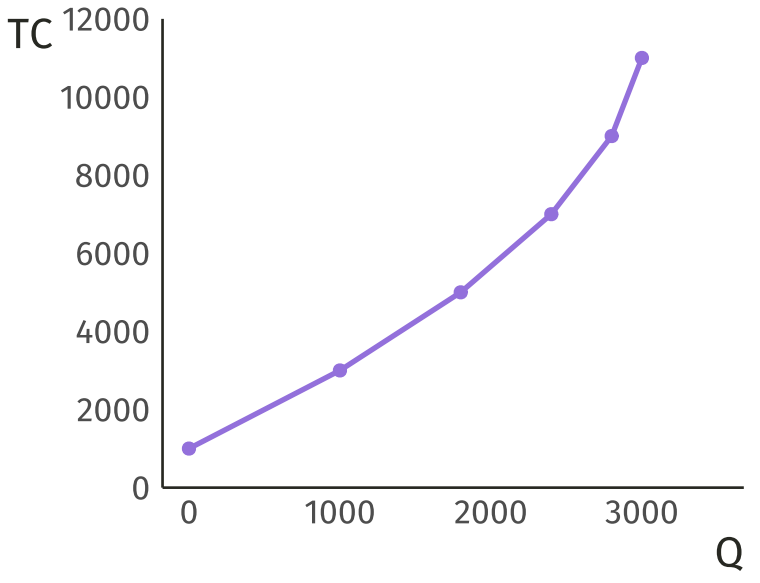
Workers (L)	Watermelons (Q)	Cost of Land	Cost of Labor	Total Cost
0	0	\$1000	\$0	\$1000
1	1000	\$1000	\$2000	\$3000
2	1800	\$1000	\$4000	\$5000
3	2400	\$1000	\$6000	\$7000
4	2800	\$1000	\$8000	\$9000
5	3000	\$1000	\$10000	\$11000

Input: Land $\longrightarrow$ must pay \$1000 per month in rent, regardless of the number of watermelons grown.

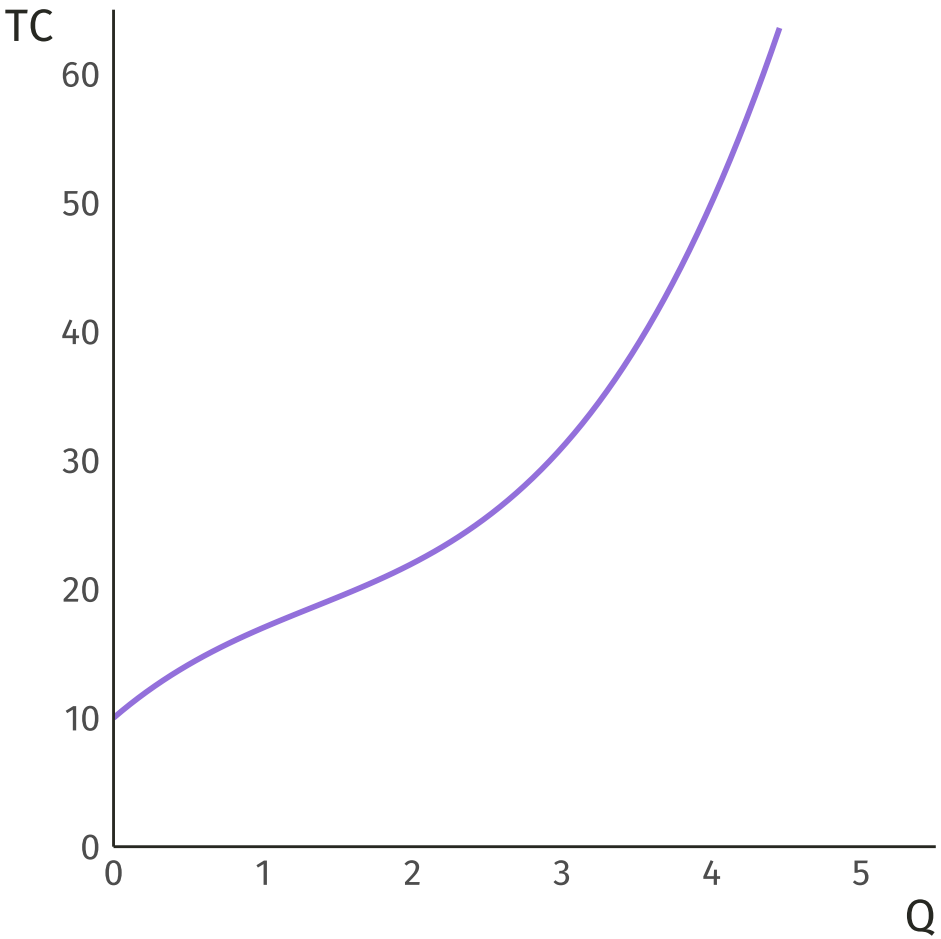
Input: Labor $\longrightarrow$ market wage is \$2000 per month.

Total Cost Curve

Watermelons (Q)	Total Cost
0	\$1000
1000	\$3000
1800	\$5000
2400	\$7000
2800	\$9000
3000	\$11000



Total Cost



Origin story

Production function + input prices
$\longrightarrow$ **total cost curve**.

Q: Why is the total cos curve S-shaped?

A: Diminishing marginal product.

Production Decisions

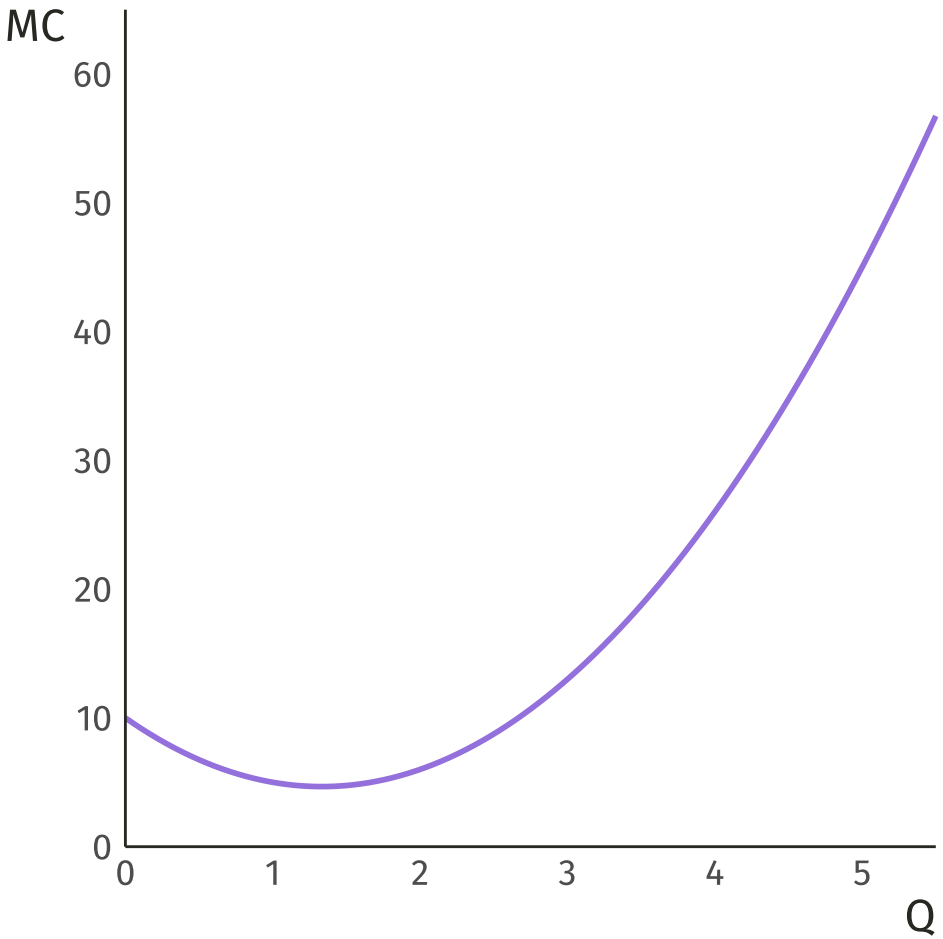
Q: How does a firm decide how much output to produce?

- To increase profit, should it produce more or fewer units?

A: Think at the margin.

- If the cost of additional units is less than the revenue from selling them, then profits rise as production increases.
- If the cost of additional units exceeds the revenue from selling them, then profits decline as production increases.

Marginal Cost



Definition

> Change in total cost that arises from a one-unit increase in output.

Fixed *vs.* Variable Costs

Total cost = fixed costs + variable costs

Fixed costs

> Costs that **do not vary** with the quantity of output produced.

- *e.g.*, rent, cost of equipment, loan payments, *etc.*
- Do not contribute to marginal cost.

Fixed *vs.* Variable Costs

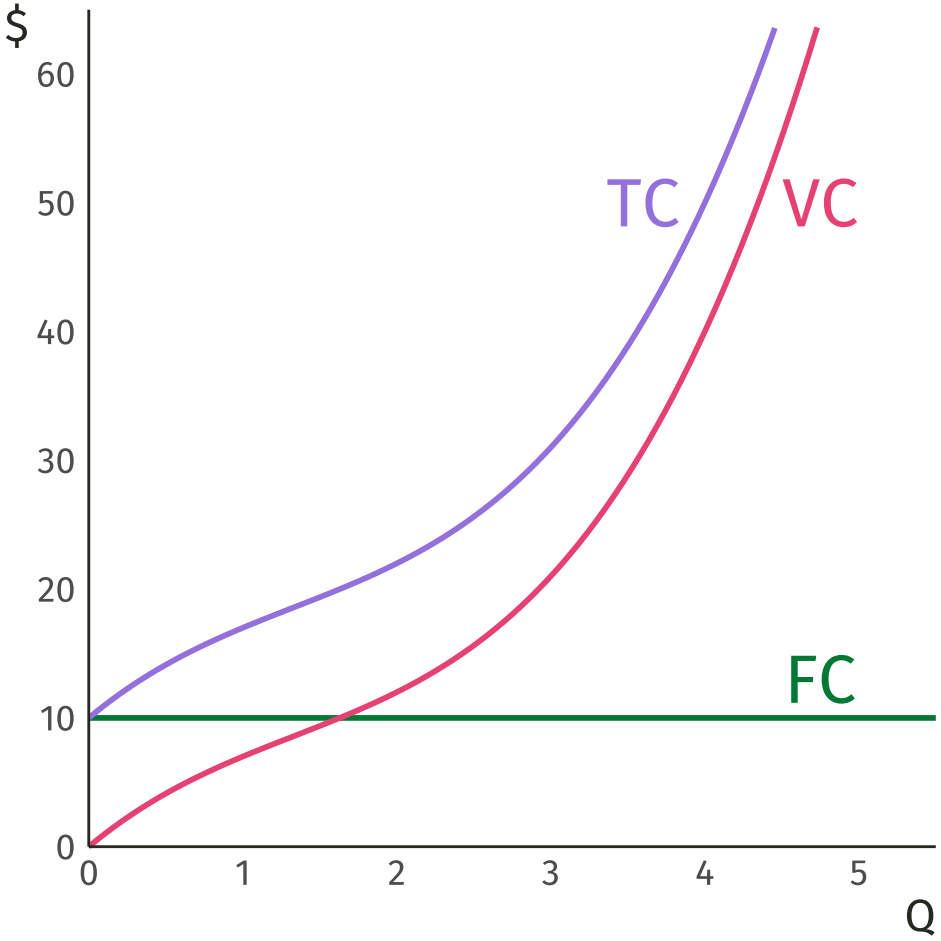
Total cost = fixed costs + variable costs

Variable costs

> Costs that **vary** with the quantity of output produced.

- *e.g.*, wages, cost of raw materials, *etc.*
- Contribute to marginal cost.

Fixed *vs.* Variable Costs



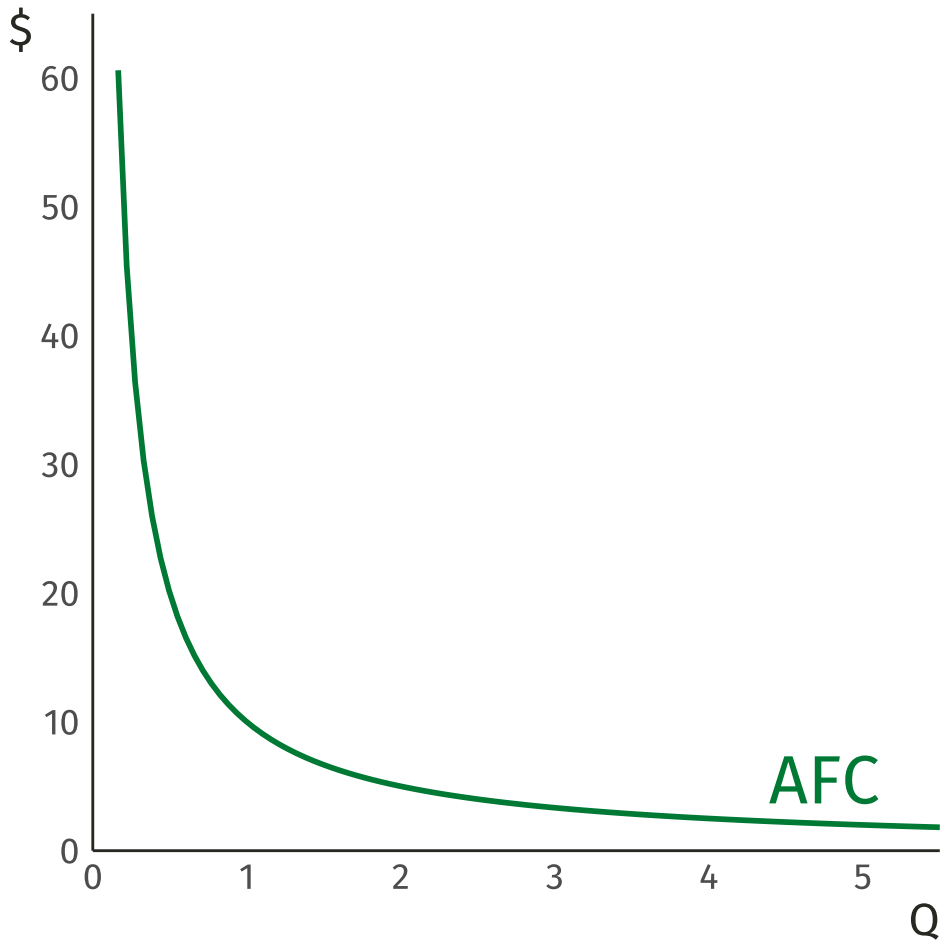
Fixed costs (FC)

> Costs that **do not vary** with Q.

Variable costs (VC)

> Costs that **vary** with Q.

Average Fixed Cost

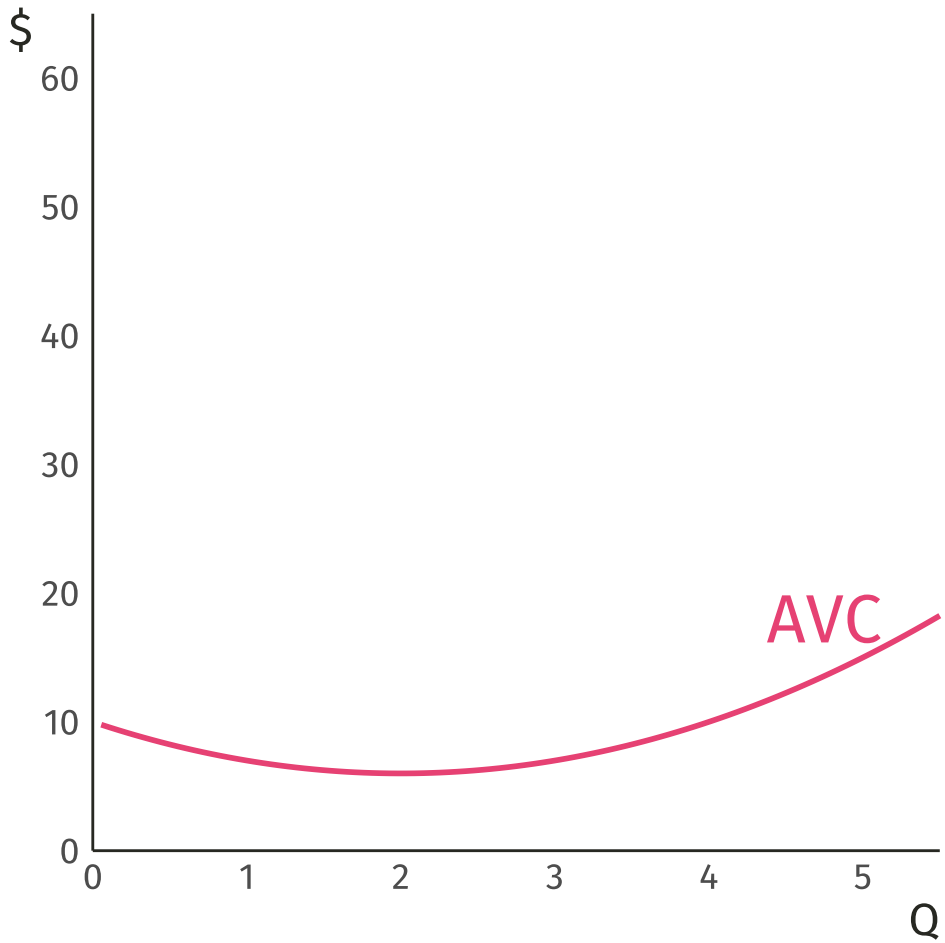


Definition

> AFC = FC ÷ Q

Decreases as Q rises $\longrightarrow$ more output spread over same fixed cost.

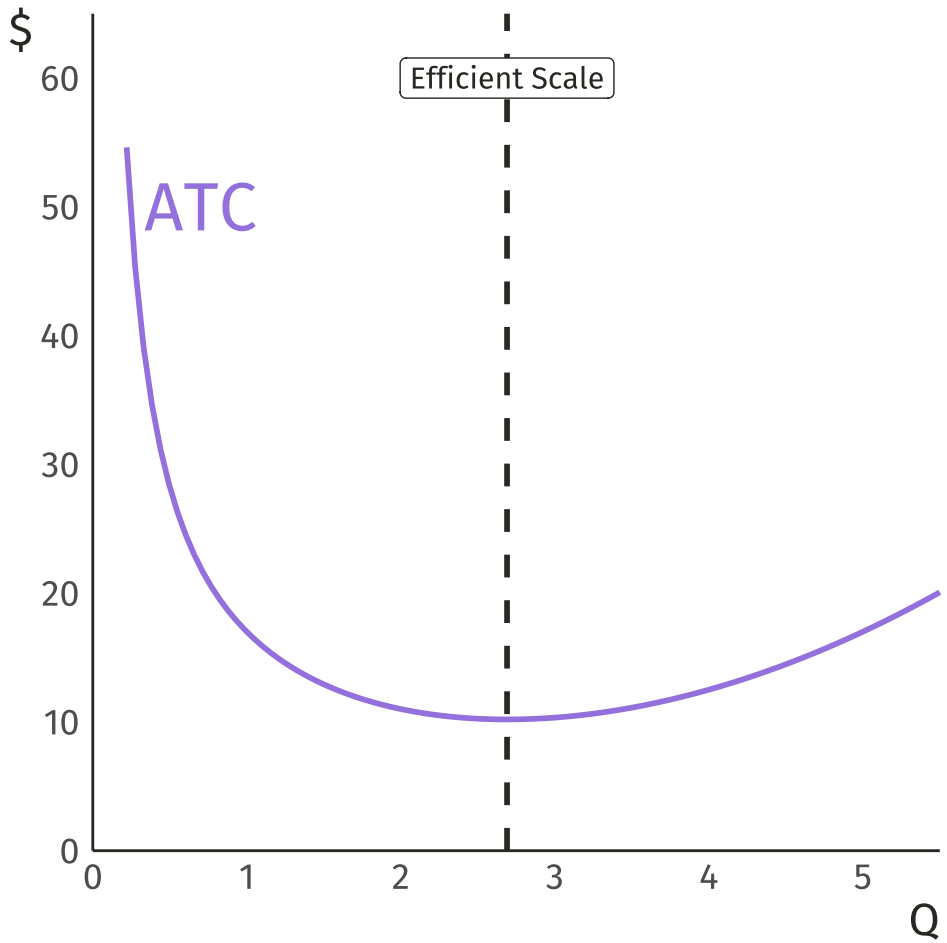
Average Variable Cost



Definition

> AVC = VC ÷ Q

Average Total Cost

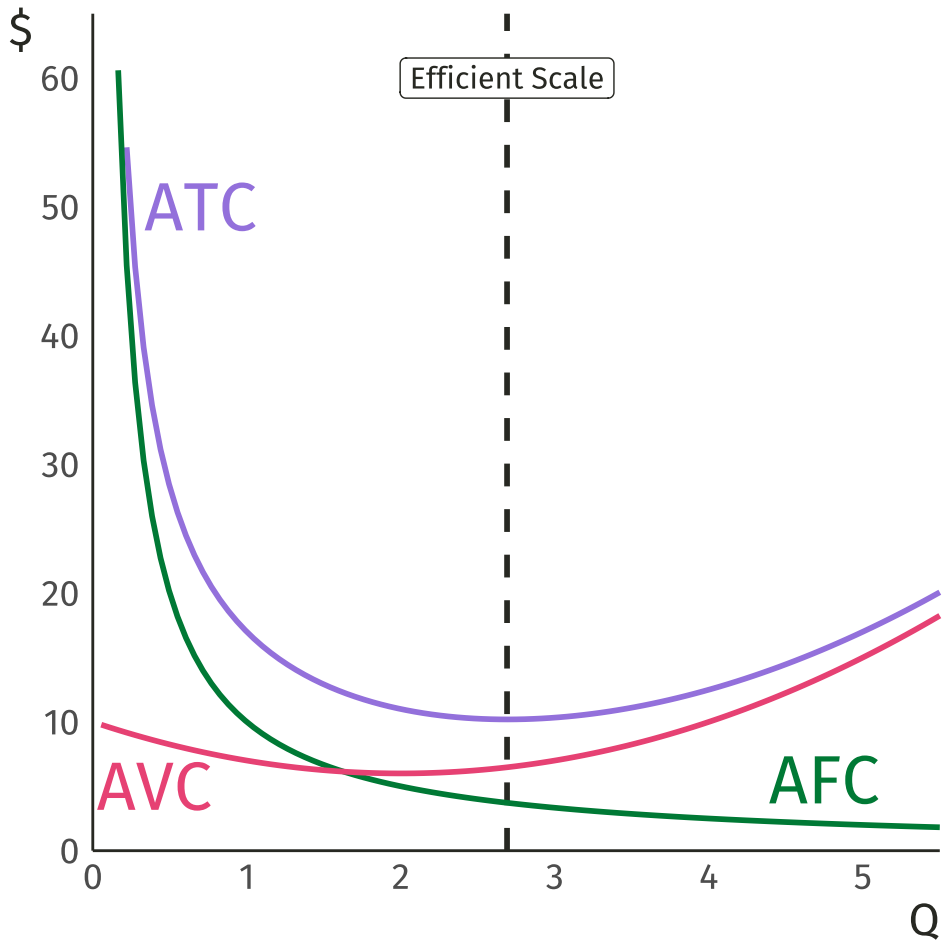


Definition

> ATC = TC ÷ Q
> = AFC + AVC

Efficient scale = Q that minimizes ATC.

Average Total Cost

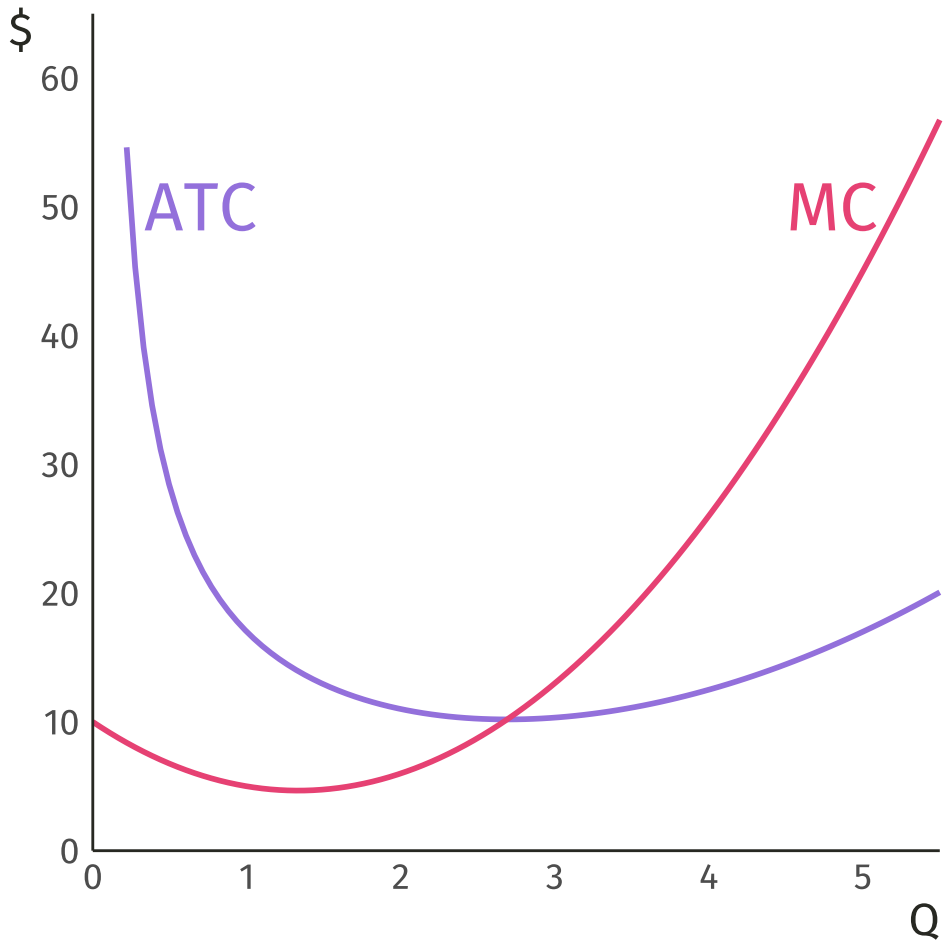


Efficient scale = Q that minimizes ATC.

Q < efficient scale: Falling AFC pulls ATC down.

Q > efficient scale: Rising AVC pulls ATC up.

Average Total Cost + Marginal Cost



MC < ATC $\Longrightarrow$ ATC is falling.

MC > ATC $\Longrightarrow$ ATC is rising.

MC crosses ATC at the Q that minimizes ATC.

Short-Run *vs.* Long-Run

Short-Run

Some inputs are fixed.

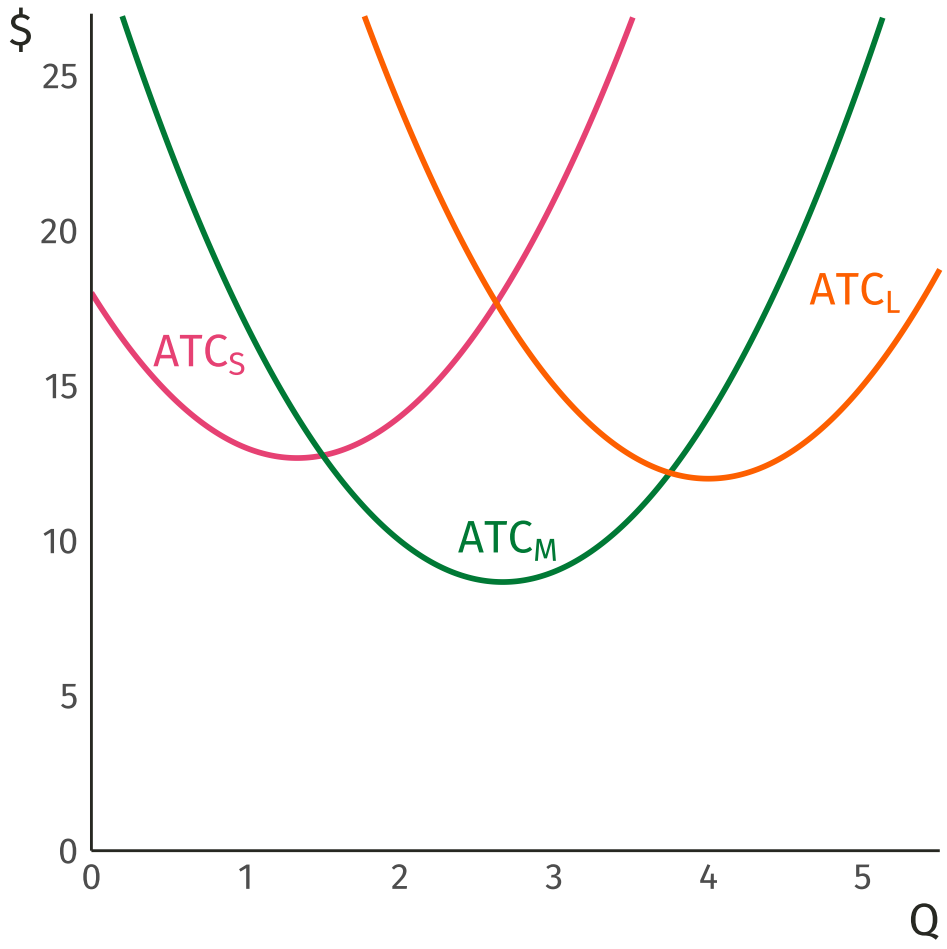
- *e.g.*, land, factories, assembly-line robots, *etc.*
- Fixed inputs $\longrightarrow$ fixed cost.

Long-Run

All inputs are variable

- *e.g.*, firms can build new factories or sell existing ones.
- Firms use most efficient mix of inputs for any Q (*e.g.*, factory with lowest ATC).

Long-Run ATC

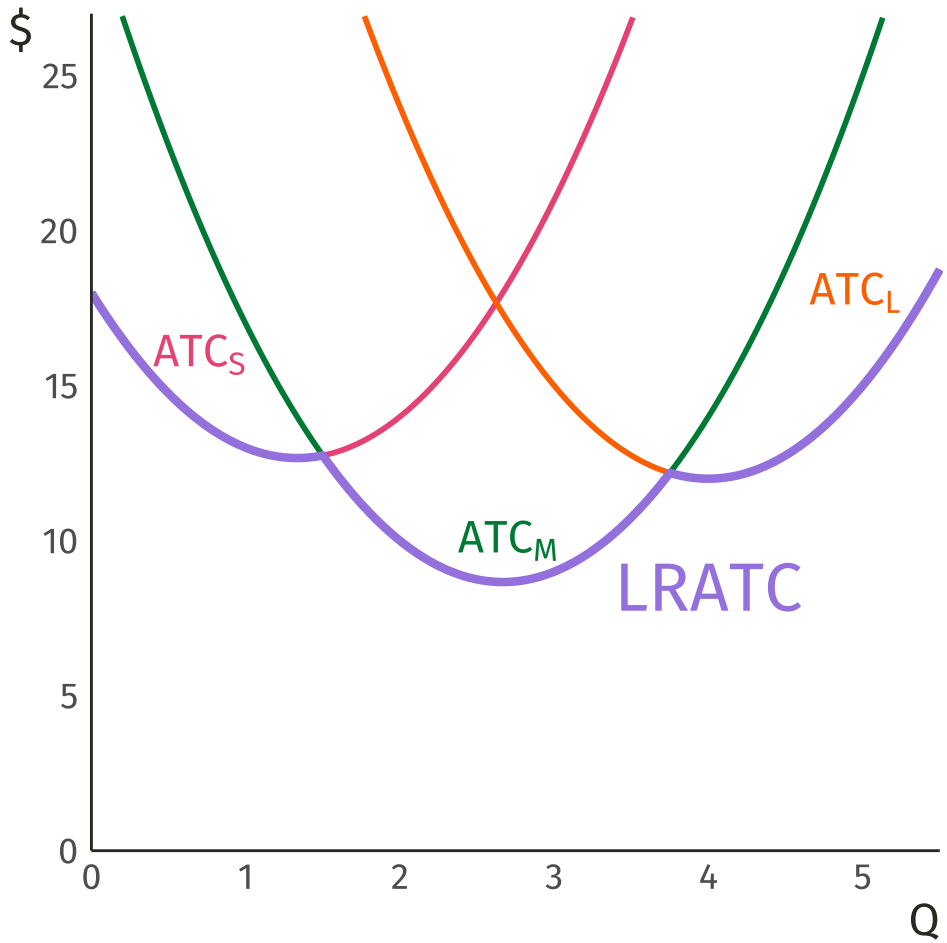


A firm can choose from three factory sizes: S, M, L.

Each factory size has its own short-run ATC curve.

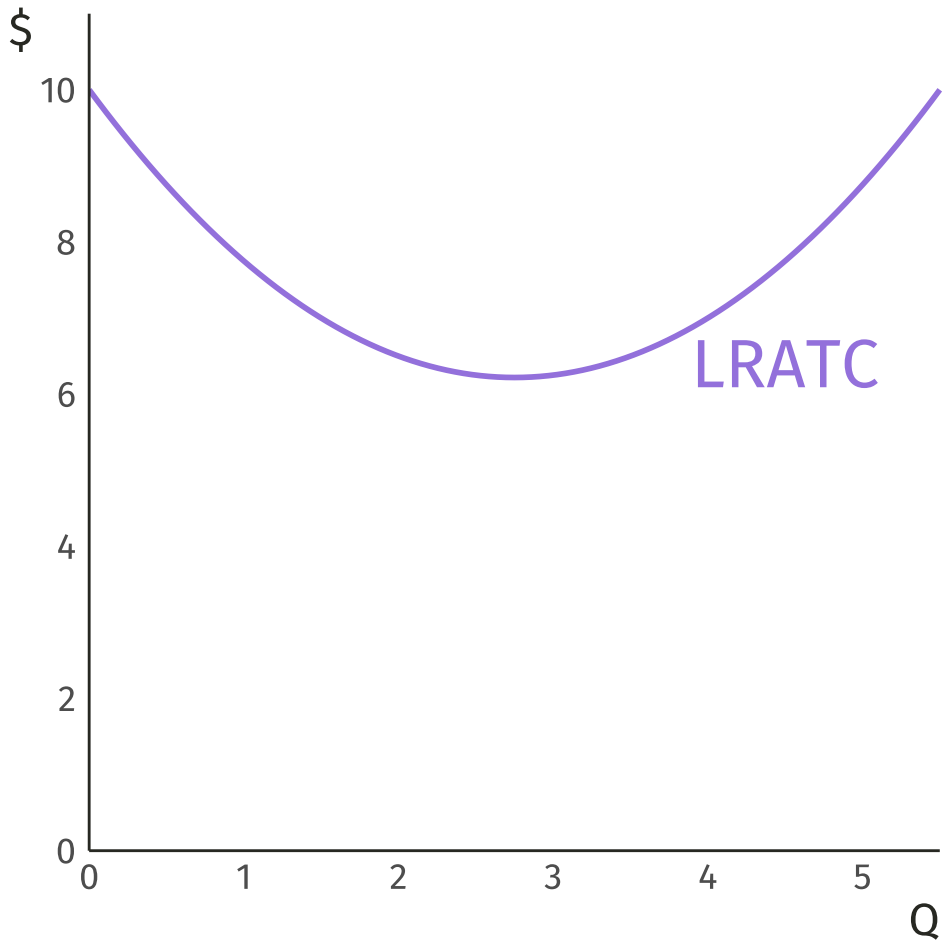
The firm can change to a different factory size in the long run, but not in the short run.

Long-Run ATC



In the long run, a firm will choose the factory size that minimizes long-run ATC given the production level.

Long-Run ATC



Typical long-run average total cost curve.

- Traced out by numerous short-run ATC curves.

However, LRATC can take a variety of forms.

- Depends on returns to scale.

Returns to Scale

Economies of scale

> Long-run ATC falls as the quantity of output rises.

- Increased specialization among workers.
- More common when Q is low.
- *e.g.*, tech start-ups?

Returns to Scale

Constant returns to scale

> Long-run ATC stays the same as the quantity of output rises.

- *e.g.*, restaurant chains?

Returns to Scale

Diseconomies of scale

> Long-run ATC rises as the quantity of output rises.

- Coordination problems in large firms.
- Failure to control costs.
- More common when Q is high.
- *e.g.*, hospitals?