

**1.5 Theory of the firm and its market structures**  
**- Production and costs**

**Syllabus item: 42 Weight: 3**

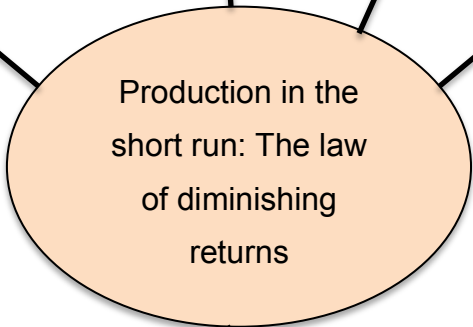
**Definition:**

- **Total product (TP):** The **total output** that a firm produces, using its fixed and variable factors in a given time period
- **Average product (AP):** The **output that is produced, on average**, by each unit of the variable factor. (Total output ÷ number of units of the variable factor employed)
- **Marginal product (MP):** The **extra output** that is produced by using an extra unit of the variable factor

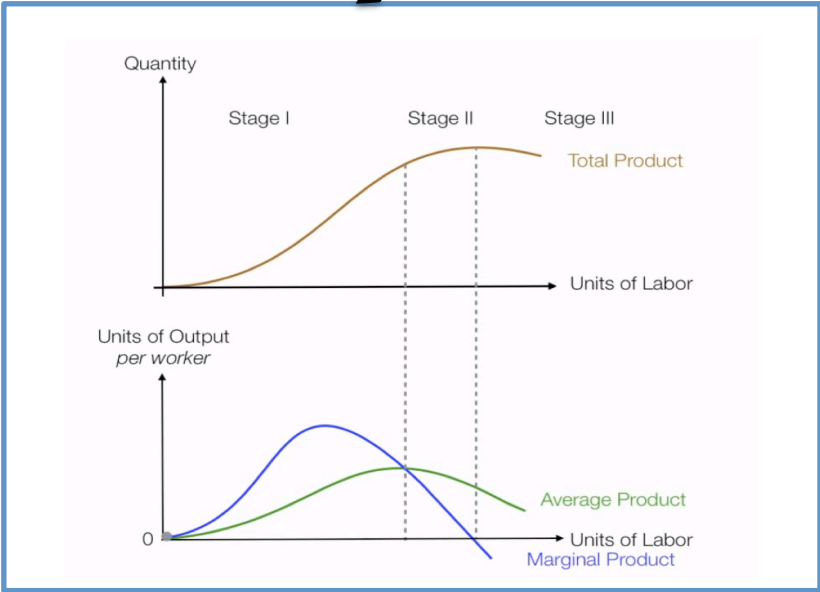
**IB Question**

- Distinguish between the short run and long run in the context of production.
- Define total product, average product and marginal product, and construct diagrams to show their relationship.
- Explain the law of diminishing returns.
- Calculate total, average and marginal product from a set of data and/or diagrams.

- **Short run:** the period of time in which at least **1 f.o.p is fixed** so that **production** can be altered by changing variable inputs.
- **Long run:** the period of time in which **all f.o.p is variable**, but the state of technology is fixed. Can expand **scale or size** of firm. All the **planning** takes place.



- **Variable factors** of production: Inputs which **can be adjusted** to alter production in the short run → Labor or materials
- **Fixed factors** of production: Inputs which **cannot be adjusted** to alter production in the short run → Capital or land



Capital	Labour (L)	Total product (TP)	Average product (AP)	Marginal product (MP)
5	0	0	-	-
5	1	10	10	10
5	2	27	13.5	17
5	3	50	16.7	23
5	4	77	19.3	27
5	5	107	21.4	30
5	6	132	22.0	25
5	7	150	21.4	18
5	8	157	19.6	7
5	9	147	16.3	-10

Table: Total, average, and marginal product per week

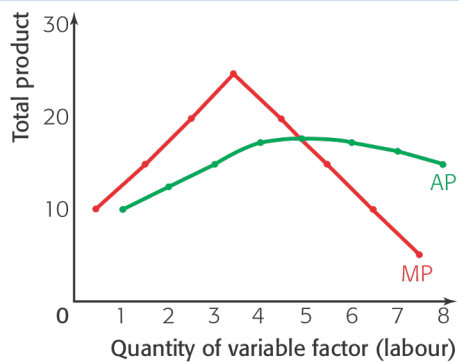


Figure 6.2 Average and marginal product curves

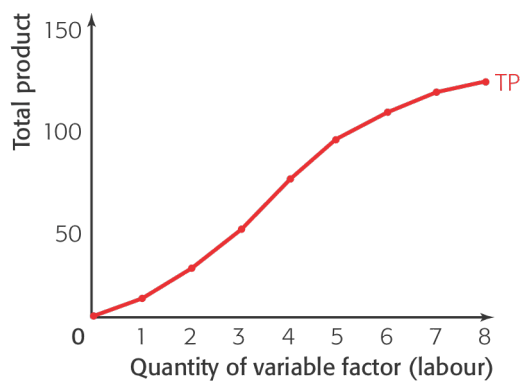


Figure 6.1 The total product curve

- The **total product keeps rising** even though the **marginal, and the average product is falling**.
- It is only when the marginal product is **negative**, with the addition of the ninth worker that **total product starts to fall**.
- **Marginal product curve cuts the average product curve** at its highest point, where it is momentarily flat.

### The law of diminishing returns:

Definition: As more and more of a variable factor (e.g. Labour) are added to a fixed factor, output will rise initially but will eventually fall.

#### 1) Short-run concept

2) Influences shape of **SRAC curve**

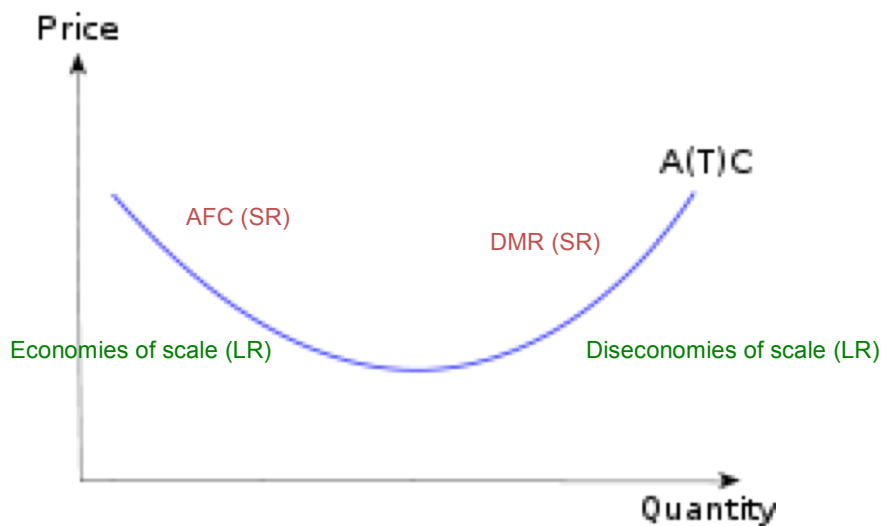
3) At least one of the f.o.p is fixed

4) Leads to inefficiency and waste of scarce resources

5) Where **MP** ( $\Delta TP$ ) starts to fall or, where **MC** ( $\Delta TC/\Delta TP$ ) starts to rise

★ (If AVC is rising, it implies diminishing marginal returns but for an accurate analysis it is necessary to do a marginal analysis, looking at changes in MC or even better at MP)

6) Output (TP) initially rises at an increasing rate (up to A), but marginal output then starts to diminish. This means that total output still increases, but at a decreasing rate (the slope of the curve tails off)



**Definition:**

Economic cost: the opportunity cost of the firm's production (including entrepreneurship)



1. Explicit costs

→ Any costs to a firm that involve the direct payment of money

i.e. Wage expense, rent or lease costs

2. Implicit costs

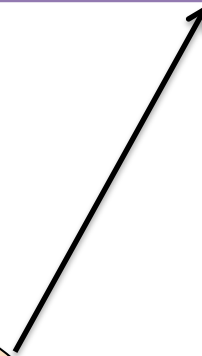
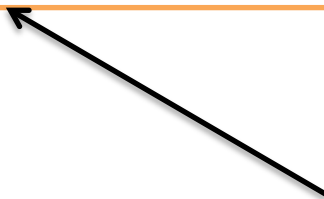
→ Represented by lost opportunity in the use of a company's own resources, excluding cash

i.e. the loss of interest income on funds, or depreciation of machinery used for a capital project.

**IB Question**

- Explain the meaning of economic costs as the opportunity cost of all resources employed by the firm (including entrepreneurship).
- Distinguish between explicit costs and implicit costs as the two components of economic costs.

Costs of production:  
economic costs



**Definition:**

- **Total costs:** the complete costs of producing output
- a) **Total fixed cost (TFC):** Total cost of the **fixed** assets that a firm uses in a given time period. They do not change as production is increased or decreased. They exist even if output is zero.
- b) **Total variable cost (TVC):** Total cost of the **variable** assets that a firm uses in a given time period. They vary with output.
- c) **Total cost (TC):**  $TFC + TVC$

**IB Question**

- Explain the distinction between the short run and the long run, with reference to fixed factors and variable factors.
- Distinguish between total costs, marginal costs and average costs.
- Draw diagrams illustrating the relationship between marginal costs and average costs, and explain the connection with production in the short run.

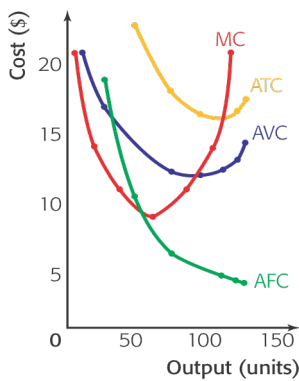


Figure 6.4 Short-run AFC, AVC, ATC, and MC curves

Short-run AFC, AVC, ATC, and MC curves

- The MC curve cuts the AVC and ATC curves at their lowest points.
- AFC falls as output increases, and, since it is the difference between ATC and AVC, the vertical gap between ATC and AVC gets smaller as output grows

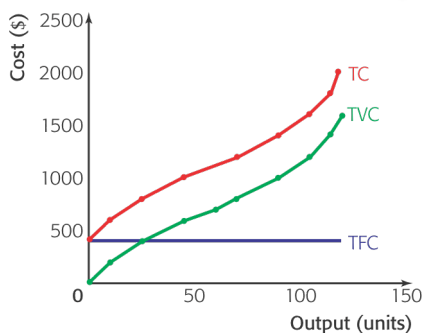
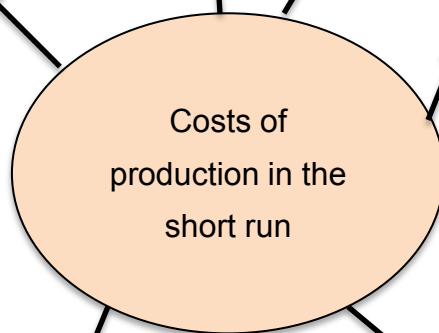


Figure 6.3 Total cost, total variable cost, and total fixed cost

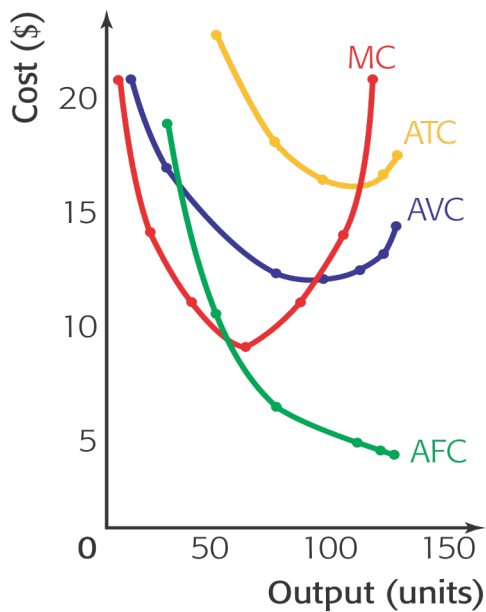


- **Short-run:** at least **1 f.o.p** is **fixed**. In other words, the firm cannot change at least 1 factor (e.g. factory building)
- **Long-run:** **all factors** **variable** and therefore the firm can plan the ideal scale of the operation.

**Definition:**

- **Average costs:** Costs per unit of output.  $\text{Total costs} \div \text{level of output}$
- a) **Average fixed cost (AFC):**  $\text{Total fixed costs} \div \text{level of output}$
- b) **Average variable cost (AVC):**  $\text{Total variable costs} \div \text{level of output}$
- c) **Average (total) cost (ATC):**  $\text{Total costs} \div \text{level of output}$
- **Marginal costs:** The increase in total cost of producing an extra unit of output.  $\text{Change in TC} \div \text{Change in level of output}$

Short-run AFC, AVC < ATC < and MC curves



Notes:

a) Average fixed cost (AFC) curve:

- AFC decreases throughout the output (Q) range.
- AFC moves closer and closer to the horizontal axis

→ Why?  $AFC = TC/Q \Rightarrow AFC \downarrow$  as  $Q \uparrow$

b) Average variable cost (AVC) curve

- The average variable cost is U-shaped.
- AVC first decreases, reaches a minimum, and then increases.

→ Why? Law of diminishing returns and the law of increasing costs

c) Average total cost (ATC) curve

- ATC has similar shape of AVC.
- It falls faster than AVC in the beginning and rises slower after reaching its minimum point.

→ Why?  $ATC = AFC + AVC$ .

When the increase in AVC outweighs the decrease in AFC, the ATC will begin to increase forming the familiar U-shaped curve.

d) Marginal cost (MC) curve:

- This curve also decreases at first, reaches a minimum, then increases.

b. When  $MC < AVC$ , AVC are decreasing When  $MC > AVC$ , AVC are increasing.

- The only way for AVC to decrease (fall) is for the extra cost of the next unit produced (MC) to be less than the AVC of all the preceding units.

- MC intersects AVC and ATC at their minimum.

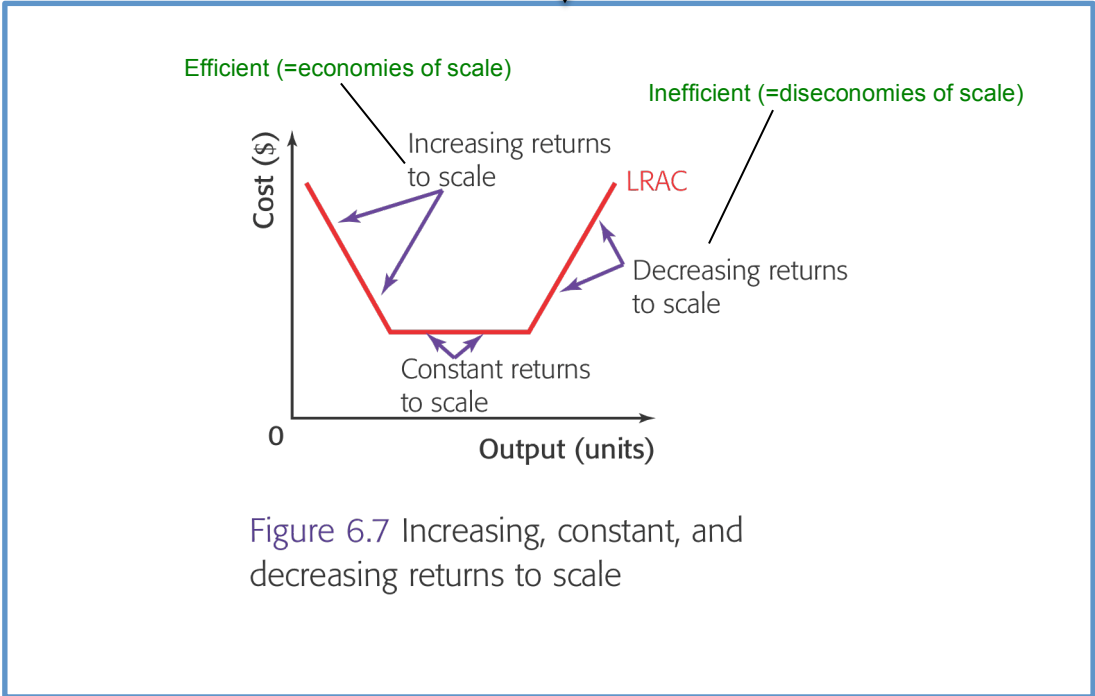
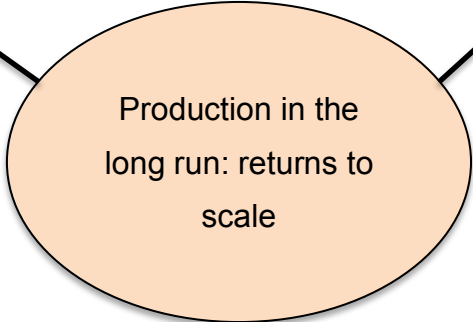
**IB Question**

- Distinguish between increasing returns to scale, decreasing returns to scale and constant returns to scale.

**Definition:**

- Returns to scale:  
 → Long run concept that examines the change in total output as a result of increasing the total inputs

(Dis) Economies of scale	Returns to scale
Long-run concept	Long-run concept
Measure the change in average unit cost	Measures the change in total output
Causes the LRAC to rise or fall	Growth of firm can result in increasing, constant or decreasing returns to scale

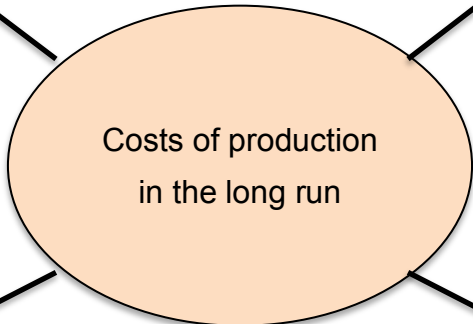


**Main idea 1**

- Long run average cost curve (LRAC):
  1. Since we know all costs are variable in the long run, we just call it the LRAC.
  2. It is constructed from a series of SRAC curves + points which are tangent to the minimums of the SRAC curves associated with a series of different output levels (Q)
  3. **U-shaped** because of the existence of **economies and diseconomies of scale**
- Short run average cost curve (SRAC):
  1. **U-shaped** because of the **hypothesis of diminishing returns.**

**IB Question**

- Outline the relationship between short-run average costs and long-run average costs.
- Explain, using a diagram, the reason for the shape of the long-run average total cost curve.



**Main idea 2**

- In theory, LRAC curve is an **“envelope” curve**, as it envelops an infinite number of short-run average cost curves.
- SRAC curves represent all of the possible **combinations of fixed and variable factors** that could be used to produce different levels of output for this firm

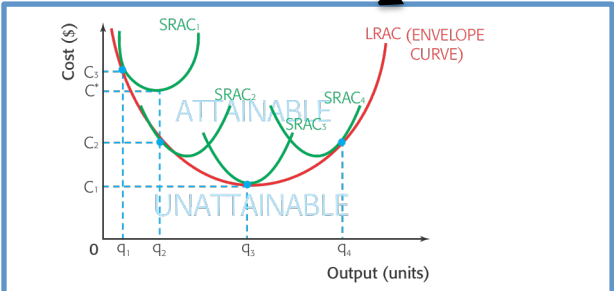


Figure 6.6 The LRAC curve and short run average cost curves

The LRAC curve and SRAC curves

- At output level  $q_3$ , LRAC is at its lowest point. This would be the **economically efficient output level** to achieve.



### Definition:

- **Economies of scale:** Any **decreases** in long-run average costs that come about when a firm alters all of its f.o.p in order to increase its scale (size) of output → **Leads to firms experiencing increasing returns to scale.**
- **Diseconomies of scale:** Any **increases** in long-run average costs that come about when a firm alters all of its f.o.p in order to increase its scale (size) of output → **Leads to firms experiencing decreasing returns to scale.**

### IB Question

- Describe factors giving rise to economies of scale, including specialization, efficiency, marketing and indivisibilities.
- Describe factors giving rise to diseconomies of scale, including problems of coordination and communication

Costs of production  
in the long run

### Main idea 1

Factors giving rise to **economies of scale:**

- Specialization
- Division of labour
- Bulk buying
- Financial economies
- Transport economies
- Large machines
- Promotional economies

### Main idea 2

Factors giving rise to **diseconomies of scale:**

- Control and communication problems
- Alienation and loss of identity

**Definition:**

• **Revenue:** Income that a firm receives from selling its products, goods, and services, over a certain time period

1. **Total revenue (TR):** All the revenue earned by the business.

$$TR = p \times q$$

2. **Average revenue (AR):**  $AR = TR \div q$

3. **Marginal revenue (MR):**  $\text{Change in TR} \div \text{Change in } q$

**IB Question**

- Distinguish between total revenue, average revenue and marginal revenue.
- Draw diagrams illustrating the relationship between total revenue, average revenue and marginal revenue.
- Calculate total revenue, average revenue and marginal revenue from a set of data and/or diagrams.

1. Perfect competition

(When elasticity of demand is infinity)

- Theory
- Perfectly elastic demand curve
- Does not have to lower price as output increases and it wishes to sell more of its product
- $AR = \text{Price} = MR$

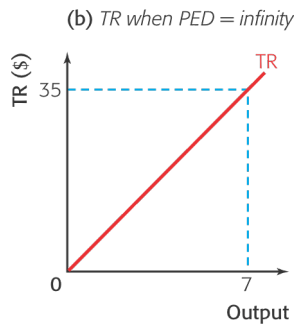
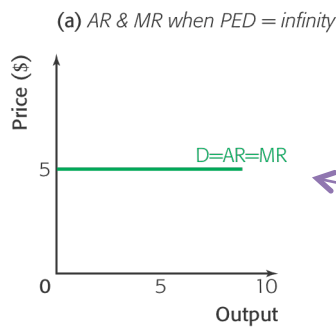
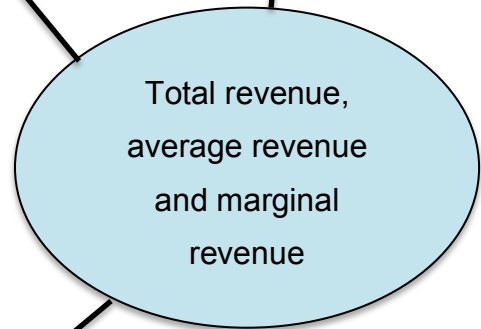


Figure 6.9 Curves for PED = infinity

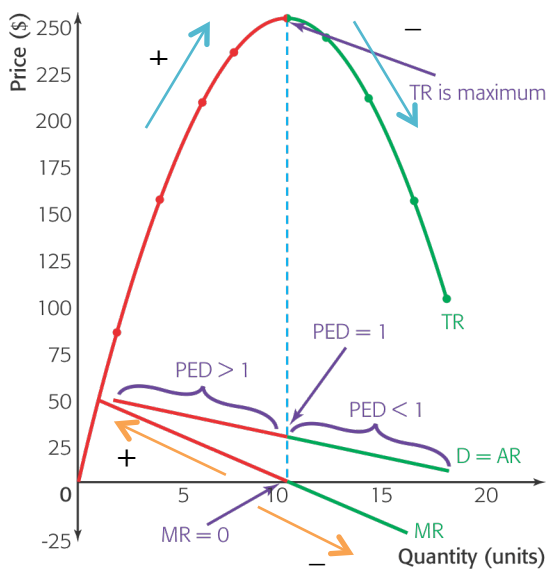


Cannot rise because consumer have perfect knowledge + products are homogenous

2. Imperfect competition (Monopoly, monopolistic competition, oligopoly etc.)

(When the demand curve is downward sloping, i.e. when elasticity of demand falls as output increases)

Price (\$)	Quantity demanded (QD)	Total revenue (TR) (\$)	Average revenue (AR) (\$)	Marginal revenue (MR)(\$)	PED
50	0	0			
45	2	90	45	45	9.00
40	4	160	40	35	4.00
35	6	210	35	25	2.33
30	8	240	30	15	1.50
25	10	250	25	5	1.00
20	12	240	20	-5	0.67
15	14	210	15	-15	0.43
10	16	160	10	-25	0.25
5	18	90	5	-35	0.11
0	20	0		-45	



- AR = Price. Price has to be lowered to sell more products → D = AR curve

- MR falls as output increases twice as steeply as the AR curve and also goes below the x axis

- TR rises at first but will eventually start to fall as output increases. This is because negative MR means that TR will fall

Figure 6.10 The relationship between D, AR, MR, TR, and PED for a normal demand curve

(↑ Helpful for firms to know the impact that a change in the price of their product will have upon the total revenue that they receive)

Notes:

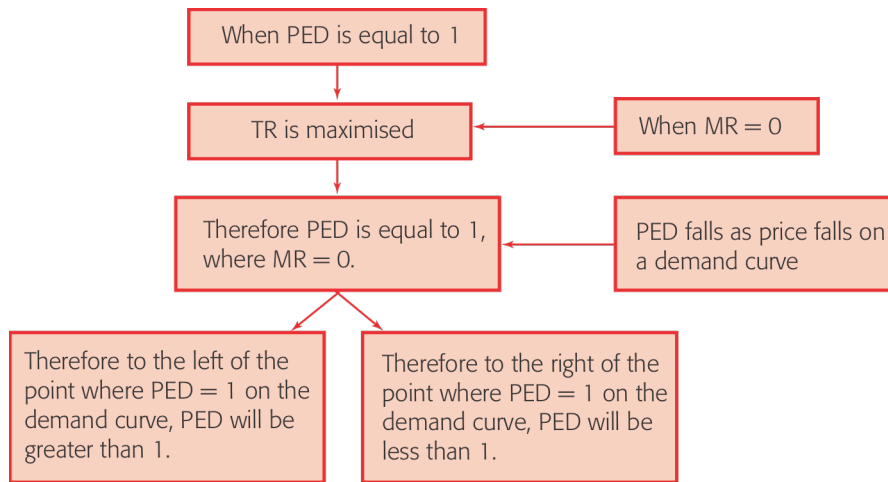


Figure 6.11 A logic tree explaining the varying values of PED on a demand curve

The basic rules are:

1. When **PED elastic** → **lower price** to increase revenue
2. When **PED inelastic** → **raise price** to increase revenue
3. When **PED unity** → **leave the price unchanged** since revenue is already maximized

**Definition:**

- **Total profit:**

→ In economics, it is **Total revenue – economic cost** (the sum of explicit costs + implicit costs)

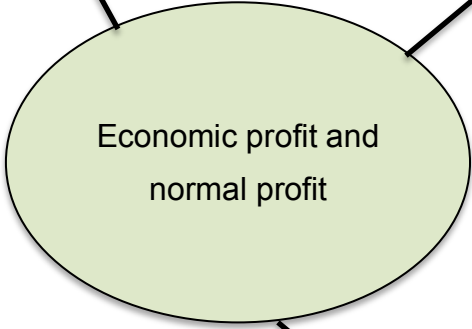
→ i.e. Abnormal, normal and loss

- **Economic cost:**

→ **Explicit costs + implicit costs**

**IB Question**

- Describe economic profit (abnormal profit) as the case where total revenue exceeds economic cost.
- Describe normal profit (zero economic profit) as the case where total revenue is equal to total economic costs or the situation in which the amount of revenue earned is just sufficient to keep the firm in its current line of business.
- Explain that economic profit (abnormal profit) is profit over and above normal profit (zero economic profit), and that the firm earns normal profit when economic profit (abnormal profit) is zero.



**Main idea 1**

➤ Profit = TR- TC → Profit = TR – EC  
(EC includes explicit and implicit costs)

- If TR = TC → **Normal profit** (or zero economic profit)
- If TR > TC → **Abnormal profit** (or economic profit)
- If TR < TC → **Loss** (or negative economic profit)

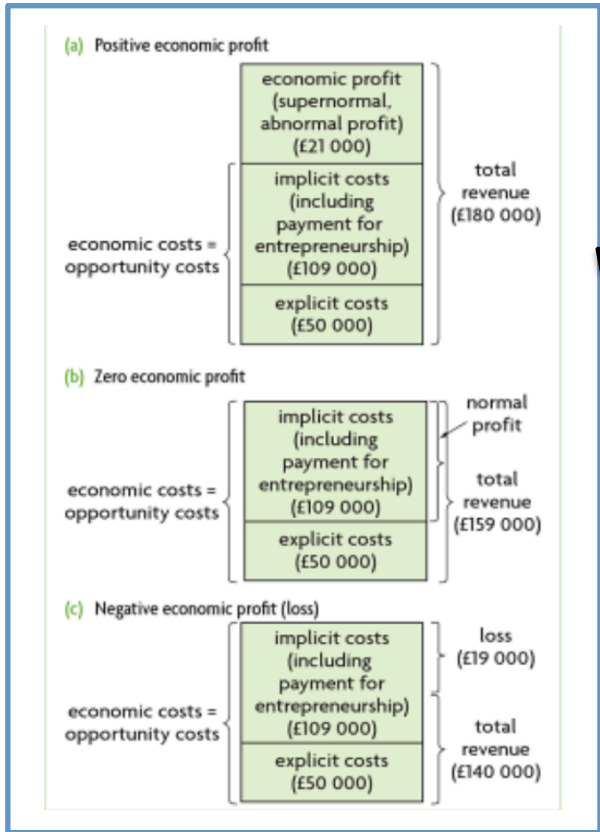
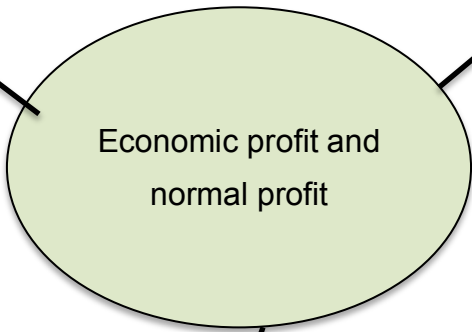
### Main idea 1

- Why a firm continues to operate even when earning zero economic profit

Zero economic profit means that  $TR = EC$ . When we say a firm is 'earning zero economic profit', the firm is earning just the necessary revenues to cover payment for entrepreneurship (a cost) and all other implicit costs and explicit costs. Thus, it means that the firm has covered all its opportunity costs, and will continue to operate.

### IB Question

- Explain why a firm will continue to operate even when it earns zero economic profit (abnormal profit).
- Explain the meaning of loss as negative economic profit arising when total revenue is less than total cost.
- Calculate different profit levels from a set of data and/or diagrams.



**Main idea 1**

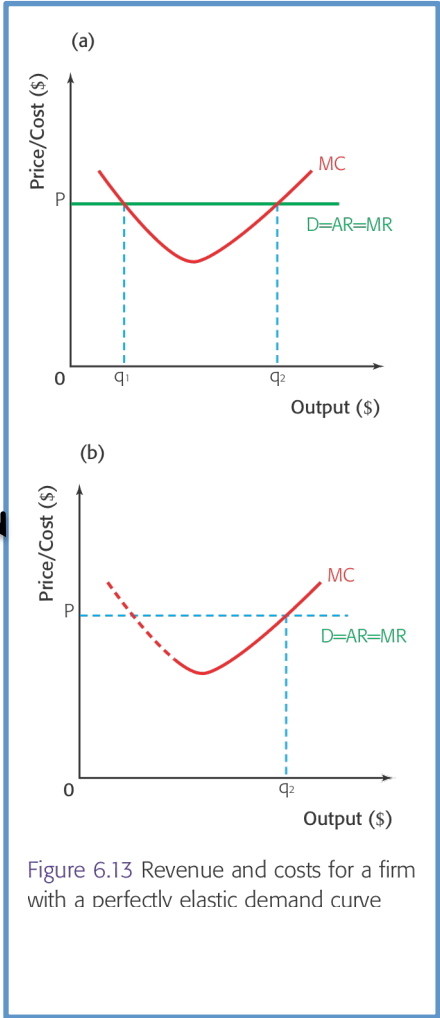
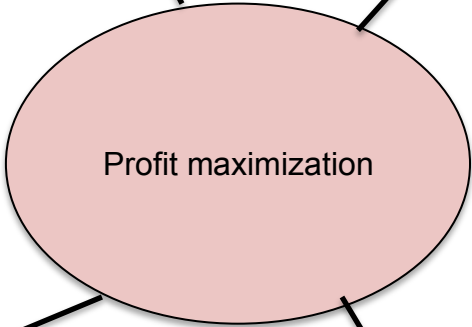
- There are two approaches to analyzing profit maximization: one involves the 1) **use of the total revenue and total cost concepts**, and the other involves the 2) **use of marginal revenues and costs**. (Though 2<sup>nd</sup> approach is more relevant to analyzing market structures)

**IB Question**

- Explain the goal of profit maximization where the difference between total revenue and total cost is maximized or where marginal revenue equals marginal cost.

**Main idea 2**

- Maximum profit  
 $MC = MR$   
(always. No matter the market structure)




### Main idea 1

- Revenue maximization:  
→ Entrepreneurs may attempt to maximize their sales revenue by producing where the marginal revenue is zero. They will actually produce above the profit maximizing level of output.
- Growth maximization:  
→ Companies may set their target to achieve growth in the short run, rather than profits, in order to gain a large market share and then dominate the market in the long run.

### IB Question

- Describe alternative goals of firms, including revenue maximization, growth maximization, satisficing and corporate social responsibility.

Alternative goals for firms



### Main idea 2

- Satisficing:  
→ It is where an economic agent aims to perform satisfactorily rather than to a maximum level, in order to be able to pursue other goals.
- Corporate social responsibility (CSR):  
→ This is where a business includes the "public interest" in its decision making.  
→ i.e. Encouraging developing in the workforce and the local community through educational projects and fair trade projects  
→ Advantages such as attracting and keeping a better workforce, building up reputation and developing brand loyalty for being an ethical business  
→ Disadvantages that companies may be adopting a CSR approach to gain a good reputation in order to take people's attention away from their main product



**Definition:**

• [Perfect competition:](#)

→ A model used as the starting point to explain how firms operate.

→ Some industries in the world that get quite close to being perfectly competitive markets

ex) **wheat industry in European Union**

(Only differences are that there are costs in order to entry or exit the industry and also it is unlikely that producers and consumers will have “perfect knowledge”)

**IB Question**

- Describe, using examples, the assumed characteristics of perfect competition: a large number of firms; a homogeneous product; freedom of entry and exit; perfect information; perfect resource mobility.

Assumptions of the model  
(Perfect competition)

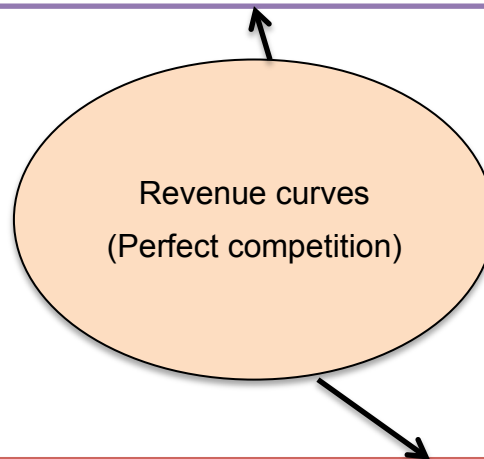
**Main idea 1**

[The assumptions of perfect competition:](#)

- Made up of large number of firms
- Individual firms are “price –takers” (cannot affect the price of the industry; must sell at whatever the price is)
- Sell “homogenous” products (identical; no brand names)
- Freedom of entry and exiting the industry (=No barriers to entry or barrier to exit)
- Perfect knowledge
- Perfect information
- Perfect resource mobility

### IB Question

- Explain, using a diagram, the shape of the perfectly competitive firm's average revenue and marginal revenue curves, indicating that the assumptions of perfect competition imply that each firm is a price taker.
- Explain, using a diagram, that the perfectly competitive firm's average revenue and marginal revenue curves are derived from market equilibrium for the industry.



### Main idea 1

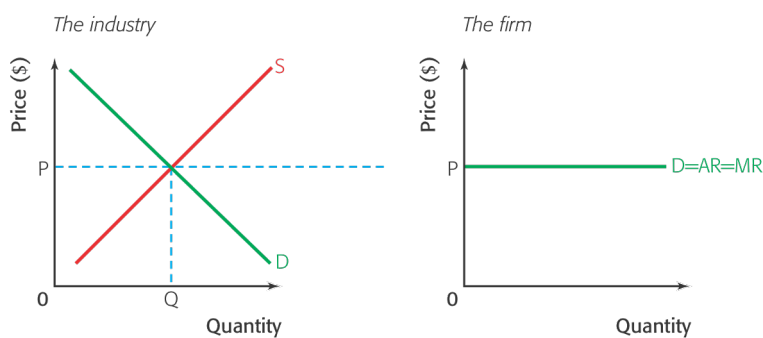
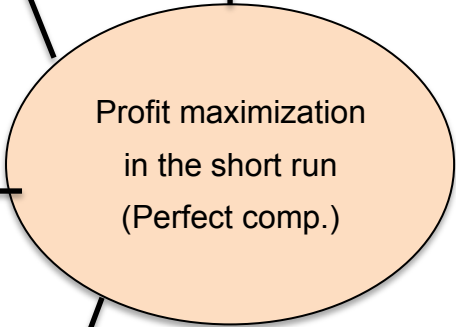
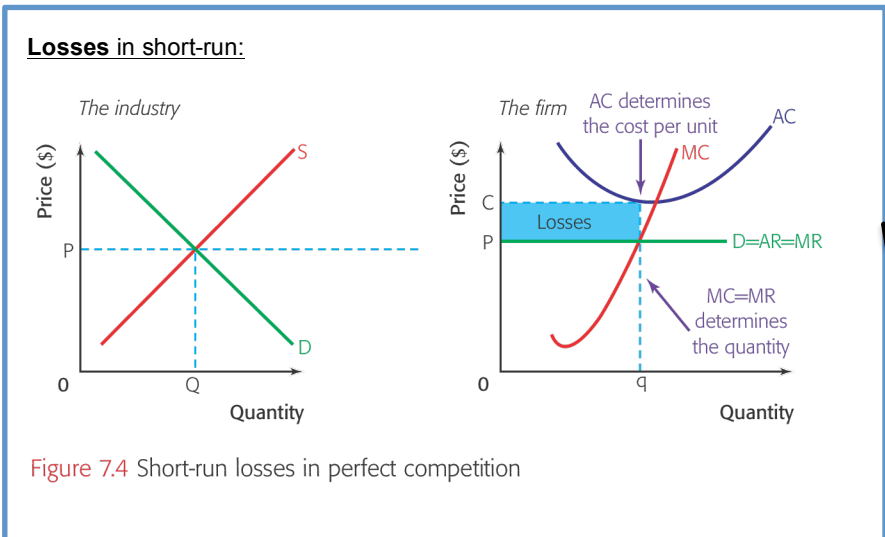
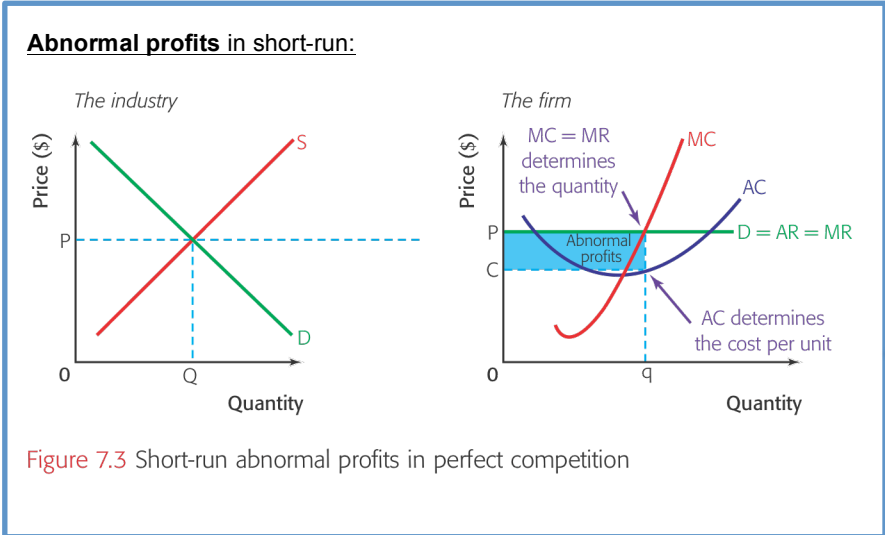
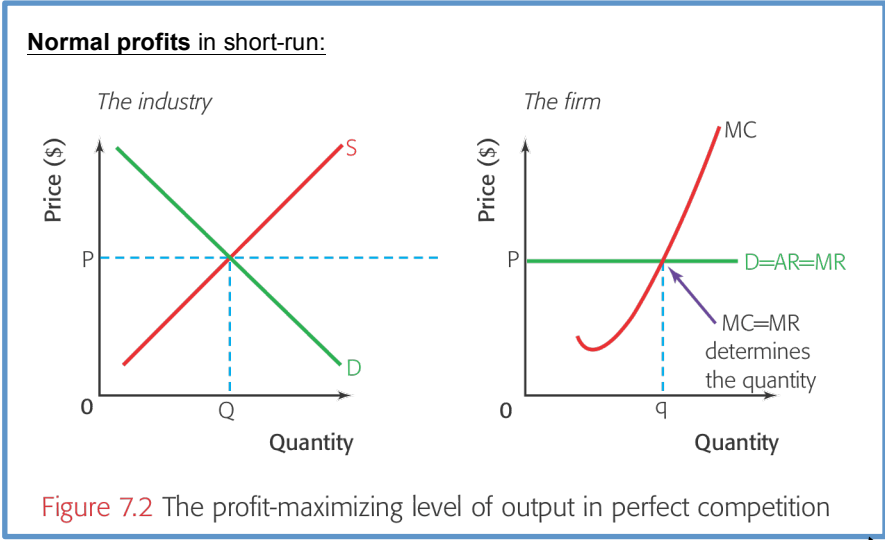


Figure 7.1 The demand curves for the industry and the firm in perfect competition

- The industry in perfect competition will face normal demand and supply curves
- Firm derives its price of P from equilibrium price in the industry (= “price taker”)
- The firm can sell as much as it wants at P as it does not affect the industry supply curve and so it does not alter the industry price
- The shape of the perfectly competitive firm's AR and MR curves are perfectly elastic because each firm is a “price-taker”

**IB Question**

- Explain, using diagrams, that it is possible for a perfectly competitive firm to make economic profit (abnormal profit), normal profit (zero economic profit) or negative economic profit in the short run based on the marginal cost and marginal revenue profit maximization rule.



### Main idea 1

- In long-run, firms in perfect competition will make normal profits (zero economic profits) There is no abnormal profits.

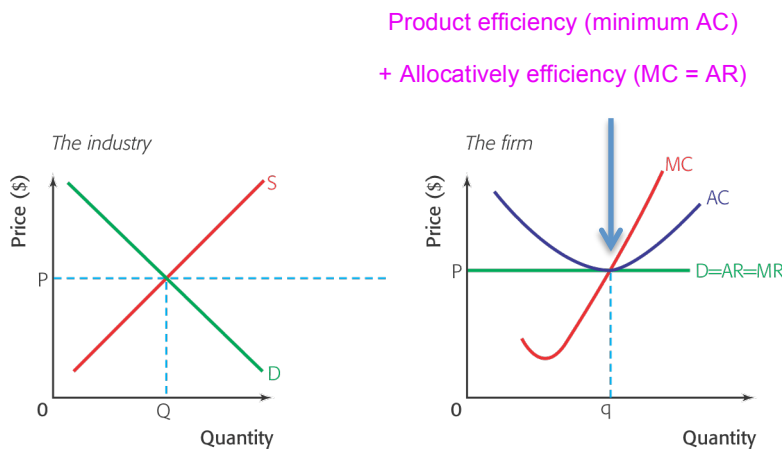


Figure 7.7 Long-run equilibrium in perfect competition

Firms are selling at price P, which they are taking from the industry.  $MC = MR$  so they are maximizing profits by producing q, and that output  $P = AC$  so they are making normal profits.

### IB Question

- Explain, using a diagram, why, in the long run, a perfectly competitive firm will make normal profit (zero economic profit).
- Explain, using a diagram, how a perfectly competitive market will move from short-run equilibrium to long-run equilibrium.

Profit maximization  
in the long run  
(Perfect competition)

## Main idea 2

### Short-run abnormal profits to long-run normal profits

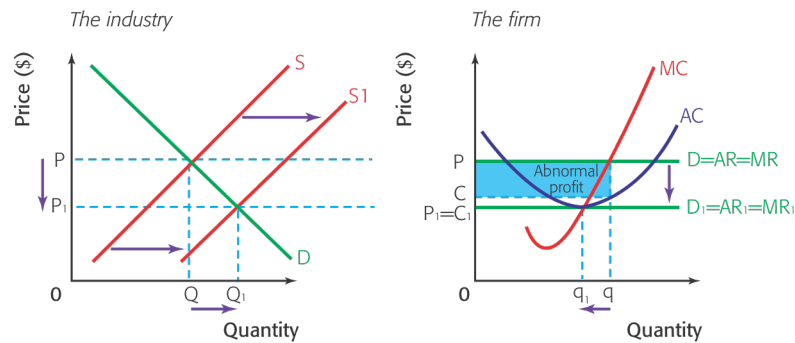


Figure 7.5 The movement from short-run abnormal profit to long-run normal profit

As more and more firms enter the industry, attracted by the abnormal profits, the industry supply curve will start to shift to the right, driving down the price → abnormal profits that they had been making will start to be eroded

As a result, we are left with the long run equilibrium position → We now find that the firms are making normal profits with  $P_1 = C_1$ . (exactly covering opportunity cost) → HOWEVER, there is no abnormal profit to attract more firms!!

- Outcome: Bigger industries producing  $Q_1$  units, with smaller firms each producing  $q_1$  units.

### Short-run loss to long-run normal profits

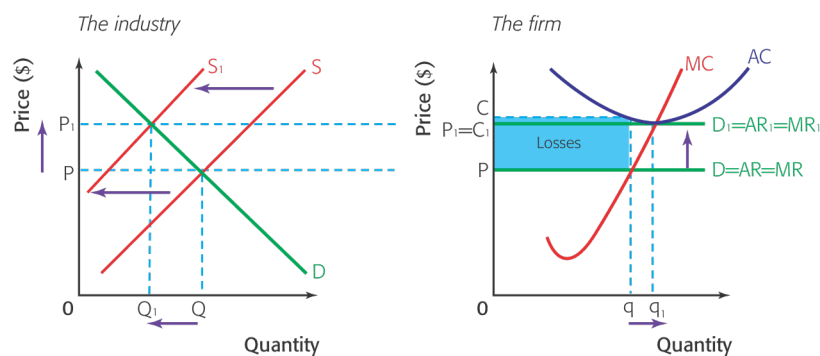


Figure 7.6 The movement from short-run losses to long-run normal profit

As more and more firms leave the industry, unable to achieve normal profit, the industry supply curve will start to shift to the left

As a result, the demand curve is  $D_1 = AR_1 = MR_1$  → We now find that the firms are making normal profits with  $P_1 = C_1$ . (exactly covering opportunity cost) → HOWEVER, there is no abnormal profit to attract more firms!!

- Outcome: A smaller industry producing only  $Q_1$  units, with bigger firms each producing  $q_1$  units.

**Definition:**

• Shut-down price:

→ The level of price that enables a firm to cover its variable costs in the **short-run**, i.e. it is the price where  $P = AVC$ . If price does not cover AVC, then the firm will shut down in the short run. (P in figure 6.12)

• Break-even price:

→ The level of price that enables a firm to cover all of its costs (FC + VC) in the **long-run**, i.e. it is the price where  $P = ATC$ . If price does not cover ATC, then the firm will shut down for good. (P1 in figure 6.12)

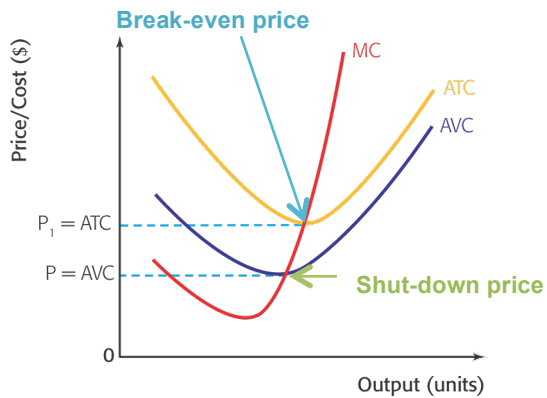


Figure 6.12 A general diagram showing short run ATC, AVC, and MC

**IB Question**

- Distinguish between the short run shut-down price and the break-even price.
- Explain, using a diagram, when a loss-making firm would shut down in the short run.
- Explain, using a diagram, when a loss-making firm would shut down and exit the market in the long run.
- Calculate the short run shutdown price and the breakeven price from a set of data

Shut-down price  
and break-even  
price

**Definition:**

- Allocative efficiency:

→ It is where **MC = AR**.

→ The condition for allocative efficiency is  $P = MC$  (or, with externalities,  $MSB = MSC$ ).

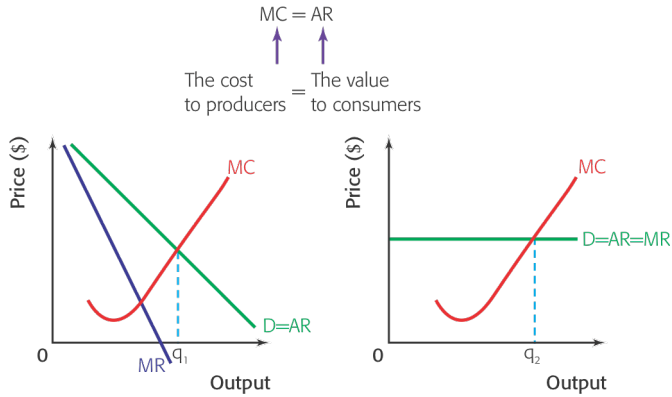
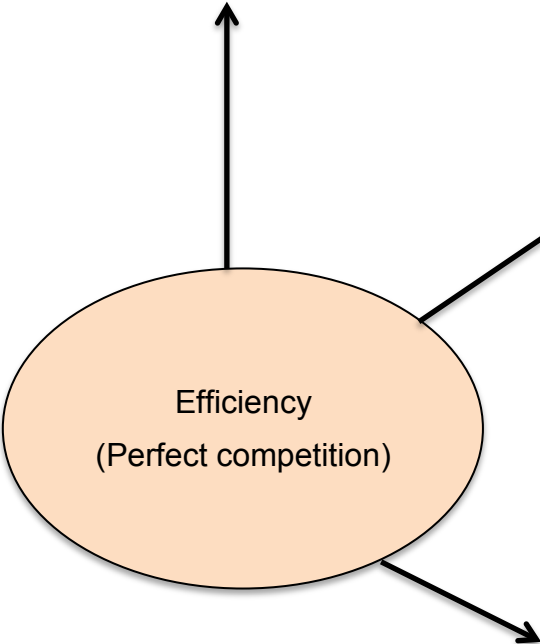


Figure 7.9 Allocative efficiency

**IB Question**

- Explain the meaning of the term allocative efficiency.
- Explain that the condition for allocative efficiency is  $P = MC$  (or, with externalities,  $MSB = MSC$ ).
- Explain, using a diagram, why a perfectly competitive market leads to allocative efficiency in both the short run and the long run.
- Explain the meaning of the term productive/technical efficiency.
- Explain that the condition for productive efficiency is that production takes place at minimum average total cost.
- Explain, using a diagram, why a perfectly competitive firm will be productively efficient in the long run, though not necessarily in the short run.



**Definition:**

- Productive/technical efficiency:

→ Producing its product **at the minimum ATC**

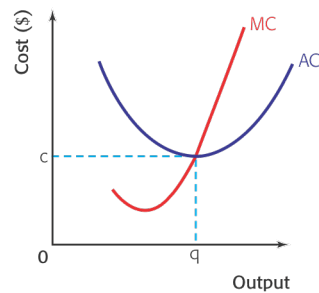


Figure 7.8 Productive efficiency

→  $q$  = productively efficient level of output ( $MC = AC$ )

**Productive and allocative efficiency with short-run profits in perfect competition:**

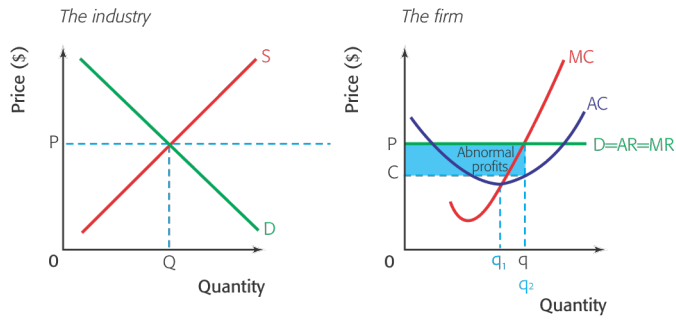


Figure 7.10 Productive and allocative efficiency with short-run profits in perfect competition

**Productive and allocative efficiency with short-run losses in perfect competition:**

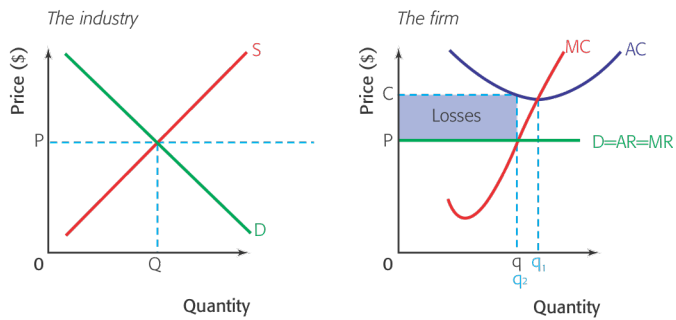


Figure 7.11 Productive and allocative efficiency with short-run losses in perfect competition

**Productive and allocative efficiency in the long run in perfect competition:**

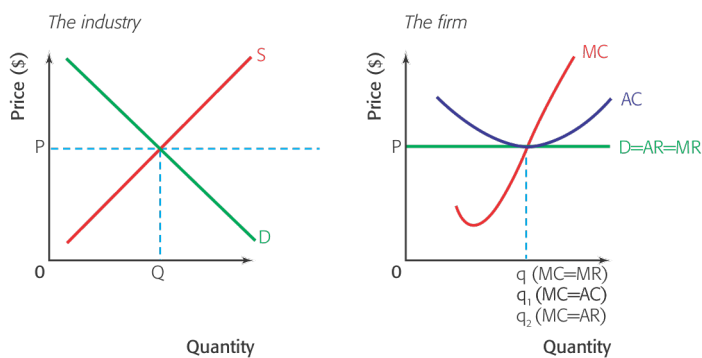


Figure 7.12 Productive and allocative efficiency in the long run in perfect competition