Unit 5
Market Structure

a. Perfect Competition
b. Monopoly
c. Monopolistic Competition
d. Oligopoly

a. Perfect Competition

5. Perfect Competition

Perfect competition is a market structure characterised by a complete absence of rivalry among the individual firms. Thus perfect competition in economic theory has a meaning diametrically opposite to the everyday use of this term. In practice businessmen use the word competition as synonymous to rivalry. In theory, perfect competition implies no rivalry among firms.

I. ASSUMPTIONS

The model of *perfect competition* is based on the following assumptions.

Large numbers of sellers and buyers

The industry or market includes a large number of firms (and buyers), so that each individual firm, however large, supplies only a small part of the total quantity offered in the market. The buyers are also numerous so that no monopsonistic power can affect the working of the market. Under these conditions each firm alone cannot affect the price in the market by changing its output.

Product homogeneity

The industry is defined as a group of firms producing a homogeneous product. The technical characteristics of the product as well as the services associated with its sale and delivery are identical. There is no way in which a buyer could differentiate among the products of different firms. If the product were differentiated the firm would have some discretion in setting its price. This is ruled out *ex hypothesi* in perfect competition.

The assumptions of large numbers of sellers and of product homogeneity imply that the individual firm in pure competition is a price-taker: its demand curve is infinitely elastic, indicating that the firm can sell any amount of output at the prevailing market

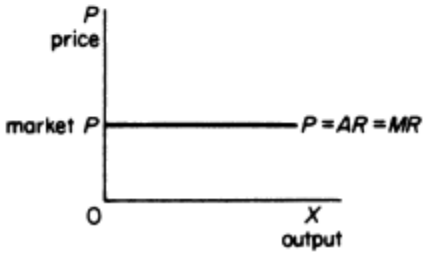


Figure 5.1

price (figure 5.1). The demand curve of the individual firm is also its average revenue and its marginal revenue curve (see page 156).

Free entry and exit of firms

There is no barrier to entry or exit from the industry. Entry or exit may take time, but firms have freedom of movement in and out of the industry. This assumption is supplementary to the assumption of large numbers. If barriers exist the number of firms in the industry may be reduced so that each one of them may acquire power to affect the price in the market.

Profit maximisation

The goal of all firms is profit maximisation. No other goals are pursued.

No government regulation

There is no government intervention in the market (tariffs, subsidies, rationing of production or demand and so on are ruled out).

The above assumptions are sufficient for the firm to be a price-taker and have an infinitely elastic demand curve. The market structure in which the above assumptions are fulfilled is called *pure competition*. It is different from *perfect competition*, which requires the fulfilment of the following additional assumptions.

Perfect mobility of factors of production

The factors of production are free to move from one firm to another throughout the economy. It is also assumed that workers can move between different jobs, which implies that skills can be learned easily. Finally, raw materials and other factors are not monopolised and labour is not unionised. In short, there is perfect competition in the markets of factors of production.

Perfect knowledge

It is assumed that all sellers and buyers have complete knowledge of the conditions of the market. This knowledge refers not only to the prevailing conditions in the current period but in all future periods as well. Information is free and costless. Under these conditions uncertainty about future developments in the market is ruled out.

Under the above assumptions we will examine the equilibrium of the firm and the industry in the short run and in the long run.

II. SHORT-RUN EQUILIBRIUM

In order to determine the equilibrium of the industry we need to derive the market supply. This requires the determination of the supply of the individual firms, since the market supply is the sum of the supply of all the firms in the industry.

Q. Explain how a firm in the market of perfect competition is in short-run equilibrium.

A. EQUILIBRIUM OF THE FIRM IN THE SHORT RUN

The firm is in equilibrium when it maximises its profits (Π), defined as the difference between total cost and total revenue:

$$\Pi = TR - TC$$

Given that the normal rate of profit is included in the cost items of the firm, Π is the profit above the normal rate of return on capital and the remuneration for the risk-bearing function of the entrepreneur. The firm is in equilibrium when it produces the output that maximises the difference between total receipts and total costs. The equilibrium of the firm may be shown graphically in two ways. Either by using the *TR* and *TC* curves, or the *MR* and *MC* curves.

1. TR-TC Approach

In figure 5.2 we show the total revenue and total cost curves of a firm in a perfectly competitive market. The total-revenue curve is a straight line through the origin, showing that the price is constant at all levels of output. The firm is a price-taker and can sell any amount of output at the going market price, with its *TR* increasing proportionately with its sales. The slope of the *TR* curve is the marginal revenue. It is constant and equal to the prevailing market price, since all units are sold at the same price. Thus in pure competition $MR = AR = P$.

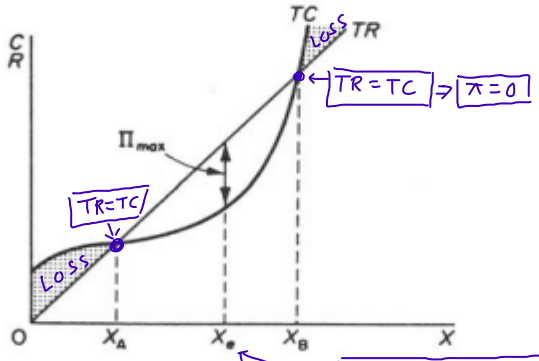


Figure 5.2

The shape of the total-cost curve reflects the U shape of the average-cost curve, that is, the law of variable proportions. The firm maximises its profit at the output X_e, where the distance between the *TR* and *TC* curves is the greatest. At lower and higher levels of output total profit is not maximised: at levels smaller than X_A and larger than X_B the firm has losses.

2. MR-MC Approach

The total-revenue–total-cost approach is awkward to use when firms are combined together in the study of the industry. The alternative approach, which is based on marginal cost and marginal revenue, uses price as an explicit variable, and shows clearly the behavioural rule that leads to profit maximisation.

In figure 5.3 we show the average- and marginal-cost curves of the firm together with its demand curve. We said that the demand curve is also the average revenue curve and

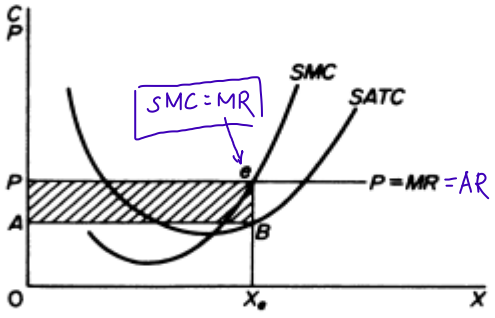


Figure 5.3

S = short run
M = Marginal
C = cost
T = Total
SMC ≡ MC
SATC ≡ SAC ≡ AC
R = Revenue

Short-run equilibrium of a firm with abnormal or excess profit.

the marginal revenue curve of the firm in a perfectly competitive market. The marginal cost cuts the *SATC* at its minimum point. Both curves are U-shaped, reflecting the law of variable proportions which is operative in the short run during which the plant is constant. The firm is in equilibrium (maximises its profit) at the level of output defined by the intersection of the *MC* and the *MR* curves (point *e* in figure 5.3). To the left of *e* profit has not reached its maximum level because each unit of output to the left of X_e brings to the firm a revenue which is greater than its marginal cost. To the right of X_e each additional unit of output costs more than the revenue earned by its sale, so that a loss is made and total profit is reduced. In summary:

(*a*) If $MC < MR$ total profit has not been maximised and it pays the firm to expand its output.

(*b*) If $MC > MR$ the level of total profit is being reduced and it pays the firm to cut its production.

(*c*) If $MC = MR$ short-run profits are maximised.

Thus the first condition for the equilibrium of the firm is that marginal cost be equal to marginal revenue. However, this condition is not sufficient, since it may be fulfilled and yet the firm may not be in equilibrium. In figure 5.4 we observe that the condition

Two conditions for equilibrium — (i) MC = MR and (ii) MC curve must cut MR curve from below — are satisfied at e, not at e'.

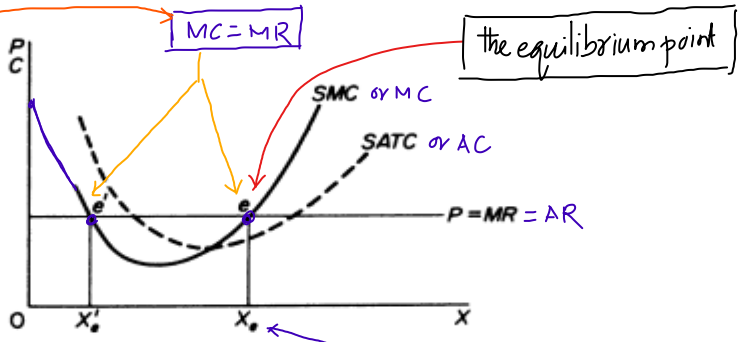


Figure 5.4

$MC = MR$ is satisfied at point e', yet clearly the firm is not in equilibrium, since profit is maximized at $X_e > X_{e'}$. The second condition for equilibrium requires that the *MC* be rising at the point of its intersection with the *MR* curve. This means that the *MC* must cut the *MR* curve from below, i.e. the slope of the *MC* must be steeper than the slope of the *MR* curve. In figure 5.4 the slope of *MC* is positive at *e*, while the slope of the *MR* curve is zero at all levels of output. Thus at *e* both conditions for equilibrium are satisfied

(i) $MC = MR$

and

(ii) (slope of *MC*) > (slope of *MR*).

It should be noted that the *MC* is always positive, because the firm must spend some money in order to produce an additional unit of output. Thus at equilibrium the *MR* is also positive.

The fact that a firm is in (short-run) equilibrium does not necessarily mean that it makes excess profits. Whether the firm makes excess profits or losses depends on the level of the *ATC* at the short-run equilibrium. If the *ATC* is below the price at equilibrium (figure 5.5) the firm earns excess profits (equal to the area *PABe*). If, however, the *ATC* is above the price (figure 5.6) the firm makes a loss (equal to the area *FPeC*). In the latter case the firm will continue to produce only if it covers its variable costs. Otherwise it will close down, since by discontinuing its operations the firm is better off: it mimimises its losses. The point at which the firm covers its variable costs is called 'the closing-down

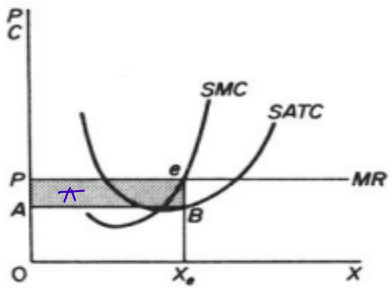


Figure 5.5

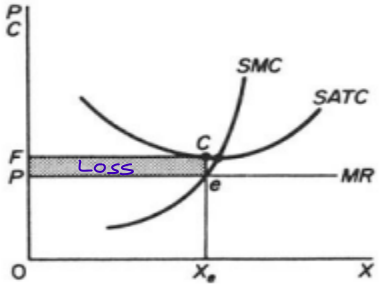


Figure 5.6

(The firm's short-run equilibrium with abnormal profits.)

(The firm's short-run equilibrium with losses)

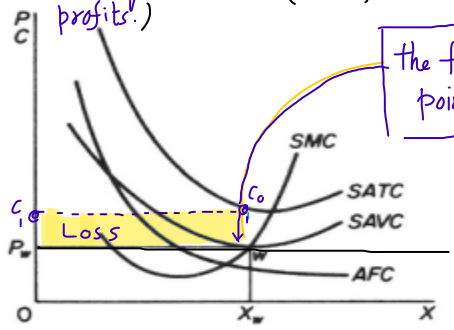


Figure 5.7

(The firm's short-run equilibrium with losses: W is the closing-down point)

point.' In figure 5.7 the closing-down point of the firm is denoted by point w. If price falls below P_w the firm does not cover its variable costs and is better off if it closes down.

Mathematical derivation of the equilibrium of the firm

The firm aims at the maximisation of its profit

$$\Pi = R - C$$

where Π = profit
R = total revenue
C = total cost

Clearly $R = f_1(X)$ and $C = f_2(X)$, given the price P.

(*a*) The first-order condition for the maximisation of a function is that its first derivative (with respect to X in our case) be equal to zero. Differentiating the total-profit function and equating to zero we obtain

$$\frac{\partial \Pi}{\partial X} = \frac{\partial R}{\partial X} - \frac{\partial C}{\partial X} = 0$$

or

$$\frac{\partial R}{\partial X} = \frac{\partial C}{\partial X}$$

The term $\partial R/\partial X$ is the slope of the total revenue curve, that is, the marginal revenue. The term $\partial C/\partial X$ is the slope of the total cost curve, or the marginal cost. Thus the first-order condition for profit maximisation is

$$MR = MC$$

Given that $MC > 0$, MR must also be positive at equilibrium. Since $MR = P$ the first-order condition may be written as $MC = P$.

(*b*) The second-order condition for a maximum requires that the second derivative of the function be negative (implying that after its highest point the curve turns downwards). The second derivative of the total-profit function is

$$\frac{\partial^2 \Pi}{\partial X^2} = \frac{\partial^2 R}{\partial X^2} - \frac{\partial^2 C}{\partial X^2}$$

This must be negative if the function has been maximised, that is

$$\frac{\partial^2 R}{\partial X^2} - \frac{\partial^2 C}{\partial X^2} < 0$$

which yields the condition

$$\frac{\partial^2 R}{\partial X^2} < \frac{\partial^2 C}{\partial X^2}$$

But $\partial^2 R/\partial X^2$ is the slope of the MR curve and $\partial^2 C/\partial X^2$ is the slope of the MC curve. Hence the second-order condition may verbally be written as follows

$$(\text{slope of } MR) < (\text{slope of } MC)$$

Thus the MC must have a steeper slope than the MR curve or the MC must cut the MR curve from below. In pure competition the slope of the MR curve is zero, hence the second-order condition is simplified as follows

$$0 < \frac{\partial^2 C}{\partial X^2}$$

which reads: the MC curve must have a positive slope, or the MC must be rising.

B. THE SUPPLY CURVE OF THE FIRM AND THE INDUSTRY

The supply curve of the firm may be derived by the points of intersection of its MC curve with successive demand curves. Assume that the market price increases gradually. This causes an upward shift of the demand curve of the firm. Given the positive slope of the MC curve, each higher demand curve cuts the (given) MC curve to a point which lies to the right of the previous intersection. This implies that the quantity supplied by the firm increases as price rises. The firm, given its cost structure, will not supply any quantity (will close down) if the price falls below P_w, because at a lower price the firm does not cover its variable costs (figure 5.8). If we plot the successive points of intersection of MC and the demand curves on a separate graph we observe that the supply curve of the individual firm is identical to its MC curve to the right of the closing-down point w. Below P_w the quantity supplied by the firm is zero. As price rises above P_w the quantity supplied increases. The supply curve of the firm is shown in figure 5.9.

The industry-supply curve is the horizontal summation of the supply curves of the individual firms. It is assumed that the factor prices and the technology are given and that the number of firms is very large. Under these conditions the total quantity supplied in the market at each price is the sum of the quantities supplied by all firms at that price. In figure 5.10 we show the industry supply as a straight line with a positive slope. It should, however, be noted that the particular shape of the market-supply curve depends on the technology and on factor prices, as well as the size distribution of the firms in the industry. All firms are not usually of the same size. The particular size of each firm in perfect competition depends on the entrepreneurial efficiency of the businessman, which is traditionally considered as a random attribute.

The firm's supply curve

SMC = MR₁

SMC = MR₂

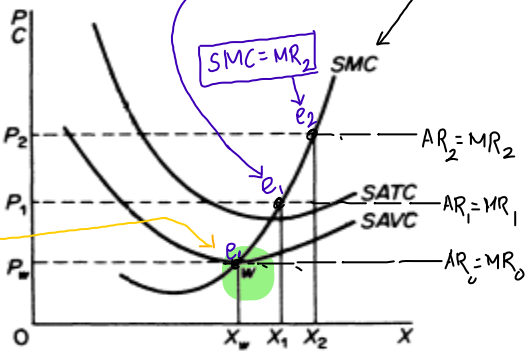


Figure 5.8

An industry's short-run supply curve

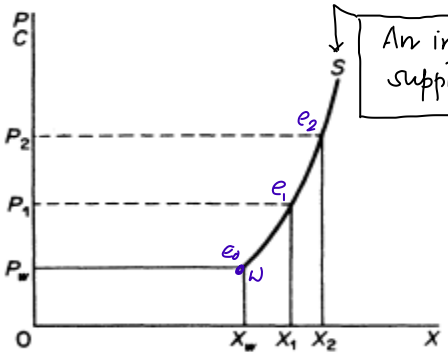


Figure 5.9

SMC = MR₁

C. SHORT-RUN EQUILIBRIUM OF THE INDUSTRY

Given the market demand and the market supply the industry is in equilibrium at that price which *clears the market*, that is at the price at which the quantity demanded is equal to the quantity supplied. In figure 5.10 the industry is in equilibrium at price P, at which the quantity demanded and supplied is $\bar{Q}$. However, this will be a short-run equilibrium, if at the prevailing price firms are making excess profits (figure 5.11) or losses (figure 5.12). In the long run, firms that make losses and cannot readjust their plant will close down. Those that make excess profits will expand their capacity, while excess profits will also attract new firms into the industry. Entry, exit and readjustment of the remaining firms in the industry will lead to a long-run equilibrium in which firms will just be earning normal profits and there will be no entry or exit from the industry.

The Short-run Equilibrium of Industry

The Long-run Equilibrium of Industry

∵ π ≡ excess profit

DD′ = Industry's or Market Demand curve

SS′ = Industry's supply curve

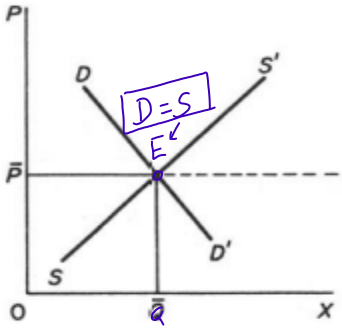


Figure 5.10 Short-run industry equilibrium

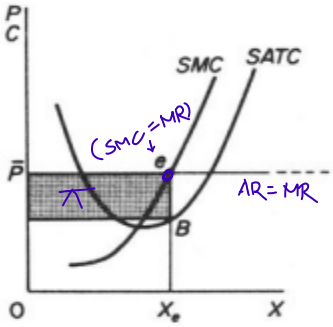


Figure 5.11 Short-run equilibrium of a firm (excess profits)

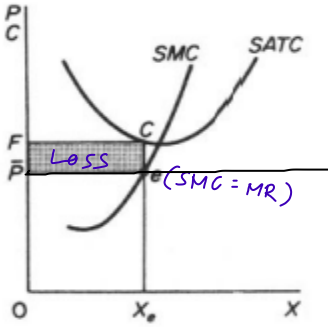


Figure 5.12 Short-run equilibrium of a firm (losses)

III. LONG-RUN EQUILIBRIUM

A. EQUILIBRIUM OF THE FIRM IN THE LONG RUN

In the long run firms are in equilibrium when they have adjusted their plant so as to produce at the minimum point of their long-run AC curve, which is tangent (at this point) to the demand curve defined by the market price. In the long run the firms will be earning just normal profits, which are included in the LAC. If they are making excess profits new firms will be attracted in the industry; this will lead to a fall in price (a down-

ward shift in the individual demand curves) and an upward shift of the cost curves due to the increase of the prices of factors as the industry expands. These changes will continue until the *LAC* is tangent to the demand curve defined by the market price. If the firms make losses in the long run they will leave the industry, price will rise and costs may fall as the industry contracts, until the remaining firms in the industry cover their total costs inclusive of the normal rate of profit.

In figure 5.14 we show how firms adjust to their long-run equilibrium position. If the price is *P*, the firm is making excess profits working with the plant whose cost is denoted by SAC_1. It will therefore have an incentive to build new capacity and it will move along its *LAC*. At the same time new firms will be entering the industry attracted by the excess profits. As the quantity supplied in the market increases (by the increased production of expanding old firms and by the newly established ones) the supply curve in the market will shift to the right and price will fall until it reaches the level of P_1 (in figure 5.13) at which the firms and the industry are in long-run equilibrium. The *LAC* in figure 5.14 is the final-cost curve including any increase in the prices of factors that may have taken place as the industry expanded.

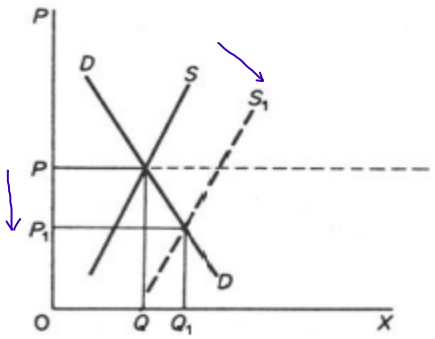


Figure 5.13

(An industry)

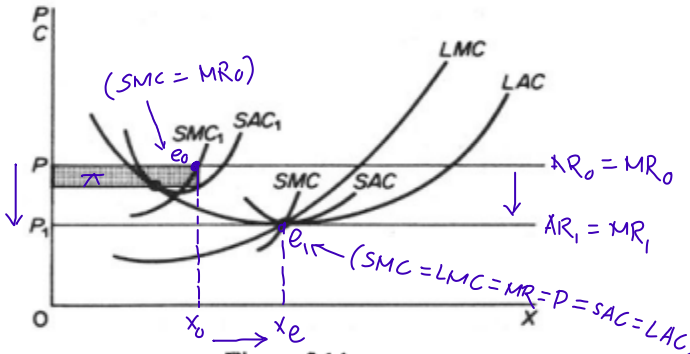


Figure 5.14

(A firm's long-run equilibrium (e_1) with normal profit)

The condition for the long-run equilibrium of the firm is that the marginal cost be equal to the price and to the long-run average cost

$$LMC = LAC = P$$

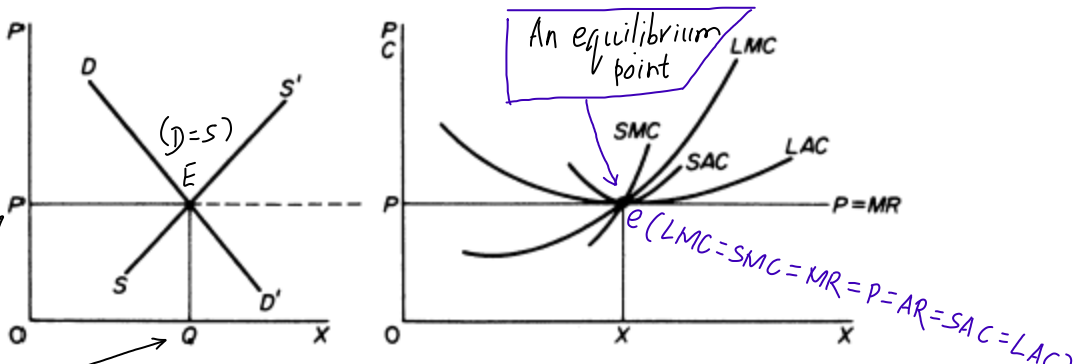
The firm adjusts its plant size so as to produce that level of output at which the *LAC* is the minimum possible, given the technology and the prices of factors of production. At equilibrium the short-run marginal cost is equal to the long-run marginal cost and the short-run average cost is equal to the long-run average cost. Thus, given the above equilibrium condition, we have

$$SMC = LMC = LAC = LMC = P = MR$$

This implies that at the minimum point of the *LAC* the corresponding (short-run) plant is worked at its optimal capacity, so that the minima of the *LAC* and *SAC* coincide. On the other hand, the *LMC* cuts the *LAC* at its minimum point and the *SMC* cuts the *SAC* at its minimum point. Thus at the minimum point of the *LAC* the above equality between short-run and long-run costs is satisfied.

B. EQUILIBRIUM OF THE INDUSTRY IN THE LONG RUN

The industry is in long-run equilibrium when a price is reached at which all firms are in equilibrium (producing at the minimum point of their *LAC* curve and making



An equilibrium price

An equilibrium quantity

(An industry's long-run equilibrium): D = S

Figure 5.15 (A firm's long-run equilibrium with normal profit)

just normal profits). Under these conditions there is no further entry or exit of firms in the industry, given the technology and factor prices. The long-run equilibrium of the industry is shown in figure 5.15. At the market price, P, the firms produce at their minimum cost, earning just normal profits. The firm is in equilibrium because at the level of output X

$LMC = SMC = P = MR$ ⇒(The firm's equilibrium condition)

This equality ensures that the firm maximises its profit.

At the price P the industry is in equilibrium because profits are normal and all costs are covered so that there is no incentive for entry or exit. That the firms earn just normal profit (neither excess profits nor losses) is shown by the equality

$LAC = SAC = P$ ⇒[the firms' nomal profit]

∵[P = AR

The Derivation of the Long-Run Supply (LS) Curve Under Perfect Competition

8.8 CONSTANT COST INDUSTRIES

Starting from a position of long-run equilibrium for the perfectly competitive firm and industry, if the market demand curve for the commodity increases, thus giving a higher market equilibrium price, each firm will expand output within its existing plant in the short run and make some pure economic profit. In the long run, more firms will enter the industry, and *if factor prices remain constant*, the market supply of the commodity will increase until the original market equilibrium price is reestablished. Thus, *the long-run market supply curve for this industry is horizontal* (at the level of minimum LAC) and the industry is referred to as a "constant cost industry."

EXAMPLE 11. In panel B of Fig. 8-8, the original market equilibrium price of $8 is established by the intersection of the short-run industry or market demand curve (D) and supply curve (S) for the commodity (see point 1 in the figure). At this price, the perfectly competitive firm (panel A) is in long-run equilibrium at point E (as in Fig. 8-7). If all firms have identical cost curves, there will be 100 identical firms in the industry, each producing 400 units of the 40,000 units equilibrium output for the industry. If, for some reason, the short-run market demand curve shifts up to D′, the new market equilibrium price of this commodity becomes $16 (point 2 in panel B of Fig. 8-8). At this new price, each of the identical 100 firms will expand output within its existing scale of plant in the short run to 600 units (given by point C) and will make a profit of $5 per unit ($CF$) and $3000 in total.

EXAMPLE 12. Since all firms in Example 11 make profits, in the long run more firms will enter the industry. If factor prices remain constant, the short-run market supply curve will shift to S′, giving (at the intersection with D′) the original market equilibrium price of $8 per unit (see point 3 in panel B). At this price, each perfectly competitive firm will return to the original long-run equilibrium point (point E in panel A). There will now be 200 identical firms, each producing 400 units of the 80,000 units new equilibrium output for the industry. By joining equilibrium points 1 and 3, we get the long-run supply curve (LS) for this perfectly competitive industry. Since the LS curve is horizontal (at the level of minimum LAC), this is a constant cost industry.

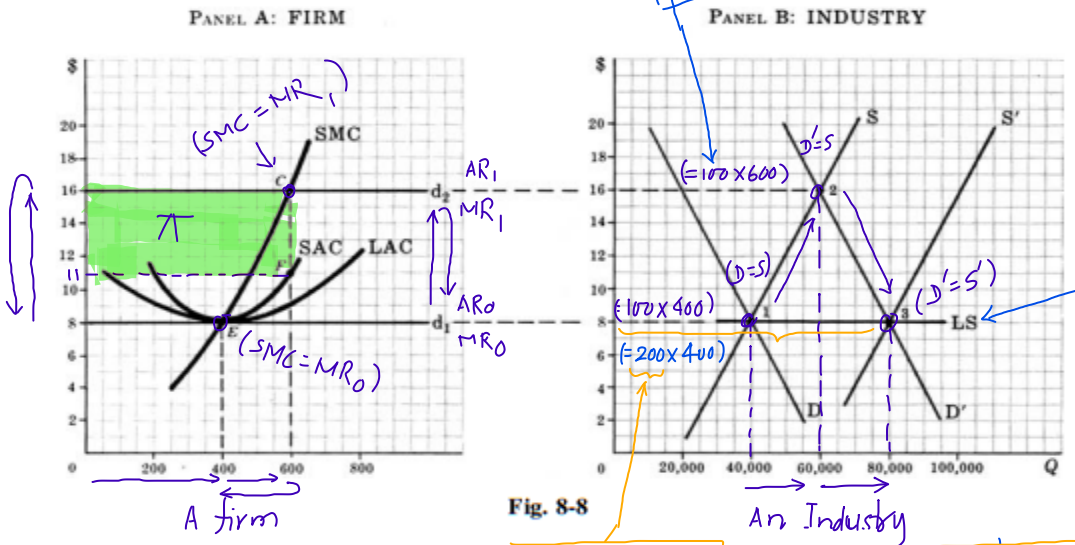


Fig. 8-8

8.9 INCREASING COST INDUSTRIES

If factor prices rise as more firms (attracted by pure economic profits in the short run) enter a perfectly competitive industry in the long run and as the industry output is expanded, we have an increasing cost industry. In this case, the industry long-run supply curve is positively sloped, indicating that greater outputs of the commodity per unit of time will be forthcoming in the long run only at higher prices.

EXAMPLE 13. In Fig. 8-9 the perfectly competitive industry and the firm are originally in long-run equilibrium at points 1 and *E*, respectively. If the short-run market demand curve shifts from D to D′ the new equilibrium price becomes $16 (point 2) and each established firm will expand output in the short run to point *C* and make *CF* profits per unit (so far Example 13 is identical with Example 11). If factor prices *rise* as more firms enter this industry, the firm's entire set of cost curves will *shift up* (from LAC, SAC, and SMC to LAC′, SAC′, and SMC′). The firm and industry will return to long-run equilibrium when the short-run industry supply curve has shifted from S to S′, giving the new equilibrium price of $12 (point 3) at which all firms just break even (point *E*′). We will now have 175 firms, each producing 400 units of the new equilibrium output of 70,000 units for the industry. Joining market equilibrium points 1 and 3, we get the rising industry LS curve.

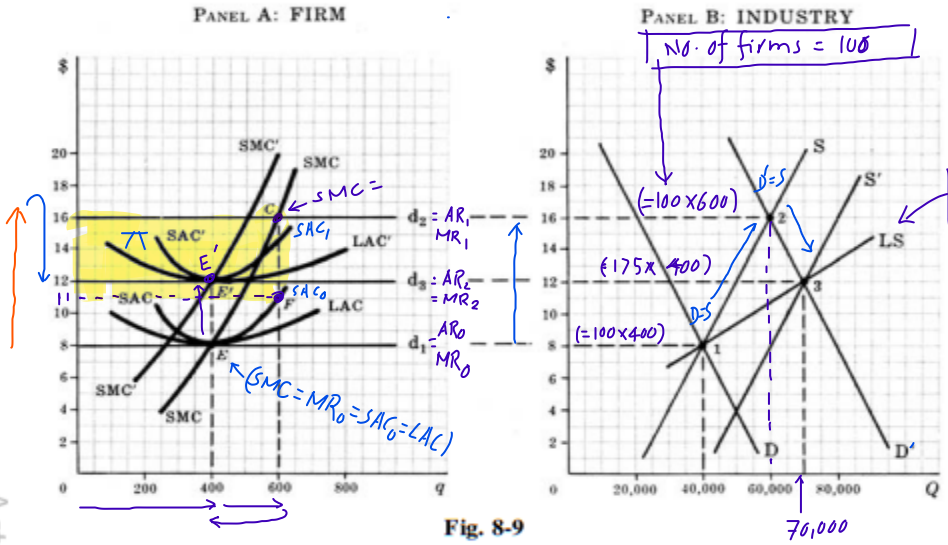


Fig. 8-9

8.10 DECREASING COST INDUSTRIES

If factor prices fall as more firms (attracted by the short-run pure economic profits) enter a perfectly competitive industry in the long run and as the industry output is expanded, we have a decreasing cost industry. In this case, the industry long-run supply curve is negatively sloped, indicating that greater outputs per unit of time will be forthcoming in the long run at *lower* prices (see Problems 8.22 and 8.23).

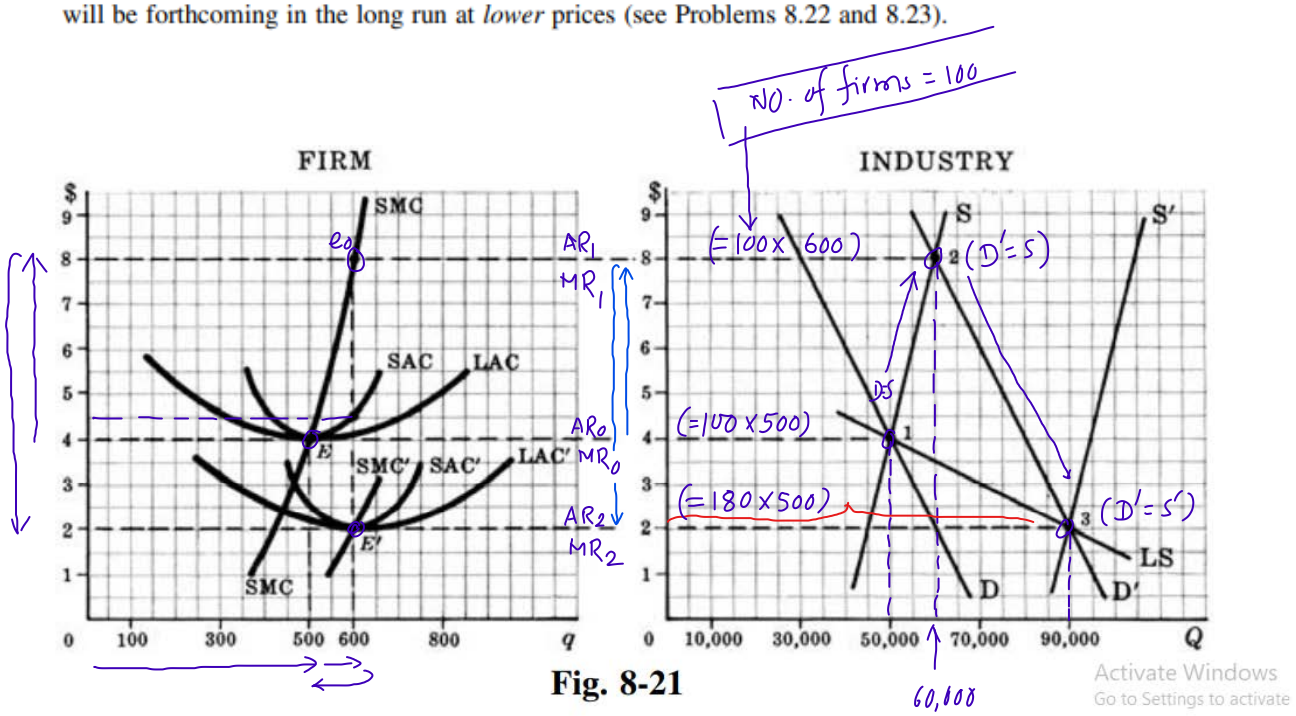


Fig. 8-21

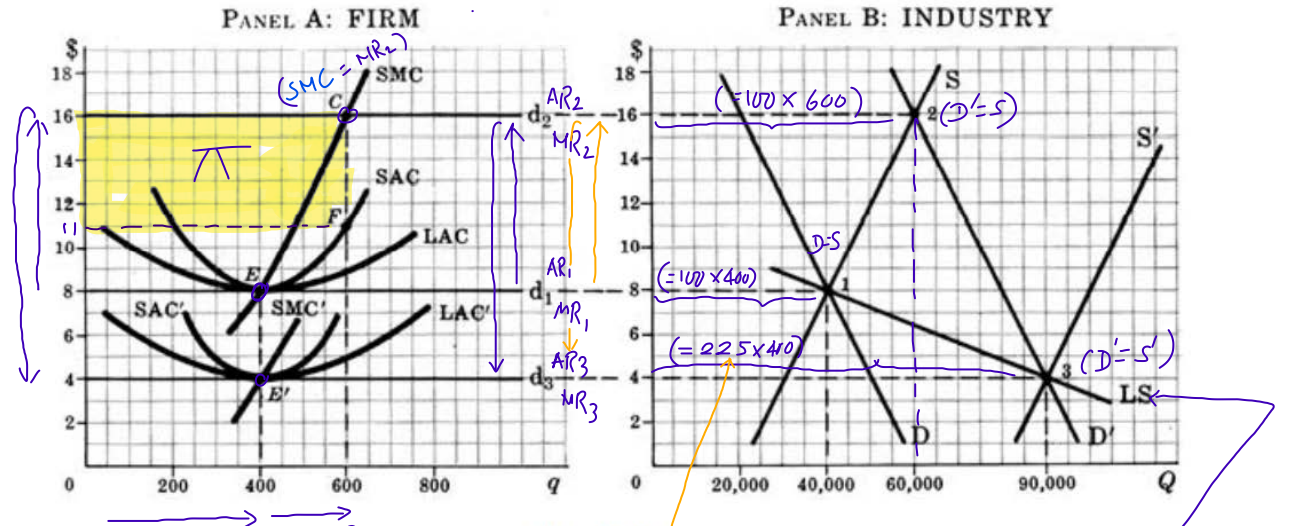


Fig. 8-22

A firm

An industry

No. of firms = 100

No. of firms = 225

Long-run supply (LS) curve of a decreasing cost industry

Glossary

Break-even point The output level at which the firm's TR equals its TC and the firm's total profits are zero.

Constant cost industry An industry whose long-run supply curve is horizontal (at the level of minimum LAC) because factor prices remain constant as industry output expands.

Decreasing cost industry An industry whose long-run supply curve is negatively sloped because factor prices fall as industry output expands.

Increasing cost Industry An industry whose long-run supply curve is positively sloped because factor prices rise as industry output expands.

Long-run equilibrium of the perfectly competitive firm The output level at which MR or P equals LMC and LMC is rising (provided that $P \geqslant$ LAC).

Marginal revenue **(MR)** The change in TR for a one-unit change in the quantity sold.

Market period The very short run or time period in which the market supply of the commodity is completely fixed.

Perfect competition The form of market organization in which (1) there are a great number of sellers and buyers of the commodity, so that the actions of an individual cannot affect the price of the commodity, (2) the products of all firms in the market are homogeneous, (3) there is perfect mobility of resources, and (4) consumers, resource owners, and firms in the market have perfect knowledge of present and future prices and costs.

Profit The excess of P over AC and TR over TC.

Short-run equilibrium of the perfectly competitive firm The output level at which MR or P equals MC and MC is rising (provided that $P >$ AVC).

Short-run supply curve The rising portion of the perfectly competitive firm's marginal cost (MC) curve, over and above its AVC curve or shut-down point.

Shut-down point The output level at which $P =$ AVC and losses equal TFC, whether the firm produces or not.

Total revenue **(TR)** It equals price times quantity.

Review Questions

1. Which of the following industries most closely approximates the perfectly competitive model? (*a*) Automobile, (*b*) cigarette, (*c*) newspaper, or (*d*) wheat farming.

Ans. (*d*) In the first three choices we have few sellers in the market; we have a differentiated product and vast amounts of capital are needed to enter the industry (among other things). These conditions are not true in wheat farming.

2. Given the supply of a commodity in the market period, the price of the commodity is determined by (*a*) the market demand curve alone, (*b*) the market supply curve alone, (*c*) the market demand curve and the market supply curve, or (*d*) none of the above.

Ans. (*a*) See Fig. 8-2.

3. Total profits are maximized where (*a*) TR equals TC, (*b*) the TR curve and the TC curve are parallel, (*c*) the TR curve and the TC curve are parallel and TC exceeds TR, or (*d*) the TR curve and the TC curve are parallel and TR exceeds TC.

Ans. (*d*) See points *A*, *B*, and *D* in Fig. 8-3.

4. The best, or optimum, level of output for a perfectly competitive firm is given by the point where (*a*) MR equals AC, (*b*) MR equals MC, (*c*) MR exceeds MC by the greatest amount, or (*d*) MR equals MC and MC is rising.

Ans. (*d*) See point *D'* in Fig. 8-4.

5. At the best, or optimum, short-run level of output, the firm will be (*a*) maximizing total profits, (*b*) minimizing total losses, (*c*) either maximizing total profits or minimizing total losses, or (*d*) maximizing profits per unit.

Ans. (*c*) Whether the firm is maximizing total profits or minimizing total losses in the short run depends on whether *P* exceeds AC or *P* falls short of AC at the best level of output.

6. If *P* exceeds AVC but is smaller than AC at the best level of output, the firm is (*a*) making a profit, (*b*) incurring a loss but should continue to produce in the short run, (*c*) incurring a loss and should stop producing immediately, or (*d*) breaking even.

Ans. (*b*) The firm minimizes losses in the short run (at a level smaller than its TFC) by continuing to produce at the best level of output (see point *C* in Fig. 8-5).

7. At the shut-down point, (*a*) *P* = AVC, (*b*) TR = TVC, (*c*) the total losses of the firm equal TFC, or (*d*) all of the above.

Ans. (*d*) See point *F* in Fig. 8-5.

8. The short-run supply curve of the perfectly competitive firm is given by

(*a*) the rising portion of its MC curve over and above the shut-down point,
(*b*) the rising portion of its MC curve over and above the break-even point,
(*c*) the rising portion of its MC curve over and above the AC curve, or
(*d*) the rising portion of its MC curve.

Ans. (*a*) See Fig. 8-5 and panel A of Fig. 8-6.

9. When the perfectly competitive firm and industry are both in long-run equilibrium

(*a*) $P = \text{MR} = \text{SMC} = \text{LMC}$, (*b*) $P = \text{MR} = \text{SAC} = \text{LAC}$,
(*c*) $P = \text{MR}$ = lowest point on the LAC curve, or (*d*) all of the above.

Ans. (*d*) See point *E* in Fig. 8-7.

10. When the perfectly competitive firm but not the industry is in long-run equilibrium,

(*a*) $P = \text{MR} = \text{SMC} = \text{SAC}$, (*b*) $P = \text{MR} = \text{LMC} = \text{LAC}$,
(*c*) $P = \text{MR} = \text{SMC} = \text{LMC} \neq \text{SAC} = \text{LAC}$, or
(*d*) $P = \text{MR} = \text{SMC} = \text{LMC} \neq \text{SAC}$ = lowest point on the LAC curve.

Ans. (*c*) See points *A* and *B* in Fig. 8-7.

11. An increase in output in a perfectly competitive and constant cost industry which is in long-run equilibrium will come (*a*) entirely from new firms, (*b*) entirely from existing firms, (*c*) either entirely from new firms or entirely from existing firms, or (*d*) partly from new firms and partly from existing firms.

Ans. (*a*) See equilibrium points 1, 3, and *E* in Fig. 8-8.

12. If factor prices and factor quantities move in the same direction, we have (*a*) a constant cost industry, (*b*) an increasing cost industry, (*c*) a decreasing cost industry, or (*d*) any of the above.

Ans. (*b*) In order to increase the industry output of a commodity, more factors are required. If factor prices rise as factor usage increases, the perfectly competitive industry LS curve will slope upward and we have an increasing cost industry. The opposite occurs for a decrease in the industry output (compare equilibrium point 3 to equilibrium point 1 in panel B of Fig. 8-9).

Curves Repeated for Practices

Figure 1

A Firm's Short-run Equilibrium Under Perfect Competition: TR and TC Approach

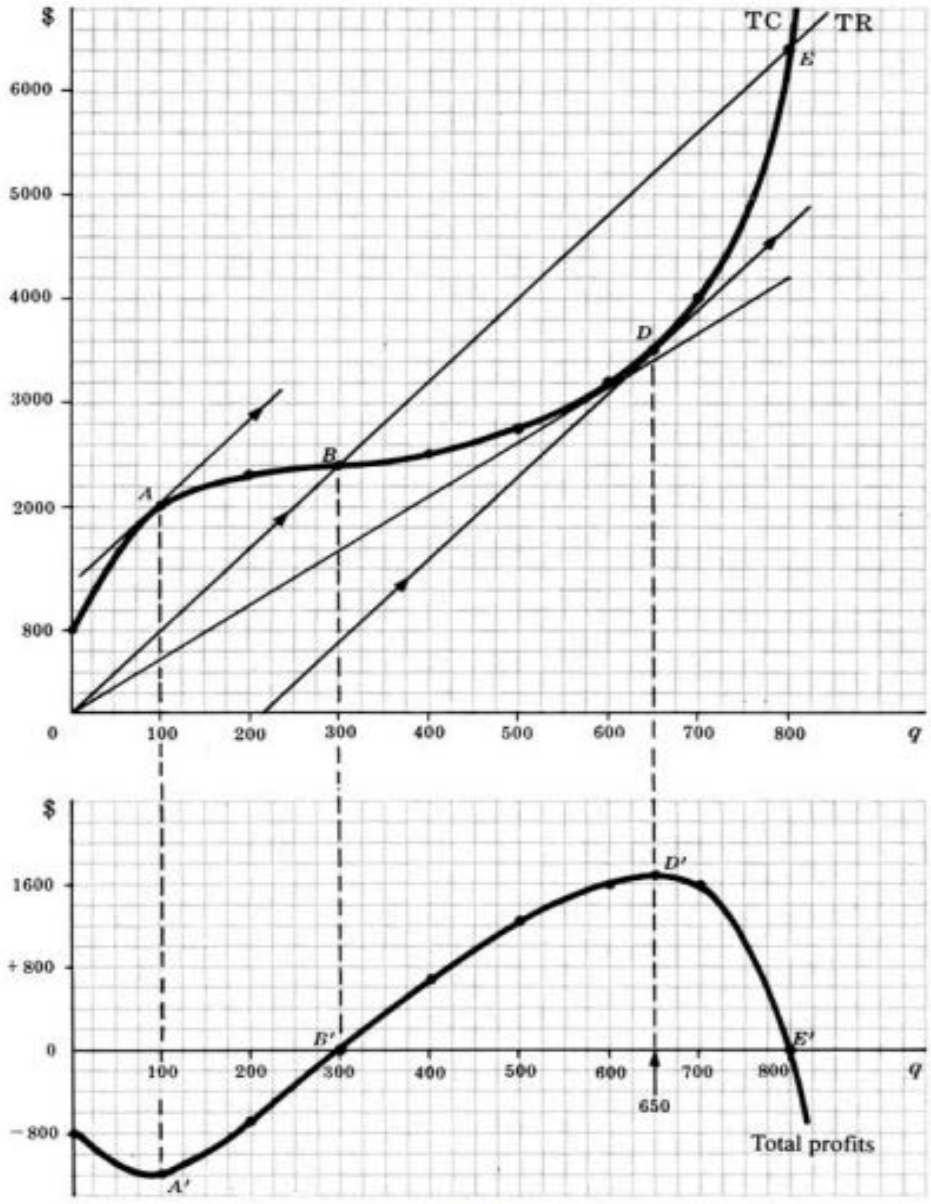


Fig. 8-3

According to the TR-TC approach in Figure 1, a firm is said to be in equilibrium at the output level (q = 650 units) where there is the maximum vertical difference between the TR and TC curves.

Figure 2

A Firm's Short-run Equilibrium Under Perfect Competition: MR and MC Approach

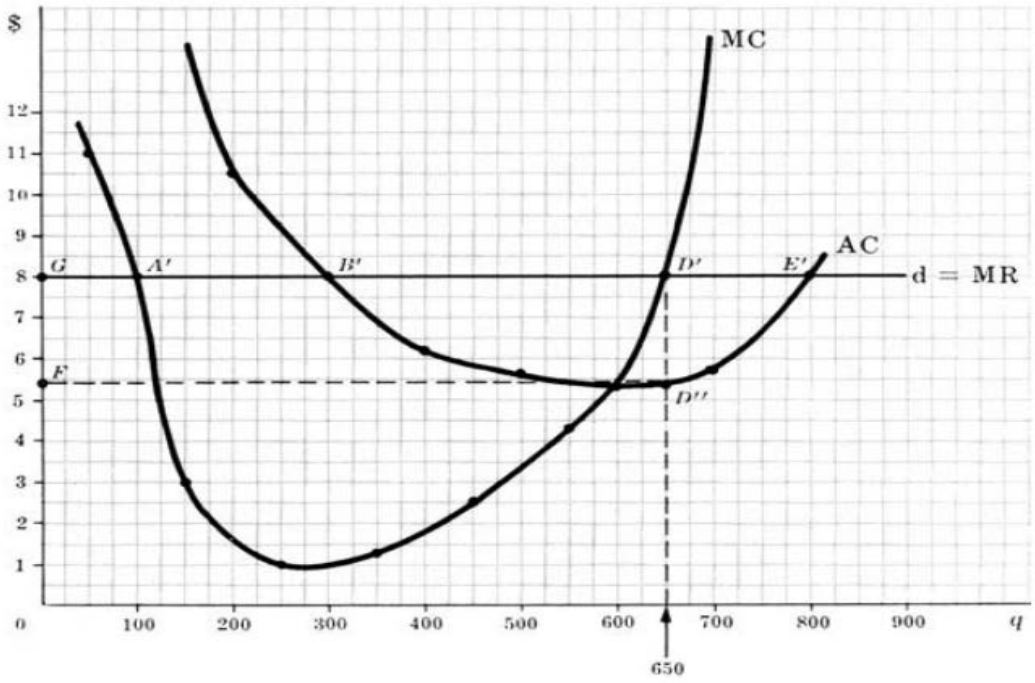
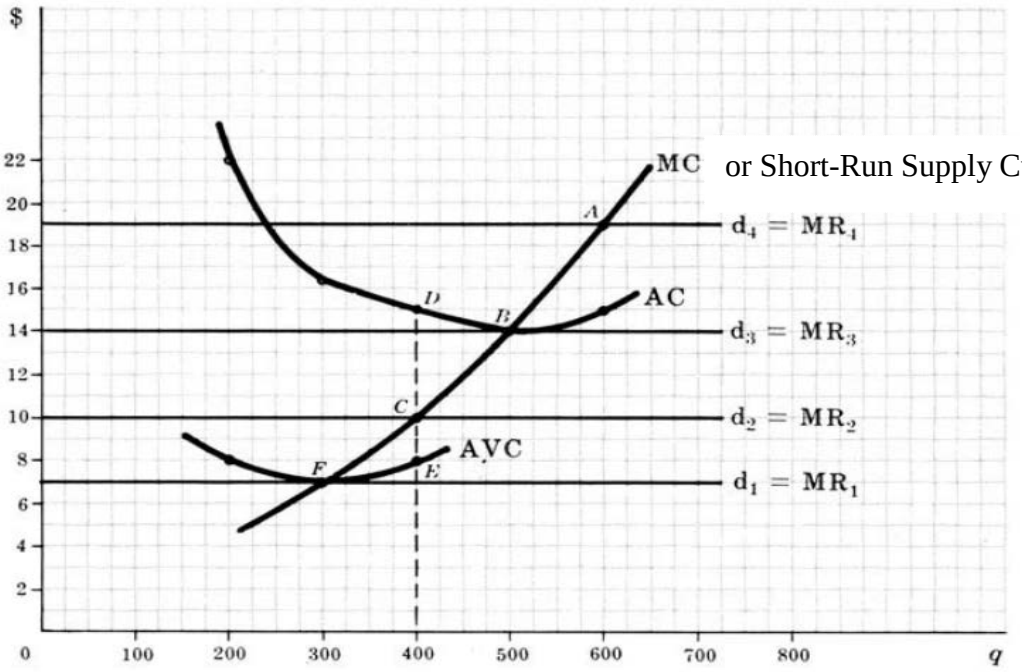


Fig. 8-4

In Figure 2, the firm's short-run equilibrium point (D') determines the equilibrium price of Rs. 8 and the equilibrium quantity of 650 units according to the MR-MC approach.

Figure 3

The Derivation of the Firm's Short-Run Supply Curve



or Short-Run Supply Curve

Fig. 8-5

EXAMPLE 8. Panel A of Fig. 8-6 gives the short-run supply curve of the firm in Example 7 and Fig. 8-5. The industry or market short-run supply curve shown in panel B is obtained on the assumption that there are 100 *identical* firms in the industry and factor prices remain constant to this industry regardless of the amount of inputs it uses. (The "$\sum$" sign refers to the "summation of.") Note that no output of the commodity is produced at prices below $7 per unit.

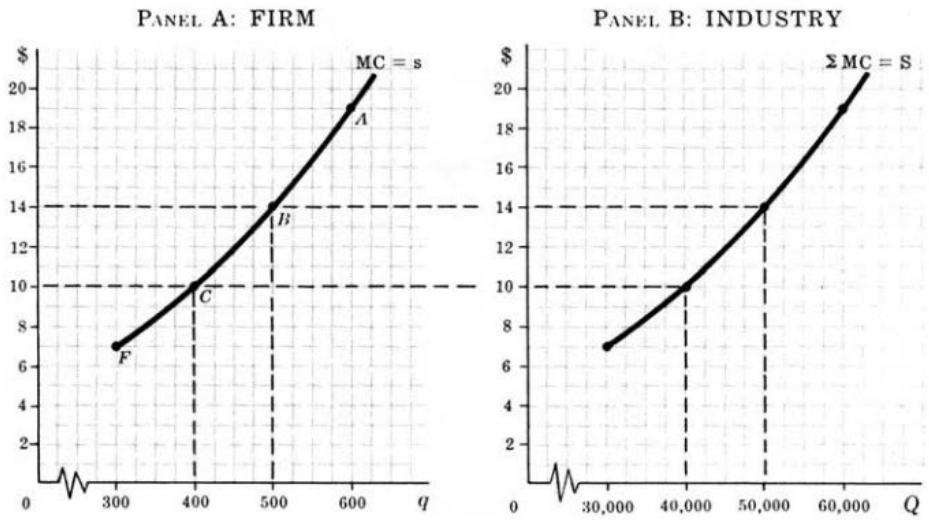


Fig. 8-6

Figure 4. The derivation of an industry's supply curve in the short-run.

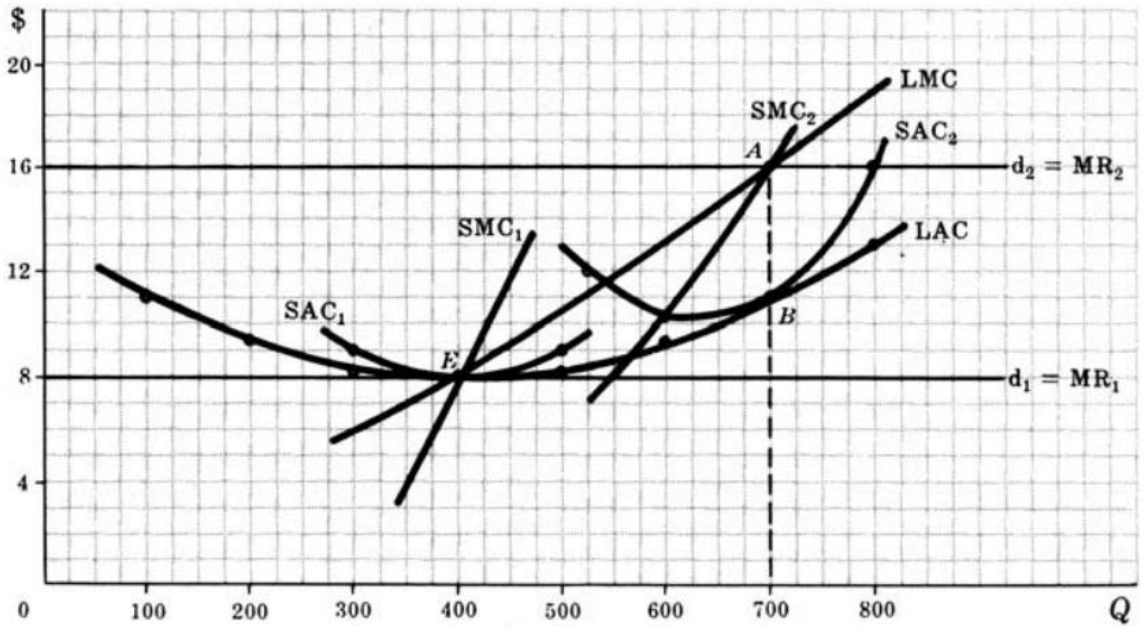


Fig. 8-7

The derivation of the LMC curve under perfect competition

Figure 5
The Derivation of the Long-run Supply Curve (LRS or LS) Under a Constant-Cost Industry (Perfect Competition)

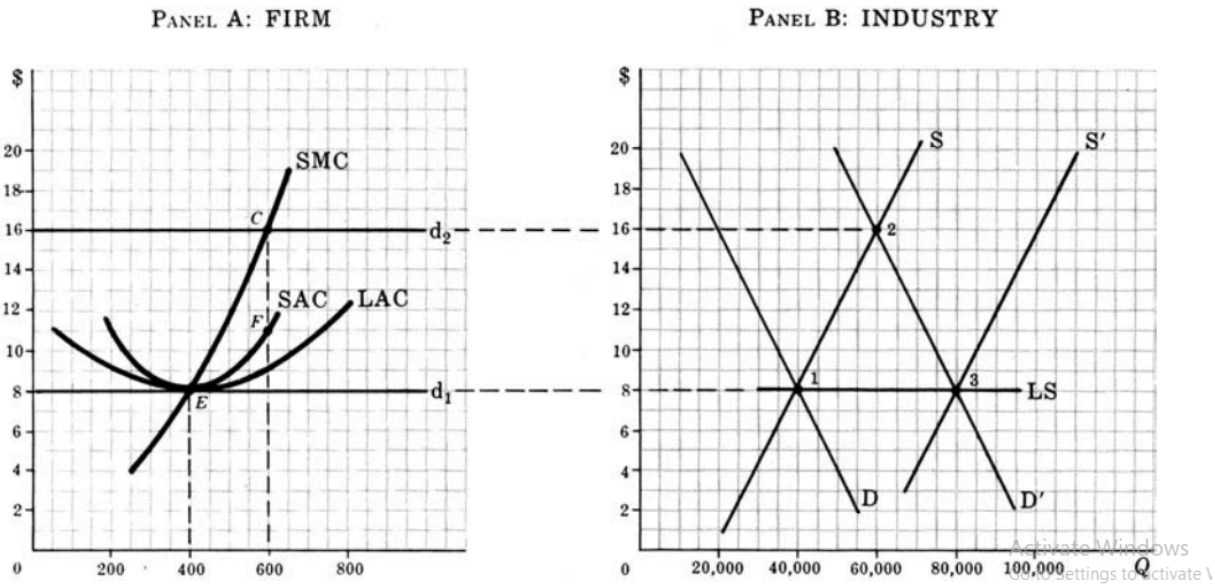


Figure 5
The Derivation of the Long-run Supply Curve (LRS or LS) Under an Increasing-Cost Industry (Perfect Competition)

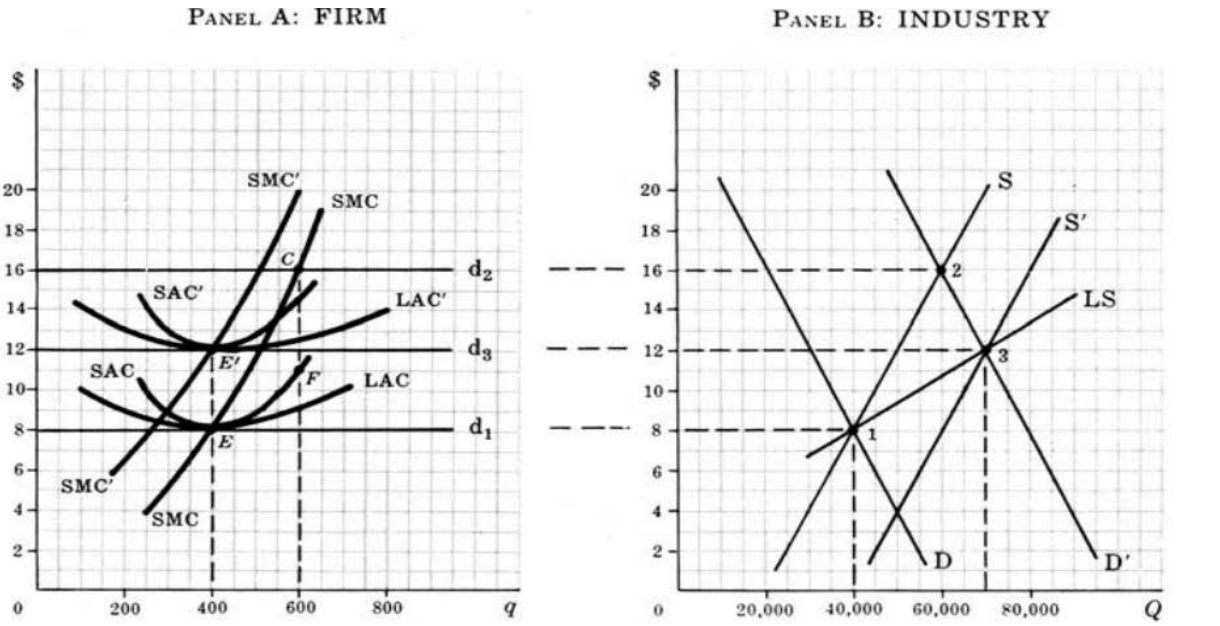


Fig. 8-9

8.1 PERFECT COMPETITION DEFINED

A market is said to *be perfectly competitive* if (1) there are a great number of sellers and buyers of the commodity, so that the actions of an individual cannot affect the price of the commodity; (2) the products of all firms in the market are homogeneous; (3) there is perfect mobility of resources; and (4) consumers, resource owners, and firms in the market have perfect knowledge of present and future prices and costs (see Problem 8.1).

In a perfectly competitive market, the price of the commodity is determined exclusively by the intersection of the market demand curve and the market supply curve for the commodity. The perfectly competitive firm is then a "price taker" and can sell any amount of the commodity at the established price.

EXAMPLE 1. In Fig. 8-1, d is the demand curve facing a "representative" or average firm in a perfectly competitive market. Note that d is infinitely elastic or is given by a horizontal line at the equilibrium market price of \$8 per unit. This means that the firm can sell any quantity of the commodity at that price.

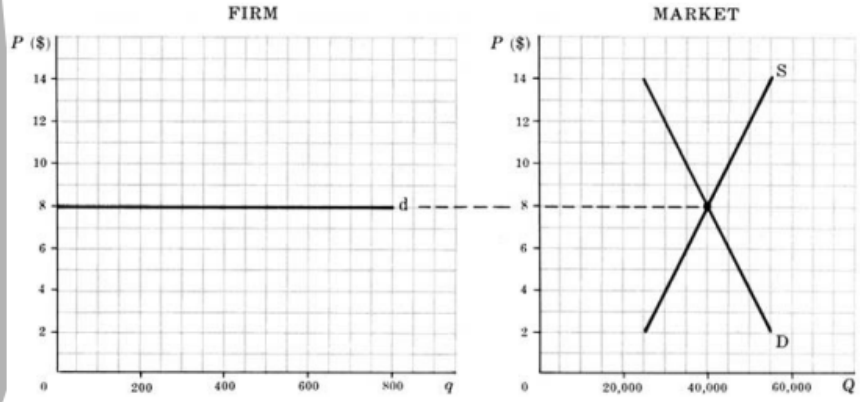


Fig. 8-1

PERFECT COMPETITION DEFINED

8.1 Explain in detail exactly what is meant by each of the four component parts of the definition of perfect competition given in the text.

(*a*) According to the first part of the definition, there are a great number of sellers and buyers of the commodity under perfect competition, each seller or buyer being too small (or behaving as though too small) in relation to the market to be able to affect the price of the commodity by one's own actions. This means that a change in the output of a single firm will not *perceptibly* affect the market price of the commodity. Similarly, each buyer of the commodity is too small to be able to extract from the seller such things as quantity discounts and special credit terms.

(*b*) The product of each firm in the market is homogeneous, identical, or perfectly standardized. As a result, the buyer cannot distinguish between the output of one firm and that of another, and so is indifferent as to the particular firm from which to buy. This refers not only to the physical characteristics of the commodity but also to the "environment" (such as the pleasantness of the seller, selling location, etc.) in which the purchase is made.

(*c*) There is perfect mobility of resources. That is, workers and other inputs can easily move geographically and from one job to another, and respond very quickly to monetary incentives. No input required in the production of the commodity is monopolized by its owners or producers. In the long run, firms can enter or leave the industry without much difficulty. That is, there are no patents or copyrights, "vast amounts" of capital are not necessary to enter the industry, and already established firms do not have any lasting cost advantage over new entrants because of experience or size.

(*d*) Consumers, resource owners, and firms in the market have perfect knowledge as to present and future prices, costs, and economic opportunities in general. Thus consumers will not pay a higher price than necessary for the commodity. Price differences are quickly eliminated and a single price will prevail throughout the market for the commodity. Resources are sold to the highest bidder. With perfect knowledge of present and future prices and costs, producers know exactly how much to produce.

8.2 (*a*) Does perfect competition as defined above exist in the real world? (*b*) Why do we study the perfectly competitive model?

(*a*) Perfect competition, as defined above, has never really existed. Perhaps the closest we may have come to satisfying the first three assumptions is in the market for such agricultural commodities as wheat and corn.

(*b*) The fact that perfect competition has never really existed in the real world does not reduce the great usefulness of the perfectly competitive model. As indicated in Chapter 1, a theory must be accepted or rejected on the basis of its ability to explain and to predict correctly, and not on the realism of its assumptions. And the perfectly competitive model does give us some very useful (even if at times rough) explanations and predictions of many real-world economic phenomena when the assumptions of the perfectly competitive model are only approximately (rather than exactly) satisfied. In addition, this model helps us evaluate and compare the *efficiency* with which resources are used under different forms of market organization.

PERFECT COMPETITION DEFINED

8.1 Explain in detail exactly what is meant by each of the four component parts of the definition of perfect competition given in the text.

(*a*) According to the first part of the definition, there are a great number of sellers and buyers of the commodity under perfect competition, each seller or buyer being too small (or behaving as though too small) in relation to the market to be able to affect the price of the commodity by one's own actions. This means that a change in the output of a single firm will not *perceptibly* affect the market price of the commodity. Similarly, each buyer of the commodity is too small to be able to extract from the seller such things as quantity discounts and special credit terms.

(*b*) The product of each firm in the market is homogeneous, identical, or perfectly standardized. As a result, the buyer cannot distinguish between the output of one firm and that of another, and so is indifferent as to the particular firm from which to buy. This refers not only to the physical characteristics of the commodity but also to the "environment" (such as the pleasantness of the seller, selling location, etc.) in which the purchase is made.

(*c*) There is perfect mobility of resources. That is, workers and other inputs can easily move geographically and from one job to another, and respond very quickly to monetary incentives. No input required in the production of the commodity is monopolized by its owners or producers. In the long run, firms can enter or leave the industry without much difficulty. That is, there are no patents or copyrights, "vast amounts" of capital are not necessary to enter the industry, and already established firms do not have any lasting cost advantage over new entrants because of experience or size.

(*d*) Consumers, resource owners, and firms in the market have perfect knowledge as to present and future prices, costs, and economic opportunities in general. Thus consumers will not pay a higher price than necessary for the commodity. Price differences are quickly eliminated and a single price will prevail throughout the market for the commodity. Resources are sold to the highest bidder. With perfect knowledge of present and future prices and costs, producers know exactly how much to produce.

8.2 (*a*) Does perfect competition as defined above exist in the real world? (*b*) Why do we study the perfectly competitive model?

(*a*) Perfect competition, as defined above, has never really existed. Perhaps the closest we may have come to satisfying the first three assumptions is in the market for such agricultural commodities as wheat and corn.

(*b*) The fact that perfect competition has never really existed in the real world does not reduce the great usefulness of the perfectly competitive model. As indicated in Chapter 1, a theory must be accepted or rejected on the basis of its ability to explain and to predict correctly, and not on the realism of its assumptions. And the perfectly competitive model does give us some very useful (even if at times rough) explanations and predictions of many real-world economic phenomena when the assumptions of the perfectly competitive model are only approximately (rather than exactly) satisfied. In addition, this model helps us evaluate and compare the *efficiency* with which resources are used under different forms of market organization.

8.3 A certain car manufacturer regards his business as highly competitive because he is keenly aware of his rivalry with the other few car manufacturers in the market. Like the other car manufacturers, he undertakes vigorous advertising campaigns seeking to convince potential buyers of the superior quality and better style of his automobiles and reacts very quickly to claims of superiority by rivals. Is this the meaning of perfect competition from the economist's point of view? Explain.

The above concept is diametrically opposed to the economist's view of perfect competition. It describes a competitive market, which stresses the *rivalry* among firms. The economist's view stresses the *impersonality* of a perfectly competitive market. That is, according to the economist, in a perfectly competitive market there are so many sellers and buyers of the commodity, each so small in relation to the market, as not to regard others as competitors or rivals at all. The products of all firms in the market are homogeneous, and so there is no rivalry among firms based on advertising and quality and style differences.

8.4 (*a*) What four different types of market organization do economists usually identify?
(*b*) Why do economists identify these four different types of market organization?
(*c*) Why do we study the two extreme forms of market organization first?

(*a*) The four different types of market organization that economists usually identify are perfect competition, monopolistic competition, oligopoly, and pure monopoly. The latter three forms of market organization fall into the realm of imperfect competition.

(*b*) Economists identify these four types of market organization in order to systematize and organize their analysis. However, in the real world, such a sharp distinction does not in fact exist. That is, in the real world, firms often exhibit elements of more than one market form and so it may be difficult to classify them into any one of the above market categories.

(*c*) We look first at the two extreme forms of market organization (i.e., perfect competition and pure monopoly) because historically, these are the models that were first developed. More importantly, these are the models that are more fully and satisfactorily developed. The monopolistic competition and oligopoly models, though more realistic in terms of actual forms of business organization in our economy (and, in general, in most other economies), are not very satisfactory and leave much to be desired from a theoretical point of view.

8.5 Suppose that the market demand in a perfectly competitive *industry* is given by $QD = 70{,}000 - 5000P$ and the market supply function is $QS = 40{,}000 + 2500P$, with P given in dollars, (*a*) Find the market equilibrium price, (*b*) find the market demand schedule and the market supply schedule at prices of \$9, \$8, \$7, \$6, \$5, \$4, \$3, \$2, and \$1, and (*c*) draw the market demand curve, the market supply curve and the demand curve of one of 100 identical, perfectly competitive firms in this industry. (*d*) What is the equation of the demand curve of the firm?

(*a*) In a perfectly competitive market (and in the absence of any interference with the operation of the forces of demand and supply such as government price controls), the price of the commodity is determined exclusively by the market demand curve and the market supply for the commodity.

$$QD = QS$$

$$70{,}000 - 5000P = 40{,}000 + 2500P$$

$$30{,}000 = 7500P$$

$$P = \$4 \text{ (equilibrium price)}$$

(*b*)

Table 8.4

P (\$)	*QD*	*QS*
9	25,000	62,500
8	30,000	60,000
7	35,000	57,500
6	40,000	55,000
5	45,000	52,000
4	50,000	50,000
3	55,000	47,500
2	60,000	45,000
1	65,000	42,500

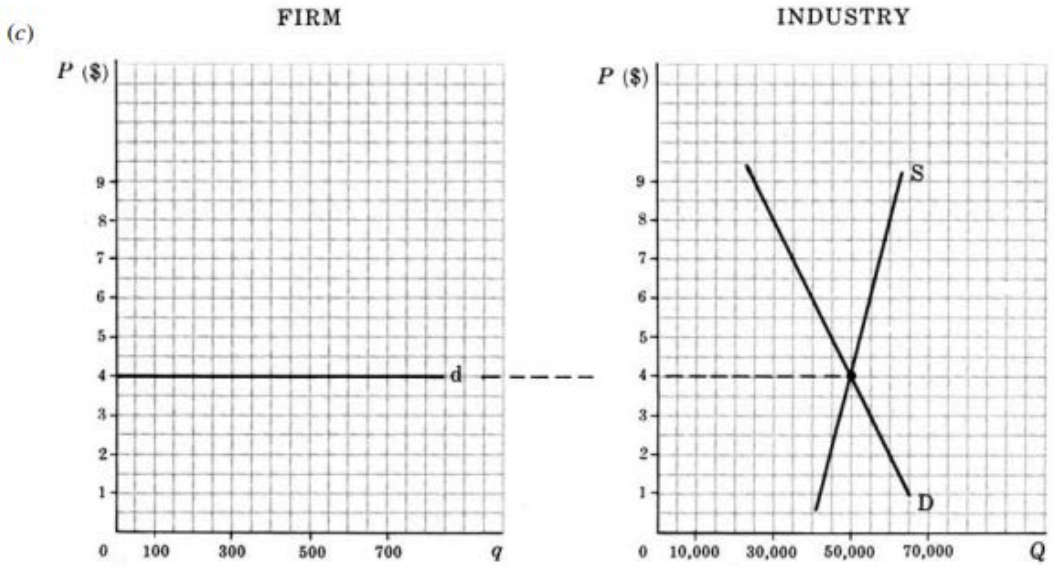


Fig. 8-10

(*d*) The equation of the demand curve for the perfectly competitive firm in this industry is given by $P = \$4$. That is, the firm can sell any quantity at that price. Note that if only one firm increases the quantity of the commodity produced and sold, the effect on the equilibrium market price will be imperceptible. If many or all firms increase output, the market supply curve will shift down and to the right, giving a lower market equilibrium price.

8.18 Must all firms in a perfectly competitive industry have the same cost curves so that when the industry is in long-run equilibrium, they will all just break even? Explain.

Most economists would answer this question in the affirmative. If some firms *appear* to have lower costs than other firms, this is due to the fact that they use *superior resources or inputs* such as more fertile land or superior management. These superior resources, under the threat of leaving to work for other firms, can extract from the firms using them the higher price or return commensurate with their greater productivity. In any event, the firm should price all resources it owns, and the forces of competition will force the firm to price all resources it does not own at their opportunity cost. So it is the owners of such superior resources who receive the benefit (in the form of higher prices or returns) from their greater productivity rather than the firms employing them (in the form of lower costs). This results in all firms having identical cost curves. Therefore, all firms just break even when the perfectly competitive industry is in long-run equilibrium.

8.25 Distinguish between (*a*) decreasing returns to scale and increasing cost industries, (*b*) increasing returns to scale and decreasing cost industries, and (*c*) constant returns to scale and constant cost industries.

(*a*) Decreasing returns to scale or diseconomies of scale refers to an upward sloping LAC curve as the firm expands its output and builds larger scales of plants. This results from factors purely *internal* to the firm (and on the assumption that as a single firm expands, factor prices will remain constant to the firm). An increasing cost industry, on the other hand, is an industry where expansion causes an increase in factor prices. This causes an upward shift in the entire set of cost curves of each firm in the industry. This increase in factor prices and the resulting upward shift in the cost curves of each firm is called an *external* diseconomy. It is external because it results from the expansion of the entire industry and, thus, is due to factors completely outside or external to the firm and over which the firm has no control.

(*b*) The opposite is true for increasing returns to scale and decreasing cost industries. Note that increasing returns to scale over a sufficiently large range of outputs is inconsistent with the existence of perfect competition. This is because the best level of output for the firm may be so large as to require only a few firms to produce the equilibrium industry output (more will be said on this in the chapters that follow).

(*c*) Constant returns to scale refers to a horizontal LAC curve or to the horizontal portion of the LAC curve. This refers to a single firm. A constant cost industry refers to an industry with a horizontal LS curve; this occurs because factor prices remain constant (or the rise in some factors is neutralized by the fall in the price of others) as industry output expands. Note that under constant returns to scale, there is no such thing as a *single or optimum scale of plant*. That is, there are many plants of different sizes, each represented by a SAC curve which is tangent to the LAC curve of the firm at the lowest point of the SAC curve.

PRICE AND OUTPUT UNDER PERFECT COMPETITION WITH CALCULUS

*__8.26__ Derive with the use of calculus the first- and second-order conditions for the output that a perfectly competitive firm must produce in order to maximize total profits.

Total profits (π) are equal to total revenue (TR) minus total costs (TC). That is,

$$\pi = \text{TR} - \text{TC}$$

where π, TR, and TC are all functions of output (Q).

Taking the first derivative of π with respect to Q and setting it equal to zero gives

$$\frac{d\pi}{dQ} = \frac{d(\text{TR})}{dQ} - \frac{d(\text{TC})}{dQ} = 0$$

so that $$\frac{d(\text{TR})}{dQ} = \frac{d(\text{TC})}{dQ} \qquad \text{and} \qquad \text{MR} = \text{MC}$$

Since under perfect competition MR $= P$, the first-order condition for profit maximization for a perfectly competitive firm becomes

$$P = \text{MR} = \text{MC}$$

The above is only the first-order condition for maximization (and minimization). The second-order condition for profit maximization requires that the second derivative of π with respect to Q be negative. That is,

$$\frac{d^2\pi}{dQ^2} = \frac{d^2(\text{TR})}{dQ^2} - \frac{d^2(\text{TC})}{dQ^2} < 0$$

so that $$\frac{d^2(\text{TR})}{dQ^2} < \frac{d^2(\text{TC})}{dQ^2}$$

Since under perfect competition the MR curve is horizontal, this means that the MC curve must be rising at the point where MR = MC for the firm to maximize its total profits (or minimize its total losses).

***8.27** A perfectly competitive firm faces $P = \$4$ and $TC = Q^3 - 7Q^2 + 12Q + 5$. (*a*) Determine by using calculus the best level of output of the firm by the marginal approach and (*b*) find the total profit of the firm at this level of output.

(*a*) $$TR = PQ = \$4Q \qquad \text{so that} \qquad MR = \frac{d(TR)}{dQ} = \$4 = P$$

and $$MC = \frac{d(TC)}{dQ} = 3Q^2 - 14Q + 12$$

Setting MR = MC and solving for Q, we get

$$4 = 3Q^2 - 14Q + 12$$

or

$$3Q^2 - 14Q + 8 = 0$$
$$(3Q - 2)(Q - 4) = 0$$

so that $$Q = \frac{2}{3} \qquad \text{and} \qquad Q = 4$$

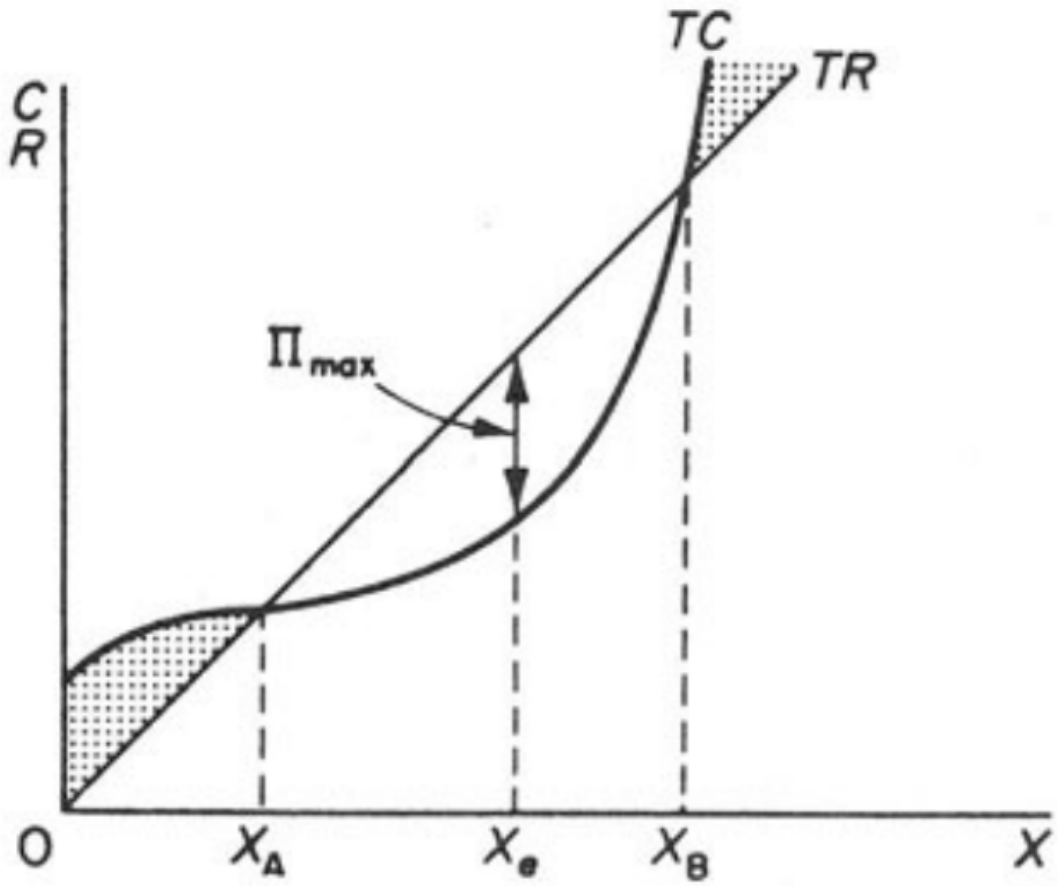
Thus, MR = MC at $Q = 1$ and $Q = 4$.

But in order for profits to be maximized rather than minimized, the MC curve must be rising (i.e., its slope must be positive) at the point where MR = MC. The equation for the slope of the MC curve is

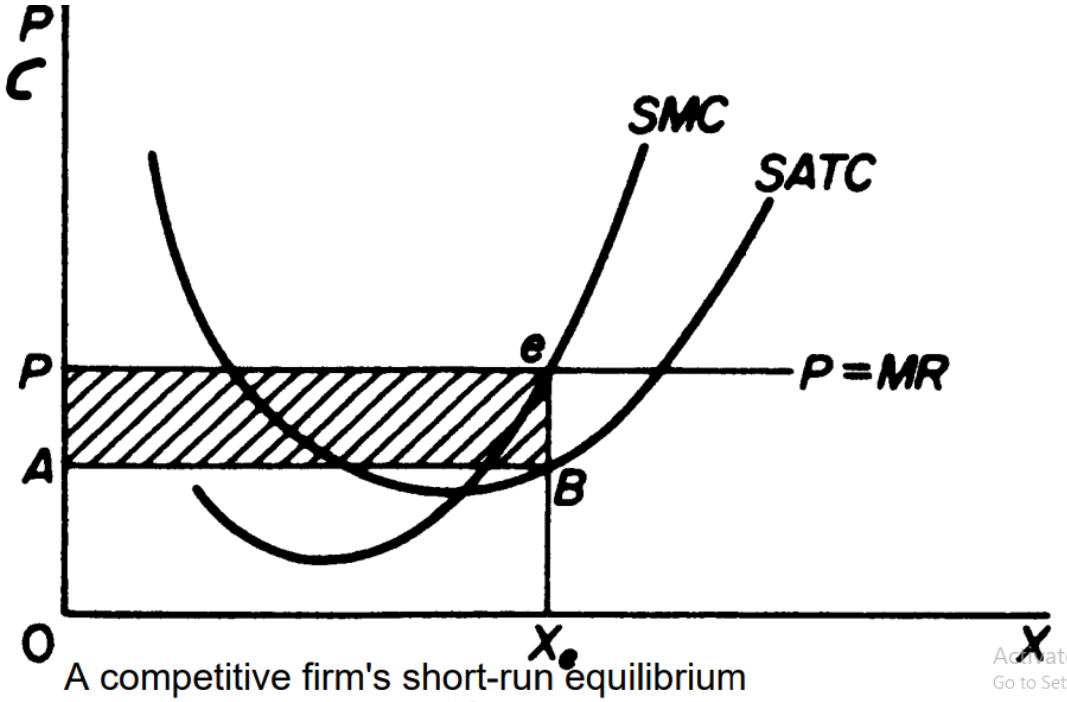
$$\frac{d(MC)}{dQ} = 6Q - 14$$

At $Q = \frac{2}{3}$, the slope of the MC curve is -10 (and so the firm minimizes total profits). At $Q = 4$, the slope of the MC curve is 10 so that the firm maximizes its total profits.

(*b*)
$$\begin{aligned}\pi &= TR - TC \\ &= 4Q - Q^3 + 7Q^2 - 12Q - 5 \\ &= -Q^3 + 7Q^2 - 8Q - 5 \\ &= -64 + 112 - 32 - 5 \\ &= \$11\end{aligned}$$

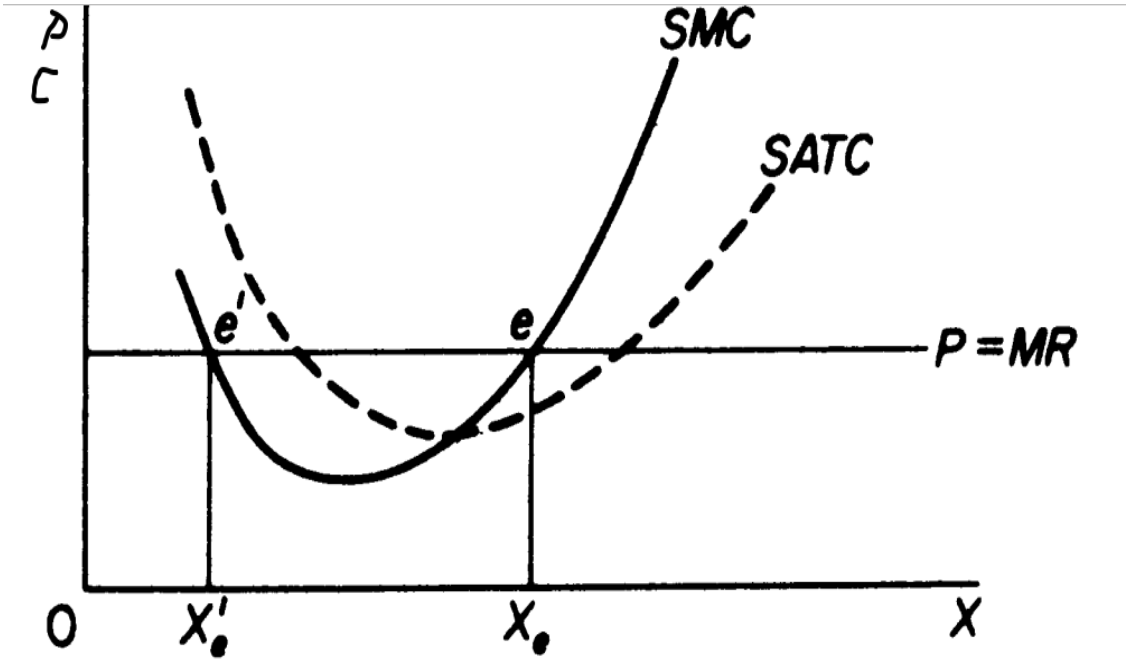


(A Competitive firm's short-run equilibrium at the output X_e that maximizes its per unit profit: TR-TC approach)



A competitive firm's short-run equilibrium

(A Competitive firm's short-run equilibrium: MR-MC approach)



The condition for a competitive firm's short-run equilibrium

Figure 5.4

The two conditions for a firm to be in the short-run equilibrium (i.e., point *e*): (i) *MC* = *MR* and (ii) the slope of *MC* > the slope of *MR*.

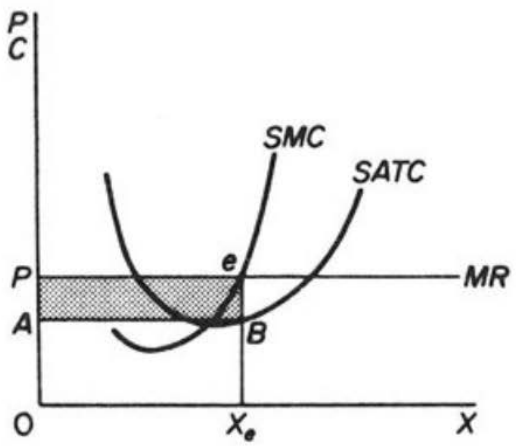


Figure 5.5

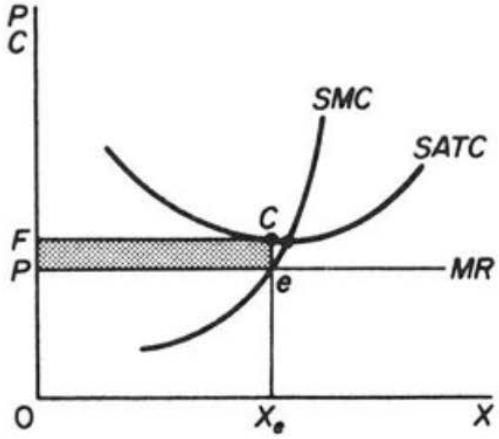
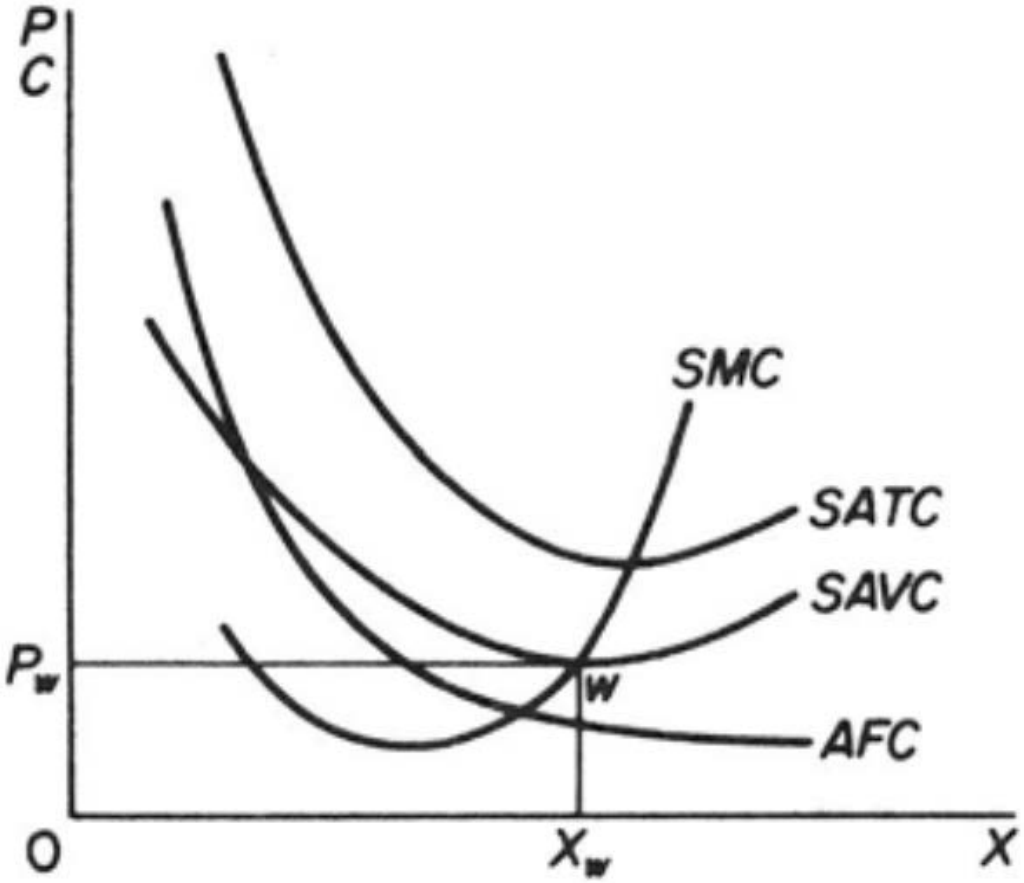


Figure 5.6

A competitive firm's short-run equilibrium with excess profits (Figure 5.5) and losses (Figure 5.6).



A competitive firm's closing-down point

Figure 5.7

Figure 5.7. A competitive firm's short-run equilibrium: How long does a competitive firm continue producing the good X in the short run? Ans. As long as the firm covers its

short-run average variable cost (SAVC or AVC); otherwise, the firm will close down its business.

FF

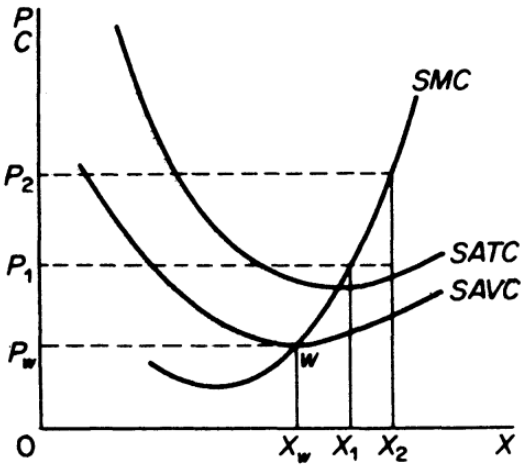


Figure 5.8

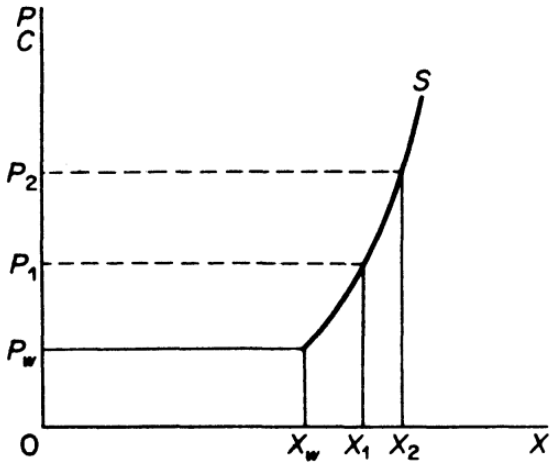


Figure 5.9

The derivation of a competitive firm's and industry's short-rum supply curves

Figures 5.8 & 5.9. A competitive firm's short-run supply curve (S or SRS in Figure 5.9) is similar to the SMC's part just above point w in Figure 5.8, because the firm cannot cover its average variable cost (AVC) at the price below P_w.

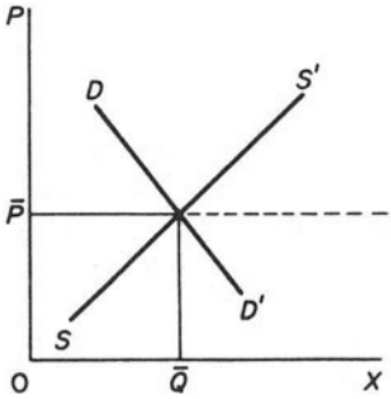


Figure 5.10 Short-run industry equilibrium

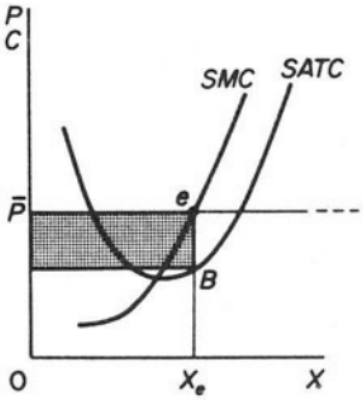


Figure 5.11 Short-run equilibrium of a firm (excess profits)

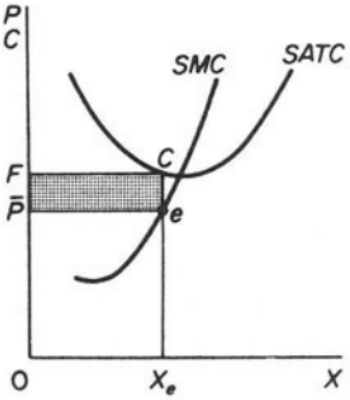


Figure 5.12 Short-run equilibrium of a firm (losses)

A competitive industry's short-run equilibrium with some firms making profits and some making losses.

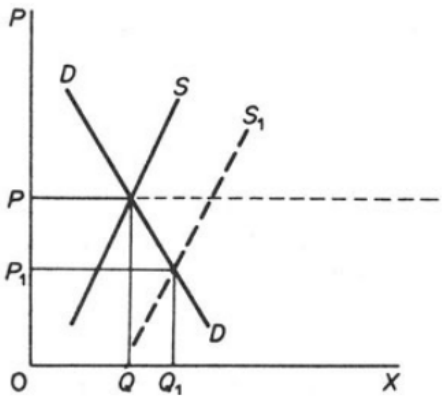


Figure 5.13

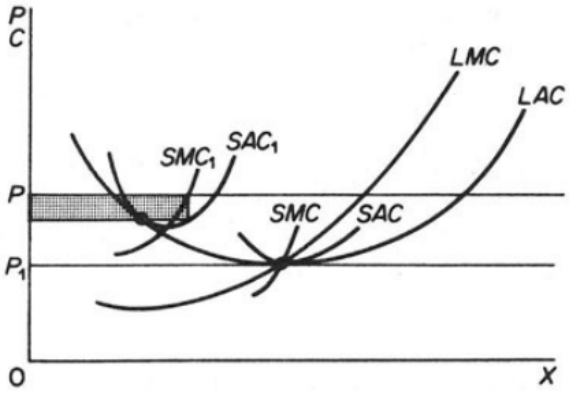


Figure 5.14

A competitive firm's long-run equilibrium wing its normal profit.

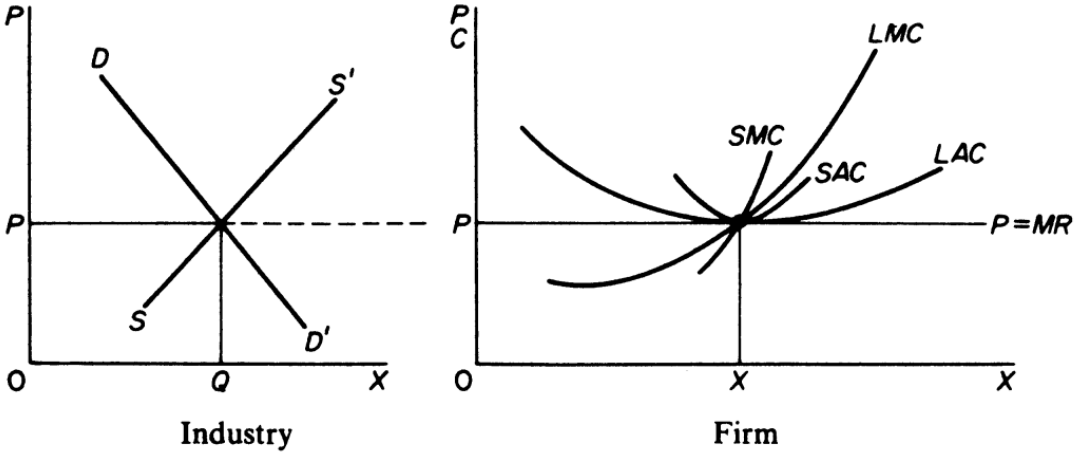


Figure 5.15

A competitive industry's long-run equilibrium where all firms will make normal profits.

b. Monopoly

I. DEFINITION

Monopoly is a market structure in which there is a single seller, there are no close substitutes for the commodity it produces and there are barriers to entry.

The main causes that lead to monopoly are the following. Firstly, ownership of strategic raw materials, or exclusive knowledge of production techniques. Secondly, patent rights for a product or for a production process. Thirdly, government licensing or the imposition of foreign trade barriers to exclude foreign competitors. Fourthly, the size of the market may be such as not to support more than one plant of optimal size. The technology may be such as to exhibit substantial economies of scale, which require only a single plant, if they are to be fully reaped. For example, in transport, electricity, communications, there are substantial economies which can be realised only at large scales of output. The size of the market may not allow the existence of more than a single large plant. In these conditions it is said that the market creates a 'natural' monopoly, and it is usually the case that the government undertakes the production of the commodity or of the service so as to avoid exploitation of the consumers. This is the case of the public utilities. Fifthly, the existing firm adopts a limit-pricing policy, that is, a pricing policy aiming at the prevention of new entry. Such a pricing policy may be combined with other policies such as heavy advertising or continuous product differentiation, which render entry unattractive. This is the case of monopoly established by creating barriers to new competition.[1]

II. DEMAND AND REVENUE

Since there is a single firm in the industry, the firm's demand curve is the industry-demand curve. This curve is assumed known and has a downward slope (figure 6.1).

We will use a linear demand function for simplicity. We have examined the properties of this form of demand in Chapter 2. They may be summarised as follows:

1. The demand equation, *ceteris paribus*, is

$$X = b_0^* - b_1^* P$$

The clause *ceteris paribus* implies that all the other factors (such as income, tastes, other prices) which affect demand are assumed constant. Changes in these factors will shift the demand curve.

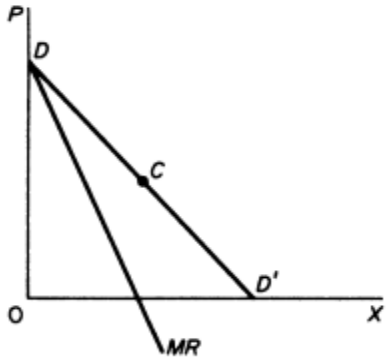


Figure 6.1

2. The slope of the demand curve is

$$\frac{dX}{dP} = -b_1^*$$

3. The price elasticity of demand is

$$e_P = \frac{dX}{dP} \cdot \frac{P}{X} = -b_1^* \cdot \frac{P}{X}$$

That is, elasticity changes at any one point of the demand curve.
(*a*) At point D the elasticity approaches infinity

$$e_P = -b_1^* \cdot \frac{P}{X} \to \infty$$

(*b*) At point D' the elasticity is zero

$$e_P = -b_1^* \cdot \frac{P}{X} = -b_1^* \cdot \frac{0}{X} = 0$$

(*c*) At the mid point C the price elasticity is unity

$$e_P = -1$$

4. The total revenue of the monopolist is

$$R = P \cdot X$$

Solving the demand equation for P we find

$$P = \frac{b_0^*}{b_1^*} - \frac{1}{b_1^*} X \infty$$

Setting $(b_0^*/b_1^*) = b_0$ and $(1/b_1^*) = b_1$ we may rewrite the price equation as

$$P = b_0 - b_1 X$$

Substituting into the revenue equation we find

$$R = PX = (b_0 - b_1 X)X$$

or

$$R = b_0 X - b_1 X^2$$

5. The average revenue is equal to the price:

$$AR = \frac{R}{X} = \frac{PX}{X} = P = b_0 - b_1 X$$

Thus the demand curve is also the AR curve of the monopolist.

6. The marginal revenue is:

$$\frac{dR}{dX} = \frac{d(b_0 X - b_1 X^2)}{dX} = b_0 - 2b_1 X$$

That is, the MR is a straight line with the same intercept as the demand curve, but twice as steep.

The general relation between P and MR is found as follows. Given

$$R = PX$$

$$MR = \frac{dR}{dX} = P\frac{dX}{dX} + X\frac{dP}{dX}$$

or

$$MR = P + X \cdot \frac{dP}{dX}$$

The marginal revenue is at all levels of output smaller than P, given that

$$P = MR - X\frac{dP}{dX}$$

and the term $(X(dP/dX))$ is positive (since the slope of the demand curve $(dP/dX) > 0$). Hence $P > MR$.

7. The relationship between MR and price elasticity e is

$$MR = P\left(1 - \frac{1}{e}\right)$$

Proof

We established that $R = P \cdot X$ where $P = f(X)$

$$MR = \frac{dR}{\partial X} = P + X\frac{\partial P}{\partial X}$$

The price elasticity of demand is defined as

$$e_P = -\frac{\partial X}{\partial P} \cdot \frac{P}{X}$$

Inverting this relation we obtain

$$\frac{1}{e} = -\frac{\partial P}{dX} \cdot \frac{X}{P}$$

Solving for dP/dX we find

$$\frac{dP}{dX} = -\frac{1}{e} \cdot \frac{P}{X}$$

Substituting in the expression of the MR we get

$$MR = P + X\left(-\frac{1}{e} \cdot \frac{P}{X}\right)$$

or

$$MR = P\left(1 - \frac{1}{e}\right)$$

III. COSTS

In the traditional theory of monopoly the shapes of the cost curves are the same as in the theory of pure competition. The AVC, MC and ATC are U-shaped, while the AFC is a rectangular hyperbola. However, the particular shape of the cost curves does not make any difference to the determination of the equilibrium of the firm, provided that the slope of the MC is greater than the slope of the MR curve (see below).

One point should be stressed here. The MC curve is *not* the supply curve of the monopolist, as is the case in pure competition. In monopoly there is no unique relationship between price and the quantity supplied (see below, p. 177).

IV. EQUILIBRIUM OF THE MONOPOLIST

A. SHORT-RUN EQUILIBRIUM

The monopolist maximises his short-run profits if the following two conditions are fulfilled: Firstly, the MC is equal to the MR. Secondly, the slope of MC is greater than the slope of the MR at the point of intersection.

In figure 6.2 the equilibrium of the monopolist is defined by point ε, at which the MC intersects the MR curve from below. Thus both conditions for equilibrium are fulfilled. Price is P_M and the quantity is X_M. The monopolist realises excess profits equal to the shaded area $AP_M CB$. Note that the price is higher than the MR.

In pure competition the firm is a price-taker, so that its only decision is output determination. The monopolist is faced by two decisions: setting his price and his output. However, given the downward-sloping demand curve, the two decisions are interdependent. The monopolist will either set his price and sell the amount that the market will take at it, or he will produce the output defined by the intersection of MC and MR, which will be sold at the corresponding price, P. The monopolist cannot decide independently both the quantity and the price at which he wants to sell it. The crucial condition for the maximisation of the monopolist's profit is the equality of his MC and the MR, provided that the MC cuts the MR from below.

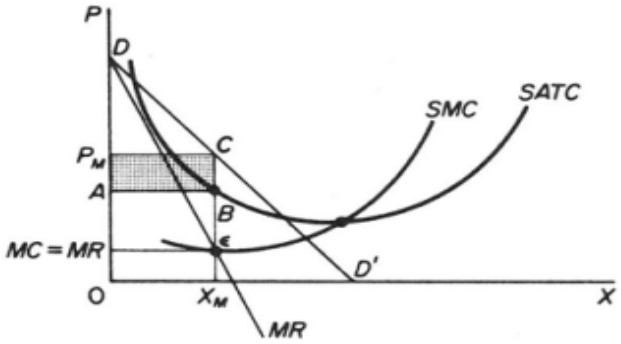


Figure 6.2

Formal derivation of the equilibrium of the monopolist

Given the demand function

$$X = g(P)$$

which may be solved for P

$$P = f_1(X)$$

and given the cost function

$$C = f_2(X)$$

The monopolist aims at the maximisation of his profit

$$\Pi = R - C$$

(*a*) *The first-order condition for maximum profit* Π

$$\frac{\partial \Pi}{\partial X} = 0$$

$$\frac{\partial \Pi}{\partial X} = \frac{\partial R}{\partial X} - \frac{\partial C}{\partial X} = 0$$

or

$$\frac{\partial R}{\partial X} = \frac{\partial C}{\partial X}$$

that is $MR = MC$

(*b*) *The second-order condition for maximum profit*

$$\frac{\partial^2 \Pi}{\partial X^2} < 0$$

$$\frac{\partial^2 \Pi}{\partial X^2} = \frac{\partial^2 R}{\partial X^2} - \frac{\partial^2 C}{\partial X^2} < 0$$

or

$$\frac{\partial^2 R}{\partial X^2} < \frac{\partial^2 C}{\partial X^2}$$

176

that is

$$\begin{bmatrix}\text{slope}\\ \text{of } MR\end{bmatrix} < \begin{bmatrix}\text{slope}\\ \text{of } MC\end{bmatrix}$$

A numerical example

Given the demand curve of the monopolist

$$X = 50 - 0{\cdot}5P$$

which may be solved for P

$$P = 100 - 2X$$

Given the cost function of the monopolist

$$C = 50 + 40X$$

The goal of the monopolist is to maximise profit

$$\Pi = R - C$$

(i) We first find the MR

$$R = XP = X(100 - 2X)$$

$$R = 100X - 2X^2$$

$$MR = \frac{\partial R}{\partial X} = 100 - 4X$$

(ii) We next find the MC

$$C = 50 + 40X$$

$$MC = \frac{\partial C}{\partial X} = 40$$

(iii) We equate MR and MC

$$MR = MC$$

$$100 - 4X = 40$$

$$X = 15$$

(iv) The monopolist's price is found by substituting $X = 15$ into the demand–price eq

$$P = 100 - 2X = 70$$

(v) The profit is

$$\Pi = R - C = 1050 - 650 = 400$$

This profit is the maximum possible, since the second-order condition is satisfied:
(*a*) from

$$\frac{\partial C}{\partial X} = 40$$

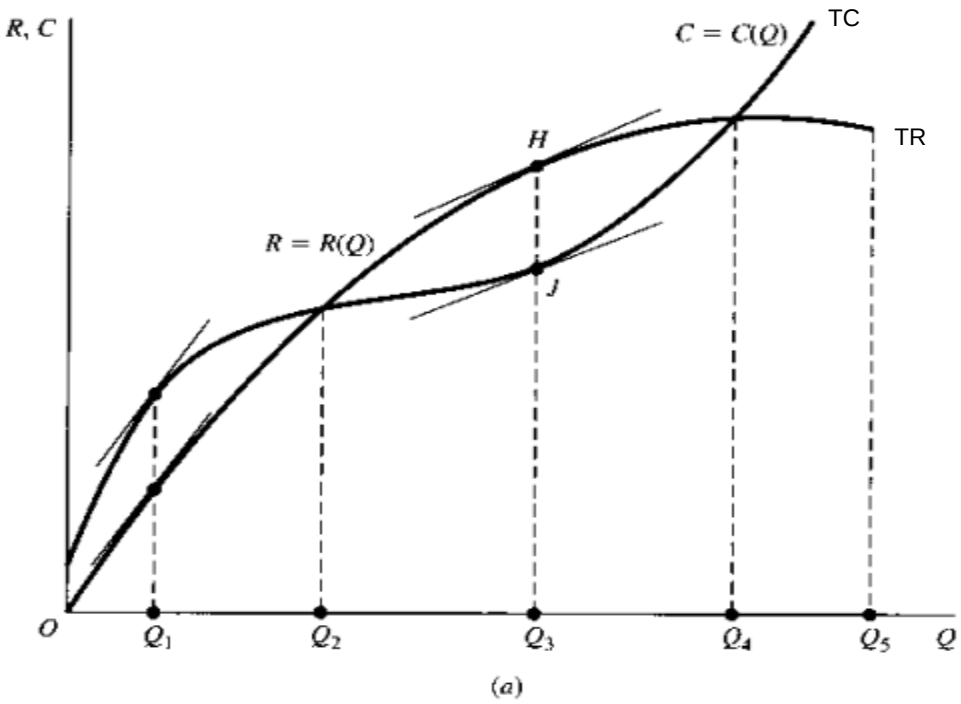
we have

$$\frac{\partial^2 C}{\partial X^2} = 0$$

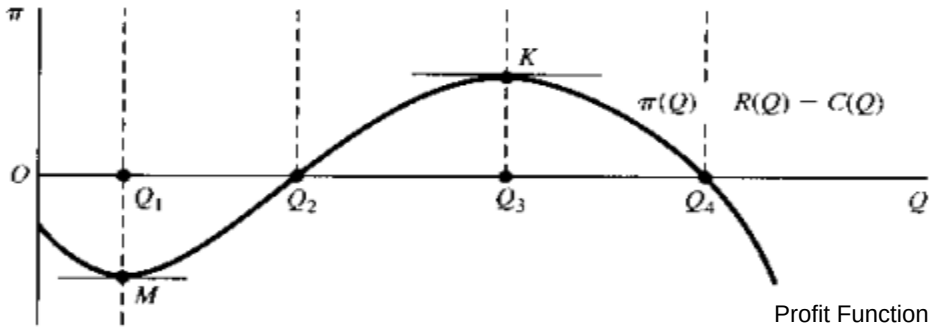
(b) from

$$\frac{\partial R}{\partial X} = 100 - 4X \qquad \text{we have} \quad \frac{\partial^2 R}{\partial X^2} = -4$$

Clearly $-4 < 0$. That is, [the slope of MC = 0] > [the slope of MR = -ve]

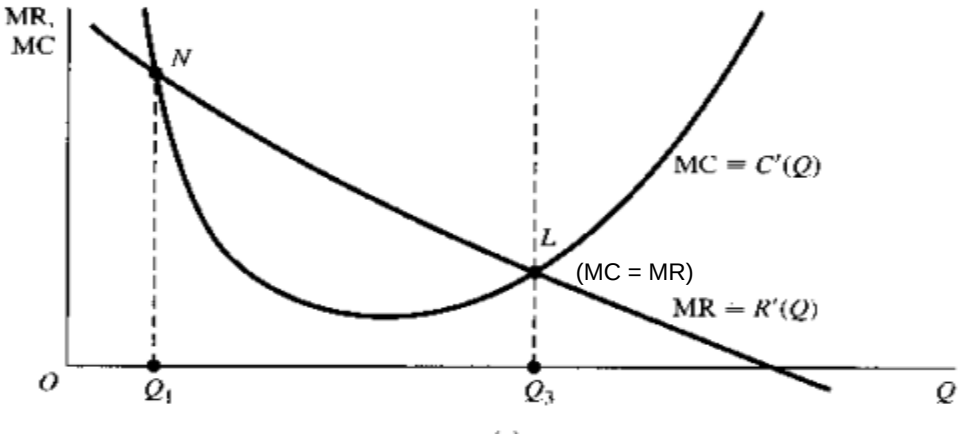


(a)



Profit Function

(b)



B. LONG-RUN EQUILIBRIUM

In the long run the monopolist has the time to expand his plant, or to use his existing plant at any level which will maximise his profit. With entry blocked, however, it is not

necessary for the monopolist to reach an optimal scale (that is, to build up his plant until he reaches the minimum point of the *LAC*). Neither is there any guarantee that he will use his existing plant at optimum capacity. What is certain is that the monopolist will not stay in business if he makes losses in the long run. He will most probably continue to earn supernormal profits even in the long run, given that entry is barred. However, the size of his plant and the degree of utilisation of any given plant size depend entirely on the market demand. He may reach the optimal scale (minimum point of *LAC*) or remain at suboptimal scale (falling part of his *LAC*) or surpass the optimal scale (expand beyond the minimum *LAC*) depending on the market conditions. In figure 6.5 we depict

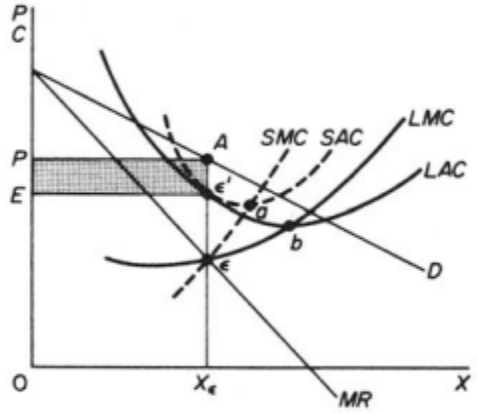


Figure 6.5 Monopolist with suboptimal plant and excess capacity

the case in which the market size does not permit the monopolist to expand to the minimum point of *LAC*. In this case not only is his plant of suboptimal size (in the sense that the full economies of scale are not exhausted) but also the existing plant is under-utilised. This is because to the left of the minimum point of the *LAC* the *SRAC* is tangent to the *LAC* at its falling part, and also because the short-run *MC* must be equal to the *LRMC*. This occurs at ε, while the minimum *LAC* is at *b* and the optimal use of the existing plant is at *a*. Since it is utilised at the level ε′, there is excess capacity.

In figure 6.6 we depict the case where the size of the market is so large that the monopolist, in order to maximise his output, must build a plant larger than the optimal and overutilise it. This is because to the right of the minimum point of the *LAC* the *SRAC*

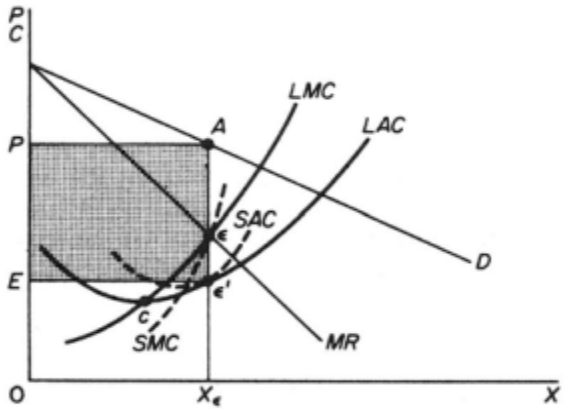


Figure 6.6 Monopolist operating in a large market: his plant is larger than the optimal (*e*) and it is being overutilised (at ε′).

and the *LAC* are tangent at a point of their positive slope, and also because the *SRMC* must be equal to the *LAC*. Thus the plant that maximises the monopolist's profits leads to higher costs for two reasons: firstly because it is larger than the optimal size, and secondly because it is overutilised. This is often the case with public utility companies operating at national level.

Finally in figure 6.7 we show the case in which the market size is just large enough to permit the monopolist to build the optimal plant and use it at full capacity.

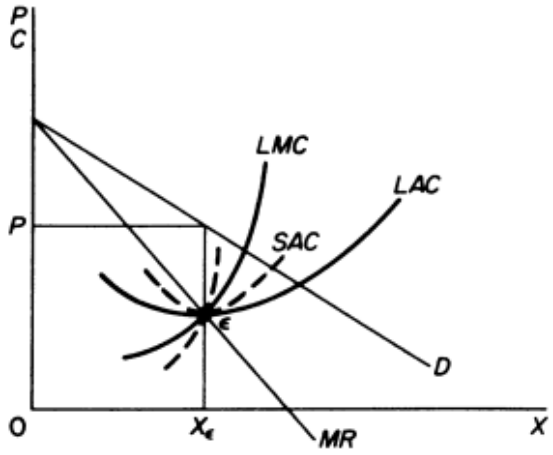


Figure 6.7

It should be clear that which of the above situations will emerge in any particular case depends on the size of the market (given the technology of the monopolist). There is no certainty that in the long run the monopolist will reach the optimal scale, as is the case in a purely competitive market. In monopoly there are no market forces similar to those in pure competition which lead the firms to operate at optimum plant size (and utilise it at its full capacity) in the long run.

Price Discrimination Under Monopoly

Meaning of Price Discrimination

Price discrimination is defined as the practice of selling the same commodity or service to different buyers at different prices on the basis of the following reasons:

a. consumer's preferences,
b. consumer's income,
c. location (e.g., hill or Terai), and
d. the ease of availability of other substitutable commodities.

The condition for Price Discrimination

1. Total market should be subdivided into two or more submarkets on the basis of elasticity of demand.
2. The submarket should be effectively separated from each other so that middle persons cannot resell the commodity from the low price to high price markets.

The Reasons for Price Discrimination

A monopolist sets different prices for the same commodity because of the following reasons:

1. to maximize profit or total revenue,
2. to capture markets by driving out the rivals from the market, and
3. to maintain social justice (e.g., low price for students in transportation sectors).

Degrees or Types of Price discrimination

1. **First-Degree Price discrimination**. Under the first-degree price discrimination, a monopolist charges different price on each consumer or each unit of a commodity or service. Because the consumer is perfectly exploited by the monopolist without leaving any surplus to the consumer and by charging the maximum possible price, Professor John Robinson also calls it *perfect price discrimination* (see Figure 3 below).
2. **Second-Degree Price Discrimination**. Under this second-degree price discrimination, a monopolist charges different prices on the basis of different groups—such as students and women; hence, it is also called a *group discrimination*—and on the basis of different quantities, such as one type charge for the minimum unit of the electricity bill and anther type of charge for the quantity above the minimum unit (see Figure 2 below).
3. **Third-Degree Price Discrimination (Market Discrimination).** Under this third-degree price discrimination, a monopolist divides the total market (total output) into two or more submarkets and then he sets different prices for each submarket on the basis of elasticity of demand and geographical locations (see Figure 1 and Figure 4 below).

   As Figure 4 shows, the following two conditions must be satisfied for the equilibrium under the third-degree price discrimination:

   i. $MC = \Sigma MR = MR_A = MR_B$
   ii. The MC curve must cut the ΣMR curve from below.

Under the *third-degree price discrimination* (by the British economist Pigou.) the increase in total revenue is achieved by taking away part of the consumers' surplus. To understand this let us concentrate on the demand curve, D (Figure 1).

If the monopolist sold all $0X$ at P he would receive $0XAP$, and the consumers would have a surplus of PAD. Assume now that the monopolist sells $0X_1$ at the price P_1 and the remaining quantity X_1X at the price P. His total revenue will be

$$0X_1CP_1 + X_1XAB = 0XAP + PBCP_1$$

(TR earned by the monopolist from the third-degree price discrimination)

that is, the monopolist has managed to take the part $PBCP_1$ from the consumers' surplus.

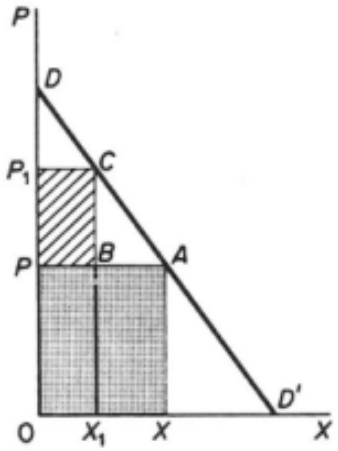


Figure 1. Third-degree price discrimination

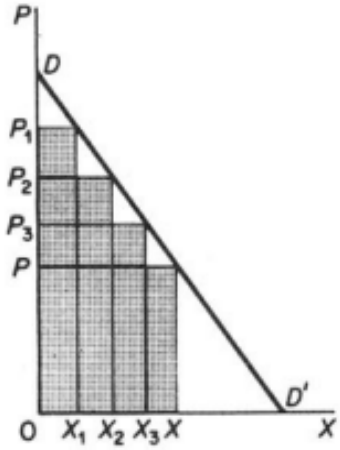


Figure 2. Second-degree price discrimination

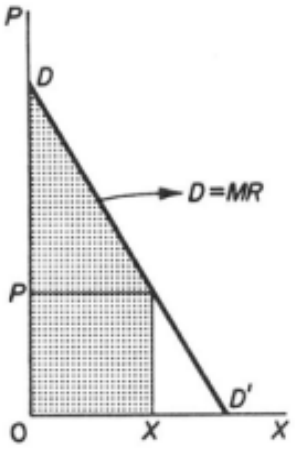


Figure 3. First-degree price discrimination

If the monopolist can negotiate and sell at more than two prices (higher than P), for example to sell $0X_1$ at P_1, X_1X_2 at P_2, X_2X_3 at P_3 and X_3X at P, he will receive a still larger part of the consumers' surplus (Figure 2). This is called a *second-degree price discrimination.*

In the limiting case in which the monopolist can negotiate individually with each buyer and sell each unit of output at its corresponding price as shown from the DD' curve, then he will receive the entire consumers' surplus (Figure 3). This is known as *first-degree price discrimination* or as 'take-it-or-leave-it' price discrimination, because in negotiating with each buyer the monopolist charges him the maximum price he is willing to pay under threat of denying the selling of any quantity to him: he offers each buyer a 'take-it-or-leave-it' choice. In this case the demand curve also becomes the MR curve of the monopolist.

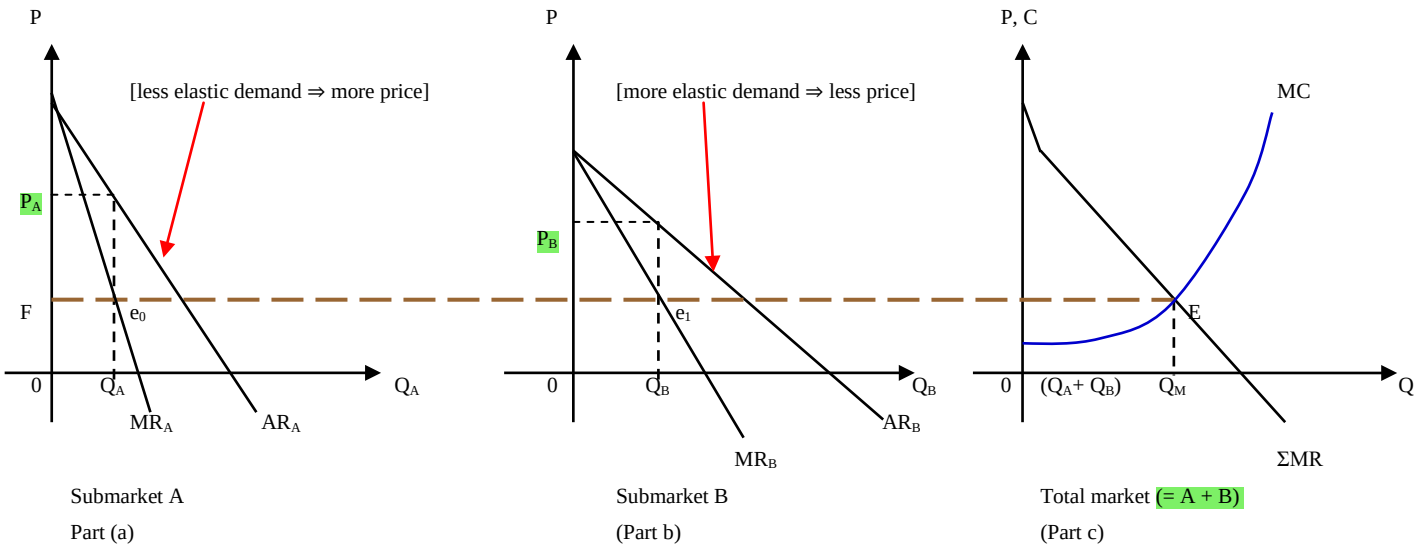


Figure 4. Third-degree (market) price discrimination.

The Part c in Figure 4 determines the total quantity of a commodity ($Q = Q_A + Q_B$) that is sold in the submarkets A and B. The two equilibrium conditions—(i) MC = ΣMR and (ii) the MC curve must cut the ΣMR curve from below—are satisfied at point E in Part c. Therefore, the OQ_M quantity is determined in Part c. Then, an EF horizontal line is drawn to divide the total output (OQ_M) of Part c into the two parts: the OQ_A output in Part a and the OQ_B output in Part b. As a result, the horizontal line EF cuts the MR_B curve at point e_1 in Part b and the MR_A curve at point e_0 in Part a. Because the demand curve (AR_A) is less elastic (steeper), more price (P_A) and less quantity (Q_A) are determined in Part a. Similarly, a less price (P_B) and more quantity (Q_B) are determined in Part b, because the demand curve (AR_B) is more elastic. Thus, market discrimination is described as the monopolist's practice to sell the total quantity (Q_M) of the same commodity at somewhat higher price in the submarket A and at somewhat lower price in the submarket B on the basis of the price elasticities of their demand curves (AR_A and AR_B).

(C) Monopolistic Competition

Meaning of Monopolistic competition

Monopolistic competition is a market structure in which many small sellers sell slightly differentiated but closely substitutable commodities. The market is a middle ground between perfect competition and monopoly. More practical types of features are taken from both perfect competition and monopoly. Trademarks and brand names protected by law and the freedom to determine price and output are some of the features taken from monopoly. The large number of sellers and free entry and exit are some features taken from perfect competition. During the 1930s, the markets of perfect competition and monopoly were severely criticized and so this monopolistic market was propounded by John Robinson and Chamberlin.

Features of Monopolistic competition

The following features are found in the market of monopolistic competition:

1. a large number of small sellers and buyers,
2. slightly differentiated but closely substitutable commodities,
3. free entry and exit,
4. a downward-slopping demand (AR) curve
5. the price determination of own commodities independently from other sellers,
6. a mixture of both monopoly and perfect competition, and
7. Profit maximization as a main goal.

Some Concepts in the Market of Monopolistic Competition

The Concepts of Product Differentiation and Demand (AR) Curve

In the market of perfect competition, the demand (AR) curve was a horizontal line because of homogeneous commodity. The monopolistic market produces slightly differentiated commodities. As s result, the demand (AR) curve changes its position from a horizontal line to a downward-slopping line.

The Concepts of Cost Curves and Selling Costs

Besides traditional cost curves like AC, AVC, MC, and AFC, the new costs (selling costs) are also included here. The selling costs play two types of roles: (i) causing upward shift in demand curve and (ii) making the demand (AR) curve steeper.

The Concepts of Industry and Product Group

In the market of perfect competition, the word *industry* was used to indicate the collection of a large number of firms producing and selling homogeneous commodities. On the other hand, the *product group* is used in the market of monopolistic competition because sellers sell slightly differentiated commodities.

The Short-run Equilibrium under Monopolistic Competition

Sellers in this market can increase their sales by

i. Reducing their prices,
ii. Improving quality of their commodities, and
iii. Increasing advertisement expenditures.

The increase in sales from the quality improvement and advertisement are long-run phenomena. In the short run, however, sellers can increase their sales by reducing their

prices. Like monopoly market, this market has a downward-slopping demand (AR) curve which indicates the following two things:

i. Consumers' strong preferences towards particular commodities, and
ii. Sellers' quasi-monopoly (control) over their own supply.

Therefore, the short-run equilibrium is analyzed through the following Figure 1.

Since a firm in a monopolistically competitive industry faces a highly elastic but negatively sloped demand curve for the differentiated product it sells, its MR curve will lie below its demand curve. The short-run equilibrium level of output for the firm is given by the point where its SMC curve intersects its MR curve from below (provided that at this output level $P \geqslant$ AVC).

EXAMPLE 1. In Fig. 1, d is the highly price-elastic demand curve faced by a typical monopolistic competitor and MR is the corresponding MR curve. The best level of output of the firm in the short run is 6 units and is given by point E, at which MR = SMC. At $Q = 6$, $P = \$9$ (point A on the demand curve) and SAC = \$7 (point B), so that the monopolistic competitor maximizes profits at $AB = \$2$ per unit and $ABCF = \$12$ in total. The monopolistic competitor would break even if $P =$ SAC and would minimize losses if $P <$ SAC, as long as $P \geqslant$ AVC at the best level of output.

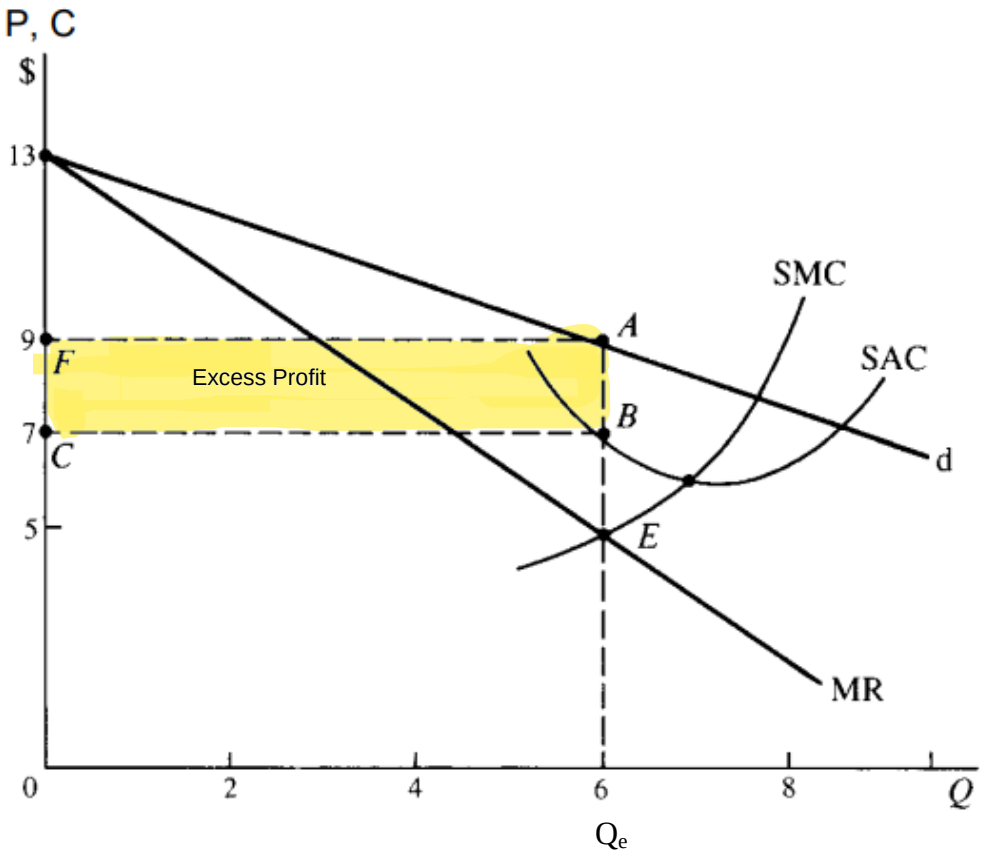


Figure 1. The short-rum equilibrium under monopolistic competition.

The Long-run Equilibrium Under Monopolistic Competition

Or

The Price and Output Determination by MR and MC Approach in the Long-run under Monopolistic Competition

There is enough time for monopolistic firms to expand the size of plants, for new firms to enter the product group, and for the all firms to change their size and position of demand curves by increasing advertisement expenditures and improving the quality of their commodities. The long-run equilibrium is based on the following assumptions:

1. A large number of small sellers and buyers,
2. The number of sellers is so large that each firm expects its price and quantity changes to be unnoticed by its rival firms,
3. Identical cost and revenue curves of all firms, and
4. equal distribution of consumers' preferences towards commodities of all firms.

Out of the four assumptions, the assumptions 3 and 4 are called heroic (less realistic). The firm will obtain the long-run equilibrium at a normal profit. The normal profit is indicated by a point of the tangency between LAC and AR curves. Therefore, this equilibrium is also known as *Chamberlin Group Equilibrium with Tangency Solution*. The two conditions must be satisfied for the long-rum equilibrium:

i. LMC = MR
ii. LMC curve must cut MR curve from below.

Figure 2 illustrates the long-run equilibrium.

If the typical or representative monopolistically competitive firm earns a profit in the short run, more firms enter the market in the long run. This causes the demand curve of the typical firm to shift down to d′ in Fig. 2 (as the firm's market share declines), so as to be tangent to the LAC curve at the output level of 4 units, at which MR′ = LMC (point E'). At $Q = 4, P =$ LAC = SAC′ = \$6 (point A') and the firm breaks even in the long run.

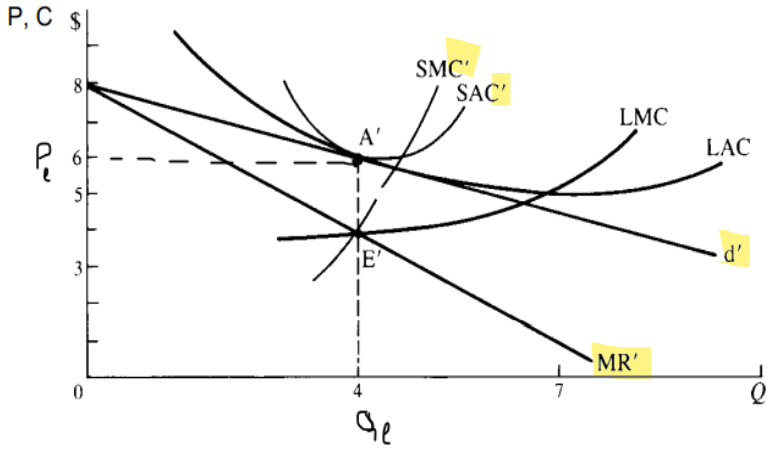


Figure 2. The long-rum equilibrium under monopolistic competition.

d. Oligopoly

Meaning of Oligopoly

Oligopoly consists of two words: *oligi* meaning a few and *polein* meaning sellers. Oligopoly, therefore, is a market structure where there are a few sellers selling homogeneous (e.g., gas, cement, etc.) and heterogeneous (e.g., TV, mobiles, car, etc.) products. Here, a few means the number of sellers or firms less than the sellers in monopolistic market. Oligopoly is therefore an example of imperfect competition that occurs when a relatively small number of firms dominate the market or when firms produce goods that are differentiated in ways that show consumer preferences.

Characteristics of Oligopoly

1. Intensive Competition

There is tough competition among a few sellers or firms because of fewness of their numbers. To an oligopolist, business is a life of constant struggle with the highest form of competition.

2. Interdependence

A few firms are interdependent upon each other because of the nature and degree of competition. While making decisions on the change in price, product quality and advertisement, each oligopolist takes it for granted that his actions will cause an immediate reaction in rival firms. So, interdependence is the source of action and reaction, moves and countermoves among firms.

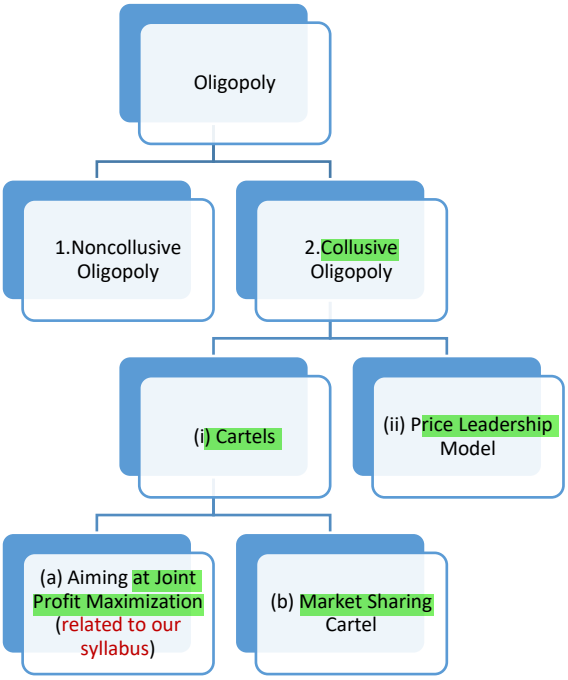
3. Barrier to Entry

Generally, barriers to entry exist in an oligopolistic market. Some major barriers are economies of scale, price-cutting, a control over important inputs, licensing, and patent rights.

Theoretical Problems in Oligopoly Pricing

It is extremely difficult of systematically analyzing the oligopolistic market due to the uncertainty in behavioral pattern of a firm. The collusion among firms may last long or break down soon. The indeterminateness of price and output is the basic feature of oligopolistic market.

Types of Oligopoly



Cartel

Meaning of Cartel

A cartel is a group of firms having an explicit and open agreement to collude. Although cartels are illegal in many countries, firms have tried to find tacit ways of helping collusion—for example, by relying on price leaders and meeting-the-competition pricing policies. Firms under the cartel under oligopolistic market make agreement on price and output determination and market sharing. Hence, a cartel is a perfect form of collusion.

Functions of Cartel

1. to fix price and
2. to share total output between oligopolistic firms.

Objectives of Cartel

1. to reduce competition between firms,
2. to reduce uncertainty created by firms,
3. to create barriers to entry for new firms, and
4. to maximize the combined profit of all firms.

Cartel Aiming at Joint-Profit Maximization

The main objectives of this type of cartel are to accept mutual interdependence to avoid nearing intensive competition.

Assumptions

1. Firms have a coalition.
2. Firms produce homogenous products.
3. Firms set up a central management board that is given the duty to determine price and output and to share market among firms.
4. Each firm provides its cost and revenue data to the Board.
5. The Board determines the cost and revenue curves of each firm on the basis of the number 4.
6. The Board then determines price and output of each firm in the way that each may make some profit.

Two Conditions

1. ΣMC = ΣMR (to determine the market output) and
2. ΣMC = MC_A = MC_B = ΣMR (to share the market or the output between the firms A and B).

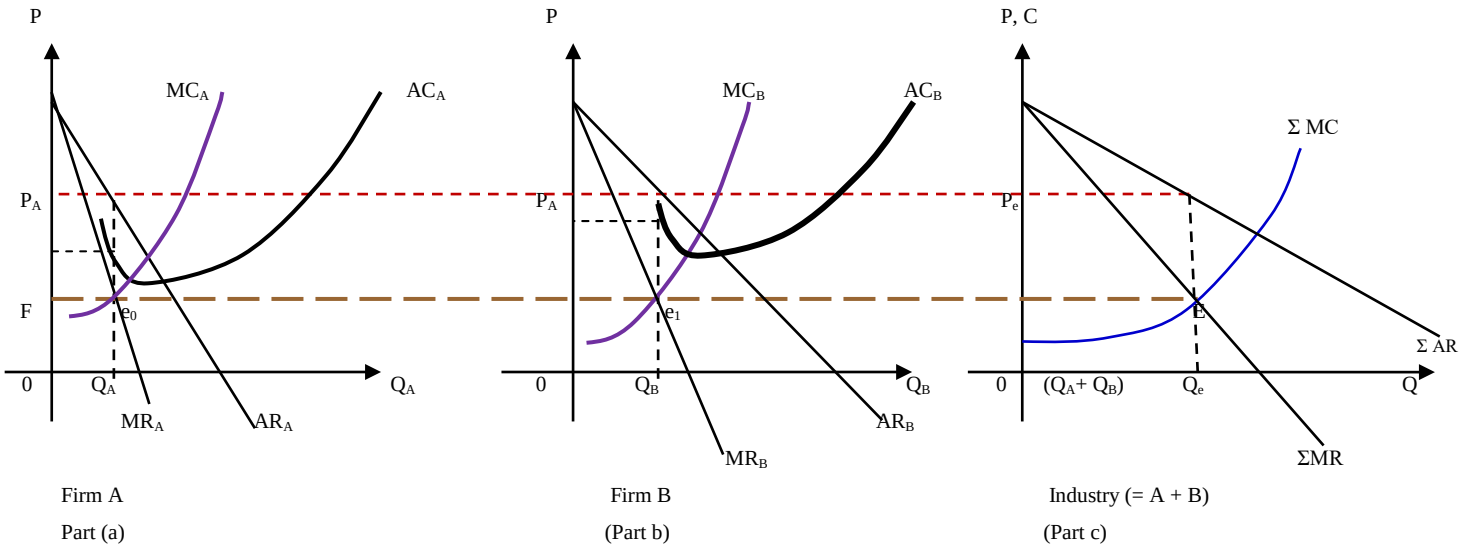


Figure 1. Cartel aimed at joint-profit maximization.

Both conditions to determine the equilibrium price and output are satisfied at point E in Part c; hence, the equilibrium price (P_e) and the equilibrium quantity (Q_e) are determined at Part c. Then, the EF horizontal line is drawn parallel in the way that the line passes through point e_1 at MR_B and point e_0 at MR_A, so that $\Sigma MC = MC_A = MC_B = \Sigma MR$ that distributes the total output ($0Q_e$) of Part c between Firm A and Firm B in the form of $0Q_A$ and $0Q_B$. Looking at the cost and revenue conditions of each firm, the Board has determined the price P_e in such a way that each can earn some profits.