Product

# The short run and the long run

- The **short run** is a time period during which **at least one input is fixed** and cannot be changed by the firm. (capital usually)
- The **long run** is a time period when **all inputs can be changed**, all inputs are variable.

# Simulation Debrief

## Fixed Resources-

Resources that **DON'T** change with the amount produced

Ex: Stapler, scissors, and table

## Variable Resources-

Resources that **DO** change as more or less is produced

Ex: Workers, paper, and staples

# Simulation Debrief

- **Total Physical Product (TP) -** is the total quantity of output produced by a firm

- **Marginal Product (MP) -** is the extra or additional output that results from one additional unit of a variable input.

$$\text{Marginal Product} = \frac{\text{Change in Total Product}}{\text{Change in Inputs}}$$

- **Average Product (AP) -** is the total quantity of output per unit of variable input, it tells us how much output each unit of input (e.g. each worker) produces on average.

$$\text{Average Product} = \frac{\text{Total Product}}{\text{Units of Labor}}$$

# Production Analysis

- **What happens to the Total Product as you hire more workers?**
- **What happens to marginal product as you hire more workers?**
- **Why does this happens?**

## The Law of Diminishing Marginal Returns:

When inputs and technology are fixed, as more and more units of a variable inputs (workers) are added to the fixed inputs, the marginal product at first increases, and then comes a point when it begins to decrease.

**Too many cooks in the kitchen!**

# Graphing Production

Short Run Production Worksheet

# Calculate MP and AP then discuss the graphs for TP, MP, and AP

| # of Workers (Input) | Total Product(TP) | Marginal Product(MP) | Average Product(AP) |
|---|---|---|---|
| 0 | 0 | - | - |
| 1 | 2 | 2 | 2 |
| 2 | 5 | 3 | 2.5 |
| 3 | 9 | 4 | 3 |
| 4 | 14 | 5 | 3.5 |
| 5 | 18 | 4 | 3.6 |
| 6 | 21 | 3 | 3.5 |
| 7 | 23 | 2 | 3.3 |
| 8 | 24 | 1 | 3 |
| 9 | 24 | 0 | 2.7 |
| 10 | 23 | -1 | 2.3 |
| 11 | 21 | -2 | 1.9 |

# Identify the three stages of returns

| # of Workers (Input) | Total Product(TP) | Marginal Product(MP) | Average Product(AP) |
|---|---|---|---|
| 0 | 0 | - | - |
| 1 | 2 | 2 | 2 |
| 2 | 5 | 3 | 2.5 |
| 3 | 9 | 4 | 3 |
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| 5 | 18 | 4 | 3.6 |
| 6 | 21 | 3 | 3.5 |
| 7 | 23 | 2 | 3.3 |
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| (1) Units of variable input (labour) | (2) Total product (units of output) = TP | (3) Marginal product (units of output) = MP $MP = \dfrac{\Delta TP}{\Delta \text{ units of labour}}$ | (4) Average product (units of output) = AP $AP = \dfrac{TP}{\text{units of labour}}$ |
|---|---|---|---|
| 0 | 0 | — | — |
| 1 | 2 | 2 | 2 |
| 2 | 5 | 3 | 2.5 |
| 3 | 9 | 4 | 3 |
| 4 | 14 | 5 | 3.5 |
| 5 | 18 | 4 | 3.6 |
| 6 | 21 | 3 | 3.5 |
| 7 | 23 | 2 | 3.3 |
| 8 | 24 | 1 | 3 |
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| 10 | 23 | −1 | 2.3 |
| 11 | 21 | −2 | 1.9 |

# The relationship between MP and AP curves

- When the marginal product curve lies above the average product curve (MP > AP), average product is increasing;

- When the marginal product curve lies below the average product curve (MP < AP), average product is decreasing.

- The MP curve always intersects the AP curve when it is at its maximum.



(c)  Total product curve

units of output

TP

0

units of variable input (labour)

units of output

AP

0

MP

units of variable input (labour)
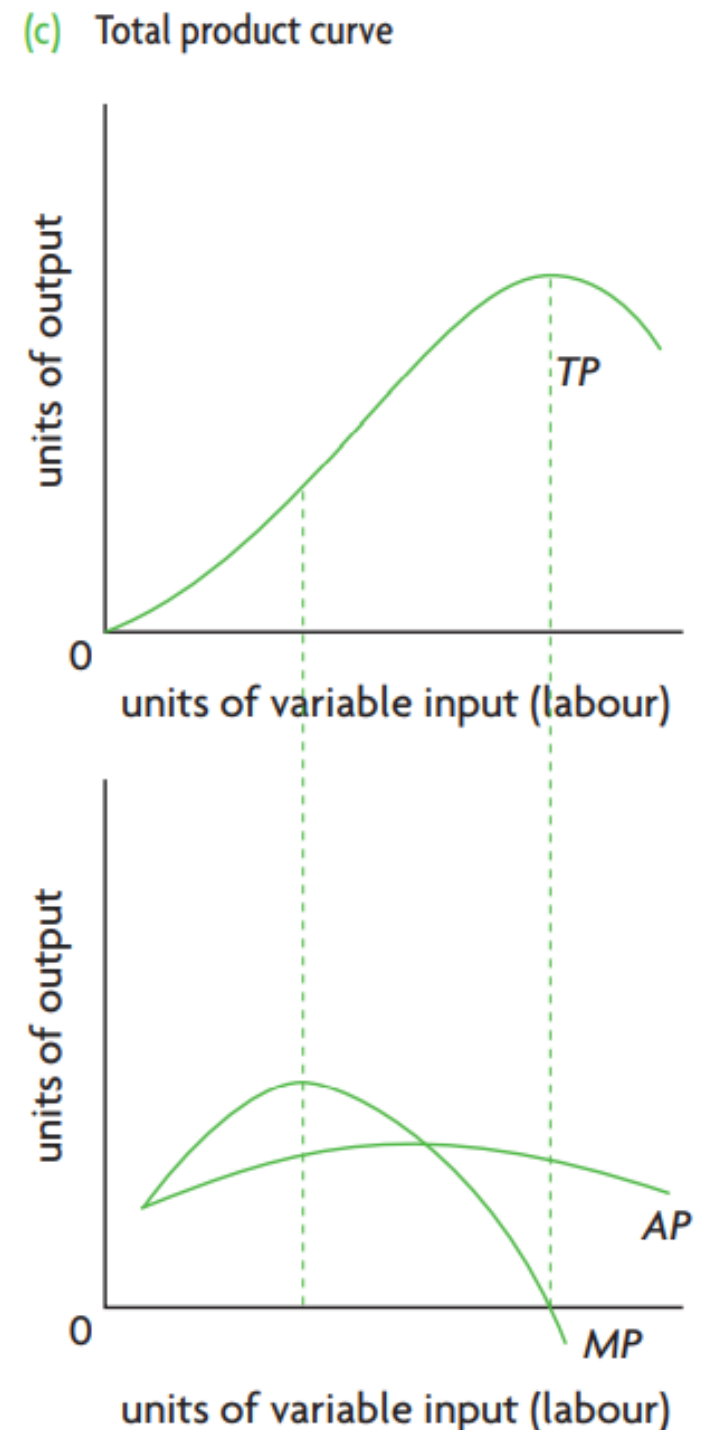
# Total product & Marginal product

**Total product**: total quantity of output produced by the firm.

**Marginal product**: extra output produced by one additional unit of a variable input.

| No. of workers (variable input) | Total product made per hour (burgers) | Marginal product (burgers made) |
|:---:|:---:|:---:|
| 0 | 0 | 0 |
| 1 | 10 | 10 |
| 2 | 30 | 20 |
| 3 | 60 | 30 |
| 4 | 75 | 15 |
| 5 | 80 | 5 |
| 6 | 80 | 0 |



**Diminishing marginal returns:**

When inputs and technology are fixed, as more and more units of a variable inputs are added to the fixed inputs, the marginal product at first increases, and then comes a point when it begins to decrease.

Short-run Cost

How Much Does it Cost to Open a Pizza Shop?

| | |
|---|---|
| **Revenue** | **¥1,000,000** |
| Decoration and equipment | - ¥200,000 |
| Raw materials | - ¥120,000 |
| Staffing | - ¥120,000 |
| Marketing | - ¥60,000 |
| **Total Costs** | **¥500,000** |
| **Accounting Profit** | **¥500,000** |
| **Forgone wages** | **- ¥120,000** |
| **Forgone rents** | **- ¥480,000** |
| **Economic Profit** | **- ¥100,000** |

# Cost of production

**Cost of production**: include money payments to buy resources plus anything else given up by a firm for the use of resources.

- **Explicit cost**: the payment made by a firm to outsiders to acquire resources for use in production. (resource not owned by itself)
- **Implicit cost**: the sacrificed income arising from the use of self-owned resources by a firm.

## Economic cost = explicit cost + implicit cost

- Accounting profit = Total revenue – explicit cost
- Economic profit = Total revenue – (explicit + implicit cost)
→Normally,  Accounting profit > Economic profit

# Fixed and variable costs

- **Fixed costs** arise from the <u>use of fixed inputs</u>. Fixed costs are costs that do not change as output changes.

- Must be paid despite the change in output.
    - E.g. Rental payments, property insurance, interest on loans.
    - Fixed costs arise only in short-run, as in the long run there are no fixed inputs.

- **Variable costs** arise from the <u>use of variable inputs</u>. These are costs that vary (change) as output increases or decreases, therefore they are 'variable'.
    - Wage cost of labour, raw materials, etc.

- **Total costs** are the sum of fixed and variable costs. It is all costs of production incurred by a firm

# Average cost

- **Average cost (AC):** cost per unit of output produced, or total cost divided by the number of units of output.

$$AC = \frac{TC}{Q_{output}}$$

| Total Cost | Average cost | Formula |
|---|---|---|
| Total fixed costs (TFC) | Average fixed costs (AFC) | $AFC = \dfrac{TFC}{Q}$ |
| Total variable costs (TVC) | Average variable costs (AVC) | $AVC = \dfrac{TVC}{Q}$ |
| Total costs (TC)<br>TC = TFC + TVC | Average total costs (ATC)<br>ATC = AFC + AVC | $ATC = \dfrac{TC}{Q}$ |

# Marginal cost

- **Marginal cost (MC)** is the extra or additional cost of producing one more unit of output. It tells us by how much total costs increase if there is an increase in output by one unit.

$$MC = \Delta TC/\Delta Q$$

- Since fixed costs are constant as output changes.

$$\rightarrow MC = \Delta TC/\Delta Q = \Delta TVC/ \Delta Q$$

# Short-run cost curves



| (1) Total product = TP or Q (units) | (2) Labour (units of labour) | (3) Total fixed cost = TFC (€) | (4) Total variable cost = TVC (€) | (5) Total cost = TC $TC = TFC+TVC$ (€) | (6) Average fixed cost = AFC $AFC = \dfrac{TFC}{Q}$ (€) | (7) Average variable cost = AVC $AVC = \dfrac{TVC}{Q}$ (€) | (8) Average total cost = ATC $ATC = \dfrac{TC}{Q}$ or $ATC = AFC+AVC$ (€) | (9) Marginal cost = MC $MC = \dfrac{\Delta TC}{\Delta Q}$ $MC = \dfrac{\Delta TVC}{\Delta Q}$ (€) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 200 | 0 | 200 | – | – | | – |
| 2 | 1 | 200 | 100 | 300 | 100 | 50 | 150 | 50 |
| 5 | 2 | 200 | 200 | 400 | 40 | 40 | 80 | 33.3 |
| 9 | 3 | 200 | 300 | 500 | 22.2 | 33.3 | 55.5 | 25 |
| 14 | 4 | 200 | 400 | 600 | 14.3 | 28.6 | 42.9 | 20 |
| 18 | 5 | 200 | 500 | 700 | 11.1 | 27.8 | 38.9 | 25 |
| 21 | 6 | 200 | 600 | 800 | 9.5 | 28.6 | 38.1 | 33.3 |
| 23 | 7 | 200 | 700 | 900 | 8.7 | 30.4 | 39.1 | 50 |
| 24 | 8 | 200 | 800 | 1000 | 8.3 | 33.3 | 41.6 | 100 |
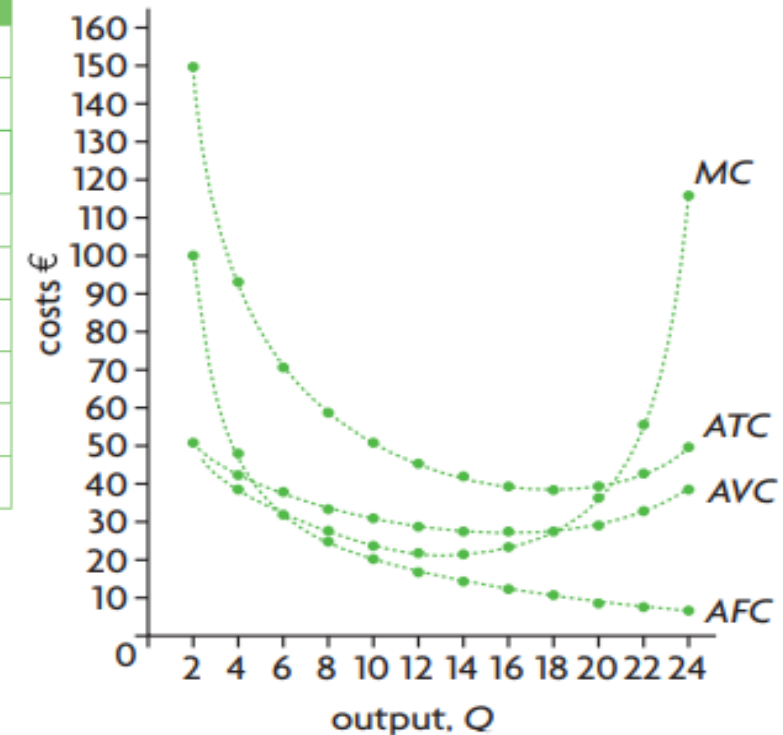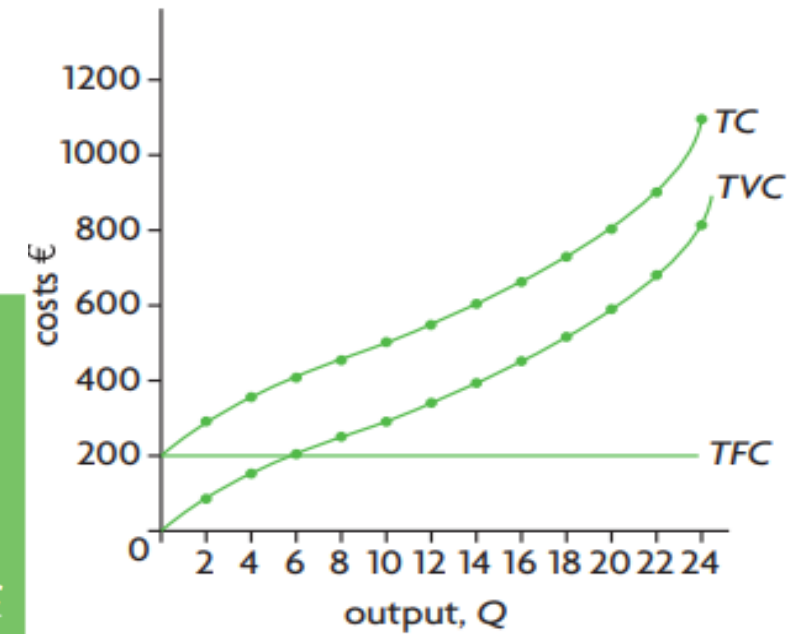
# Short-run cost curves

- **TFC** curve is parallel to the horizontal axis.
- **TVC** increases as output increases. It does not increase at a constant rate; this is due to the law of diminishing marginal returns.
- **TC = TVC + TFC**



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- **AFC** falls continuously as output increases.
- **AVC** fall at first, it reach a minimum and then begin to rise.
- **ATC** curve is the vertical sum of AFC and AVC
  - The vertical differences between ATC and AVC equals to AFC, so they gradually move closer to each other.
- The **MC** curve intersects both the AVC and ATC curves at their **minimum points**.
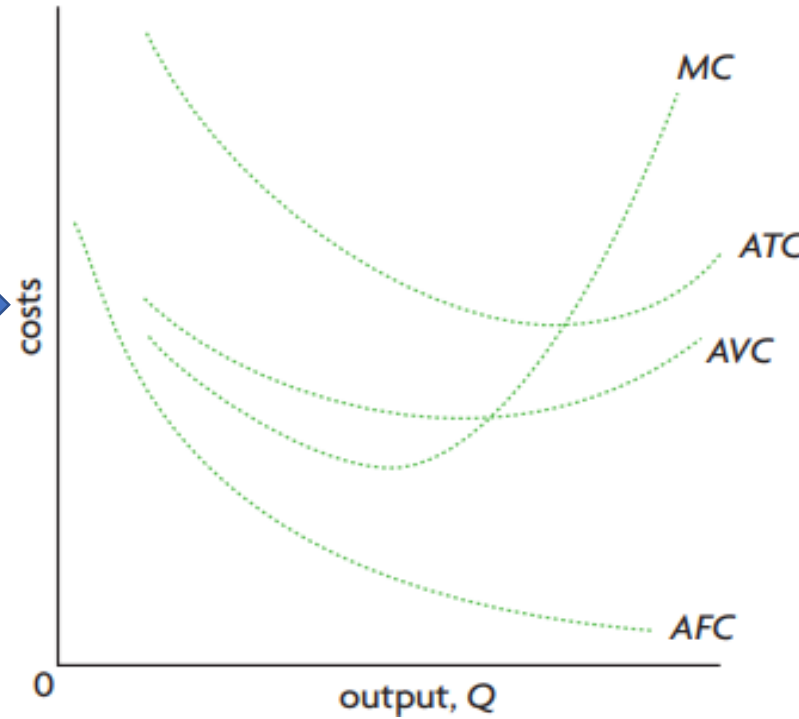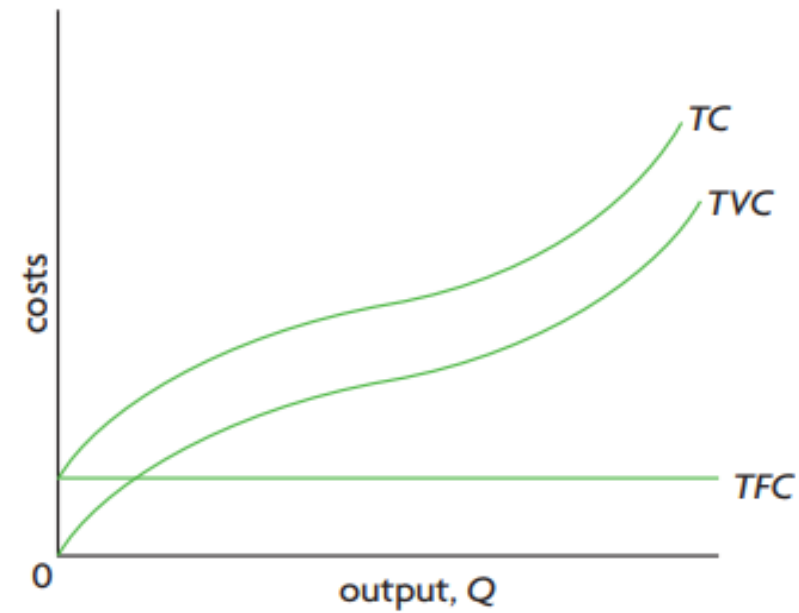
# Mirror image of MP &MC

**Diminishing marginal returns:**

When inputs and technology are fixed, as more units of the variable inputs are added to the fixed inputs, the MP at first increases, and then comes a point when it begins to decrease.

→ This will cause total output to rise by diminishing amount!

• When MP increases, MC decreases;

• when MP is maximum, MC is minimum.

• When MP falls, MC increases.

→ **MP are mirror images of MC**



marginal product curve: diminishing marginal returns

units of variable input (labour)

marginal cost curve: increasing marginal costs

supply curve
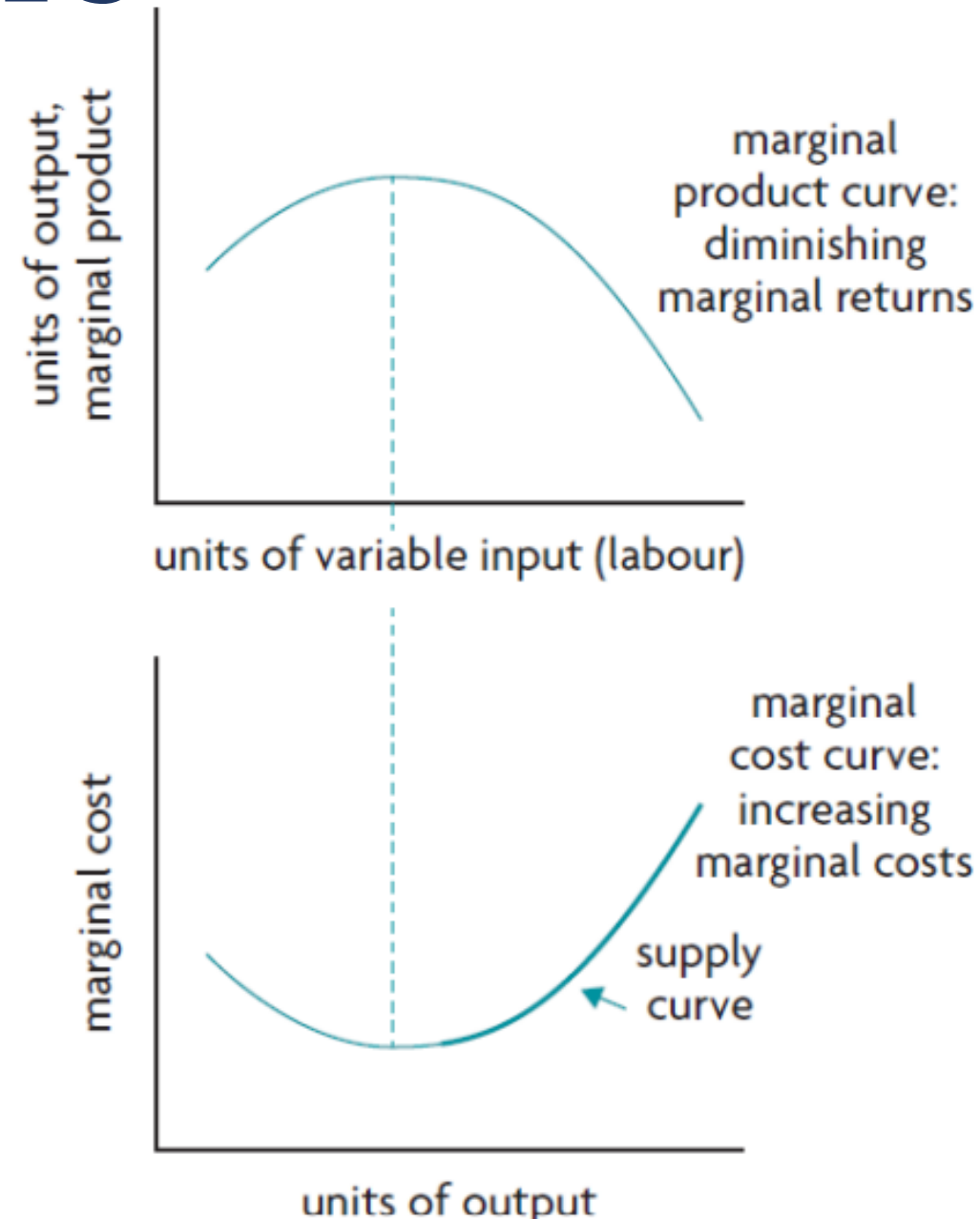
units of output

# Mirror image of AP&AVC

$$AP = \frac{Q(output)}{Units\ of\ inputs(no.\ of\ workers)}$$

$$AC(AVC) = \frac{TVC}{Q(output)} = \frac{cost/unit * Units\ of\ input}{Q(output)}$$

$$= cost/unit * \frac{1}{AP}$$

- When AP increases, AVC decreases;
- When AP falls, AVC increases.
- When AP is maximum, AVC is minimum.

➔ **AP are mirror images of AVC**
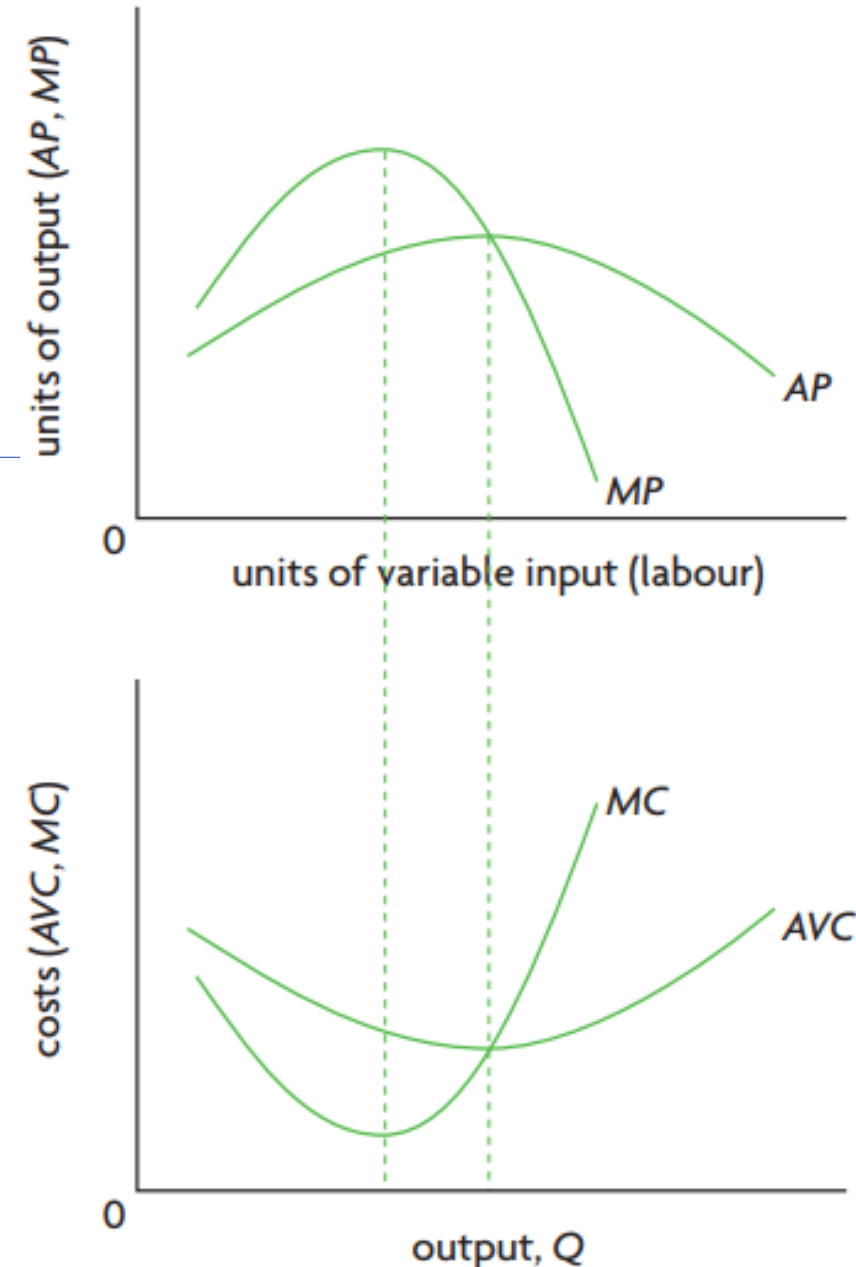
# The relationship between Marginal and Average

| | Average | Marginal | |
|---|---|---|---|
| **Product** | Average product $=TP/Q_{input}$ | Marginal product $=\Delta TP/\Delta Q_{input}$ | MP > AP ➜ AP goes up<br>MP < AP ➜ AP goes down<br>MP = AP, AP maximum |
| **Cost** | Average cost $=TC/Q_{output}$ | Marginal cost $=\Delta TC/\Delta Q_{output}$ | MC < AC ➜ AC goes down<br>MC > AC ➜ AC goes up<br>MC = AC, AC minimum |

➜ The **MP curve** always intersects the **AP curves** at its **maximum points**.

➜ The **MC curve** always intersects the **AC curves** at its **minimum points**.

# Calculation of TC, MC and AC

| Total product (number of units, Q) | Total cost (TC) ($) | Marginal cost (MC) ($) | Average cost (AC) ($) |
|---|---|---|---|
| 1 | 12 | 12 | 12 |
| 2 | 20 | 8 | 10 |
| 3 | 26 | 6 | 8.67 |
| 4 | 34 | 8 | 8.5 |
| 5 | 46 | 12 | 9.2 |
| 6 | 62 | 16 | 10.33 |
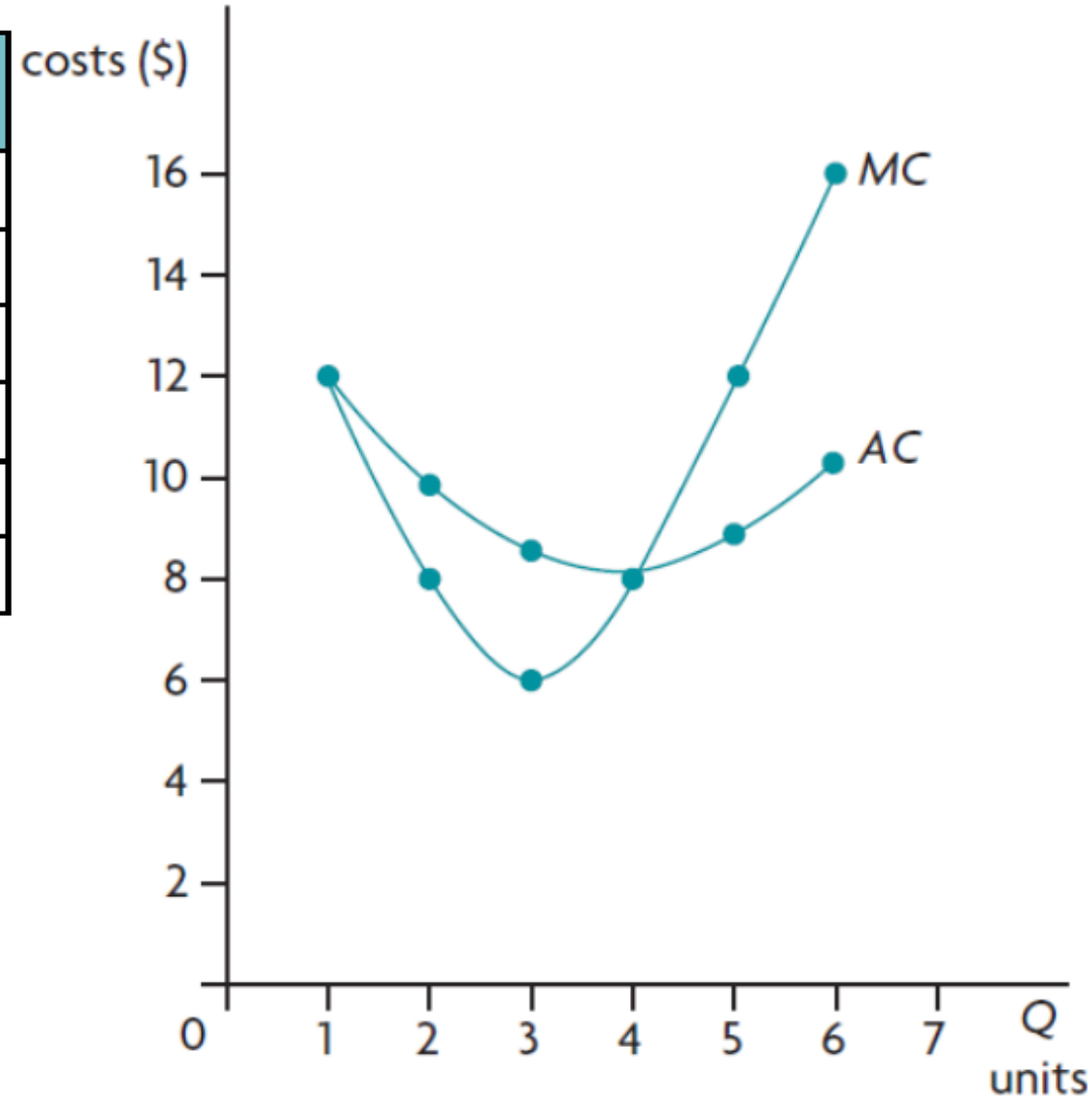
# The relationship between AC and MC in short run

- In the short run, MC and AC curve based on the law of diminishing marginal return when at least one factor of production is fixed.

    - When the MC curve lies below the AC curve (MC<AC), average cost is falling.
    - When the MC curve lies above the AC curve (MC>AC), average cost is increasing.

→ MC curve always intersects the AC curve when it is at its minimum.
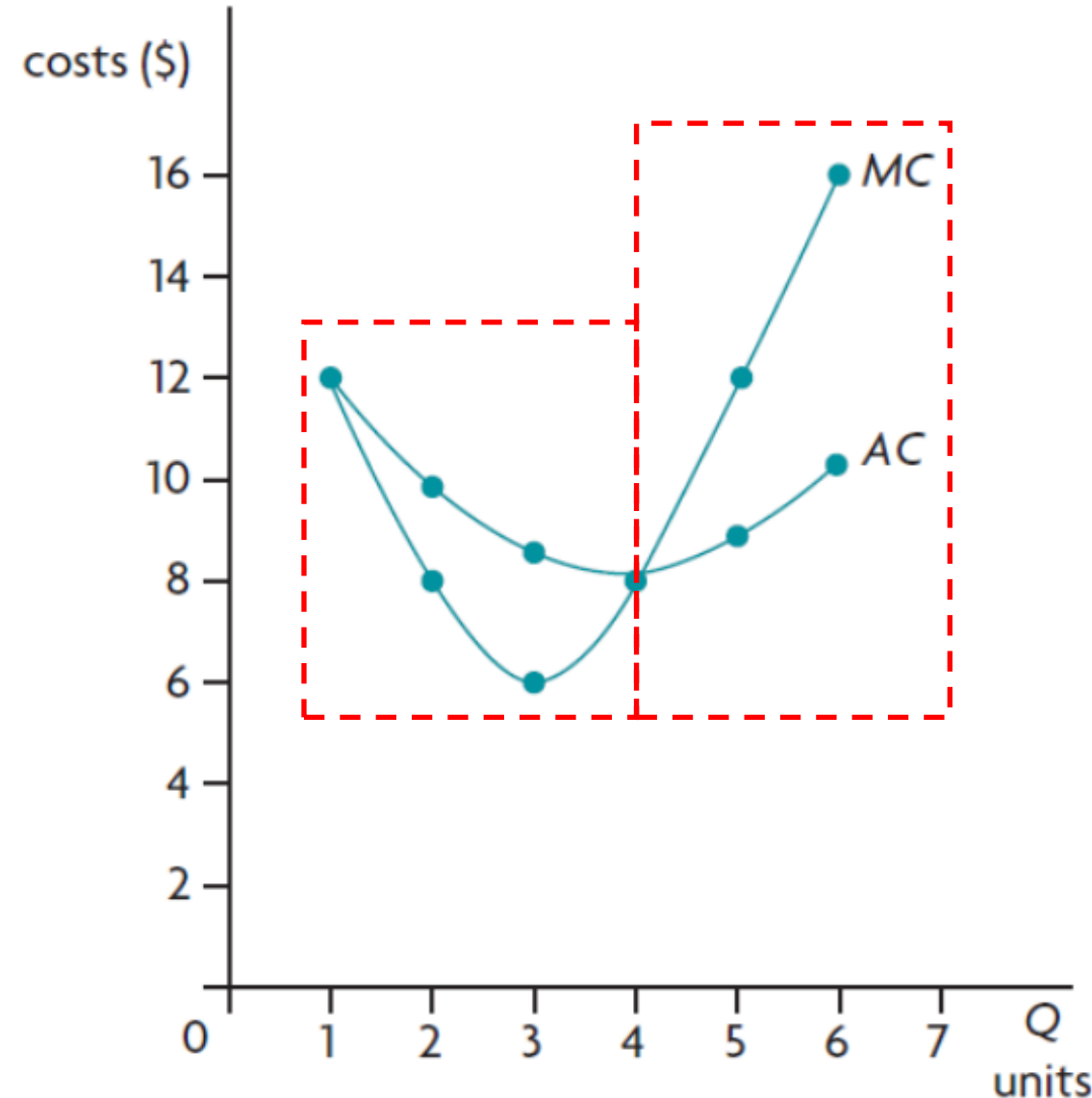
Long-run Cost

# Cost of production in the long run

In the **long run**, the firm can vary all its factors of production, it grows larger by increasing all its factors of production.

- If a firm wants to expand production, it must think in terms of increasing its fixed inputs, otherwise its production will run into diminishing returns.

SRAC (Short Run Average Cost)

$SRAC_2$

$SRAC_3$

$SRAC_4$

$SRAC_5$

…

…

…

Series new SRAC adds up and it forms the LRAC.

LRAC (Long Run Average Cost)

# Series of SRATCs

- In short-run, if the producer want to increase its output from $Q_1$ to $Q_2$, it can only produce at the lowest possible cost up to point **a**.

- In long run, the producer can expand its production size and produce $Q_2$ at a lower average cost.

- In $SRATC_1$, the lowest possible cost is **a**. at $SRATC_2$, output can increase at the lowest possible cost until point **b** is reached.

- The producer will keep increase the production size in order to continue to minimize average costs as output increases.
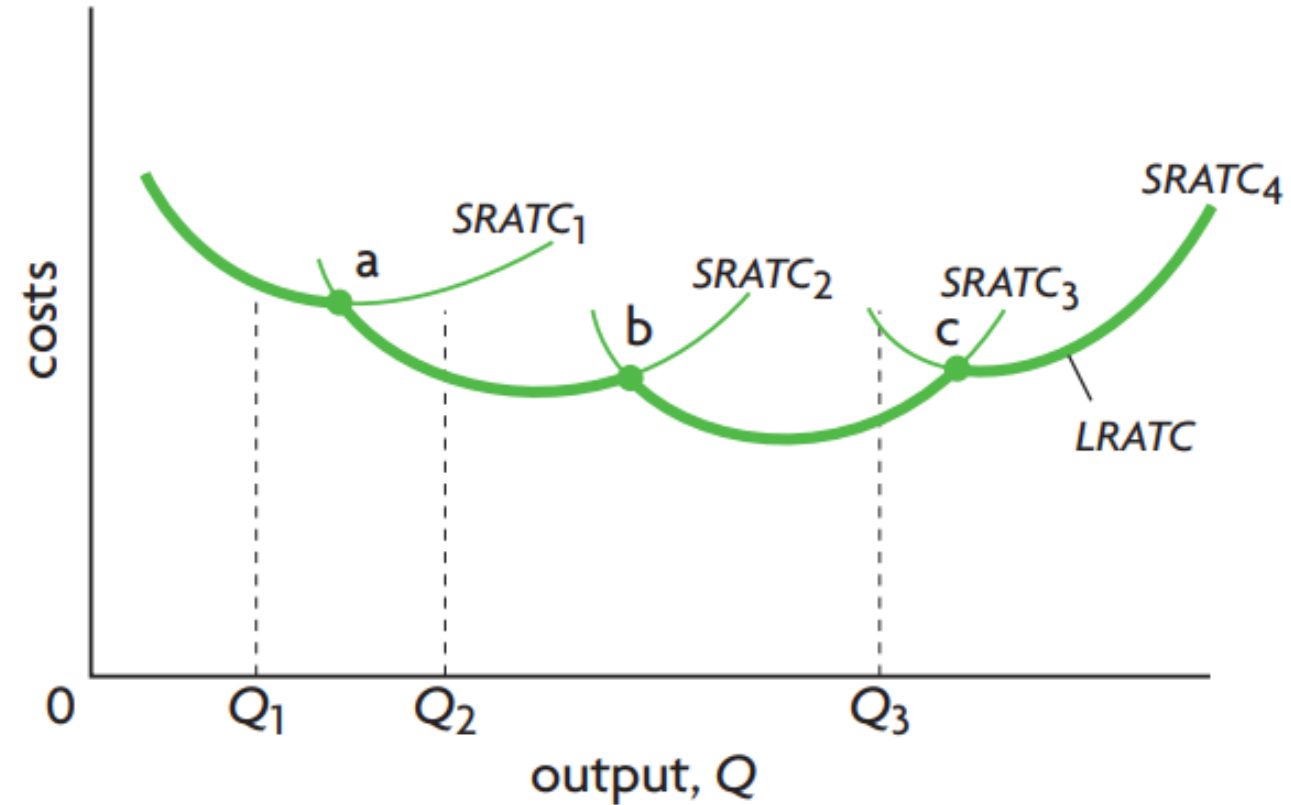
# Short-run and Long-run average total cost

- If **output=Q1**, the optimal size will be small size (SAC1) producing at point **b** with cost of **C1**.

- If **output=Q1***, both small and medium size will be fine, **AC=C1***

- If **output=Q2**, the optimal size will be medium size (SAC2) producing at point **d** with cost of **C2**.

- If **output=Q2***, both medium and large size will be fine, **AC=C2**

- **In the short run, the firm cannot choose whatever size they want.**

- **In the long run, the firm gets to choose the firm size which minimizes average costs.**
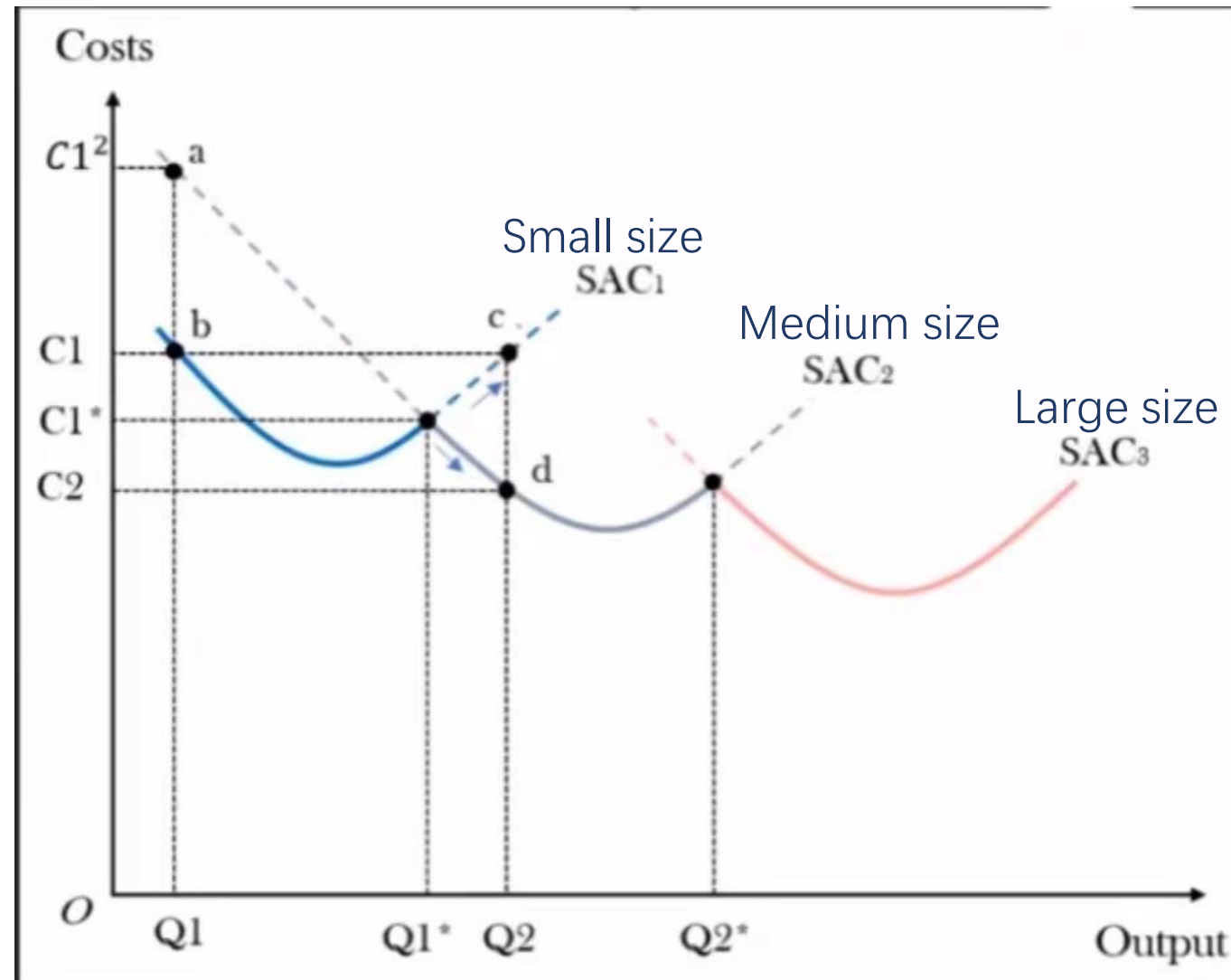
# Short run AC & Long run AC curve

- Series of SRAC curve trace out the LRAC curve, which is the curve that just touches (is tangent to) each of the short-run curves.

- The long-run ATC curve is a much flatter U-shape than the short-run ATC curve. In addition, all the short-run curves lie on or above the long-run.

- SRAC keep shifting to the right, because there is more and more output being produced.

- The firm can choose where on the long-run curve it wishes to be, it will end up on the SRATC curve at the point where this just touches the long-run curve.

- **At the long run average costs curve represents the lowest possible average costs at the particular output level.**
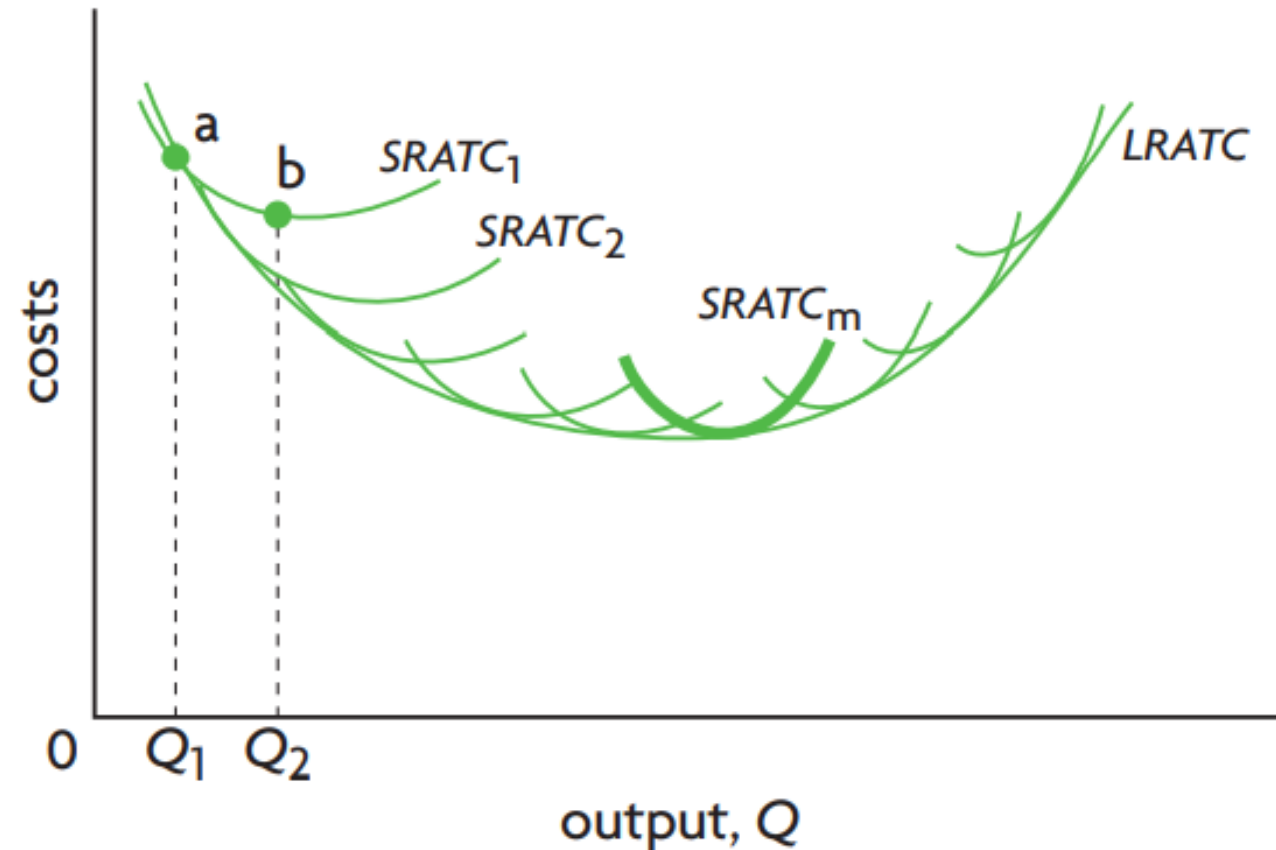
# Economies and diseconomies of scale
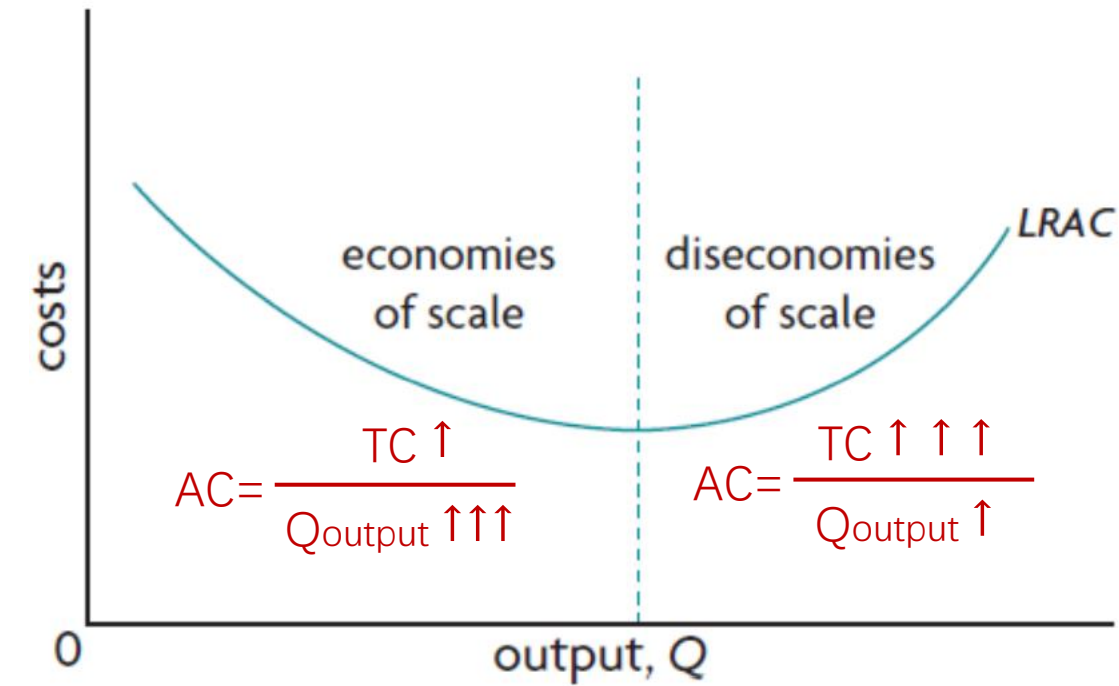


- **The long-run average cost curve** is defined as a curve that shows the lowest possible average cost that can be attained by a firm for any level of output when all of the firm's inputs are variable.

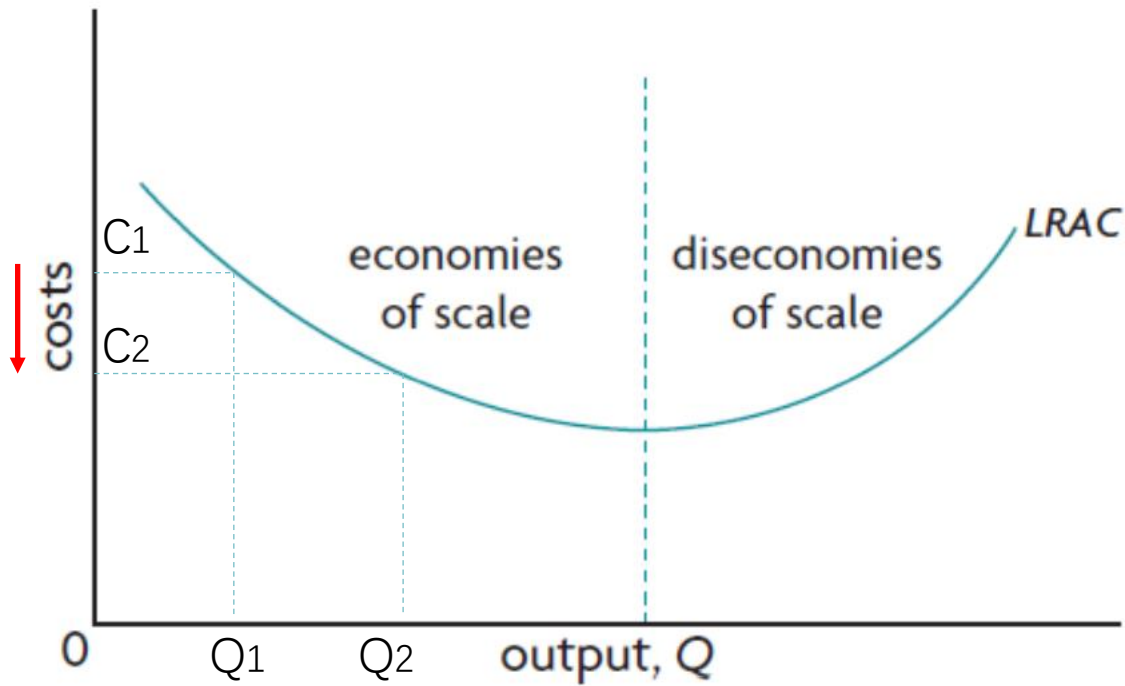- The SRAC curves first move downward and after a point they move upward.

→ **LRAC is in U-shape**

**Reason: Economies and diseconomies of scale**

*\* Nothing to do with diminishing marginal return (short run only)*

# Economies and diseconomies of scale



$$AC = \frac{TC \uparrow}{Q_{output} \uparrow\uparrow\uparrow}$$
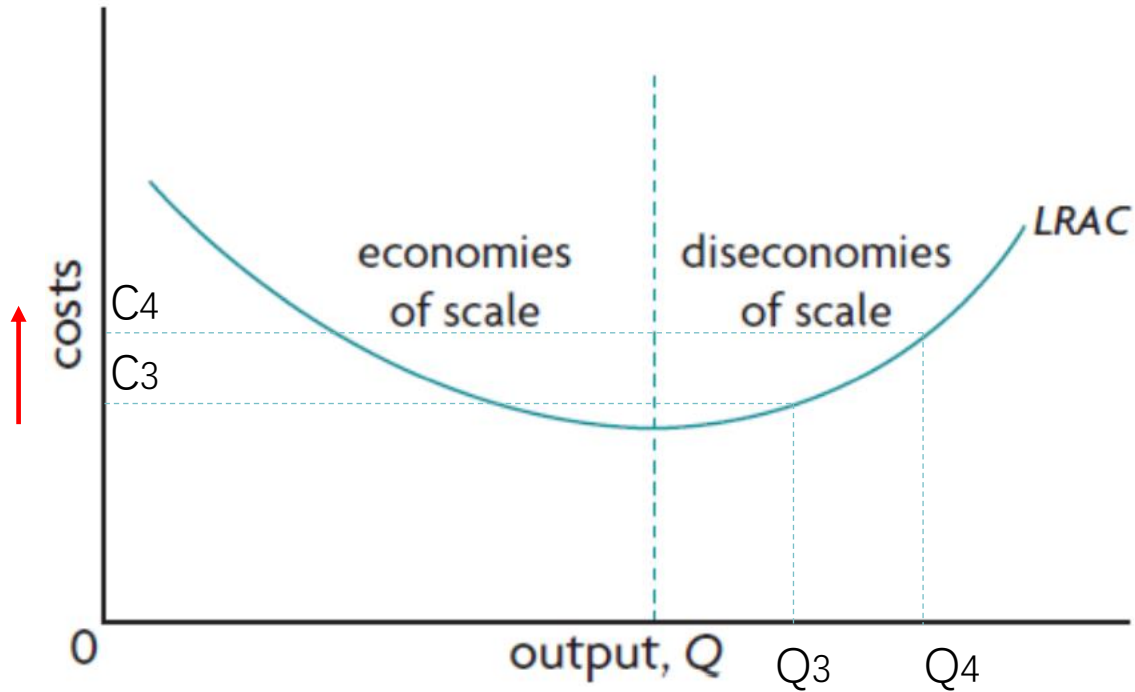
→ AC is decreasing

**Economies of scale**: decreases in average costs of production over the long run as a firm increases all its factors of production.

Reasons for downward-sloping portion of the LRAC curve:

1. Specialisation of labour
2. Specialisation of management
3. Bulk buying of inputs (factors of production)
4. Efficiency of capital equipment.
5. Indivisibilities of capital equipment
6. Indivisibilities of efficient processes
7. Financing economies (larger firms may have lower interest rate)
8. Spreading of certain costs over larger volumes of output (marketing, advertising, design, R&D, etc.)

# Economies and diseconomies of scale



**Diseconomies of scale**: increases in the average costs of production in the long run as a firm increases its output by increasing all its inputs.

Reason for upward-sloping portion of the LRAC curve:

1. Co-ordination and monitoring difficulties. (top-down)
2. Communication difficulties （horizontal）
3. Poor worker motivation

$$AC= \frac{TC \uparrow \uparrow \uparrow}{Q_{output} \uparrow}$$

→ AC is increasing

# Economies and diseconomies of scale

| Capital | Labour | Output | %Δ inputs | %Δ output | |
|---|---|---|---|---|---|
| 20 | 150 | 3000 | | | |
| 40 | 300 | 7500 | 100% | 150% | Increasing return to scale |
| 60 | 450 | 12000 | 50% | 60% | Increasing return to scale |
| 80 | 600 | 16000 | 33.33% | 33.33% | Constant return to scale |
| 100 | 750 | 18000 | 25% | 12.5% | Decreasing return to scale |
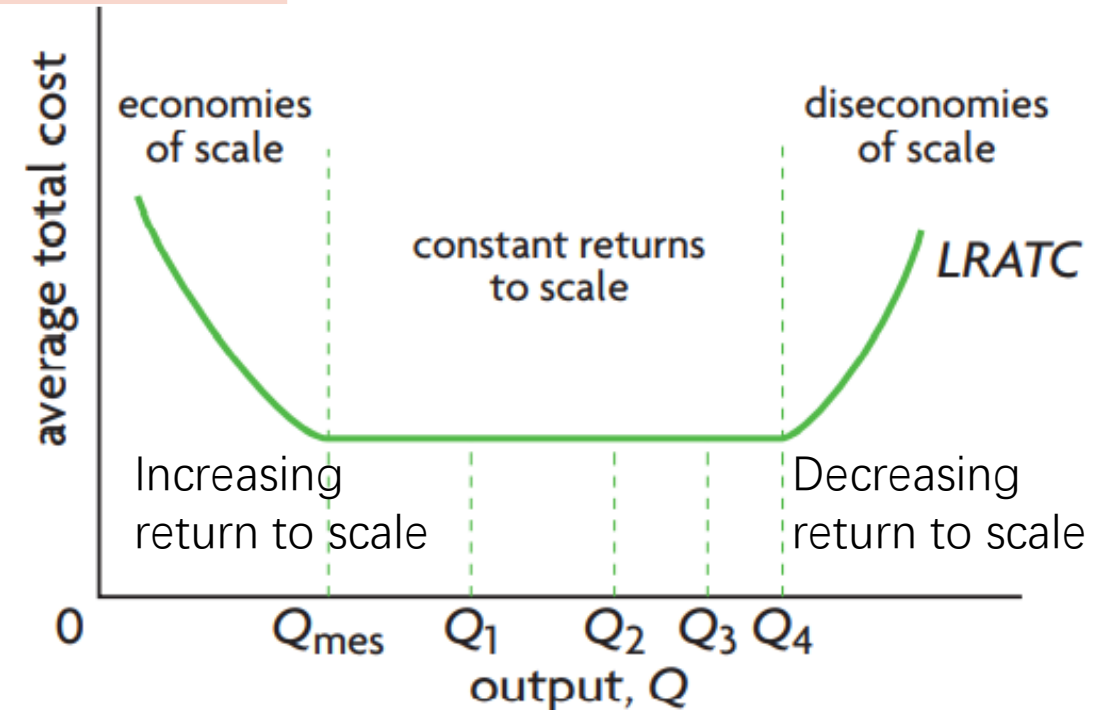
# Production in the long run

- **Increasing returns to scale**: output increases more than in proportion to the increase in all inputs.

   **(%Δinputs < %Δoutput)**

- **Constant returns to scale**: output increases in the same proportion as all inputs.

   **(%Δinputs = %Δoutput)**

- **Decreasing returns to scale**: output increases less than in proportion to the increase in all inputs.

   **(%Δinputs > %Δoutput)**
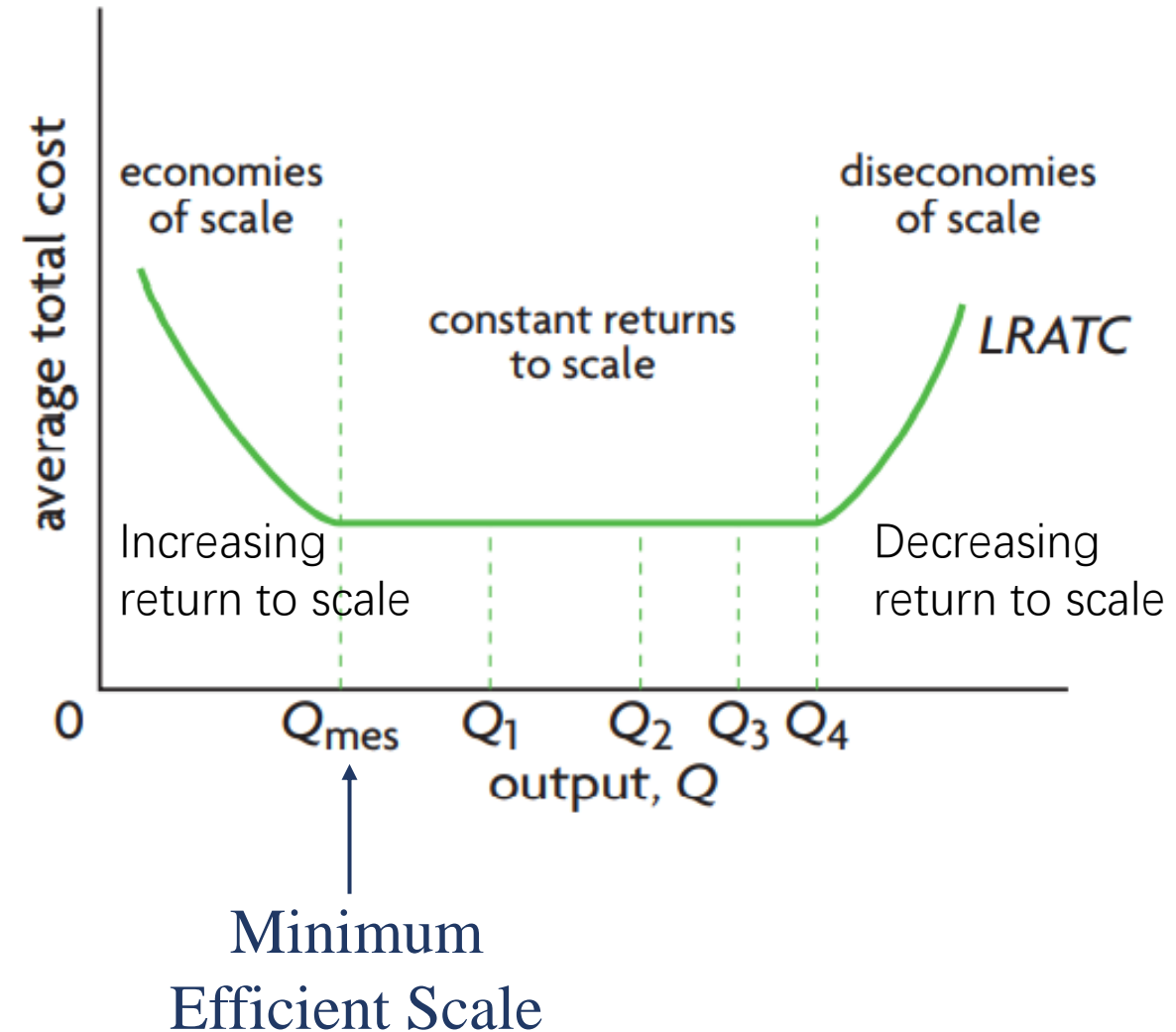
# Constant returns to scale for some large firms

After exhausting economies of scale, some firms exhibit constant returns to scale, and do not run into diseconomies of scale even as size becomes very large.



(b)  Few large firms
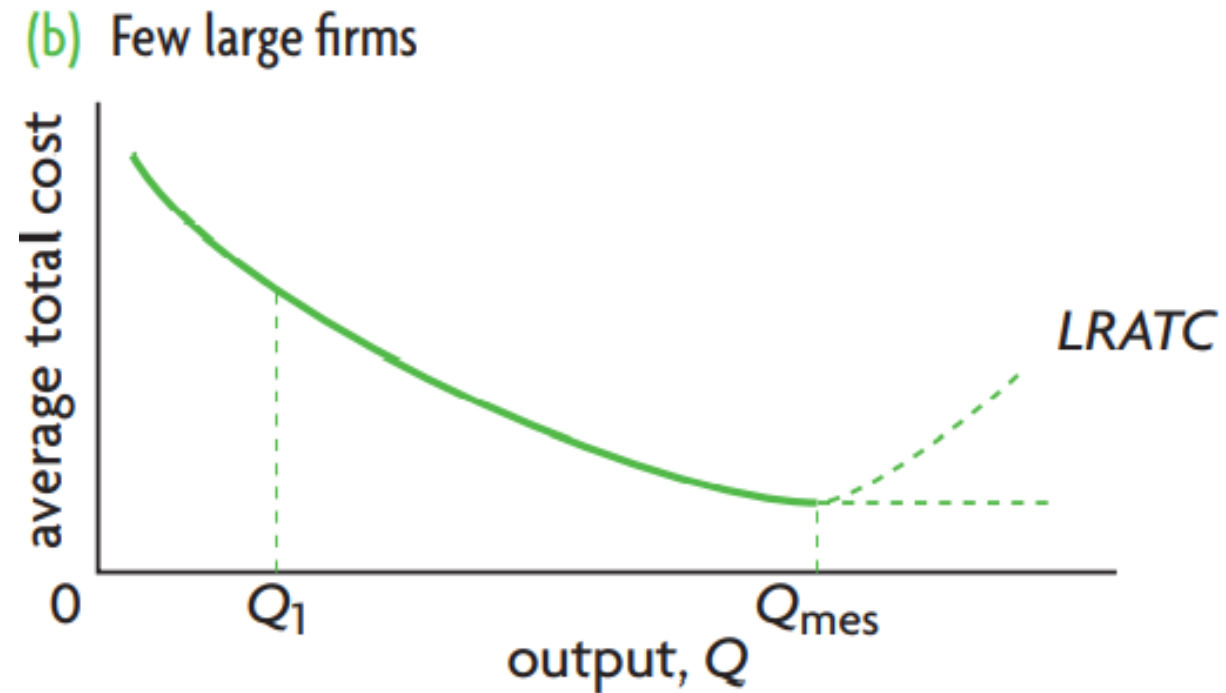
Revenue

# Profit = Total revenue – Total Cost

# Revenue

Revenues are the payments firms receive when they sell the goods and services they produce.

- **Total revenue (TR):** the amount of money received by firms when they sell a good/service.
  **TR = P x Q**

- **Average revenue (AR):** revenue per unit of output sold.
  **AR = TR / Q**
  AR=Price   ( AR= TR/Q = (Price*Q)/Q =Price)
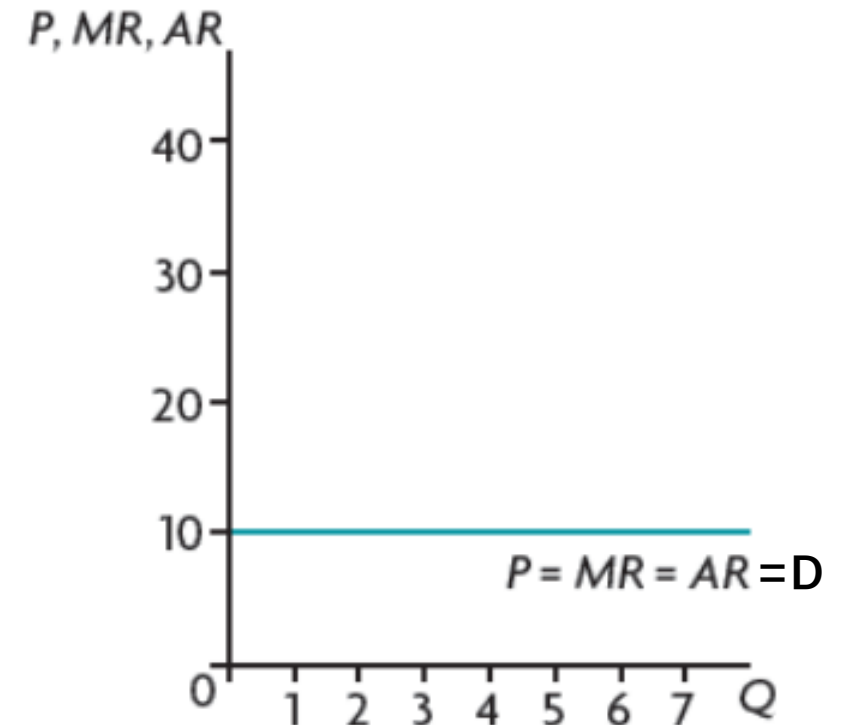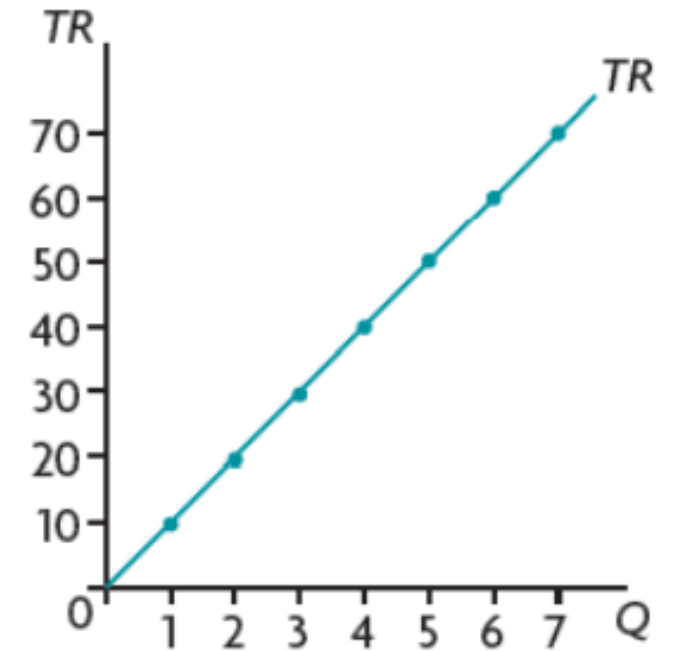
- **Marginal revenue (MR):** additional revenue arising from the sales of an additional unit of output.
  **MR = ΔTR/ΔQ**

# Revenue curve in **perfect competition**,

- Many buyers and sellers (infinite)
- Homogeneous products
- firm has no control for the price (price taker)
- No barriers to entry / exit
- Perfect information

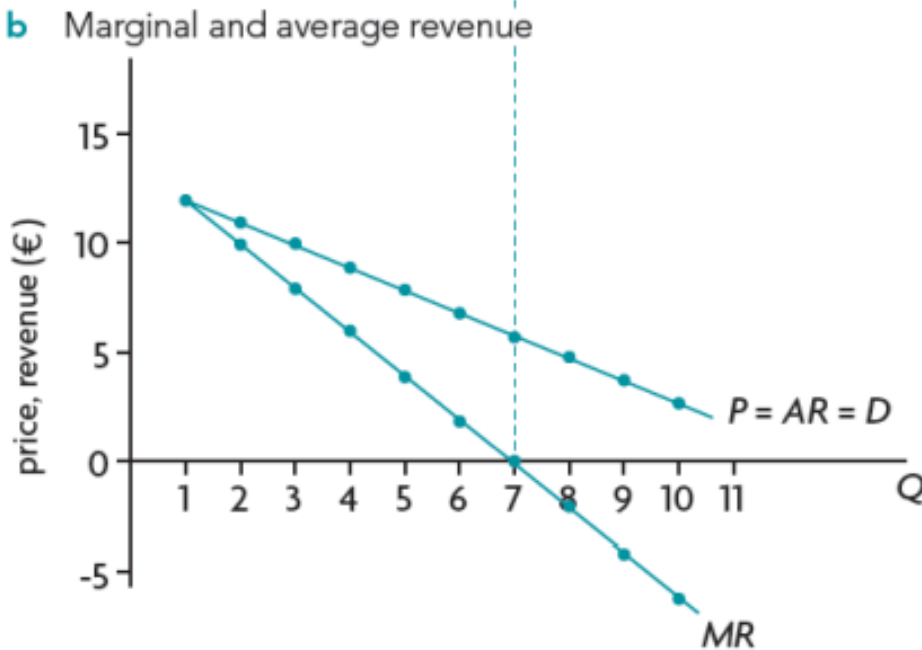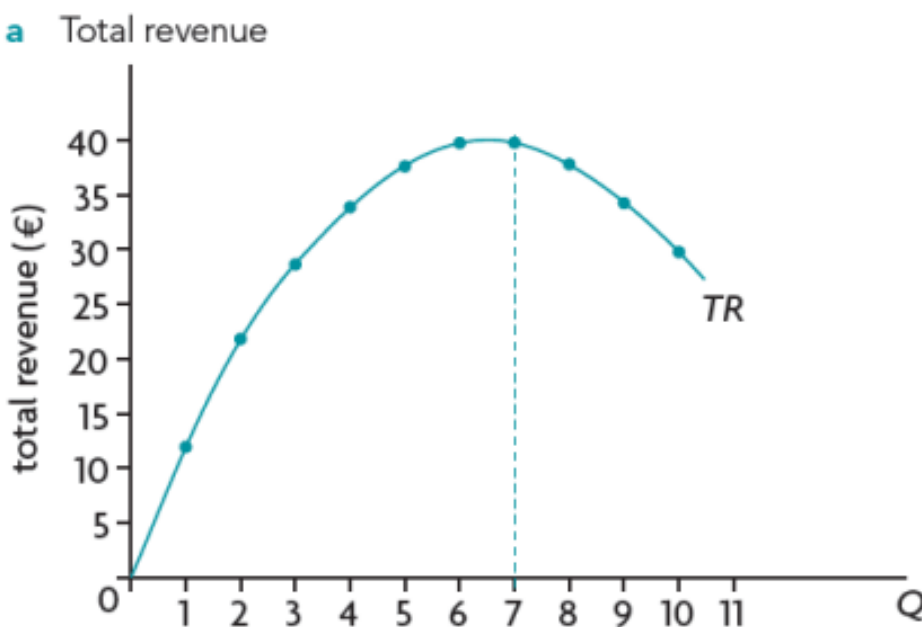| 1 Units of output (Q) | 2 Product price (P) (€) | 3 Total revenue $TR = P \times Q$ (€) | 4 Marginal revenue $MR = \Delta TR \Delta Q$ (€) | 5 Average revenue (€) MR=TRQ (€) |
|---|---|---|---|---|
| 0 | – | – | – | – |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 20 | 10 | 10 |
| 3 | 10 | 30 | 10 | 10 |
| 4 | 10 | 40 | 10 | 10 |
| 5 | 10 | 50 | 10 | 10 |
| 6 | 10 | 60 | 10 | 10 |
| 7 | 10 | 70 | 10 | 10 |



$P = MR = AR = D$

Revenue curve in **imperfect competition**:

- Fewer buyers and sellers
- Differentiated goods
- Firms are price makers
- Higher barriers to entry/exit
- Imperfect information

The price of the good changes as the quantity of output changes. The lower the price the greater the quantity of output.


a  Total revenue


b  Marginal and average revenue

| 1<br>Units of output<br>(Q) | 2<br>Product price<br>(P)<br>(€) | 3<br>Total revenue<br>($TR = P \times Q$)<br>(€) | 4<br>Marginal revenue<br>MR=$\Delta$TR$\Delta$Q<br>(€) | 5<br>Average revenue<br>AR=TRQ<br>(€) |
|---|---|---|---|---|
| 0 | – | – | – | – |
| 1 | 12 | 12 | 12 | 12 |
| 2 | 11 | 22 | 10 | 11 |
| 3 | 10 | 30 | 8 | 10 |
| 4 | 9 | 36 | 6 | 9 |
| 5 | 8 | 40 | 4 | 8 |
| 6 | 7 | 42 | 2 | 7 |
| 7 | 6 | 42 | 0 | 6 |
| 8 | 5 | 40 | –2 | 5 |
| 9 | 4 | 36 | –4 | 4 |
| 10 | 3 | 30 | –6 | 3 |

Revenue curve in **imperfect competition**:

- The AR = P curves represent the demand curve facing the firm. (since TR=P*Q, AR=TR/Q → P=AR)

- The MR curve lies below the demand curve. Reason → The firm must lower its price in order to sell more output. The lower price is charged not only for the last unit of output, but all the previous units of output sold.

- **Marginal revenue** → equals to the amount of the price of the last unit sold minus what is lost by selling all the other units of output at the now lower price.



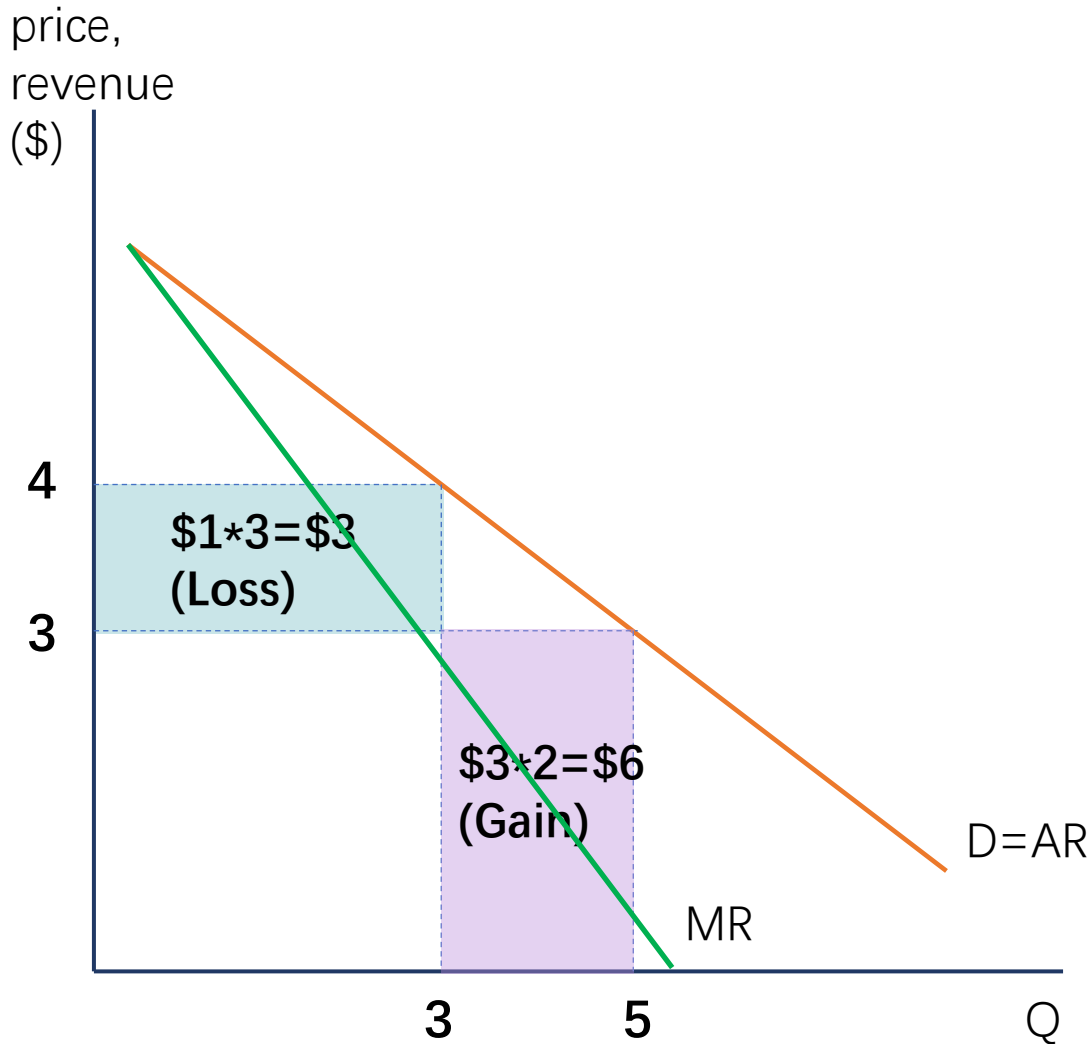a  Total revenue
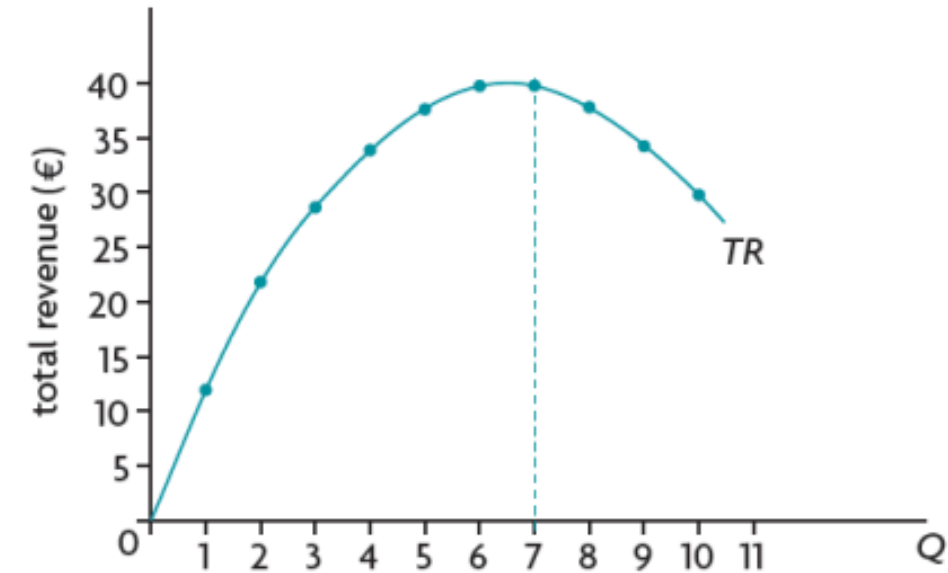
b  Marginal and average revenue
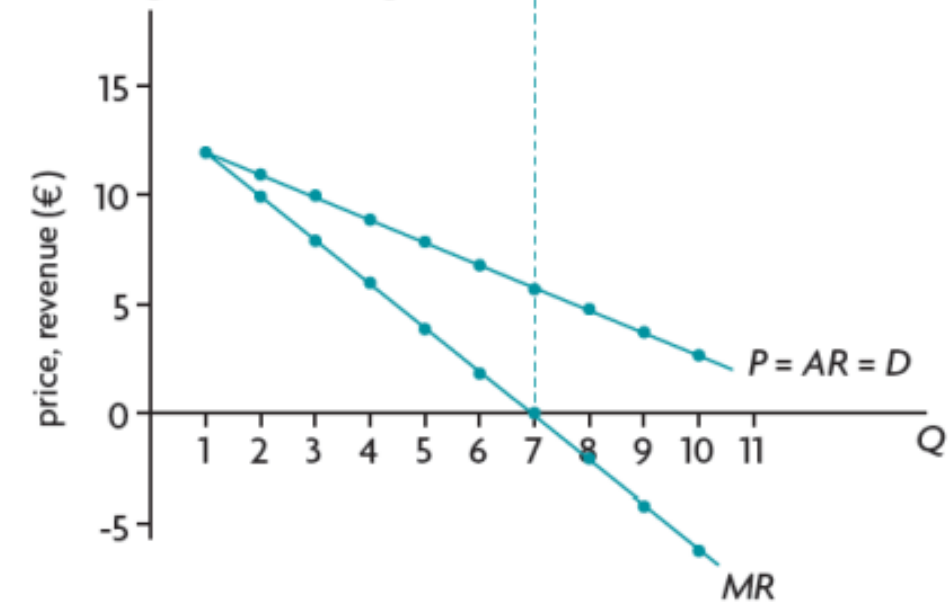
# Why MR curve lies below the demand(D=AR) curve?



price,
revenue
($)

4

3

$1*3=$3
(Loss)

$3*2=$6
(Gain)

D=AR

MR

3    5    Q

When price decrease from $4 to $3:
- TR1 = 4*3=$12
- TR2 = 3*5=$15

➢**Loss**: lose $1 for all the previous output sold ($1*3=$3)
➢**Gain**: gain the additional quantity demanded times the lower price ($3*2=$6)

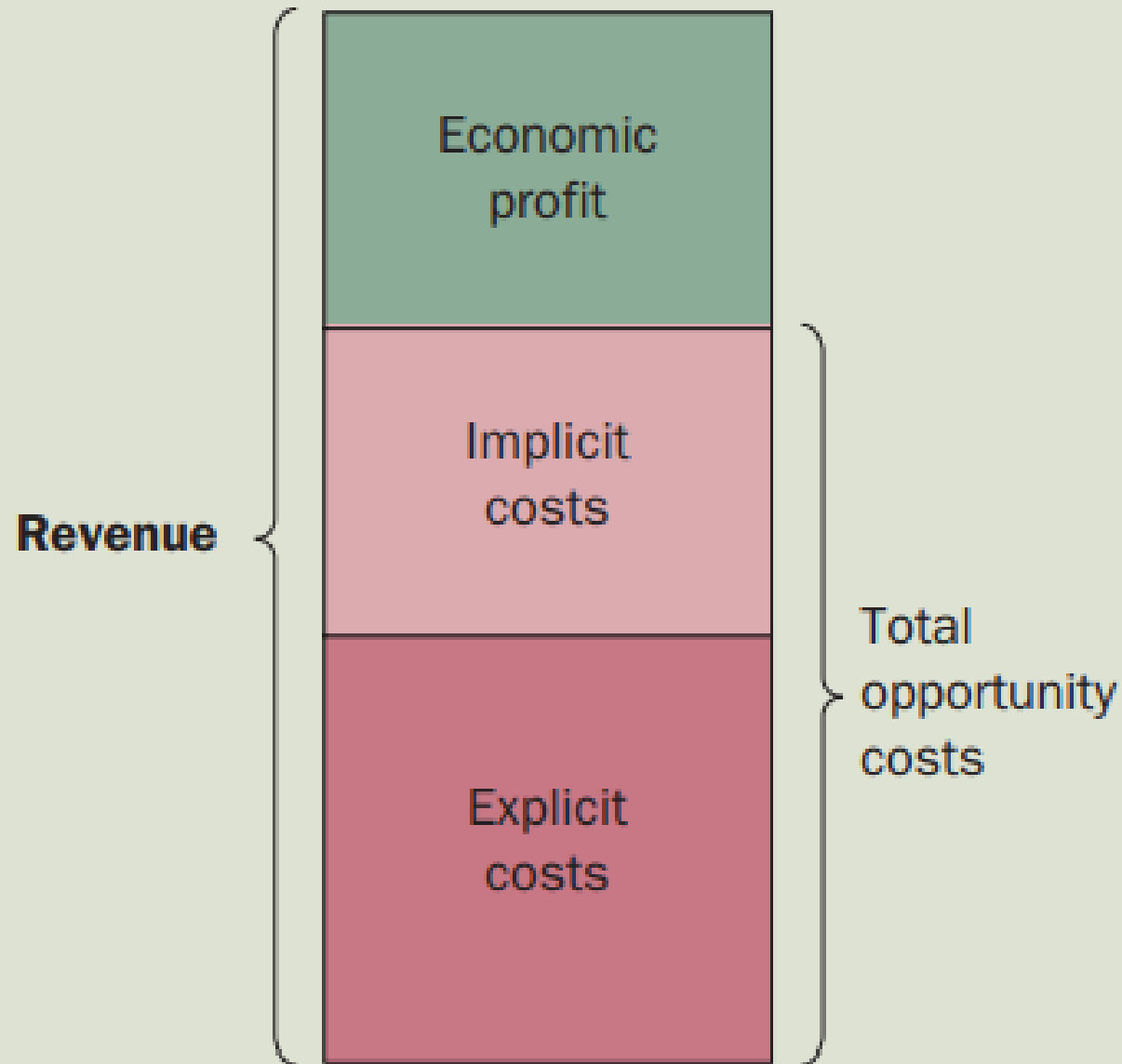➔MR = (15-12)/(5-3)=$1.5

**In order to sell more output, firm must lower its price. The lower price is charged not only for the last unit of output but all the previous units of output sold.**
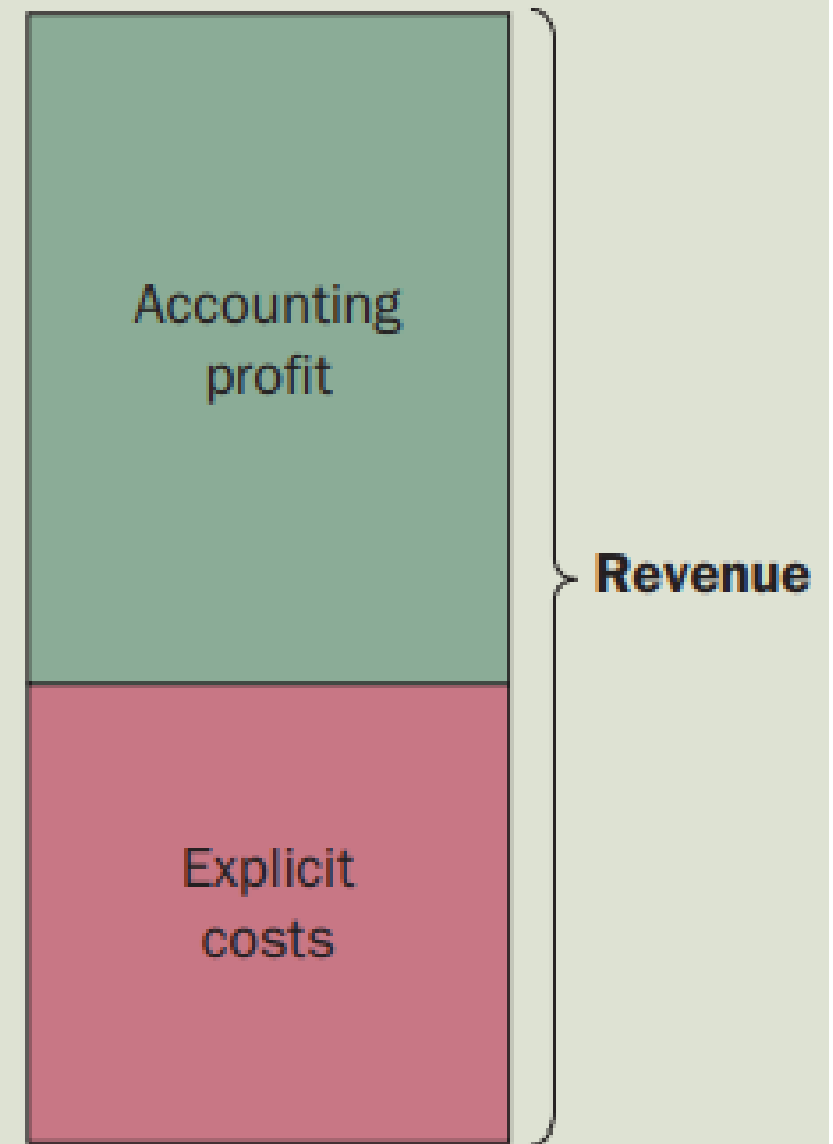
Profit

**How an Economist Views a Firm**

Revenue
- Economic profit
- Implicit costs
- Explicit costs

Total opportunity costs (Implicit costs + Explicit costs)

**How an Accountant Views a Firm**

Revenue
- Accounting profit
- Explicit costs

# Economic profit

- For a business to be profitable from an economist's standpoint, total revenue must cover all the opportunity costs, both explicit and implicit.

**Economic profit = Total revenue – (explicit + implicit cost)**

- A firm making positive economic profit will stay in business. It is covering all its opportunity costs and has some revenue left to reward the firm owners.

# Normal profit

- **Normal profit**: **minimum amount of revenue** that the firm must receive to **covers implicit +explicit cost** so that it will keep the business running (as opposed to shutting down).
  - It covers **all opportunity costs** including the payment for entrepreneur's entrepreneurial and risk-taking functions, as well as the opportunity costs of employing self-owned resources. (an implicit cost)
  - Total revenue = economic costs
  - Economic profit = 0
  - Break-even point of the firm
  - The firm will continue to operate.

# Profit

Standard economic theory assumes that firms display rational behavior by trying to maximize their profits.

**Profit maximization**

Firm determining the level of output that the firm should produce to:
- make profit as large as possible. (profit maximization)
- make the loss as small as possible (loss minimization)

➔ Two approaches:
- TR-TC maximized
- Choose to produce the level of output where MC = MR

# Analysis of profit maximization

## 1. Based on total revenues and total costs approach

Profit = Revenues – economic costs

      = Total revenue – (the sum of explicit costs + implicit costs)

      = **TR-TC**

**Goal: produce the level of output where TR-TC is as large as possible.**

- TR>TC (economic cost) → Positive profit: abnormal profit
- TR=TC (economic cost) → Zero profit: normal profit
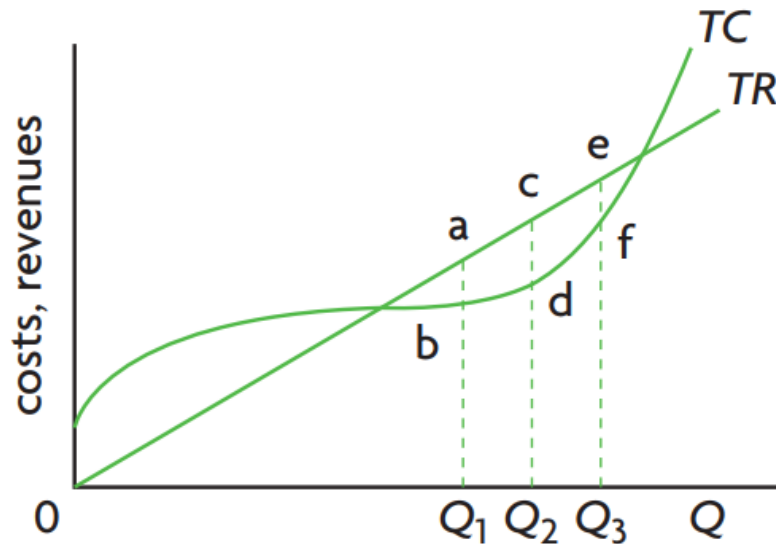- TR<TC (economic cost) → Negative profit: loss

# Illustration of TR and TC approach - for a firm with no ability to influence price

Put TR & TC together, and look at levels of output where TR lies above TC, and the difference between total revenue and total cost is largest.

## Abnormal profit

- Produce at Q2 with profit = c-d

## Normal profit

- Produce at Q2 with profit = 0

## Loss

- Produce at Q2 with profit = a-b(negative)

# Illustration of TR and TC approach
# - for a firm does have the ability to influence price

Put TR & TC together, and look at levels of output where TR lies above TC, the difference between total revenue and total cost is largest.
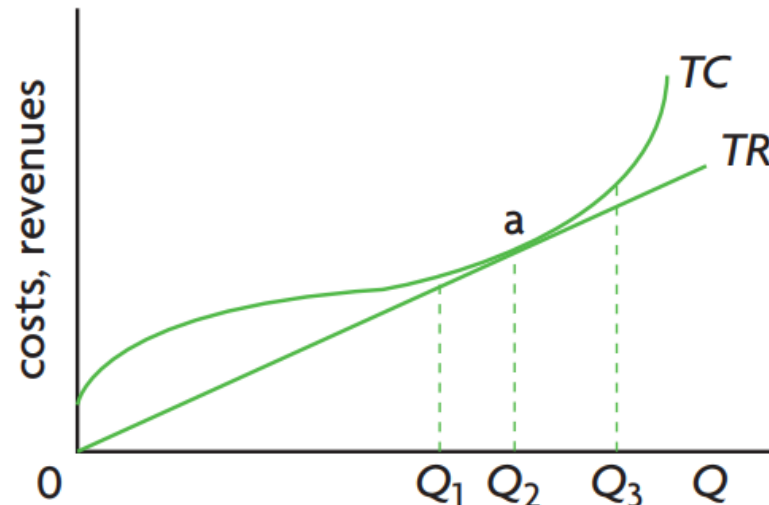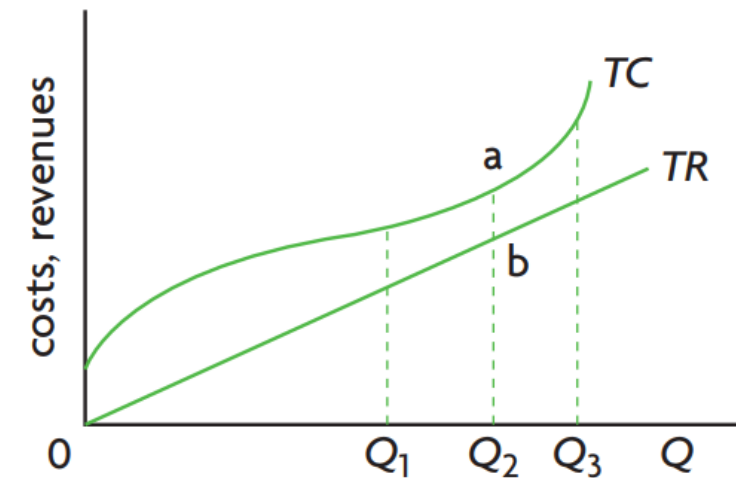
## Profit maximization

A profit-making firm. Profit is maximized at output level $Q_{\pi max}$

- Normal profit at point a or b
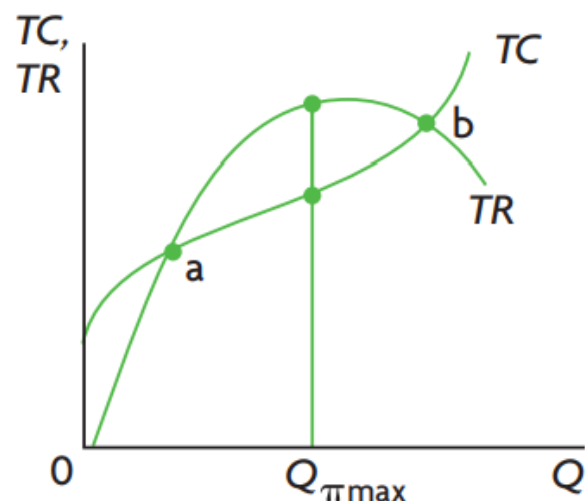
## Loss minimization

There is no level of output where TR>TC, the firm can only make a loss. Loss minimized at $Q_{lmin}$



(a) Profit maximisation



(b) Loss minimisation
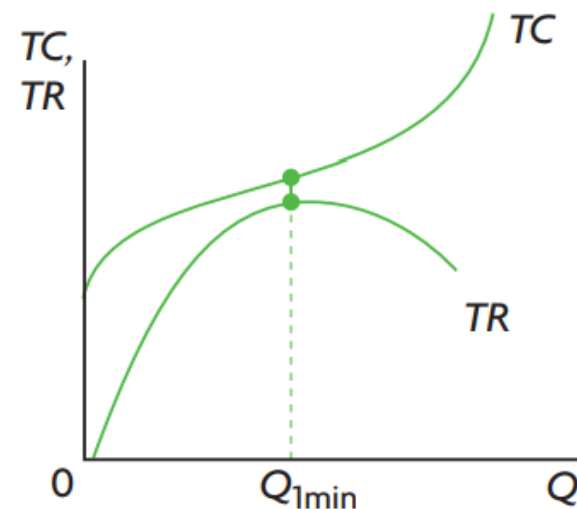
# Analysis of profit maximization

## 2. Based on marginal revenues and marginal costs

- Comparison of MR with MC to determine the profit-maximizing level of output. (or loss-minimizing level)
- Choose to produce the level of output where MC = MR

# Illustration in diagram
# for a firm with no ability to influence the price

- When firm is producing at $Q_1$ where $MR>MC$, an additional unit of good production will bring additional revenue(MR) bigger than its additional cost (MC), it is worthwhile for firm to increase its output until it reaches $Q\pi max$.

- When firm is producing at $Q_2$ where $MR<MC$, an additional unit of good production will bring additional revenue(MR) smaller than its additional cost (MC), the firm will cut back its Q back to $Q\pi max$.

- So the firm will produce at $Q\pi max$ where $MC=MR$



a  Price constant
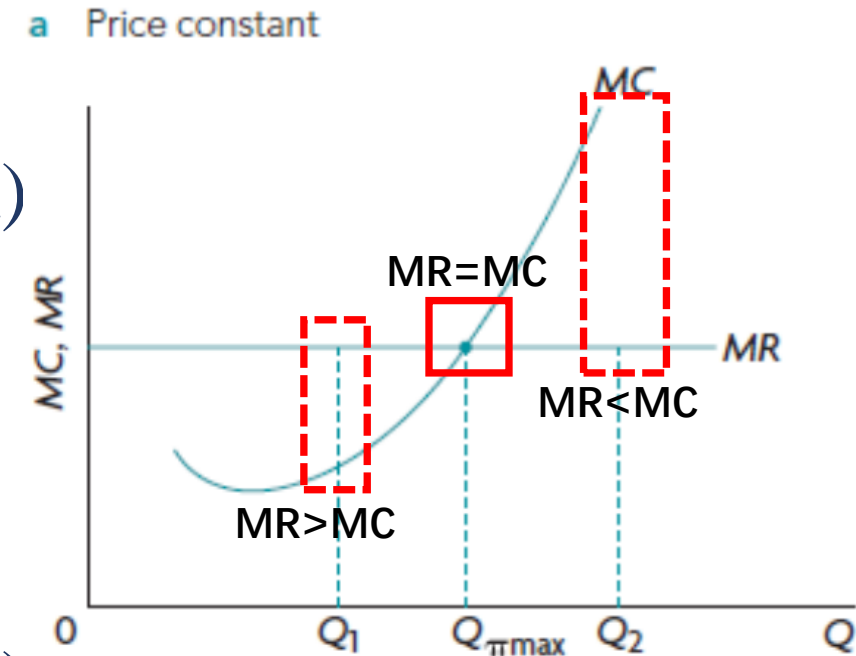
# Illustration in diagram for a firm with the ability to influence price

- When firm is producing at $Q_1$ where MR>MC, an additional unit of good production will bring additional revenue(MR) bigger than its additional cost (MC), it is worthwhile for firm to increase its output until it reaches $Q_{\pi max}$.

- When firm is producing at $Q_2$ where MR<MC, an additional unit of good production will bring additional revenue(MR) smaller than its additional cost (MC), the firm will cut back its Q back to $Q_{\pi max}$.

- So the firm will produce at $Q_{\pi max}$ where MC=MR

b  Price varies with output
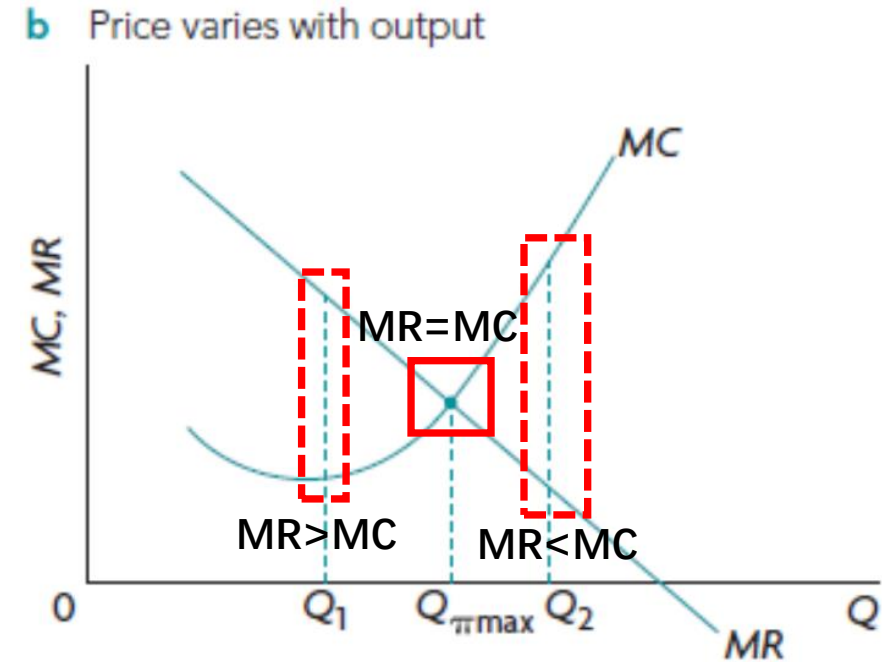
# The shut-down price

- **In short run:** the firm will continue to produce as long as the price is greater than minimum AVC, even though it may be making a loss.

- In short run, a loss-making firm still have to pay the fixed cost and cannot exit the industry.

  → **It will shut-down when price < minimum AVC**

- **In Long run:** the firm stops producing (leaves the industry) and shuts down when price falls below minimum ATC

  → **It will shut-down when price < minimum ATC**

  P = minimum ATC is the lowest price that the firm would be willing to accept in order to remain in the business.

# The break-even price

- The break-even price, or the price at which total revenues are exactly equal to total costs, occurs at the firm's break-even point.
- It is the same for both the short run and the long run, and is where **P = minimum ATC**.
- the firm earns normal profit.
- In the **long run, the break-even price = shut-down price**

## Class exercise

Suppose that a firm with some control over price faces the costs and prices per unit of output shown in the table below:

| Units of output (Q) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Total cost ($) | 15 | 18 | 20 | 21 | 23 | 26 | 30 | 35 |
| Price ($) | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 |

a. Use TR and TC approach to determine the level of output at which the firm will maximize profit.

b. Determine the level of output at which the firm will maximize profit using the MR and MC approach.

# Exercise answer

| Units of output (Q) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Total cost | 15 | 18 | 20 | 21 | 23 | 26 | 30 | 35 |
| Price | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 |
| Total revenue = P*Q | 10 | 18 | 24 | 28 | 30 | 30 | 28 | 24 |
| Profit=TR-TC | -5 | 0 | 4 | 7 | 7 | 4 | -2 | -11 |
| Marginal revenue | 10 | 8 | 6 | 4 | 2 | 0 | -2 | -4 |
| Marginal cost | 15 | 3 | 2 | 1 | 2 | 3 | 4 | 5 |

- MR & MC approach is more precise than TR & TC approach.
- Use the larger one in TR & TC approach.

# Summary of revenue concepts

| Revenue concepts | Definition | Formula |
|---|---|---|
| Total revenue | The total earnings of a firm from the sale of its output. | $TR = P \times Q$ |
| Marginal revenue | The additional revenue of a firm arising from the sale of an additional unit of output. | $MR = \Delta TR\ \Delta Q$ |
| Average revenue | Revenue per unit of output. | $AR = ER\ Q = P$ |

# Summary of cost concepts

| Cost concepts | | |
|---|---|---|
| Explicit cost | The monetary payment made by a firm to an outsider to acquire an input. | |
| Implicit cost | The income sacrificed by a firm that uses a resource it owns. | |
| Total cost ($TC$) | The sum of explicit and implicit costs | |
| Average total cost ($AC$) | Total cost per unit of output. | $AC = TC\ Q$ |
| Marginal cost ($MC$) | The change in cost arising from one additional unit of output. | $MC = \Delta TC\ \Delta Q$ |
| Long-run average cost ($LRAC$) curve | A U-shaped curve showing average costs in the long run when all of the firm's inputs are variable. | |

# Summary of profit concepts

| Profit concepts | | |
|---|---|---|
| Profit | Total revenue minus total cost (the sum of explicit plus implicit costs). | TR−TC |
| Normal profit | Occurs when total revenue equals total cost. It is the minimum amount of revenue required by a firm to keep running. | TR=TC |
| Abnormal profit | Profit that results when total revenue is greater than total cost. It is revenue that is over and above normal profit. | TR>TC |
| Loss | Negative profit; occurs when total revenue is less than total cost | TR<TC |

Firm Business Objectives

# Firm Business Objectives

1. **Rational producer behavior → profit maximization**
   - firms are guided by the goal to maximize profit.

2. **Revenue maximization**
   - Firm owner's objective: profit maximization
   - Firm management's objective: revenue maximization
   - Reasons:
     ① Sales are easier to identified and measured.
     ② Sales are linked with the rewards for managers and employees.
     ③ Assumption that revenue from more sales will increase more rapidly than costs. Profit will increase as a result.
     ④ Increased sales → feeling of success; Decreased sales→ feeling of failure.

# Additional goals of firms

## 3.  Growing maximization

- Achieving economies of scale, lower average costs and increase profitability.
- Diversify into production of different products and markets, it will reduce its dependence on a single product or market.
- Greater market power to influence prices and increase profitability.
- Reduce the risk of affecting by recession.
- Reconciles the interests of both owners and managers.

## 4.  Market share

- High market share → economies of scale (falling costs per unit of output) → increasing profitability
- Indicator of product's popularity among buyers.
- Indicator of company performance (in relation to its competitors)
- Approach:
  - a) lower its price;
  - b) Introduce new/innovative products;
  - c) Advertising → may increase cost, but it's worthwhile to do so.

# Additional goals of firms

5. **Satisficing**
   - Different interest groups within a firm, each with its own objectives which may overlap or may conflict.
   - The pursuit of many objectives that are placed in a hierarchy.
   - Firms try to achieve satisfactory rather than optimal or "best" results.

7. **Corporate social responsibility: ethical and environmental concerns.**
   - **Pros:**
     - ✓Better image for workers(productivity concerned)  and buyers(sales concerned)
     - ✓Less government regulation.
     - ✓more stock market investment
   - **Actions:**
     - ✓Avoidance of polluting activities
     - ✓Engaging in environmentally sound practices
     - ✓Support for human rights
     - ✓Art and athletics sponsorships
     - ✓Donations to charities