CHAPTER FOUR

PERFECT COMPETTION

2.1 Definition and Assumptions

Perfect competition is a market structure which is characterized by a **complete absence of rivalry among the individual firms**.

Assumptions:_

1. Large number of sellers and buyers

2. Products of the firms are homogeneous.

- These two assumptions make the PCM firm to be **price taker** and makes its demand curve to be a **horizontal line**

3. No government intervention

4.The goal of all firms is profit maximization

5.Free entry and exit of firms

6. Perfect mobility of factors of production

Definition and Assumptions Cont…

Cost, Demand and revenue functions

- The market the per unit cost (AVC &AC) have U –shape
- Given the horizontal demand function, the TR of a firm operating under PCM is given by TR = P*Q
- ✓ Since the market price is constant at P*, TR function is linear and the amount of TR depends on the quantity of sales.
- The marginal revenue (MR) and average revenue (AR) of a firm operating under PCM are equal to the market price.

$$MR=dTR/dQ= d(P*Q)/d(Q)=P$$

$$AR=TR/Q=P*Q/Q=P$$

2.2 Short run equilibrium

2.2.1 Short run equilibrium of the firm

- A firm is said to be in **equilibrium** when it **maximizes its profit**
- **Determination of equilibrium** of the firm operating in a PCM means **determination of the profit maximizing output** since the firm is a price taker.
- It can be done by total and marginal approach.

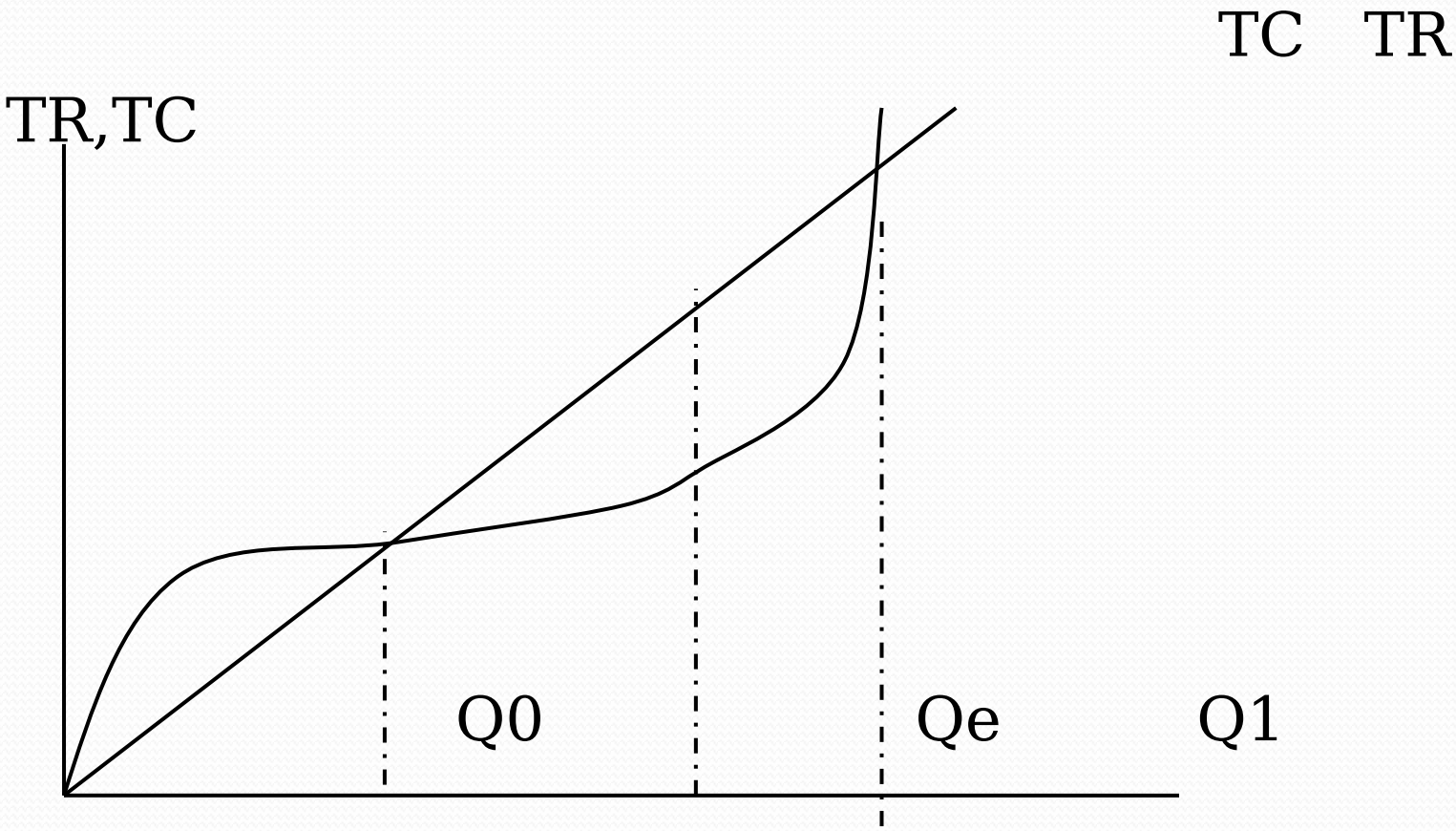
A. Total Approach

- Here the **profit maximizing level of output** is that level of output at which the **vertical distance between the TR and**

cont …

The profit maximizing output level is Q^e b/e at this output level that the vertical distance b/n TR and TC curves (or profit) is maximum.

For all output levels $< Q_0$ and $> Q_1$ profit is negative b/e TC> TR.



Short run equilibrium of the firm cont…

B. Marginal Approach

profit maximized when: **MR=MC and MC is increasing**

Mathematically

Profit (Π) = TR-TC= AR*Q-AC*Q

FOC…….$\frac{d\pi}{dQ}=\frac{dTR}{dQ}-\frac{dTC}{dQ}=MR-MC=0, MR=MC$

(necessary condition)

SOC……. $\frac{d^2\pi}{dQ^2}<0$ $\frac{d^2TR}{dQ^2}-\frac{d^2TC}{dQ^2}<0$ (sufficient condition)

- which means, Slope of MR (zero) < Slope of MC or Slope of MC > 0 or Mc is increasing,

Short run equilibrium of the firm cont …

- **Short run profit** of a PCM firm depends on the **level of ATC and P at equilibrium point thus**;

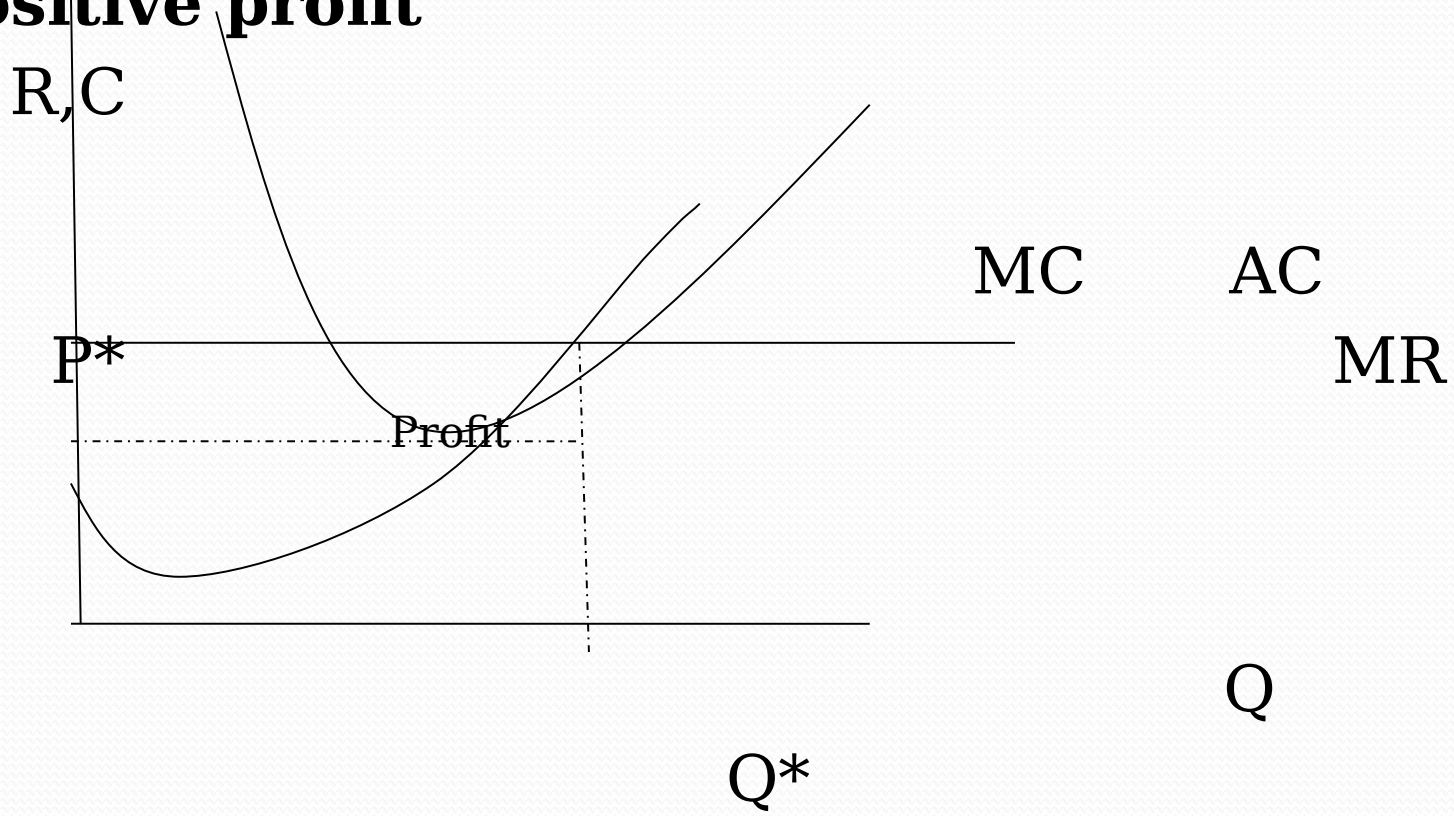
1. When **ATC < P** at equilibrium, the firm earns a **positive profit**
2. If the **ATC = P** at equilibrium, the firm gets **zero profit**
3. When the **ATC > P** at equilibrium, the firm **incurs a loss**

- In fact, the **firm will continue to Produce** as far as the **price is sufficient to cover the AVC or TR sufficiently covers the TVCs**.

Short run equilibrium of the firm cont …

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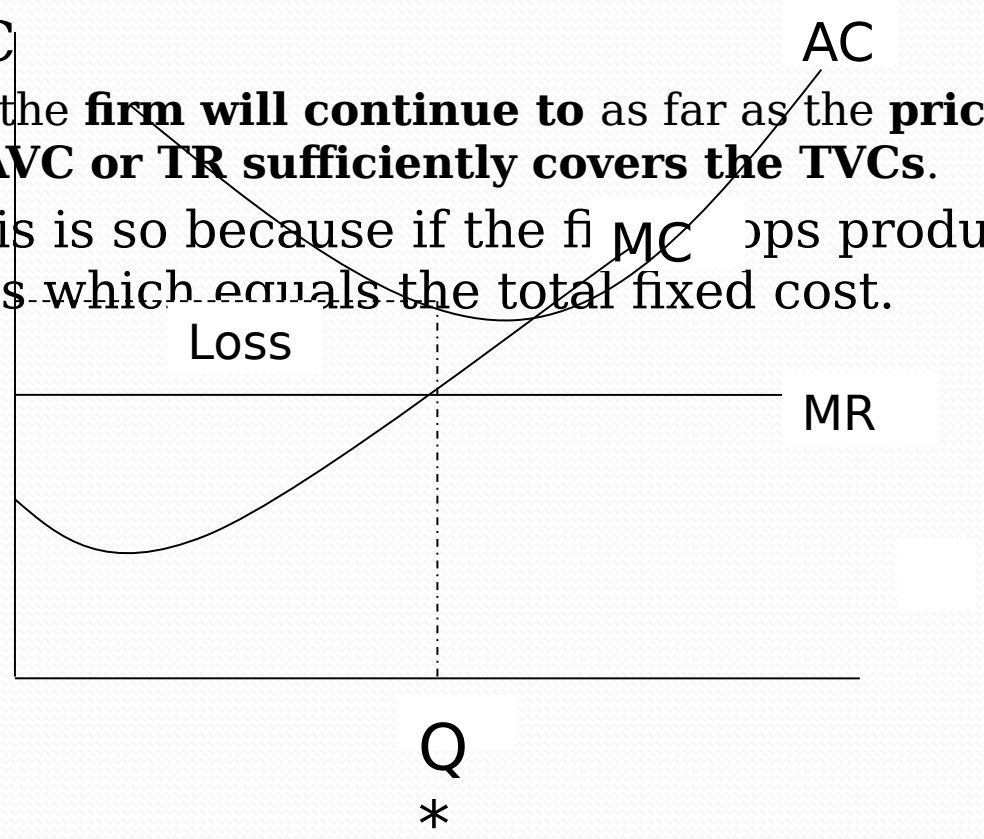
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Short run equilibrium of the firm cont …

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In fact, the **firm will continue to** as far as the **price is sufficient to cover the AVC or TR sufficiently covers the TVCs**.

- This is so because if the fi ops production he will incur a loss which equals the total fixed cost.

Short run equilibrium of the firm cont …

- **Shut down output** is level output at which TR and TVCs are equal (AVC equals the market price) .
- **Break-even point** is the output level at which **market price is equal to the AC** of production so that the firm obtains only normal profit (zero profit).

Numerical Example

Suppose that the firm operates in a perfectly competitive market. The market price of his product is $10. The firm estimates its cost of production as, $TC=10q-4q^2+q^3$

- What level of output should the firm produce to maximize its profit?
- Determine the level of profit at equilibrium.

Short run equilibrium of the firm cont …

Solution

A. Given: P=$10 and TC= $10q - 4q^2+q^3$

The firm maximize profit when MC=MR & MC is rising

- In a PCM, MR = market price i.e. MR=10
-

$$MC=\frac{dTC}{dq}=\frac{d(10q-4q^2+q^3)}{dq}=10-8q+3q^2$$

At equilibrium: MR=MC $=10 - 8q + 3q^2 = 10$

$\rightarrow - 8q + 3q^2 = 0$

$\rightarrow q (-8 + 3q) = 0$

$\rightarrow q = 0$ or $q = 8/3$

Short run equilibrium of the firm cont …

- To determine which level of output maximizes profit we have to use the SOC test (increasing MC)
- To see this first we determine the slope of MC= -8 + 6q

1. At q=0, slope of MC is -8 + 6 (0) = -8 i.e. MC is decreasing at q=0.

   Thus, q = 0 is not equilibrium output

2. At q = 8/3, slope of MC is -8 + 6 (8/3) = 8, which is positive, implying that MC is increasing at q = 8/3, thus, the equilibrium output level is q = 8/3

B. π = TR-TC =$ 10 * 8/3-

=10 (8/3) – [4 $(8/3)^2$ + $(8/3)^3$]

= $ 80/3 - 23.12= $ 3.55

Short run equilibrium of the firm cont …

C. To stay in operation the firm needs the price to be equals at least to the minimum AVC.

- AVC is minimal when derivative of AVC with respect to Q is equal to zero.
- Since, $TVC = 10q - 4q^2 + q^3$, $AVC = 10 - 4q + q^2$

$$\frac{dAVC}{dq} = 0 \qquad \frac{d(10 - 4q + q^2)}{dq} = 0$$

$$\Rightarrow \qquad \Rightarrow -4 + 2q = 0$$

$\therefore q = 2$

i.e. AVC is minimum when output is equal to 2 units.

- The minimum AVC is obtained by

2.2.2 Short run equilibrium of the industry

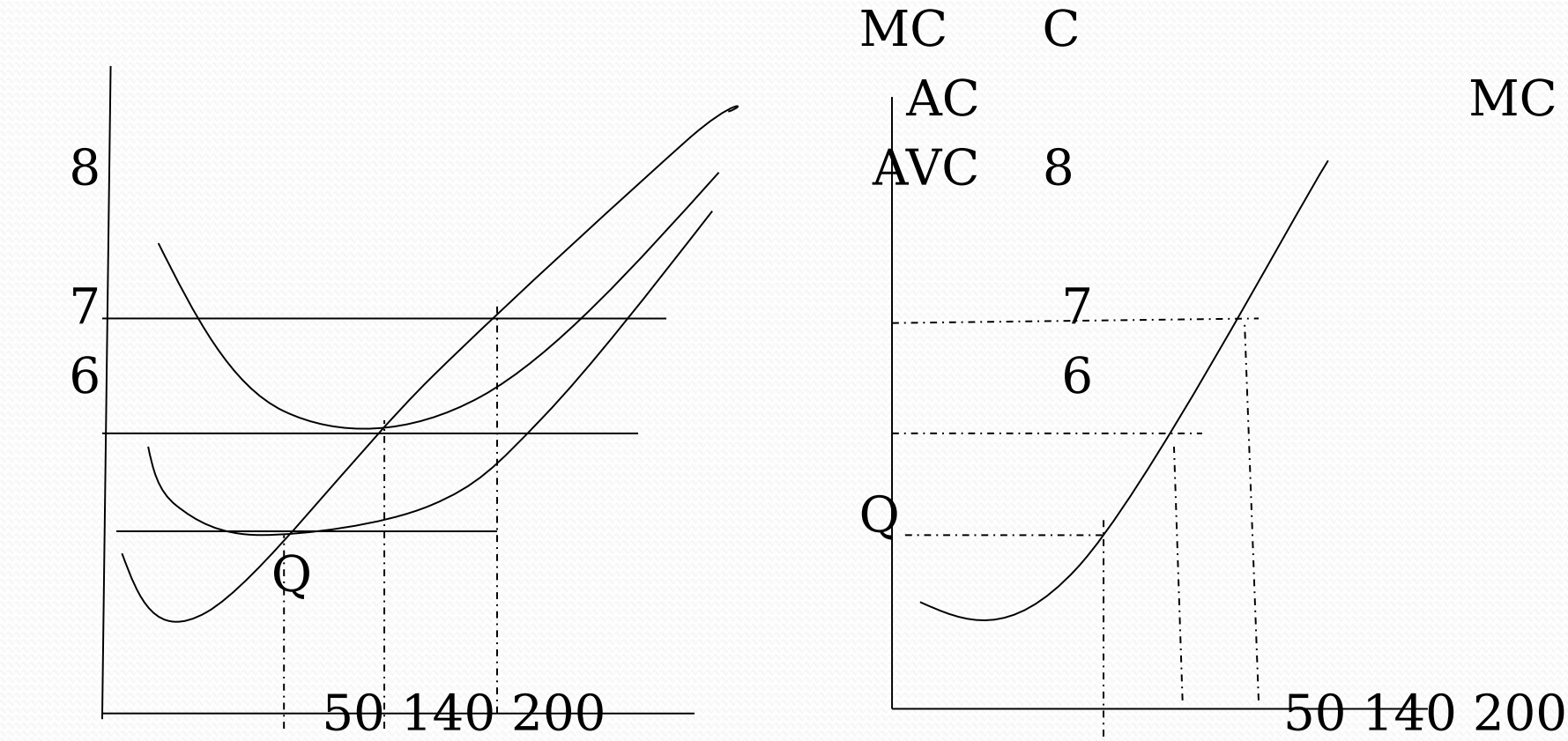
- It is defined by intersection of market dd & market ss
- It determines equilibrium price and quantity
- Unlike the individual demand curve, the **market demand curve is down-ward sloping**, indicating that as the market price of the commodity increases, the total quantity demanded for the product decreases and vice versa.
- Level of profit of the industry in the short run depends on the value of AC and P at equilibrium

1. When AC <P positive profit

2.3 The short run supply curve

The short run supply curve of the firm

- **It** is part of MC curve which lies above the minimum AVC



Short run supply Cont…

Example: given that the perfectly competitive firm incurs a total cost of $TC=100+60Q-12Q^2+Q^3$,then derive the short run supply function

It is part of the MC above the minimum of AVC

$TC=100+60Q-12Q^2+Q^3 \Rightarrow MC=60-24Q+3Q^2$

But $TVC=60Q-12Q^2+Q^3 \Rightarrow AVC=60-12Q+Q^2$

$(AVC')=0 \Rightarrow -12+2Q=0 \Rightarrow Q=6$ is the output at the minimum point of AVC

The supply function is given by $P=60-24Q+3Q^2$,$Q \geq 6$

The short run supply curve Cont…

The short run curve of an industry supply

- It is the total supply or market supply of a given product.
- It is the horizontal summation of the supply curves of all individual firms.
- The total quantity supplied in the market at each price is the sum of the quantities supplied by all firms at that price.
- This is based on the assumption that the factor prices and the technology are given.

2.2.4 The long-run Equilibrium

1-Long run equilibrium of an individual firm

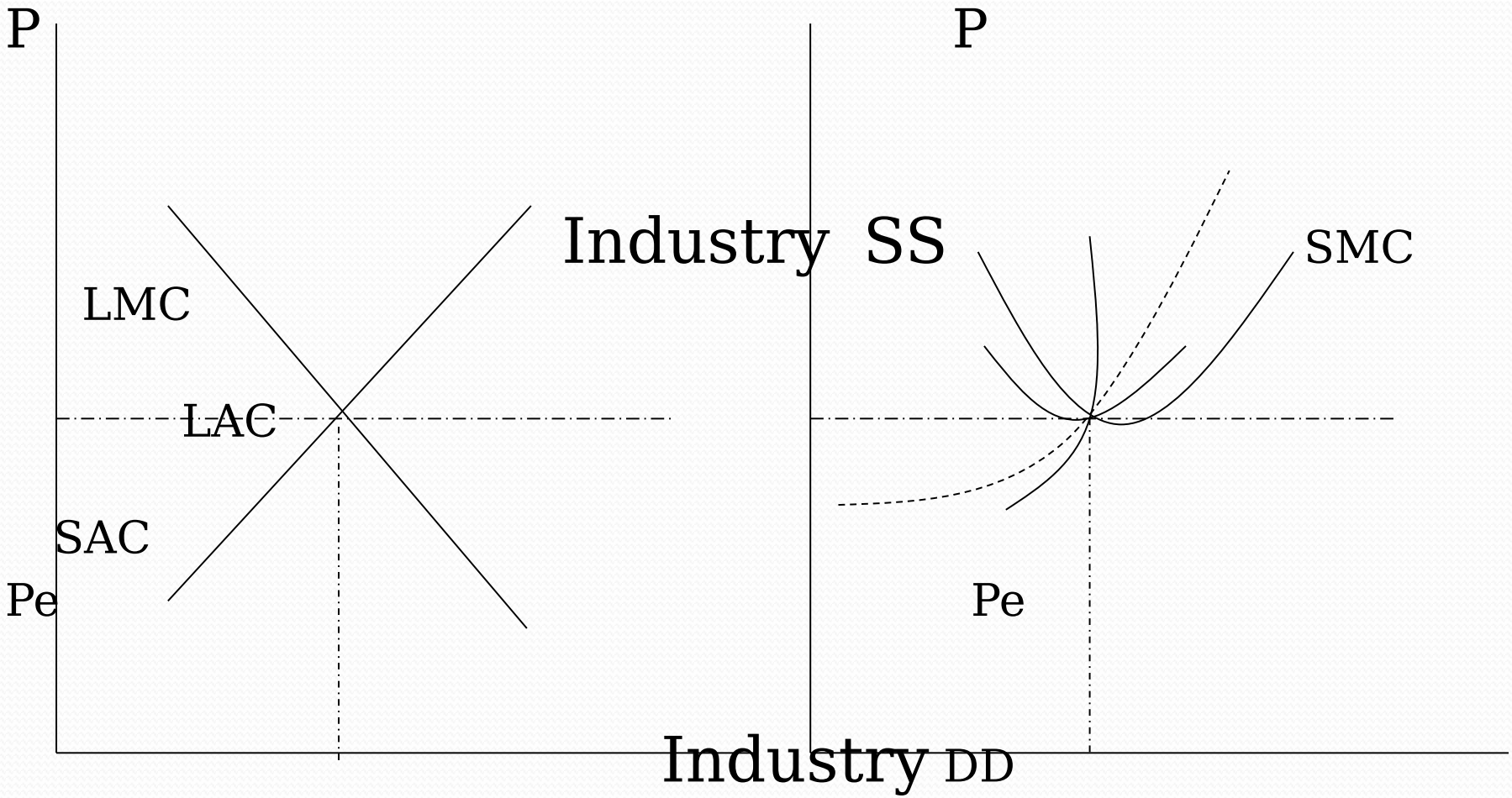
- **It exists when the market price is equal to the minimum long run AC** i.e. **LMC = LAC = P.**
- Since price is equal to LAC at the long run equilibrium, **firms will earn just normal profits (zero profits),**because ;

A. positive profit attracts new firms and forces the market price down to the equilibrium
B. Negative profit leads some firms to leave the market which forces the market price upward to the equilibrium point

- **At equilibrium SMC=LMC=SAC=LAC=P= MR**

The long-run Equilibrium

- long-run equilibrium of the industry is defined by the price at which all individual firms are in equilibrium, marking just normal profit.



The long-run Equilibrium Cont…

Long run shut down decision

- In the long run all costs are variable **the firm shuts down when its revenue falls below the long run total cost or,**
- if the **market price falls below the minimum LAC of the firm.**

The long-run supply curves the firm & industry

- **A firm's long- run supply curve:** is its LMC curve above the minimum of its LRAC curve
- **The long run supply curve of the industry:** is the horizontal sum of the supply of individual which is up ward sloping, provided that the firms are of different in size.

The long-run Equilibrium Cont…

2. Long-run equilibrium of the industry

- An industry is in the long-run equilibrium when the price is reached at which **all firms are in equilibrium.**
- That is, when all firms are producing at the minimum point of their LAC curve and making just normal profits.
- Under these conditions there is no further entry or exit of firms in the industry, so that the industry supply remains stable.
- At this price all firms are in equilibrium because: LMC=SMC=P=MR and they get only normal profit because LAC=SAC=P

PCM and optimal resource allocation

- In the PCM leads to an **optimal allocation of resources** which is shown by the following conditions;

1st The output is produced at the minimum feasible cost. That is all firms produce at the minimum of their LAC.

2nd Consumers pay the minimum possible price which just covers the MC of production, i.e. price equals just opportunity cost so that the consumers are not exploited.

3rd Plants are used at full capacity in the long- run so that there is no waste of resources.

4th Firms earn only normal profits.

- All these conditions are prevail in the long run equilibrium of the industry and justify the fact that

Review questions

1. XY Enterprises is a small firm in the steel office chairs industry, which is perfectly competitive. The market price of each chair is Br.640. The cost function of the firm is TC = 240Q – 20Q2 + Q3.

A. What is the profit maximizing output?

B. What is the AVC when the level of output is 20 units?

C. What is the profit earned by the XY Enterprises if the output sold in the market is 20 units?

D. Suppose the local government imposes a specific tax of Rs.325 per chair on the XY Enterprises, calculate the profit maximizing output

E. The local government imposes a specific tax of Br.325 per chair on the XY Enterprises. If the firm is producing 15 units, the profits earned by the XY Enterprises is

Review questions Cont…

Given; TC= TC = 240Q – 20Q2 + Q3 and P=640

MC = 240 – 40Q + $3Q^2$ and MR = P = 640

a. Profit maximize when

MR = MC ⇒ 640 = 240 – 40Q + $3Q^2$

⇒ 3Q2– 40Q– 400=0 ⇒ **Q = 20** or –6.67.

But negative value does not make sense therefore profit maximizing output is 20 units.

b. AC = TC/Q = 240 – 20Q + Q2 ,at Q = 20

AC = 240 – (20 x 20) +20^2 = Br.240

c. Profit (π) = TR – TC

Review questions Cont…

d. When a tax of Br.325 per chair is imposed on the XY Enterprises

$TC = 240Q - 20Q^2 + Q^3 + 325Q = -20Q^2 + Q^3 + 565Q$

$MC = 565 - 40Q + 3Q^2$

The profit maximizing when $640 = 565 - 40Q + 3Q^2$ or

$3Q^2 - 40Q - 75 = 0 \Rightarrow \mathbf{Q = 15}$ or –1.67

Therefore the profit maximizing output Q = 15 chairs.

e. Profit (π) = TR – TC

TR = (15 x 640) = Br.9600

$TC = 565O - 20O^2 + O^3 = Br.7350$

Review questions Cont...

2. A bicycle manufacturer sells bicycles in a perfectly competitive market. The cost function is $TC = 5000 + 150Q - 20Q^2 + Q^3$. What is the price below which the manufacturers shutdown operations?

- The shutdown point is where P= the least possible AVC.

$TC = 5{,}000 + 150Q - 20Q^2 + Q^3$

$TVC = 150Q - 20Q^2 + Q^3 \Rightarrow AVC = TVC/Q = 150 - 20Q + Q^2$

At the lowest level AVC is equivalent to $MC = 150 - 40Q + 3Q^2$

$150 - 40Q + 3Q^2 = 150 - 40Q + 3Q^2 \Rightarrow 2Q^2 - 20Q = 0$

$\therefore Q = 10$ or 0

The AVC is lowest when the output is 10.

$AVC = 150 - (20 \times 10) + 10^2 = 50$

$\therefore$If the price falls below 50, the firm will shut down operations.