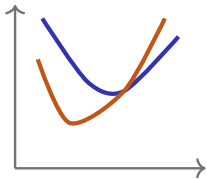


# Production, Cost & Perfect Competition

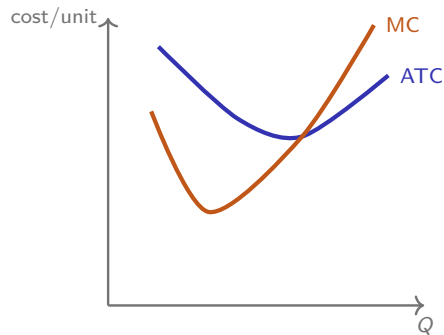
## AP Microeconomics ■ Unit 3

### AP Microeconomics



## 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

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# 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*

# 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

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## 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

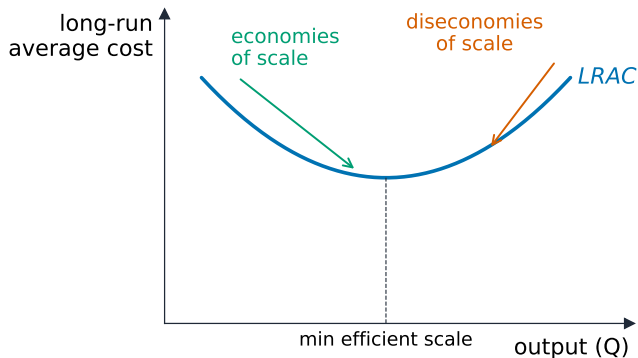
A market is **allocatively efficient** when  $P = MC$ : the last unit is worth exactly what it cost society to make.

### Why perfect competition

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

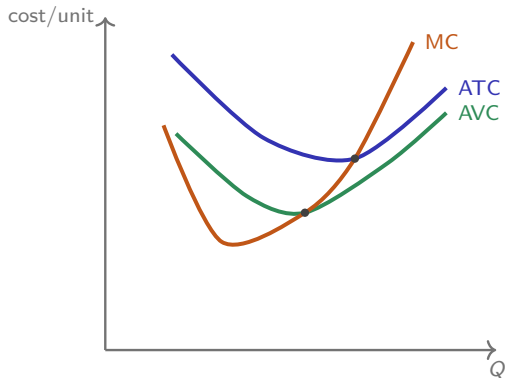
Productive efficiency is about *cost*; allocative efficiency about *quantity*. A firm can achieve one and fail the other.

# 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.

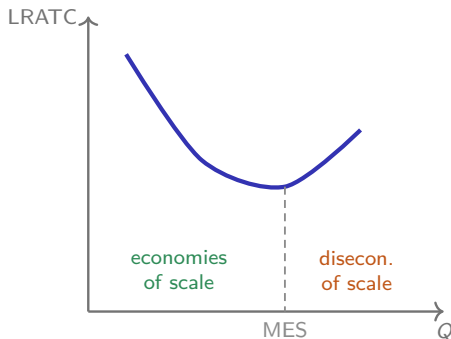
When *MC* is below the average, it pulls the average **down**; above it, **up**. The U-shape is the mirror of the marginal-product hill.

# 3

## Long run & scale

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## 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.

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Profit

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## 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.

## 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.

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## Profit maximization

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## 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

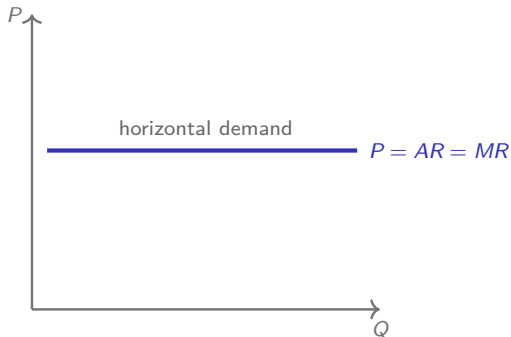
Long run: exit if  $P < ATC$ ; enter if  $P > ATC$ . Break even (**normal profit**) at  $P = \text{minimum } ATC$  – the **break-even price** 盈亏平衡价格.

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## Perfect competition

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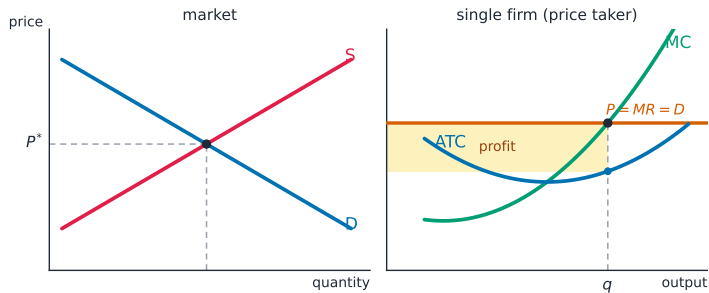
# Perfect competition



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

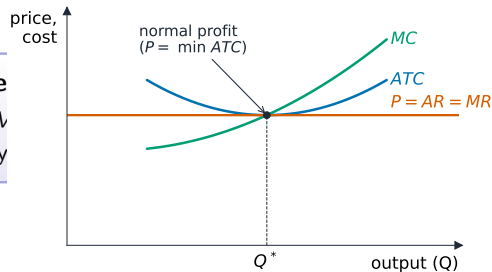
## Productive efficiency 生产效率

$P = \min ATC$  – 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

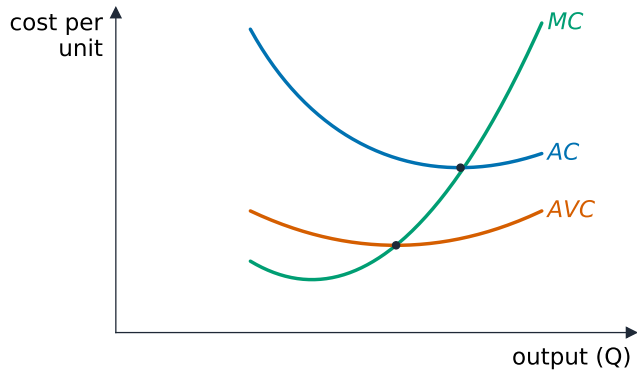
**Diminishing returns** give  
U-shaped costs;  $MC$  cuts  
 $AVC/ATC$  at their minimums

**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.

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Recap

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## Unit 3 – key takeaways

1

### Curves

MC cuts ATC and AVC at their minima

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### Profit

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

3

### Profit types

accounting vs economic; zero economic is normal

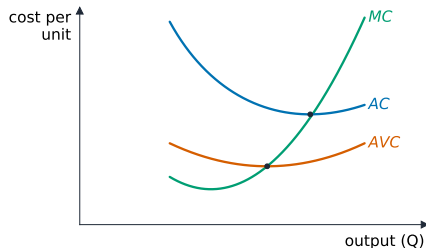
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### Competition

$P = MR = AR$ ; 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