

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
→ no out-of-pocket payments.
- *e.g.*, starting a different business, investing in the stock market, *etc.*

Costs

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

Total cost = \$5,000 for either option.

Accounting vs. Economic Profits

Accounting profit

$$= \text{total revenue} - \text{explicit cost}$$

Economic profit

$$= \text{total revenue} - (\text{explicit cost} + \text{implicit cost})$$

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

⇒ Current business is less profitable than the next-best option.

2. Economic profit $= 0$

⇒ Current business is just as profitable as the next-best option.

3. Economic profit > 0

⇒ Current business is more profitable than the next-best option.

Production Technology

Output: The product that a firm produces.

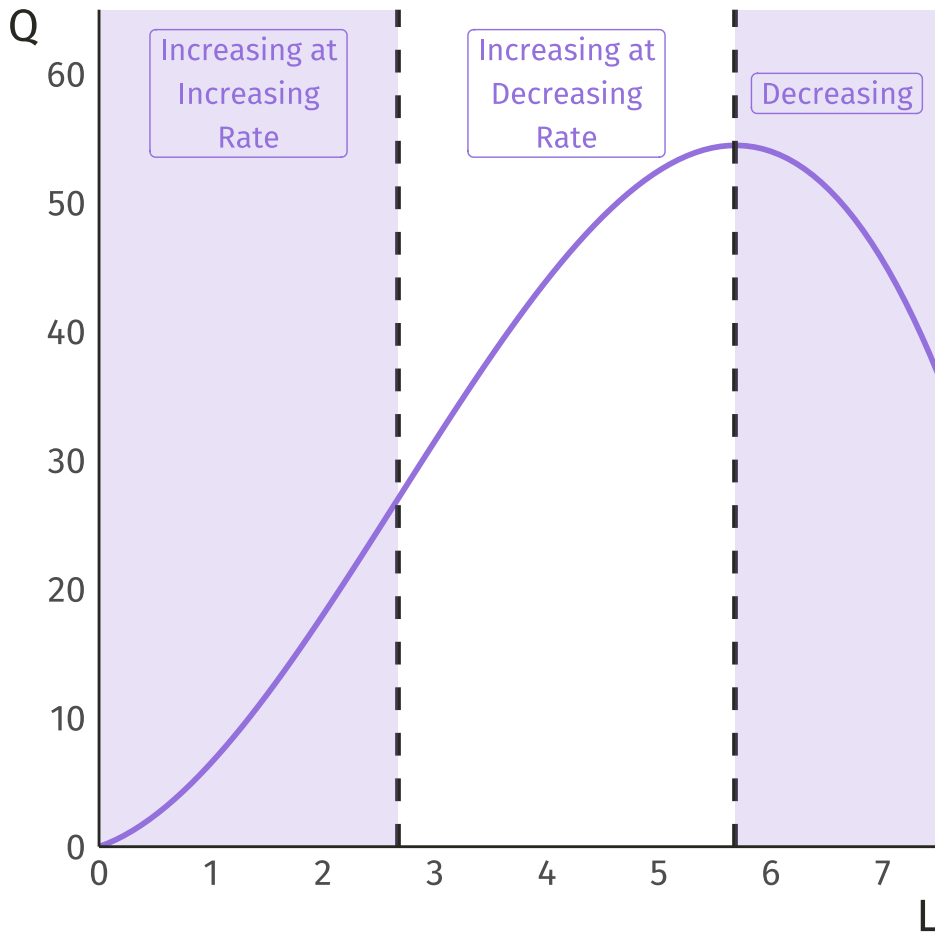
Inputs: Resources used in a firm's production process to produce output.

- 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.

Inputs \longrightarrow production technology \longrightarrow output

Total Product

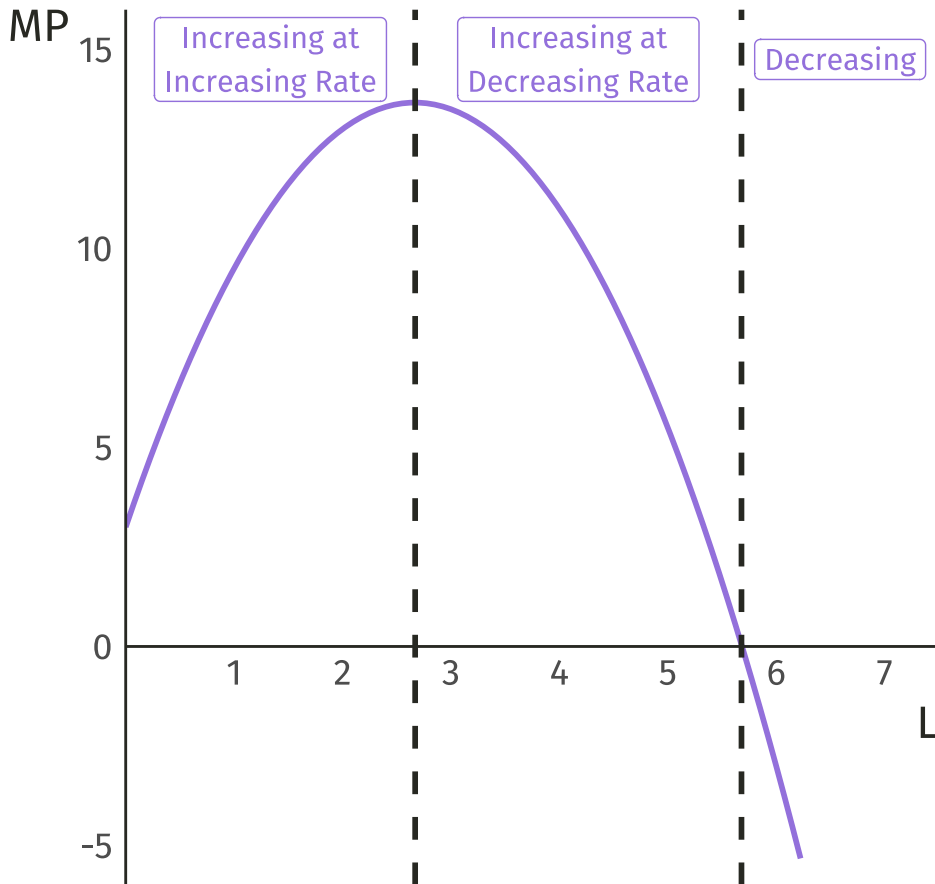


Definition

Total amount of output from a given quantity of input.

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

Marginal Product

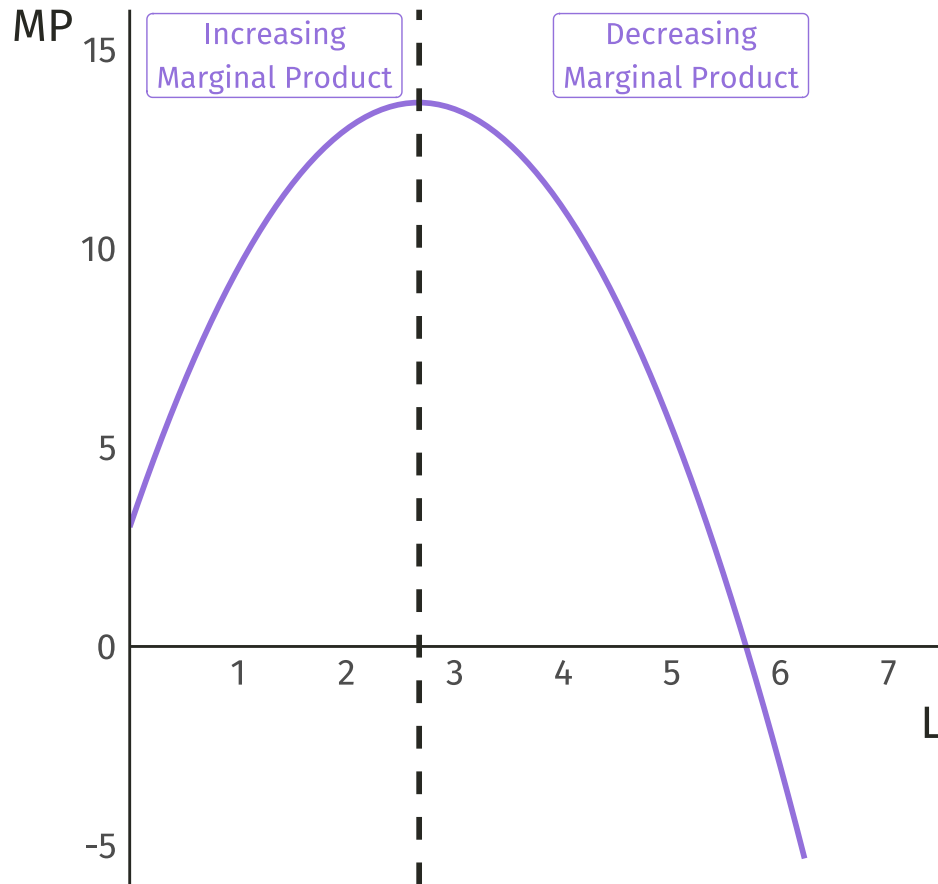


Definition

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 $\text{Marginal Product} \times P \geq \text{Wage}$.

A: You should hire 4 workers.

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

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

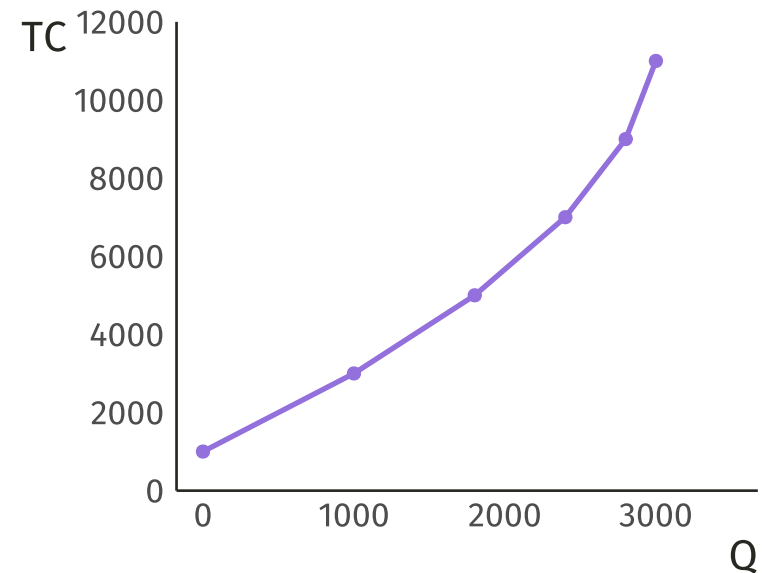
Workers (L)	Watermelons (Q)	Cost of Land	Cost of Labor	Total Cost
0	0	\$1000	\$0	\$1000
1	1000	\$1000	\$2000	\$3000
2	1800	\$1000	\$4000	\$5000
3	2400	\$1000	\$6000	\$7000
4	2800	\$1000	\$8000	\$9000
5	3000	\$1000	\$10000	\$11000

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

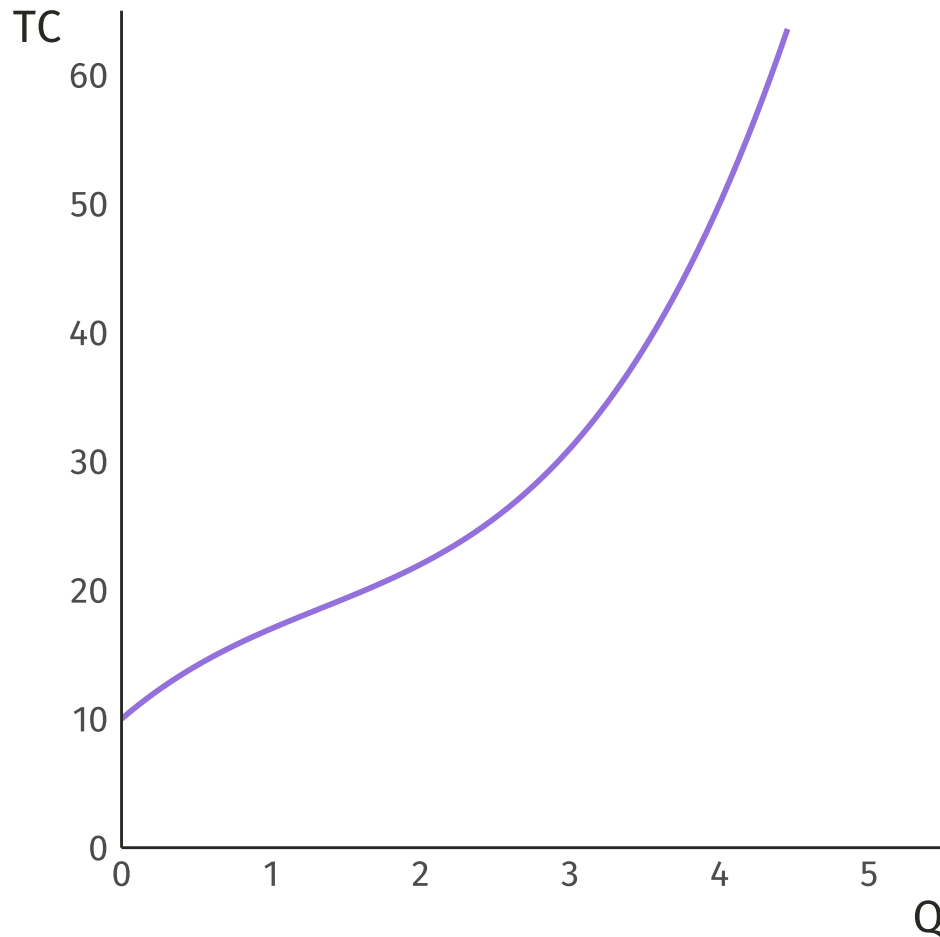
Input: Labor → market wage is \$2000 per month.

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
→ **total cost curve**.

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

A: Diminishing
marginal product.

Production Decisions

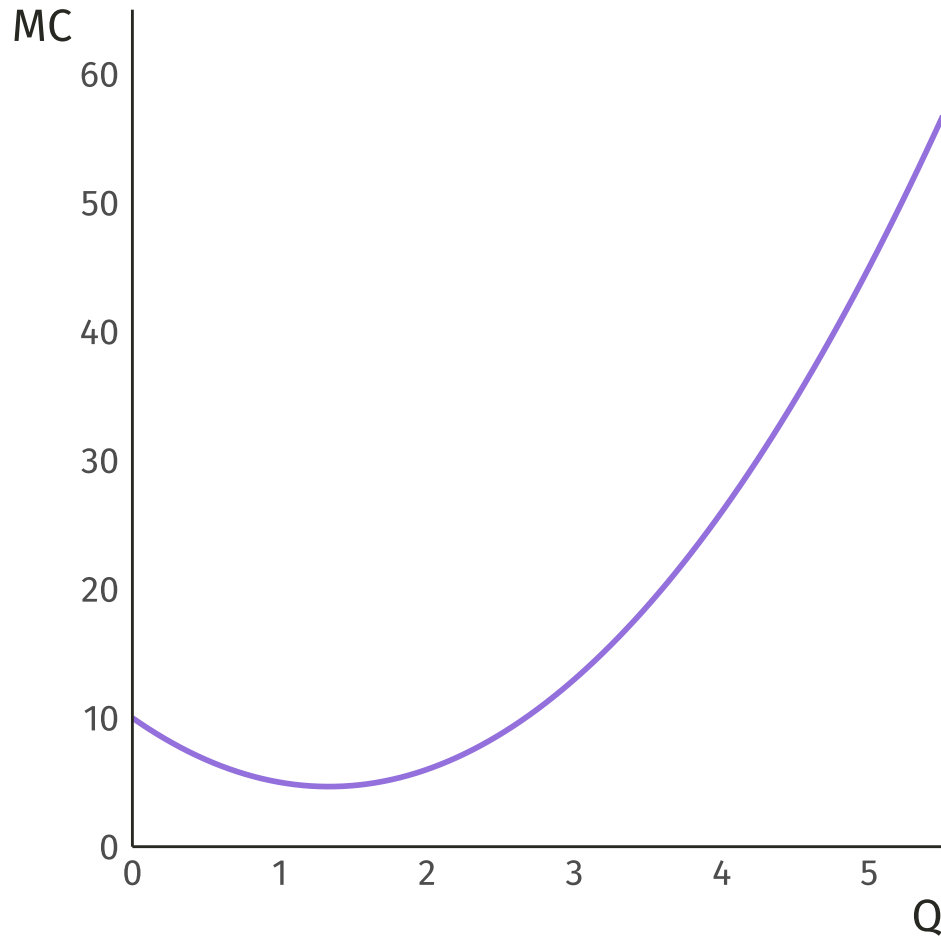
Q: How does a firm decide how much output to produce?

- 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

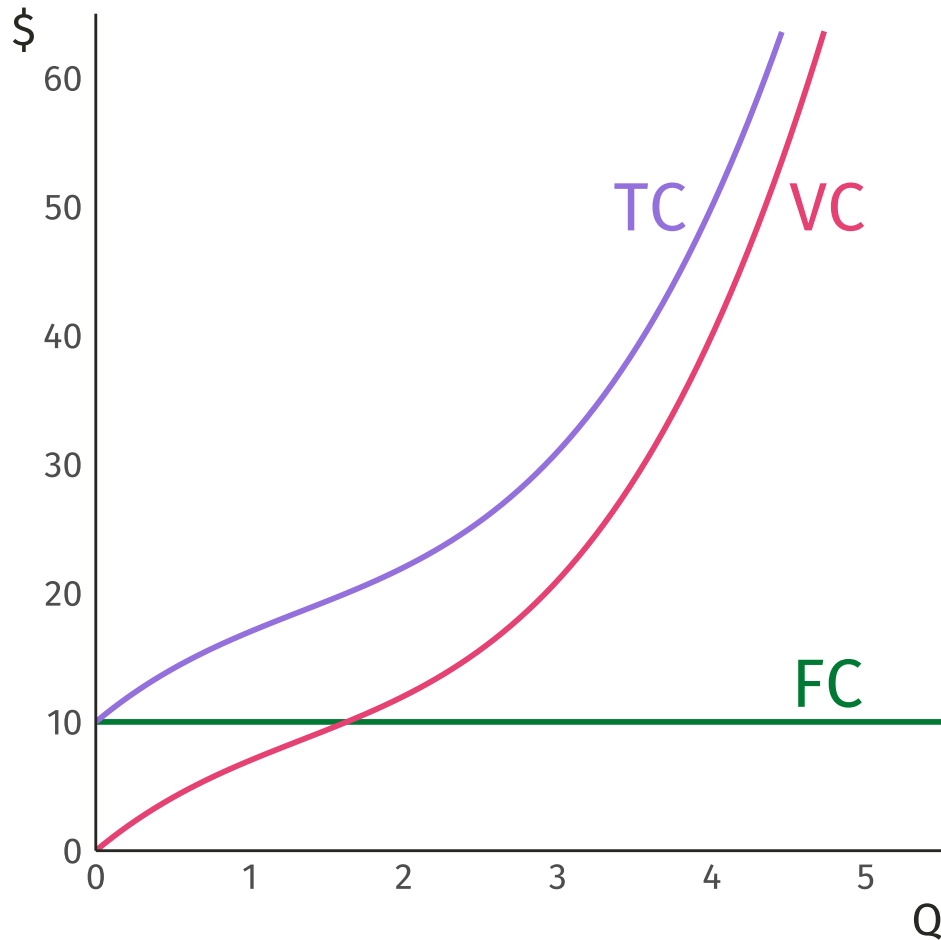
Total cost = **fixed costs** + **variable costs**

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



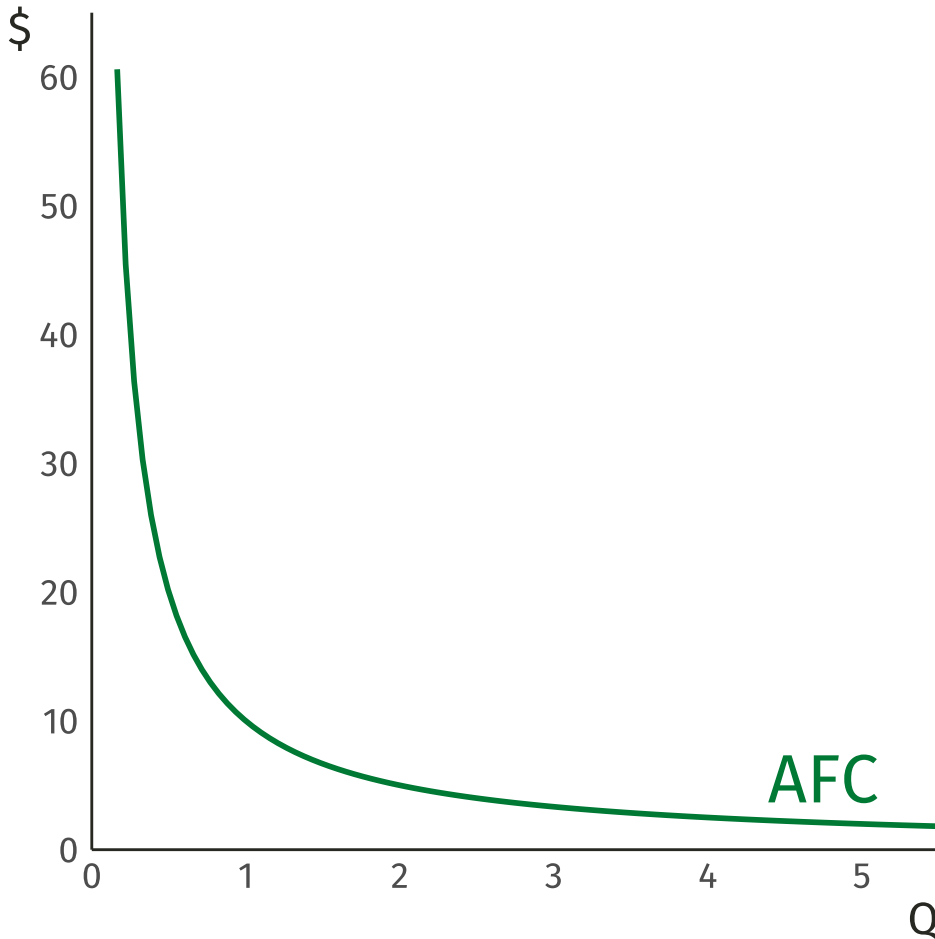
Fixed costs (FC)

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

Variable costs (VC)

Costs that **vary** with Q.

Average Fixed Cost

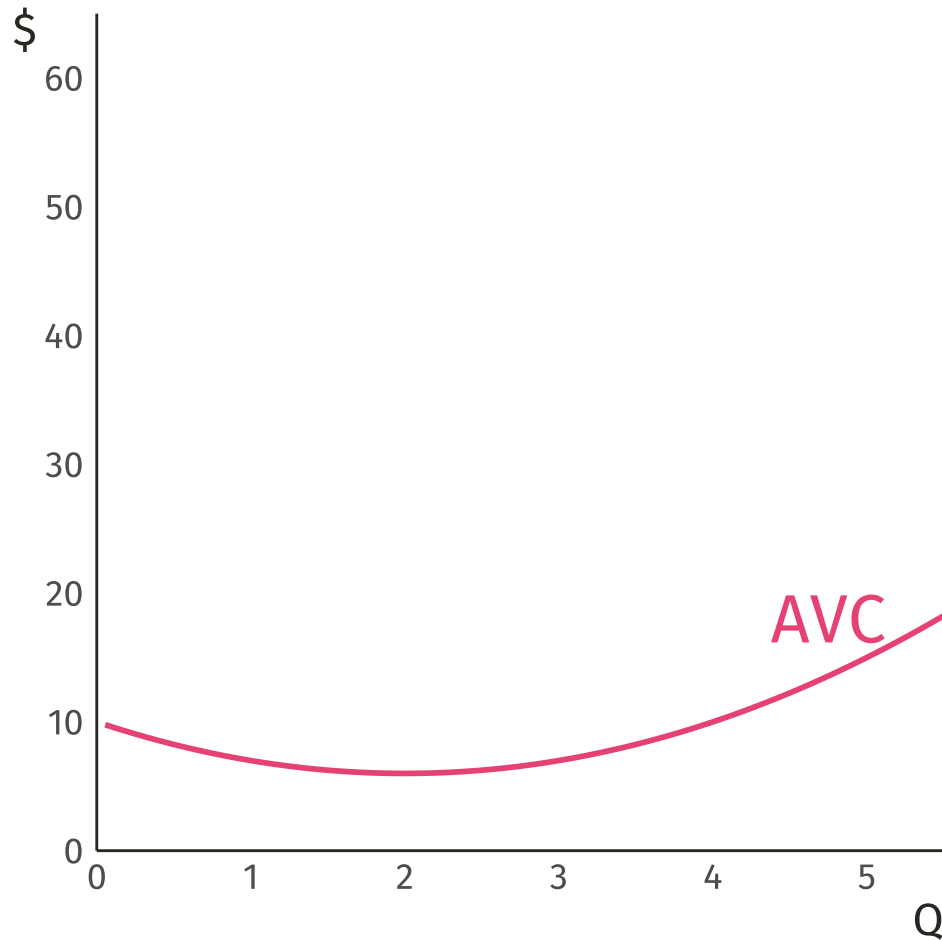


Definition

$$AFC = FC \div Q$$

Decreases as Q rises
→ more output
spread over same fixed
cost.

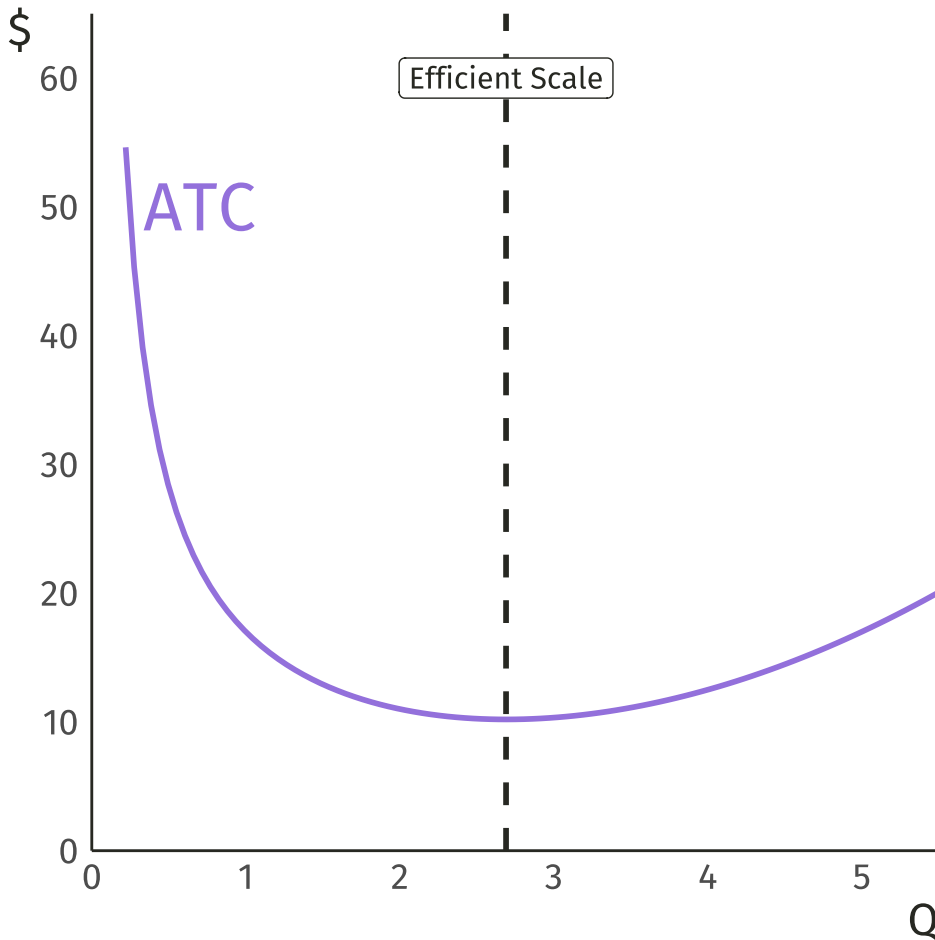
Average Variable Cost



Definition

$$AVC = VC \div Q$$

Average Total Cost

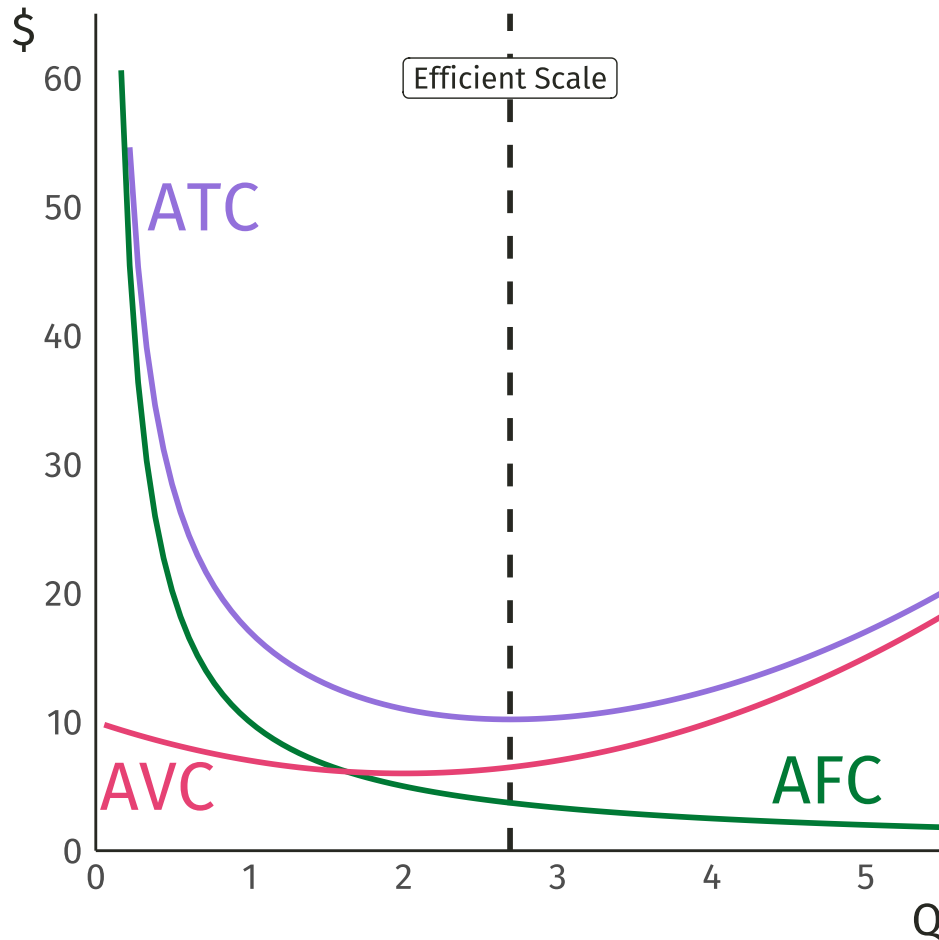


Definition

$$\begin{aligned} \text{ATC} &= \text{TC} \div Q \\ &= \text{AFC} + \text{AVC} \end{aligned}$$

Efficient scale = Q that minimizes ATC.

Average Total Cost

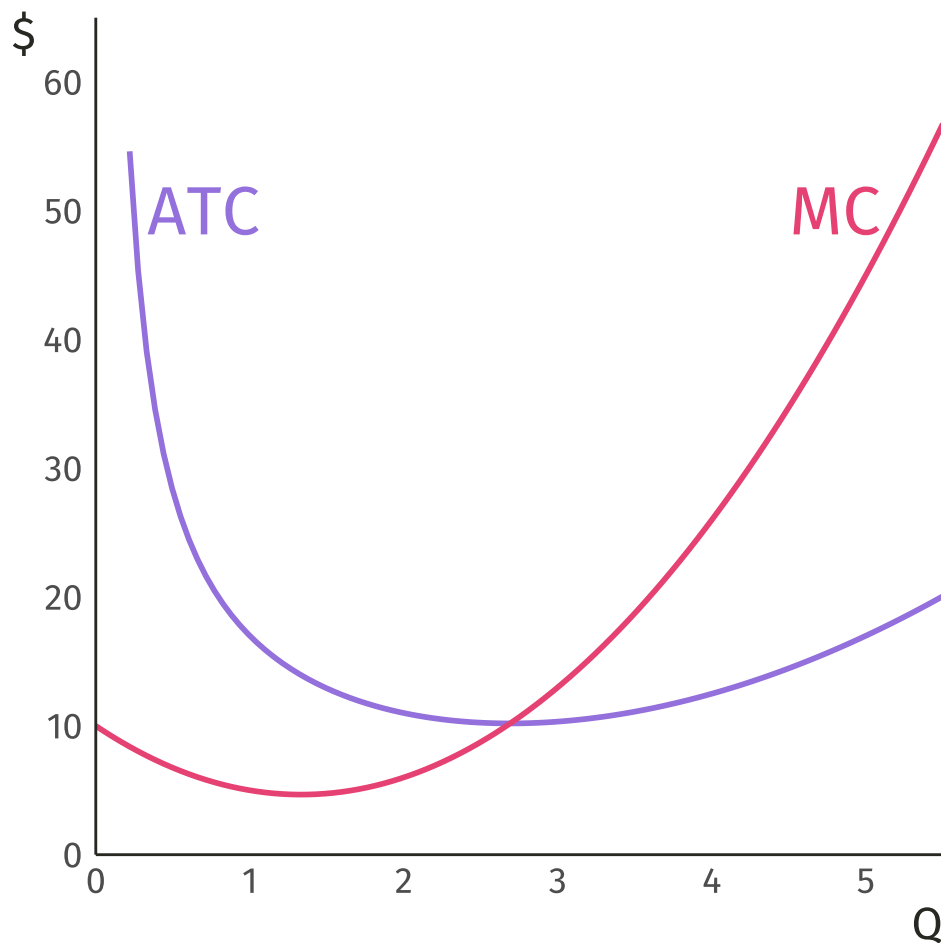


Efficient scale = Q that minimizes ATC.

$Q <$ efficient scale:
Falling AFC pulls ATC down.

$Q >$ efficient scale:
Rising AVC pulls ATC up.

Average Total Cost + Marginal Cost



$MC < ATC \implies$ ATC is falling.

$MC > ATC \implies$ ATC is rising.

MC crosses ATC at the Q that minimizes ATC.

Short-Run vs. Long-Run

Short-Run

Some inputs are fixed.

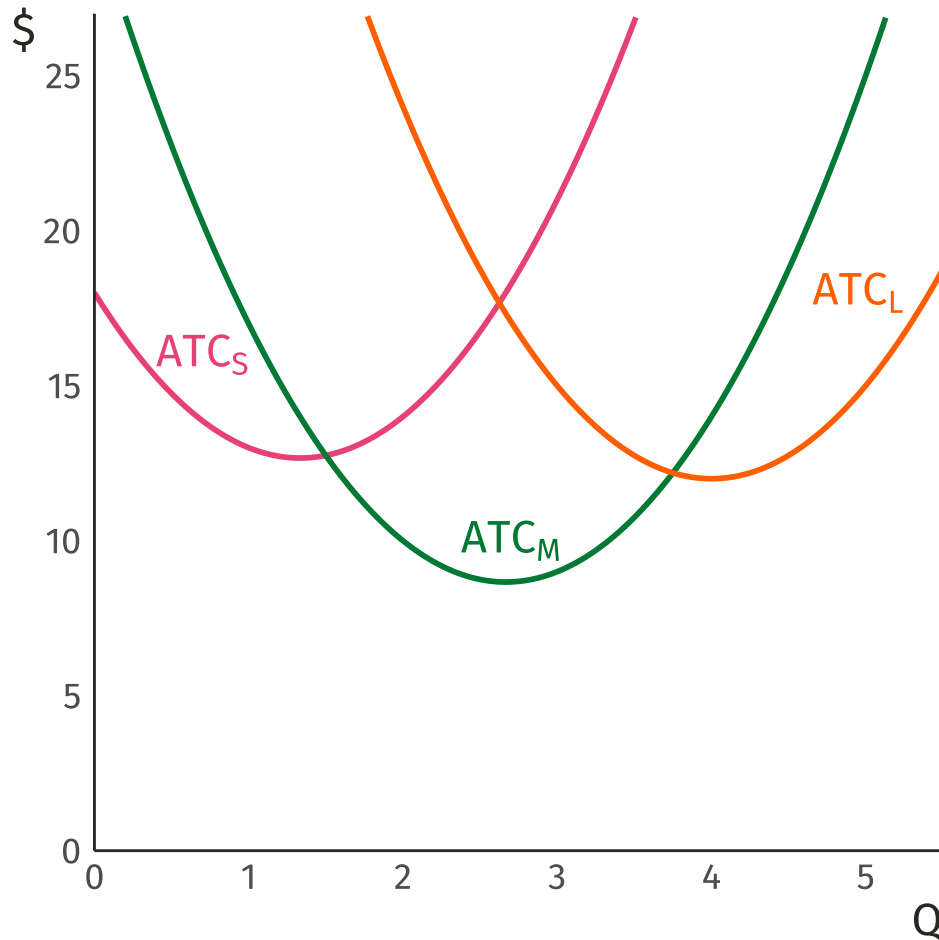
- *e.g.*, land, factories, assembly-line robots, *etc.*
- Fixed inputs \longrightarrow fixed cost.

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

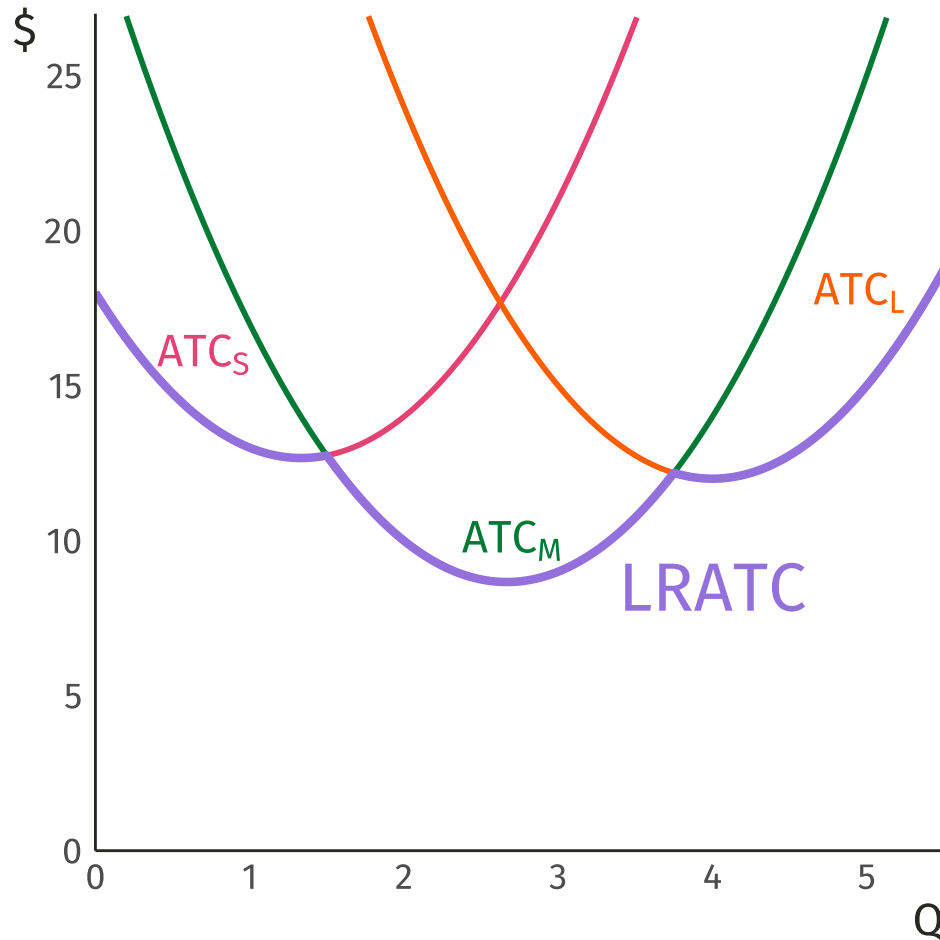


A firm can choose from three factory sizes: S, M, L.

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

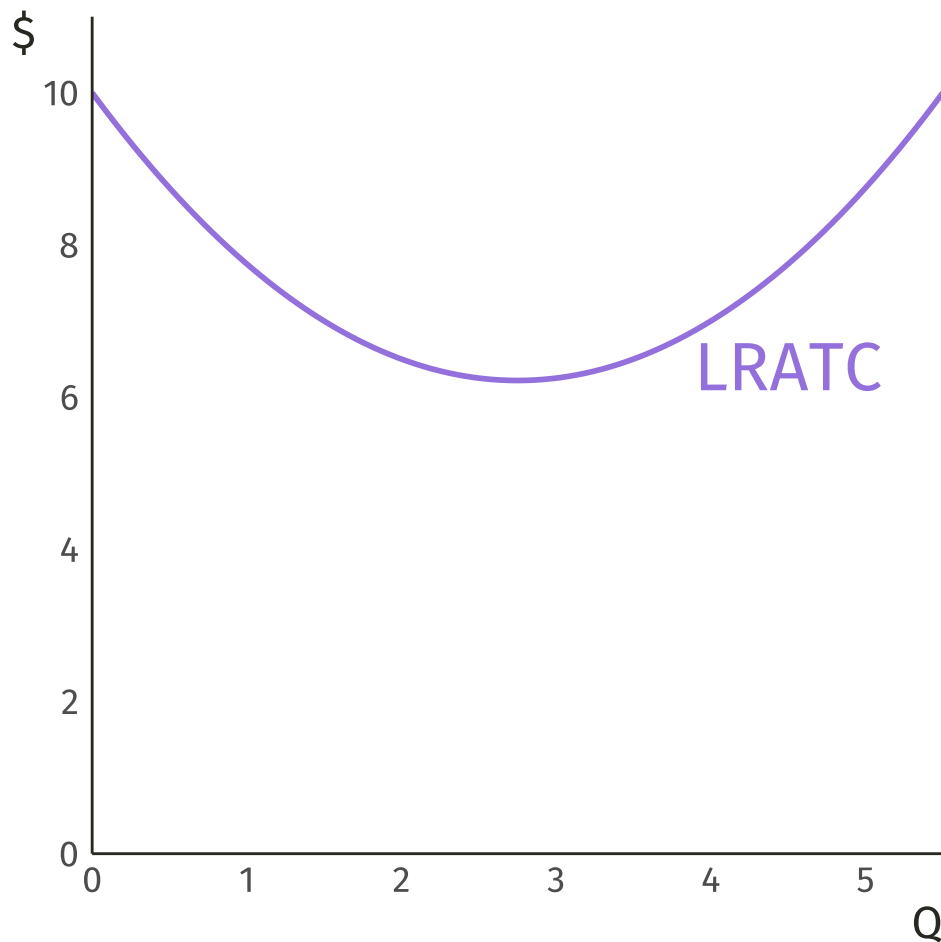
The firm can change to a different factory size in the long run, but not in the short run.

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?