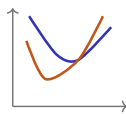


Production, Cost & Perfect Competition

AP Microeconomics • Unit 3

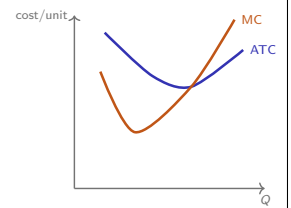
AP Microeconomics



Production, Cost & Perfect Competition

What we will cover

- 1 Production & marginal product
- 2 Short-run costs
- 3 Long-run costs & scale
- 4 Types of profit
- 5 Profit maximization
- 6 Perfect competition



1 Production

Production, Cost & Perfect Competition

Production

The production function

The **production function** 生产函数 links **inputs** 投入 to **output** 产出.

- **Short run** 短期: at least one input **fixed** (the factory)
- **Long run** 长期: **every** input variable

Add workers to a fixed factory: **marginal product** 边际产量 $MP = \frac{\Delta TP}{\Delta L}$, **average product** 平均产量 $AP = \frac{TP}{L}$.



Machines and labour turn inputs into output

Production, Cost & Perfect Competition

Production

Diminishing marginal returns

The **law of diminishing marginal returns** 边际收益递减规律: past some point, each extra variable input adds **less** – workers crowd the fixed factory.

Worked example – the bakery

One oven (fixed). Workers give $TP = 10, 24, 33, 39$ loaves.

$MP = 10, 14, 9, 6$. Diminishing returns begin with the **third** worker.



Fixed plant + more labour eventually crowds

2 Costs

Short-run costs

Total cost splits into **fixed cost** 固定成本 (FC) and **variable cost** 可变成本 (VC):
 $TC = FC + VC$.

$$AFC = \frac{FC}{Q} \text{ falls}$$

$$AVC = \frac{VC}{Q}$$

$$ATC = AFC + AVC$$

Marginal cost 边际成本 $MC = \frac{\Delta TC}{\Delta Q}$ – the cost of one more unit.

Output, and two kinds of efficiency

Total product

Total product is total output from a given quantity of the variable input; its slope is the marginal product.

Productively efficient

A firm is **productively efficient** when it produces at the minimum of average total cost – no cheaper way to make that output.

Allocatively efficient

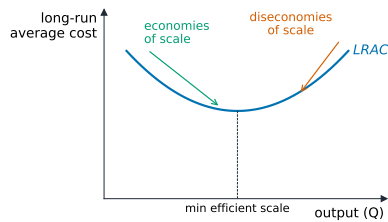
A market is **allocatively efficient** when $P = MC$: the last unit is worth exactly what it cost society to make.

Why perfect competition

In long-run equilibrium it achieves both – which is the benchmark every other market structure is compared against.

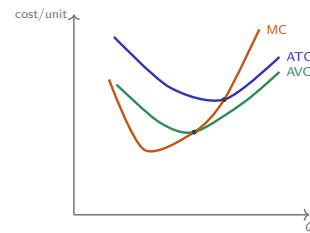
Productive efficiency is about **cost**; allocative efficiency about **quantity**. A firm can achieve one and fail the other.

Long-Run Production Costs



Economies and diseconomies of scale on the long-run average cost curve

The U-shaped cost curves

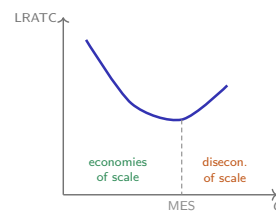


MC cuts AVC and ATC at their **minimum** points.

When MC is below the average, it pulls the average **down**; above it, **up**. The U-shape is the mirror of the marginal-product hill.

3 Long run & scale

Long-run cost & returns to scale



Long run: **no fixed costs** 无固定成本. LRATC is the **envelope** 包络线 of all plant sizes.

- **economies of scale** 规模经济: LRATC falls
- **constant returns** 规模报酬不变: flat
- **diseconomies** 规模不经济: rises

Minimum efficient scale 最小有效规模: smallest Q at lowest LRATC.

4 Profit

Production, Cost & Perfect Competition
└ Profit

Types of profit

Accounting profit 会计利润

$TR - \text{explicit costs}$ 显性成本
(money paid out)

Economic profit 经济利润

$TR - (\text{explicit} + \text{implicit costs})$ 隐性成本

Normal profit 正常利润: economic profit = 0 – exactly covers every cost incl. **opportunity cost** 机会成本

The per-unit costs, and the two kinds of profit

average total cost $ATC = TC/Q$ – the U-shaped curve

average variable cost $AVC = VC/Q$; the gap between ATC and AVC is average fixed cost, and it shrinks as Q rises

marginal cost the cost of one more unit – it cuts ATC and AVC at their **minimum points**

explicit costs 显性成本 out-of-pocket payments

implicit costs 隐性成本 the **opportunity cost** of resources the owner already has – their own time and capital

the two profits accounting profit subtracts explicit costs only; **economic profit** subtracts both

A firm with \$80,000 accounting profit and \$90,000 of implicit costs is making an economic loss, and should be doing something else.

Production, Cost & Perfect Competition
└ Profit

Economic profit – worked example

Maria opens a cafe

She leaves a \$50,000 salary (an **implicit cost** 隐性成本). $TR = \$200,000$; explicit costs = \$130,000.

Accounting profit = $200,000 - 130,000 = \$70,000$.

Economic profit = $70,000 - 50,000 = \$20,000 > 0$ – opening was the better choice.

5 Profit maximization

Production, Cost & Perfect Competition
└ Profit maximization

The profit-maximizing rule

$$MR = MC$$

$MR > MC$: make more

$MR < MC$: make less

Measure the profit

At $Q = 50$, $MR = MC = \$8$, $P = \$12$, $ATC = \$9$.

Economic profit = $(P - ATC) \times Q = (12 - 9) \times 50 = \150 .

Produce, or shut down?

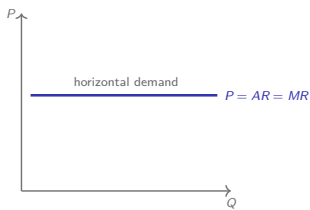
Short run: $P \geq AVC$
keep producing – covers
variable cost & some fixed

Short run: $P < AVC$
shut down 停产法则
– lose only fixed cost

Long run: exit if $P < ATC$; enter if $P > ATC$. Break even (**normal profit**) at $P = \text{minimum } ATC$ – the **break-even price** 盈亏平衡价格.

6 Perfect competition

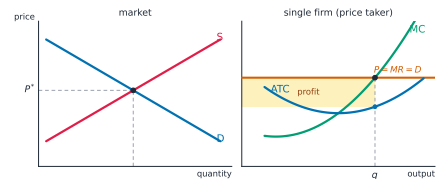
Perfect competition



A **perfectly competitive market** 完全竞争市场: many tiny firms, identical products, **free entry/exit** 自由进出, perfect info.

Each firm is a **price taker** 价格接受者: $P = AR = MR$. It produces where $P = MC$.

The market sets the price; the price-taking



short-run $P > ATC$ attracts entry $\Rightarrow S$ right $\Rightarrow P \rightarrow \min ATC$ (long-run zero profit)

The market sets the price; the price-taking firm produces where $MC = P$, here with short-run profit

Short-run profit, break-even, loss

$P > ATC$
profit

$P = ATC$
break even

$P < ATC$
loss (if $P \geq AVC$)

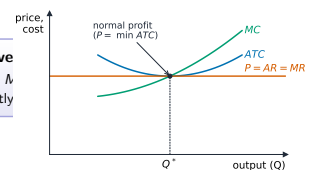
Long run: profit draws firms to **enter** (price falls); loss pushes firms to **exit** (price rises). It settles at $P = MC = \min ATC$.

Why perfect competition is efficient

Productive efficiency 生产效率
 $P = \min ATC$ – made at
the lowest possible cost

Allocative
 $P = MC$
exactly

In long-run equilibrium a competitive market achieves **both** at once:
 $P = MC = \text{minimum } ATC$.



A perfectly competitive firm makes only normal profit in the long run

Key points

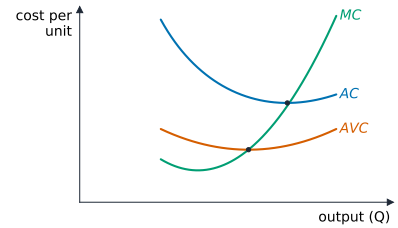
Diminishing returns give U-shaped costs; **MC** cuts **AVC/ATC** at their minimums

Economic profit subtracts opportunity cost; zero = normal profit

Every firm maximises where $MR = MC$

Perfect competition → $P = MC = \min ATC$

Check yourself, in detail



The short-run marginal, average, and average variable cost curves

Exam tips

- Know the cost curves: AFC falls, ATC/AVC are U-shaped, and **MC cuts ATC and AVC at their minimums**.
- Every firm maximises profit at $MR = MC$; check the shutdown rule ($P \geq AVC$ in the short run).
- Distinguish **accounting profit** (revenue – explicit costs) from **economic profit** (also minus implicit/opportunity costs); zero economic profit is normal.
- "Diminishing returns" is short-run (one fixed input); "economies of scale" is long-run (all inputs vary).
- In perfect competition $P = MR = AR$; entry/exit drive long-run economic profit to zero at minimum ATC.

7

Recap

Unit 3 – key takeaways

1 Curves

MC cuts ATC and AVC at their minima

2 Profit

every firm at $MR = MC$; shutdown if $P < AVC$

3 Profit types

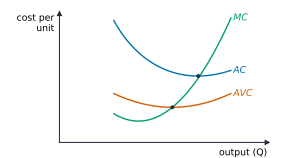
accounting vs economic; zero economic is normal

4 Competition

$P = MR = AR$; entry drives long-run profit to zero

Check yourself

- 1 State the profit-maximizing rule.
- 2 When should a firm shut down in the short run?
- 3 What is economic profit in long-run perfect competition?
- 4 Why is $MC = MR$ the rule, not maximum revenue?



Answers 1. produce where $MR = MC$ 2. when price is below average variable cost
3. zero – entry competes it away 4. profit is revenue minus cost, not revenue