PRICE AND OUTPUT DETERMINATION UNDER OLIGOPOLY

A diversity of specific market situations works against the development of a single, generalized explanation of how an oligopoly determines price and output. Pure monopoly, monopolistic competition and perfect competition, all refer to rather clear cut market arrangements, oligopoly does not. It consists of the **'tight'** oligopoly situation in which two or three firms dominate the entire market and the **'loose'** oligopoly situation where six or seven firms occupy the maximum share of the market. Other firms share the balance. It includes both **differentiation** and **standardisation.** It encompasses the cases in which firms are acting in collusion and in which they are acting independently. Therefore, the existence of various forms of oligopoly prevents the development of a general theory of price and output. The element of mutual interdependence in oligopolistic market further complicates the determination of price and output.

Price determination takes different forms under oligopoly. These forms are discussed below :

1. Independent Pricing. Independent pricing is of two forms like

(*i*) If oligopoly has homogeneous product, pricing by individual firms is not definite. There may be price war or price rigidity, and

(*ii*) If oligopoly has differential product, every firm enjoys monopoly power. Every firm aims pricing at maximum profit. Thus, independent pricing for some time or otherwise will discontinue and they will start price cullusion.

2. Collusive Pricing. In this case, cartel may take place by firms for price collusion. Cartel is the arrangement among different firms to regulate the prices and output. Firms sell such outputs at agreed prices as fixed by the cartel group. But this collusive prices can not continue for a long time as difference of opinion are bound to arise even on small issues.

3. Price Leadership. A large firm may act as a leader in price determination. The other firms agree to sell their output, at price determined by the leader firm. This is popularly known as **'Price Leadership'** Generally, it is of four types :

(*a*) **Barometric Price Leadership.** This is the firm follows a price fixed by the wisest producer.

(*b*) **Dominant Price Leadership.** This is the firm when the largest firm fixes a price and other follows.

(*c*) **Aggressive Price Leadership.** This is the firm when domianting big firm fixes the price and forces others either to accept or go out of business. This type of price leadership is also known as **'Exploitative Price Leadership'**.

(*d*) **Effective Price Leadership.** This is the price which is accepted by the all fims who have some cost conditions and less elastic demand. This intends to eliminate wasteful competition.

Here we should remember that price leadership is not workable in actual practice. Its main bottlenecks are :

(*i*) Some firms may find it difficult to accept the price fixed by the leader due to higher costs.

(*ii*) New producers may not follow the prices leadership.

(*iii*) Some firms may raise their sales by lowering their prices secretly.

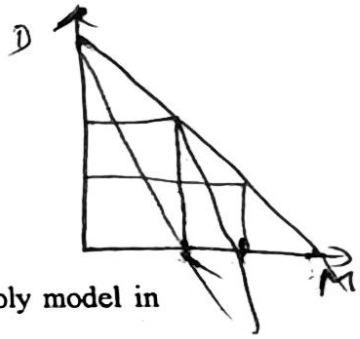
(*iv*) Some firms may raise their sales by increasing the quality of their product.

(*v*) The price leadership may not be wise, efficient and capable of fixing the right price in the market.

CLASSICAL/DUOPOLY MODELS

The uncertainty in respect of behaviour pattern of a firm under oligopoly arising our of their unpredictable action and reaction makes a systematic analysis of oligopoly difficult. However, classical and modern economists have developed a variety of models based on different behavior assumptions. These models can broadly be classified into two categories (I) **Classical Duopoly Models** and (II) **Modern Duopoly Models**. When there are only two sellers of a product, there, exists duopoly. Duopoly is a special case of oligopoly. Duopoly is a special case in the sense that it is limiting case of oligopoly as there must be at least two sellers to make the market oligopolistic in nature. These models are :

1. The Cournot's Duopoly model
2. The Edgeworth Duopoly model
3. The Chamberlin Duopoly model
4. The Bertrand's Duopoly model



I. COURNOT'S DUOPOLY MODEL

Augustin Cournot, a French economist, was the first to develop a formal duopoly model in 1838. To illustrate his model, Cournot assumed :

(a) two firms, dealing with mineral water well;

(b) both operate their wells at zero marginal cost;

(c) both face a demand curve with constant negative slope;

(d) each seller acts on the assumption that his competitor will not react to his decision to change his price.

On the basis of these assumptions, Cournot has concluded that each seller ultimately supplies one-third of the market and charges the same price. While one-third of the market remains unsupplied.

Diagram Representation. Cournot's duopoly model is presented in Fig. 1. To begin the analysis, suppose that there are only two firms. A and B. Initially, A is the only seller of mineral water in the market. In order to maximise his profits (or revenue), he sells quantity OQ where his MC = 0 MR, at price OP_2. His total profit is OP_2PQ.

Now let B enters the market. The market open to him is QM which is half of the total market. He can sell his product in the remaining half of the market. He assumes that A will not change his price and output as he is making the maximum profit *i.e.*, A will continue to sell OQ at price OP_2. Thus, the market available to B is QM and the demand curve is PM. When to get maximise revenue, B sells ON at price OP_1. His total revenue is maximum at QRPN. Note that *B* supplies only QN = 1/4 = (1/2)/2 of the market.)

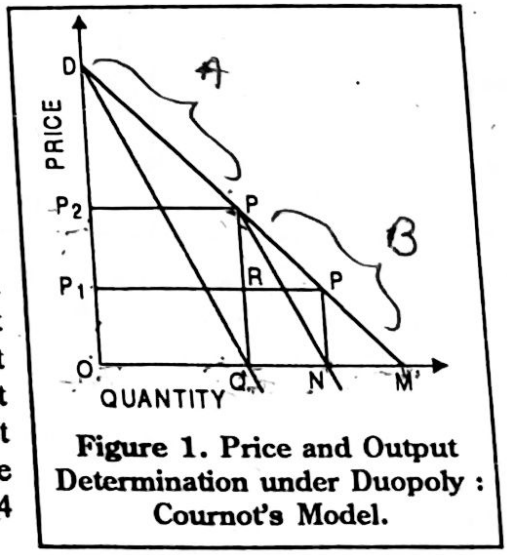


Figure 1. Price and Output Determination under Duopoly : Cournot's Model.

With the entry of *B*, price falls to OP_1. Therefore, A's expected profit falls to OP_1RQ. Faced with this situation, A attempts to adjust his price and output to the changed conditions. He assumes that B will not change his output QN and price OP_1 as he is making maximum profit. Accordingly, A assumes that B will continue to supply 1/4 of market and he has 3/4 (= 1 – 4) of the market

available to him. To maximise his profit. A supplies 1/2 of (3/4), i.e., 3/8 of the market. In this way, A's market share has fallen from 1/2 to 3/8.

Now it is B' s turn to react. Considering Cournot's assumption, B assumes that A will continue to supply only 3/8 of the market and market open to him equals $1 - 3/8 = 5/8$.

In order to maximise his profit under the new conditions B supplies $1/2 \times 5/8 = 5/16$ of the market. It is now for A to reappraise the situation and adjust his price and output accordingly.

This process of action and reaction continues in successive periods. In the process, *A* continues to loose his market share and B continues to gain. Finally situation is reached when their market shares equal at 1/3 each. Any further attempt to adjust output produces the same result. The firms, therefore, reach their equilibrium position where each one supplies one- third of the market.

The equilibrium of firms, according to Cournot's model, has been presented in table I.

Table I

Period	*Firm A*	*Firm B*
I	$\frac{1}{2}(1)=\frac{1}{2}$	$\frac{1}{2}\left(\frac{1}{2}\right)=\frac{1}{4}$
II	$\frac{1}{2}\left(1-\frac{1}{4}\right)=\frac{3}{8}$	$\frac{1}{2}\left(1-\frac{3}{8}\right)=\frac{5}{16}$
III	$\frac{1}{2}\left(1-\frac{5}{16}\right)=\frac{11}{32}$	$\frac{1}{2}\left(-\frac{11}{32}\right)=\frac{21}{24}$
IV	$\frac{1}{2}\left(1-\frac{21}{64}\right)=\frac{43}{128}$	$\frac{1}{2}\left(1-\frac{43}{128}\right)=\frac{85}{256}$
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N	$\frac{1}{2}\left(1-\frac{1}{3}\right)=\frac{1}{3}$	$\frac{1}{2}\left(1-\frac{1}{3}\right)=\frac{1}{3}$

Cournot's equilibrium solution is stable. For given the action and reaction, it is not possible for any of the two sellers to increase their market share. It can be shown as follows.

A's shere = 1/2 (1 – 1/3) = 1/3.

Similiarly B's share = 1/2 (1 – 1/3) = 1/3.

Cournot;'s model of duopoly can be extended to the general oligopoly. For example, if there are three sellers, the industry, and firms will be in equilibrium when each firm supplies 1/3 of the market. Thus, the three sellers together supply 3/4 of the market, 1/4 of the market remaining unsupplied. The formula for determining the share of each seller in an oligopolistic market is : $Q \div (n + 1)$, where Q = market size, and n = number of sellers.

Criticism of the model

Although Cournot's model yields a stable equilibrium, still it has been criticised on the following grounds :

(1), Cournot's behavioural assumption [asssumption (*d*) above] is naive to the extent that it implies that firms continue to make wrong calculations about the competitor's behaviour. Each seller continues to assume that his rival will not change his output even though he reportedly observes that his rival firm does change its output.

(2) The assumption of zero cost of production is totally unrealistic. If this assumption is dropped, it does not alter his position.

(3) Total market at each stage is assumed to be constant which is not the case in practical life.

(4) It is a closed model i.e. entry is not considered.

2. CHAMBERLIN'S DUOPOLY MODEL- A SMALL GROUP MODEL

Chamberlin's model of duopoly recognises interdependence of firms in such a market. Chamberlin argues that in the real world of oligopoly firms are not so native that they wil not learn from the past experience. However, he makes the same assumptions as the exponents of old classical models have done. In other words, his model is also based on the assumption of homegeneous products, firms of equal size with identical costs, no entry by new firms and full knowledge of demand.

Recognition of interdependence of firms in an oligopolistic market given us a result quite different from that of Cournot. Chambrilin argues that firms are aware of the fact that their output or price decision will definitely invite reactions of other firms. Therefore, he goes not visualise any price war in oligopolistic markets. He also rules out the possibility of firms adjusting their outputs over a period of time and thus reaching the equilibrium at an output level lower than that would be reached under monopoly.

According to Chamberlin, recognition of possible sharp reactions to an oligopolistic firm's price or output manipulations would avert harmful competition amongst the firms in such a market and would result in a stable industry equilibrium with the monopoly price and monopoly output. He further stated that no collusion is required for obtained this solution. In case firms in an oligopolistic market are aware of their mutual dependence, and willing to learn from their past experience,then in order to maximise their individual and joint profits they will charge the monopoly price.

Chamberlin's model can be explained in the frame work of a dupoly market. Chamberlin, like Cournot, assumes linear demand for the product. For simplicity we assume that even in this case the cost of producing the good is zero. Chamberlin model has been illustrated in figure 2. In this figure DQ is the market demand curve. If firm A is first to enter the market, it will produce output OQ_1 because at this level of output its marginal revenue is equal to marginal cost (MR = MC = 0). The firm can charge price OP_1 which is the monopoly price. This will maximise its profits. At price OP_1 elasticity of demand is unity. Firm B entering market at this stage considers that its demand curve is CQ and will thus produce Q_1Q_2 so as to maximise its profit. It will charge price OP_2. It now realises that it cannot sell QQ_1 quantity at the monopoly price and thus decides to reduce the output to QQ_3, which is one–half of the monopoly output QQ_1. Firm B can continue to produce quantity Q_1Q_2 which is same as Q_3Q_1. The industry output thus is OQ_1 and the price rises to the level OP_1. This is an ideal situation from the point of view of both firms A and B. In this case, the joint output of the two firms is

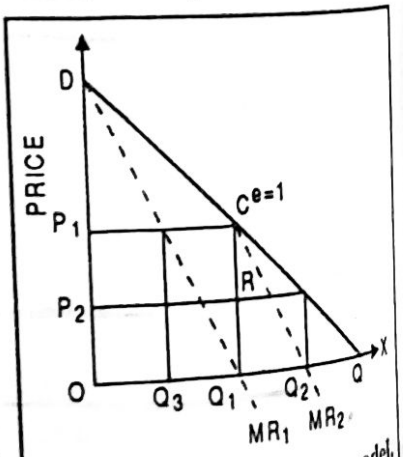


Figure 2. Chamberlin's model.

monopoly output and they charge monopoly price. Thus, considering the assumption of equal costs (costs = 0) the market will be shared equally between firms *A* and *B*.

Appraisal of the model. Chamberlin's model is certainly more realistic than earlier models. It assumes that firms recognise interdependence and then act in a manner that monopoly solution is reached. In the real world, there are certain difficulties in reaching this solution. In the absence of collusion, firms must have a good knowledge of market demand curve which is almost impossible to obtain. In case this information is lacking, firms will not know how to reach monopoly solution. Further, Chamberlin ignores entry. In fact, oligoplistic markets are rarely closed. So if we recognise the fact of entry, it would not be certain that the stable monopoly solution will ever be reached. Differences in costs and market opportunities are also hinderance for attaining a monopoly-type outcome by the independent actions of firms in oligopolies.

3. BERTRAND'S MODEL OF DUOPOLY

In 1883, a French mathematician named **Joseph Bertnard** developed his own model of Duopoly. Bertrands model differs from Cournot' model in respect of his behavioural assumption. Under **Cournot's** model, each seller assumes his rival's output to remain constant, while **Bertrand's** model assumed that the price of the competitor's firm remains constant. Thus Bertrand's model concentrate on price competitions.

Assumptions : The Bertrand model is based on the following assumptions.

(*i*) There are two competitive firms.

(*ii*) Each firm is perfectly aware of the demand curve.

(*iii*) Each firm aims at maximisation of it profit.

(*iv*) Each firm acts on the assumption that its rival will not change it price.

Explanation

Bertrand's model can be explained with the help of reaction curves of both the firm A and B. In Fig. 3, the price is shown on Y-axis and output of firm A is shown on Y-axis and output of firm A is shown on X-axis and that of B's output is shown on X-axis.

From figure, we see tht YQ_A is the demand curve of firm A and YQ_B is the demand curve of B. The maximum output that firm A can sell OQ_A and that firm B can sell is OQ_B. Now, let us suppose firm A is the first to act and it chooses that price it believes will maximise its profits. Suppose the profit maximising price is OP. At price OP, firm A will sell OM quantity of output.

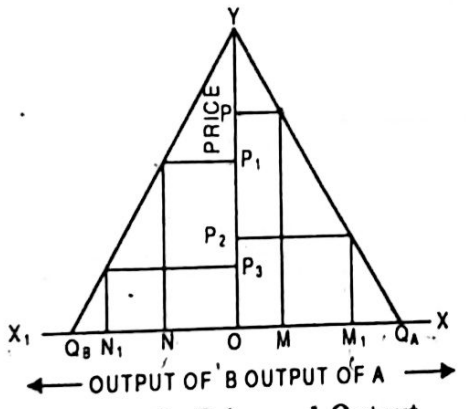


Figure 3. Price and Output Determination under Duopoly : Bertrand's Model.

Here, firm B enters the market. It sets a lower price, i.e. OP_1 on the assumption that firm A will not change its price. At the lower price firm B will be able to attract some of the A's customers. At OP_1 price, firm B is able to sell ON output. The firm A find that some of his customer are attracted towards firm B so as reaction firm A will lower the price to OP_2 and will be able to sell OM_1. On the assumption that firm B will keep its price constant. Knowing this fact, firm B will react to price reduction by firm A and B reaction will reduce the price further to OP_3. At this reduced price, firm will be able to sell ON_1 output. This cut throat competition will continue till both firms are able to

sell their entire output OQ_A and OQ_B at zero price. However, if both the firms enter into an agreement, they will be able to share the market jointly and reap the benefit of charging higher price.

Criticism of the Model

Bertrand's model has been criticised on the same grounds as Cournot's model. Bertrand's behavioural assumption that firms never learn from their past experience seems to be unrealistic. If cost is assumed to be zero, price will fluctuate between zero and upper limit of the price, instead of stabilising at a point.

4. EDGEWORTH'S DUOPOLY MODEL

Edgeworth developed his model of duopoly in 1897. Edgeworth's model follows Bertrand's assumption that each seller assumes his rival's price, instead of his output, to remain constant. His model is illustrated in Fig. 4.

In this figure we have supposed that there are two sellers, A and B, in the market who face identical demand curves. A has his demand curve DD_B and as DD_A. Let us also assume that seller A has a maximum capacity of output OM and B has a maximum output capacity of OM'. The ordinate ODA measures the price.

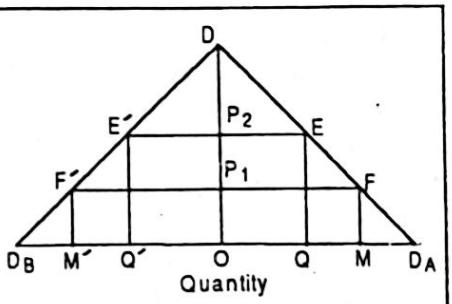


Figure 4. Edgeworth's Model of Duopoly.

To explain Edgeworth's model, let us assume, to begin with, that A is the only seller in the market. Following the profit maximising rule of a monopoly seller, he sells OQ and charges a price, OP_2. His monopoly profit under zero cost, equals OP_2EQ. Now, let B enter the market. B assumes that A will not change his price since hs is making maximum profit. He sets his price slightly below A's price (OP_2) , and is able to sell his total output. At this price, he captures a substantial part of A's market.

Seller A , on the other hand, that his sales have gone down. In order to regain his market , A sets his price slightly below B's price. This leads to price-war between the sellers. The price-war takes the form of price-cutting which continues until price reaches OP_1 At this price both A and B are able to sell their entire output- A sells OQ and B sells OQ'. The price OP_1 could therefore be expected to be stable. But, according to Edgeworth, price OP_1 should not be stable.

Simple reason is that, once price OP_1 is set in the market, the sellers observe an interesting fact. This is, each seller realise that his rival is selling his entire output and he will therefore not change his price, and each seller thinks that he can raise his price to OP_2 and can make pure profit. This realisation forms the basis of their action and reaction. For example, let seller A take the initiative and raise his price to OP_2. Assuming A to retain his price OP_2.B finds that if he raise his price at a level slightly below OP_2 he can sell his entire output at a higher price and make greater profit. Therefore, *B* raises his price according to his plan.

Now it is *A*'s turn to know the situation and react.*A* finds that his price is higher than B's price and his total sale has fallen. Therefore assuming B to retian his price, A reduces his price slightly below B's price. Thus, the price-war between A and B begins once again. This process continues indefinitely and price keeps moving up and down between OP_1 and OP_2. Obviously, according to Edgeworth's model of duopoly, equilibrium is unstable and indeterminate since price and output are never determined. In the words of Edgeworth, "there will be an indeterminate tract through which the index of value will oscilliate, or, rather will vibrate irregularly for an indefinite length of time.

In a netshell Edgeworth's model, like Cournot's is based on a native assumption, i.e. each seller continues to assume that his rival will never change his price even though they are proved repeatedly wrong. But according to Hotelling Edgeworth's model is definitely an improvement upon Cournot's model in that it assumes price, rather than output, to be the relevant decision variable fo the sellers.

OLIGOPOLY MODELS-MODERN APPROACH

The modern approach of oligopoly model can be divided into two categories.

I. Non-collusive models and

II. Collusive models.

Non-collusive models assume that there is no collusive between the firms. There is no agreement between the sellers directly or indirctly regarding price fixation, market sharing or ledership and competition among them for profit maximisation Non-collusion models of oligopoly explain the price and output determination in an oligopolistic market. For example, **Sweezy's Kinked Demand Curve** models is regarded as most important model of this kind.

Collusive models, on the other hand, assume that there is some kind of agreement between sellers. They work under a **cartel** or **leadership**. Let us explain there models in detail.

I. Non-collusive models

Under non-collusive model, we shall explain price rigidity i.e. Sweezy's Kinky Demand curve or equalibrium under independent action.

(A) PRICE RIGIDITY-SWEEZY'S KINKY DEMAND CURVE MODEL Or EQUILIBRIUM UNDER INDEPENDENT ACTION

In 1939, Prof. Sweezy presented the kinked demand curve analysis to explain price rigidities in oligopolistic markets.

Sweezy found that if the oligopolistic firm lowers its price, its rivals will lower the price in order to avoid losing their customers. Thus the firm lowering the price will not be able to increase its demand much. This portion of its demand curve is relatively inelastic. On the other hand, if the oligopolistic firm increases its price, its rivals will not follow it and change their prices. Thus the quantity demanded of this firm will fall considerably. This portion of the demand curve is relatively elastic. In these two situations, the demand curve of the oligopolistic firm has a Kink at the prevailing market price which explains price rigidity.

Assumptions

The kinked demand curve hypothesis of price rigidity is based on the following assumptions:

1. There are few firms in the oligopolistic market.
2. The product produced by one firm is a close substitute for the other firms.
3. The product is of the same quality. There is no product differentiation.
4. No advertising expenditures.
5. There is an established or prevailing market price for the product at which all the sellers are satisfied.
6. Each seller's attitude depends on the attitude of his rivals.

7. Any attempt on the part of a seller to push up his sales by reducing the price of his product will be counteracted by other sellers who will follow his move.
8. If he raises the price others will not follow him, rather they will stick to the prevailing price and cater to the customers, leaving the price-raising seller behind.
9. The marginal cost curve passes through the dotted portion of the marginal revenue curve so that changes in marginal cost do not affect output and price.

Explanation

Following these assumptions, the price-output relationship in the oligopolist market is given in Figure 5. In this figure, KPD is the kinked demand curve and OP_o the prevailing price in the oligopoly market for the OR product of one seller. Starting from point P, corresponding to the current price OP (OP_0) any increase in price above it will considerably reduce his sales, for his rivals are not expected to follow his price increase. This is because the KP portion of the kinked demand curve is elastic, and the corresponding portion KA of the MR curve is positive. Therefore, any price-increase will not only reduce his total sales but also his total revenue and profit.

On the contrary, if the seller reduces the price of the product below OP_o (or P), his rivals will also reduce their prices. Though he will increase his sales, his profit would be less than before. The reason is that the PD portion of the kinked demand curve below P is less elastic and the corresponding part of marginal revenue curve below R is negative. Thus in both the price-raising and price-reducing situations the seller will be a loser. He would stick to the prevailing market price OP_o which remains rigid.

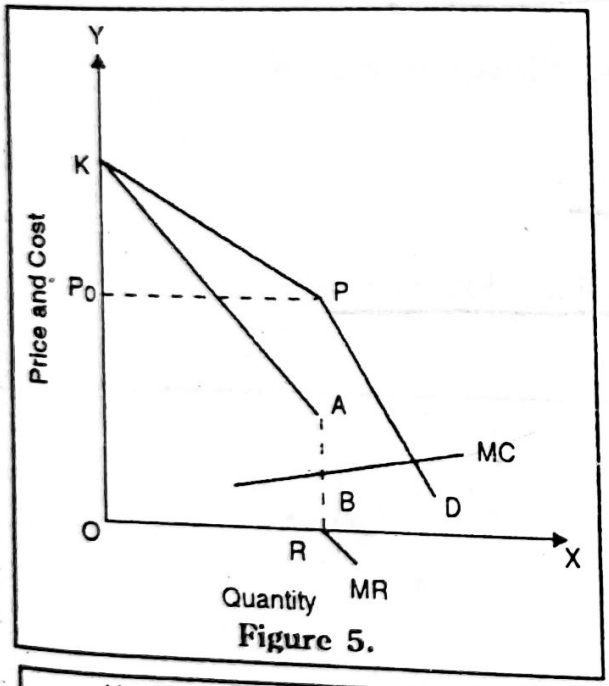


Figure 5.

In order to understand the working of the kinked demand curve, let us analyse the effect of changes in cost and demand conditions on price stability in the oligopolistic market.

Changes in Costs. In oligopoly under the kinked demand curve analysis changes in costs within a certain range do not affect the prevailing price. Let us suppose the cost of production falls so that the new MC curve is MC_1 to the right, as in Figure 6. It cuts the MR curve in the gap AB so that the profit-maximising output is OR which can be sold at OP_o price. It should be noted that with any cost reduction the new MC curve will always cut the MR curve in the gap because as costs fall, the gap AB continues to widen due to two reasons : (1) As costs fall, the upper portion KP of the demand curve becomes more elastic because of the greater certainty that a price rise by one seller will not be followed by rivals and his sales would be considerably reduced. (2) With the reduction in costs the lower portion PD of the kinked curve becomes more inelastic, because of the greater certainty that a price reduction by one seller will be followed by the other rivals.

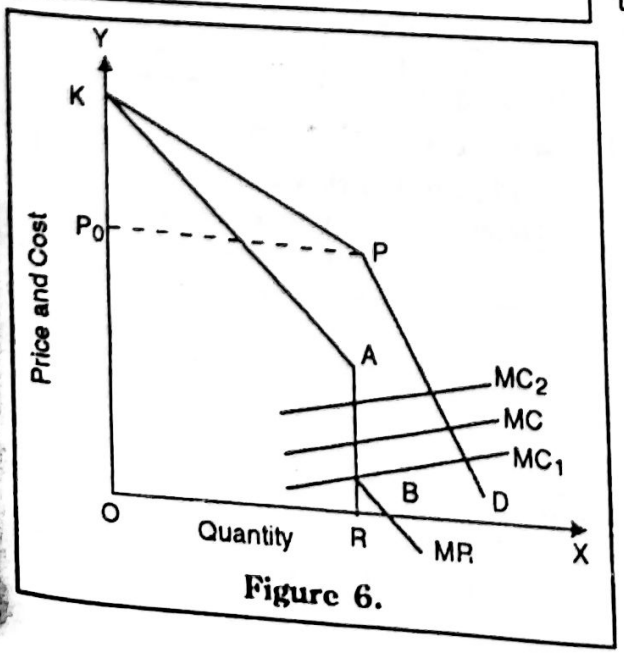


Figure 6.

Thus the angle KPD tends to be a right angle at P and the gap AB widens so that any MC curve below point A will cut the marginal revenue curve inside the gap. As a result there is the same output OR at the same price OP_0 and large profits for the oligopolistic sellers.

In case the cost of production rises the marginal cost curve will shift to the left of the old curve MC as MC_2. So long as the higher MC curve intersects the MR curve within the gap upto point A, the price situation will be rigid. However, with the rise in costs the price is not likely to remain stable indefinitely and if the MC curve rises above point A, it will intersect the MC curve in the portion KA so that a lesser quantity is sold at a higher price. Thus there may be price stability under oligopoly even when costs change so long as the MC curve cuts the MR curve in its discontinuous portion. Therefore, chances of the existence of price-rigidity are greater where there is a reduction in costs than there is a rise in costs.

Changes in Demand. We now explain price rigidity where there is a change in demand with the help of Figure 7. D_2 is the original demand curve. MR_2 is its corresponding marginal revenue curve and MC is the marginal cost curve. Suppose there is a *decrease* in demand shown by D_1 curve and MR_1 is its marginal revenue curve. When demand *decreases*, a price-reduction move by one seller will be followed by other rivals. This will make LD_1, the lower portion of the new demand curve, more inelastic than the lower portion HD_2 of the old demand curve. This will tend to make the angle at L approach a right angle. As a result, the gap EF in MR_1 curve is likely to be wider than the gap AB of the MR_2 curve. The marginal cost curve MC will, therefore, intersect the lower marginal revenue curve MR_1 inside the gap EF, thus showing a stable price for the oligopolistic industry. Since the level of the kinks H and L of the two demand curves remains the same, the same price OP is maintained after the decrease in demand. But the output level falls from OQ_2 to OQ_1. This case can be reversed to show *increase* in demand by taking D_1 and MR_1 as the original demand and marginal revenue curves and D_2 and MR_2 as the higher demand and marginal revenue curves respectively. The price OP is maintained but the output rises from OQ_1 to OQ_2. So long as the MC curve continues to intersect the MR curve in the discontinuous portion, there will be price rigidity.

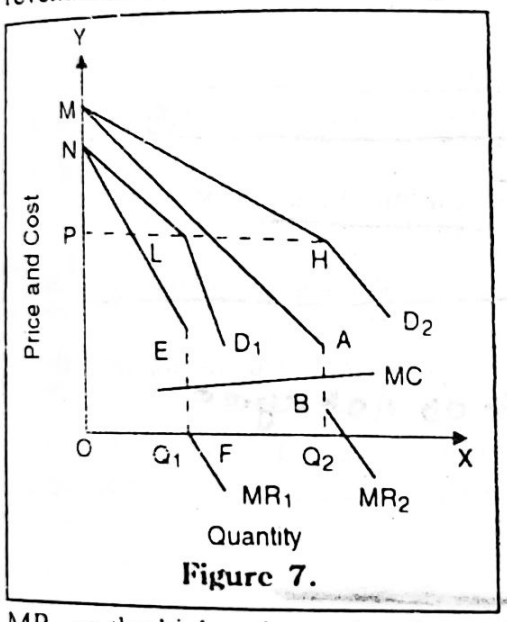


Figure 7.

However, if demand *increases*, it may lead to a higher price. When demand increases, a seller would like to raise the price of the product and others are expected to follow him. This will tend to make the upper portion MH of the new demand curve elastic than the NL portion of the old curve. Thus the angle at H becomes obtuse, away from the right angle. The gap AB in the MR_2 curve becomes smaller and the MC curve intersects the MR_2 curve above the gap, indicating a higher price and lower output. If, however, the marginal cost curve passes through the gap of MR_2, there is price stability.

The whole analysis of the kinked demand curve points out that price rigidity in oligopolistic markets is likely to prevail if there is a price reduction move on the part of all sellers. Changes in costs and demand also lead to price stability under normal conditions so long as the MC curve intersects the MR curve in its discontinuous portion. But price increase rather than price rigidity may be found in response to rising cost or increased demand.

Reasons for Price Stability

There are a number of reasons for price rigidity in certain oligopoly markets. (*i*) individual sellers in an oligopolistic industry might have learnt through experience the futility of price wars

and thus prefer price stability. (*ii*) They may be content with the current prices, outputs and profits and avoid any involvement in unnecessary insecurity and uncertainty. (*iii*) They may also prefer to stick to the present price level to prevent new firms from entering the industry. (*iv*) The sellers may intensify their sales promoting efforts at the current price instead of reducing it. They may view non-price competition better than price rivalry. (*v*) After spending a lot of money on advertising his product, a seller may not like to raise its price to deprive himself of the fruits of his hard labour. Naturally, he would stick to the on-going price of the product. (*vi*) If a stable price has been set through agreement or collusion, no seller would like to disturb it, for fear of unleashing a price war and thus engulfing himself into an era of uncertainty and insecurity. (*vii*) Lastly, it is the kinked demand curve analysis which is responsible for price rigidity in oligopolistic markets.

Criticism

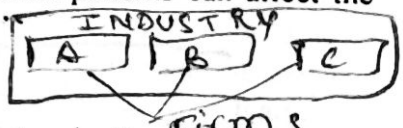
Kinked demand curve given by **Prof. Sweezy** has been criticised on the following grounds :

1. Not Proper Explanation of Price Determination. The Kinked Demand Curve is criticised on the ground that it does not explain how the prevailing price is determined. It merely helps to explain why oligopolistis will not change the prevailing price if it yields them reasonable profit.

2. Wrong Assumptions. The theory of kinked demand curve is based on the assumption that other firms will follow price decrease but not price increase. The said assumption of Kinked Demand Theory could not be proved empirically. Oligopoly prices are not as rigid particularly in an upward direction as the kinked demand theory implies.

3. It Ignores Non-Price Competition. The price rigidity theory given by Prof. Sweezy does not take into consideration non-price competition. The oligopolist may charge the prevailing price but at the same time allow several concessions to the customers. It makes the real price flexible even if money price remains rigid. Moreover, Sweezy model ignores, credit facilities, concessions and other promotional facilities given to the customers.

4. It fails to consider Competitive Reaction. The Kinked Demand Curve of **Prof. Sweezy** fails to consider competitive reaction patterns. **Prof. Baumol** found that the Kinky demand curve does not show how the oligopolistic firm's view of competitive reaction patterns can affect the change ability of whatever price it charges from the consumer.



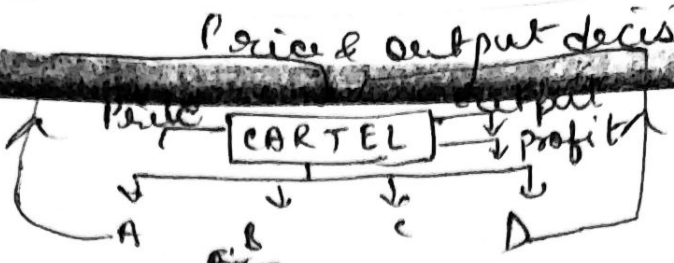
B. EQUILIBRIUM UNDER COLLUSION

The modern economists are of the view that independent price determination cannot exist for long in oligopoly. It leads to uncertainty and insecurity and to overcome them there is a tendency among oligopolists to act collectively by tacit collusion. In addition, the firms can gain the economies of production. All the firms in oligopoly tend to enlarge their size and lower their costs of production per unit and capture maximum share of the market.

Collusive oligopoly is a situation in which firms in a particular industry decide to join together as a single unit for the purpose of maximising their joint profits and to negotiate among themselves so as to share the market. The former is known as (*i*) the joint profit maximisation cartel and (*ii*) the latter as the market-sharing cartel. There is another type of collusion, known as leadership, which is based on tacit agreements. Under it, one firm acts as the price leader and fixes the price for the product while other firms follow it. Price leadership is of three types : low-cost firm, dominant firm, and barometric.

(a) CARTELS

A cartel is an association of independent firms within the same industry. The cartel follows common policies relating to prices, outputs, sales and profit maximisation and distribution of products.



Cartels may be voluntary or compulsory and open or secret depending upon the policy of the government with regard to their formation. They are of many forms and use many devices in order to follow varied common policies depending upon the type of the cartel. Here, we discuss two most common types of cartels : (1) joint profit maximisation or perfect cartel; and (2) market-sharing cartel.

1. Joint Profit Maximisation Cartel under Perfect Collusion

The uncertainty is found in an oligopolistic market which provide an incentive to rival firms to form a perfect cartel. Perfect cartel is an extreme form of perfect collusion. Under it, firms producing a homogeneous product form a centralised cartel board in the industry. The individual firms surrender their price-output decisions to this central board. The board determines for its members the output, quotes the price to be charged and the distribution of industry profits. The central board acts like a single monopoly whose main aim is to maximise the joint profits of the oligopolistic industry.

Assumptions

The analysis of joint profit maximisation cartel is based on the following assumptions :

1. Only two firms A and B are assumed in the oligopolistic industry that form the cartel.
2. Each firm produces and sells a homogeneous product that is a perfect substitute for each other.
3. The market demand curve for the product is given and is known to the cartel.
4. The number of buyers is large.
5. The price of the product determines the policy of the cartel.
6. The cost curves of the firms are different but are known to the cartel.
7. The cartel aims at joint profit maximisation.

Joint Profit Maximisation Solution

Given these assumptions, and given the market demand curve and its corresponding MR curve, joint profits will be maximised when the industry MR equals the industry's MC. Figure 8 shows the situation where D is the market (or cartel) demand curve and MR is its corresponding marginal revenue curve. The aggregate marginal cost curve of the industry ΣMC is drawn by the lateral summation of the MC curves of firms A and B, so the $\Sigma MC = MC_a + MC_b$. The cartel solution that maximises joint profit is determined at point Σ where the Σ MC curve intersects the industry MR curve. Consequently, the total output is OQ which will be sold at OP = (QF) price. As under monopoly, the cartel board will allocate the industry output by equating the industry MR to the marginal cost of each firm. The share of each firm in the industry output is obtained by drawing a straight line from E_o to the vertical axis which passes through the curves MC_b and MC_a of firms B and A at points E_b and E_a respectively. Thus

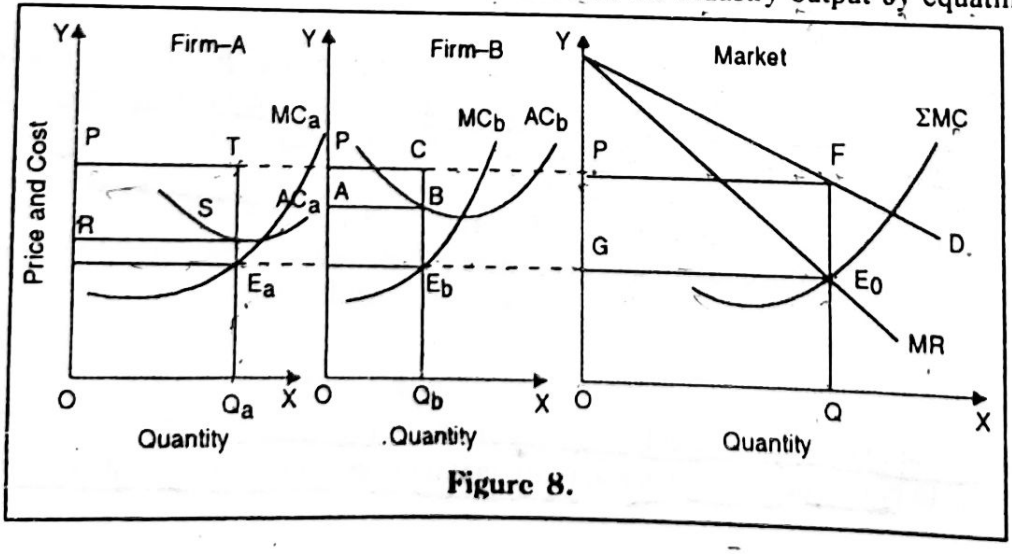


Figure 8.

the share of firm A is OQ_a and that of firm B is OQ_b which equal the total output OQ (= OQ_a + OQ_b) . The price OP and the output OQ distributed between A and B firms in the ratio of OQ_a - OQ_b is the monopoly solution. Firm A with the lower costs sells a larger output OQ_a than the firm B with higher costs so that $OQ_a > OQ_b$. But this does not mean that A will be getting more profit than B. The joint maximum profit is the sum of RSTP and ABCP earned by A and B respectively. It will be pooled into a fund and distributed by the cartel board according to the agreement arrived at by the two firms at the time of the formation of the cartel.

Advantages. Perfect collusion by oligopolistic firms in the form of a cartel has many *advantages*. It avoids price wars among rivals. The firms forming a cartel gain at the expense of customers who are charged a high price for the product. The cartel operates like a monopoly organisation which maximises the joint profit of firms. Generally, joint profits are high than the total profits earned by them if they were to work independently..

Problems of a Cartel

The problems of cartels are stated below :

1. It is difficult to make an accurate estimate of the *market demand curve*.
2. The estimation of the market MC curve may be inaccurate because of the supply of wrong data about their MC by individual firms to the cartel.
3. The formation of a cartel is a slow process which takes a long time for the agreement to arrive at by firms especially if their number is very large.
4. *The larger the number of firms* in a cartel, the less are its chances of survival for long because of the distrust. The cartel will, therefore, break down.
5. In theory, the cartel-members agree on joint profit maximisation. But in practice, they seldom agree on profit distribution. In general to do not agree
6. The price of the product fixed by the cartel cannot be changed even if the market conditions require it to be changed. This is because it takes a long time for the members to arrive at an agreed price. No change in price
7. Price stickiness gives rise to **'chislers'** who secretly cut the price or violate the quota agreement.
8. Unless all member firms in the cartel are strongly committed to cooperation, outside disturbances, such as a sharp fall in demand, may lead to the break down of the cartel.
9. Some high-cost uneconomic firms may refuse to shut down or leave the cartel despite the cartel board's request.

(b) MARKET-SHARING CARTEL

Another type of perfect collusion in an oligopolistic market is found in practice which relates to market-sharing by the member firms of a cartel. There are two main methods of market-sharing: (*a*) non-price competition; and (*b*) quota system. They are discussed as under :

(*a*) **Non-Price Competition Cartel.** The non-price competition agreement among oligopolistic firms is a loose form of cartel. Under this type of cartel, the low-cost firms press for a low price and the high-cost firms for a high price. But ultimately, they agree upon a common price below which they will not sell. Such a price must allow them some profits. The firms can compete with one another on a non-price basis by varying the colour, design, shape packing etc. of their product and having their own different advertising and other selling activities. Thus each firm shares the market on a non-prices basis while selling the product at the agreed common price.

(*b*) **Market Sharing by Quota Agreement.** The second method of market sharing is the quota agreement among firms. All firms in an oligopolistic industry enter into a collusion for charging

an agreed uniform price. But the main agreement relates to the sharing of the market equally among member firms so that each firm gets profits on its sales.

Assumptions

This analysis is based on the understated assumptions :

1. Only two firms can enter into market-sharing agreement on the basis of the quota system.
2. Each firm produces and sells a homogeneous product.
3. The number of buyers is large.
4. The market demand curve for the product is given and known to the cartel.
5. Each firm has its own demand curve having the same elasticity as that of the market demand curve.
6. Both firms share the market equally.
7. Cost curves of the two firms are identical.
8. There is no threat of entry by new firms.
9. Each sells the product at the agreed uniform price.

Market-Sharing Solution

With these assumptions, the equal market sharing between the two firms is explained in Fig. 9 where D is the market demand curve and *d*/MR is its corresponding MR curve. Σ MC is the aggregate MC curve of the industry. The ΣMC curve intersects the *d*/MR curve at point E which determines QA (= OP) price and total output OQ for the industry. This is the monopoly solution in the market-sharing cartel.

How will the industry output be shared equally between the two firms ? Let us assume that the *d*/MR is the demand curve of each firm and *mr* is its corresponding MR curve. AC and MC are their identical cost curves. The MC curve intersects the *mr* curve at point *e* so that the profit maximisation output of each firm is Oq. Since the total output of the industry is OQ which is equal to $2 \times O_q$ = (OQ = 20*q*), it is equally shared by the two firms as per the quota agreement. Thus each sells Oq output at the same price *q*B (= OP) and earns RP per unit profit. The total profit earned by each firm is RP × Oq and by both is RP × 20q or RP × OQ.

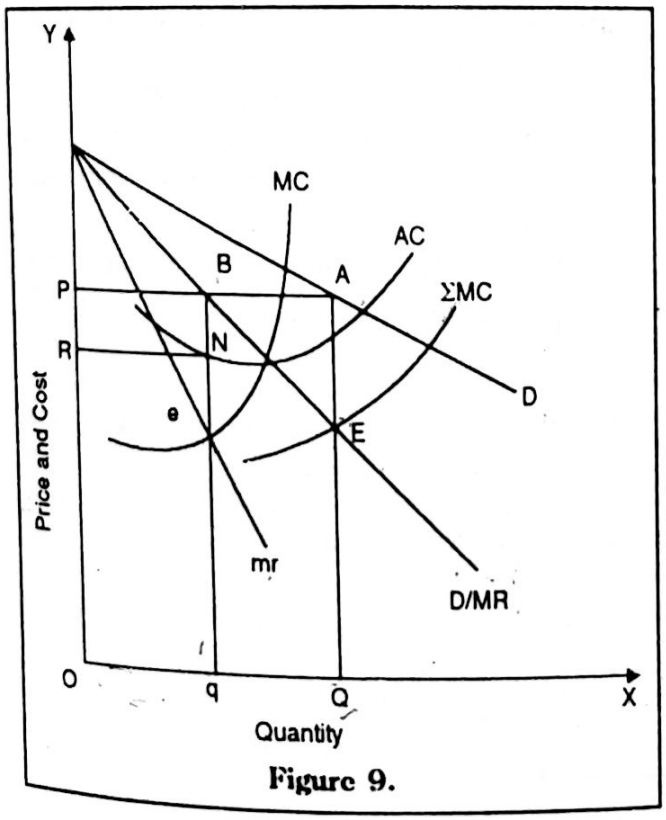


Figure 9.

In practice, there are more than two firms in an oligopolistic industry which do not share the market equally. Moreover, their cost curves are also not identical. In case their cost curves differ, their market shares will also differ. Each firm will charge an independent price in accordance with its own MC and MR curves. They may not sell the same quantity at the agreed common price. They may be charging a price slightly above or below the profit maximisation price depending upon its cost conditions. But each will try to be nearest the profit maximisation price. This will lead to the breaking up of the market sharing agreement.

Threat of Entry

Suppose there is a constant threat of entry into the oligopolistic industry. In that case if the firms agree on the price OP, new firms will enter the industry, reduce their sales and profits. This may ultimately lead to excess capacity and uneconomic firms in the industry. The existence of excess capacity and uneconomic firms will raise the average costs and the firms will be earning only normal profits.

If the existing oligopolists are wiser, they may forestall entry by charging a price lower than the profit maximisation price OP. In this way the collusive oligopolists by charging a lower price will be earning larger profits in the long-run, and continue their exclusive control over the market by keeping the new entrants out for ever. Therefore, we can conclude that under perfect collusive oligopoly pricing has not any set pattern of price behaviour. The resultant price and output will depend upon the reaction of the collusive oligopolists towards the profit maximisation price and their attitude towards the existing and potential rivals.

C. Imperfect Collusion in Oligopoly

The cases of perfect collusion (centralised cartel and Market- Sharing cartel) do not exist in the real world. The case of a perfect collusion stands as a polar extreme where the maximisation of joint profits is emphasised. But mutual distrust among member firms and their unwillingness to give up all of their sovereignty make it most unlikely that cases of perfect collusion could long endure. In fact, collusion is always imperfect. The cases of imperfect collusion also try to raise prices and profits, but they never assume the position of monopoly. We may find a number of cases of imperfect collusion, but in the present section, we shall discuss the important case of price leadership.

Price Leadership

Price leadership is said to exist when the price at which most or all of the firms in the industry offer to sell is determined by the leader (one of the firms of the industry). This method was formulated by the German economist, **Prof. Heinrichvon Stackelberg**. This is also known as Leadership Solution or Followership Solution.

Here, we shall discuss only two important cases of price leadership–

(1) Price Leadership by a Low-Cost Firm, and

(2) Price Leadership by a Dominant Firm.

Let us explain these two cases in detail.

1. The Low-Cost Price Leadership Model. In the low-cost price leadership model, an oligopolistic firm having lower costs than the other firms sets a lower price which the other firms have to follow. Thus the low-cost firm becomes the price leader.

Assumptions

The low-cost firm model is based on the assumptions of :

1. There are two firms A and B.
2. Their costs differ. A is the low-cost firm and B is the high-cost firm.
3. They have identical demand and MR curves. The demand curve faced by them is 1/2 of the market demand curve.
4. The number of buyers is large.
5. The market industry demand curve for the product is known to both the firms.

Explanation

In figure 10, D is the industry demand curve and d/MR is its correspond ing marginal revenue curve which is the demand curve for both the firms and *mr* is their marginal revenue curve. The cost curves of the low-cost firm A are AC_a and MC_a and of the high-cost firm B are AC_b and MC_b.

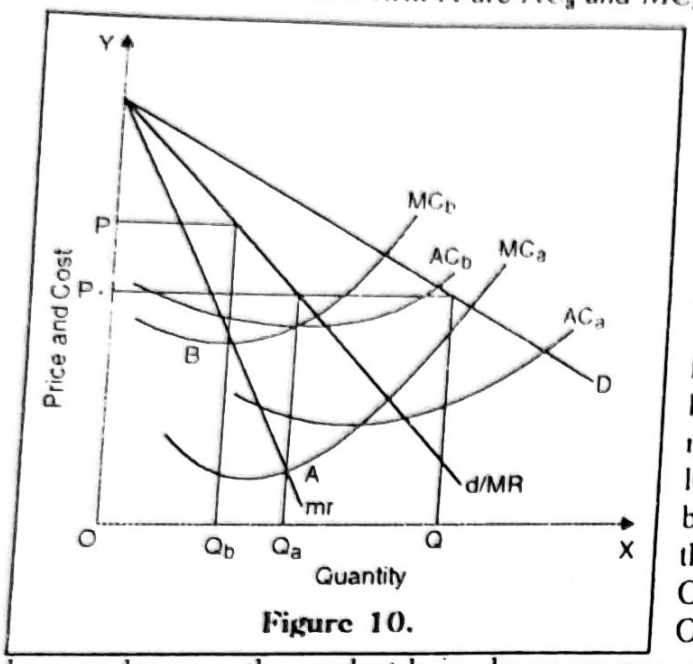


Figure 10.

If the two firms act independently, the high cost firm B would charge OP price per unit and sell OQ_b quantity, as determined by point B where its MC_b curve cuts the *mr* curve. Similarly, the low-cost firm A would charge OP_1 price per unit and sell OQ_a quantity, as determined by point A where its MC_a curve cuts the *mr* curve. As there is a tacit agreement between the two firms, the high-cost firm B has no choice but to follow the price leader firm A. It will, therefore, sell OQ quantity, at a lower price OP_1 even though it will not be earning maximum profits. On the other hand, the price leader A will earn much higher profits at OP_1 price by selling OQ_a quantity. Since both A and B sell the same quantity OQ_a the total market demand OQ is equally divided between the two, $OQ = 2\ OQ_a$. But if firm B sticks to OP price, its sales will be zero because the product being homogeneous, all its customers will shift to firm A.

The price-leader firm A can, however, drive firm B out of the market by setting a lower price than OP_1, lower than the average cost AC_b of firm B. Firm A would become a monopoly firm. But in such a situation it will have to face legal problems. Therefore, it will be in its interest to fix OP_1 price and tolerate firm B in order to share the market equally and maximise its profits.

Price leadership model with unequal market Shares. The two firms will have different demand curves along with their different cost curves. The low-cost firm's demand curve will be more elastic than that of the high-cost firm. The high-cost firm would maximise its profits by selling less at a higher price while the low-cost firm would sell more at a lower price and maximise its profits. If they enter into a common price agreement, the high- cost firm will sell more quantity at a lower price set by the price leader by earning a little less than the maximum profits. But this is only possible so long as the price set by the leader covers the AC of the high-cost firm.

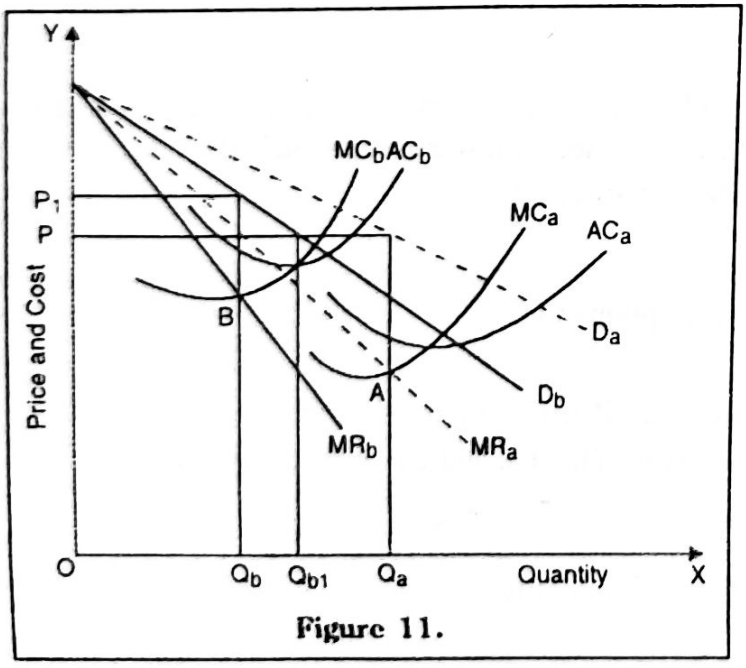


Figure 11.

The price leadership model with unequal market shares is given in Figure 11, where the market demand curve is not shown to simplify the analysis. In the figure, D_a is the demand curve of the low-cost firm A and MR_a is its marginal revenue curve. The demand curve and MR curve of the high-cost firm B are D_b and MR_b. The low-cost firm A sets the price OP and the quantity

OQ_a when its MC_a curve cuts its MR_a curve at point A. The price OP_1 and the quantity OQ_b of the high-cost firm B are determined when its MC_b curve cuts its MR_b curve at point B. Following the price leader firm A, when firm B accepts the price OP, it sells more quantity OQ_{b1} and earns less than maximum profits. It will pay the follower firm to sell this quantity at OP price so long as this price covers its average cost. If it does not follow the leader firm and tries to sell OQ_b quantity at its profit maximisation price OP_1, it will have to close down because its customers will switch over to the leader firm which charges low price OP. However, if there is no agreement for sharing the market between the leader and the follower firms, the follower can adopt the price of the leader (OP) but produce a lower quantity (less than OQ_{b1}) than required to maintain the price in the market and thus push the leader to a non-profit maximisation position by producing less output.

2. The Dominant Firm Price Leadership Model. This is a typical case of price leadership where there is one large dominant firm and a number of small firms in the industry. The dominant firm fixes the price for the entire industry and the small firms sell as much product as they like and the remaining market is filled by the dominant firm itself. It will, therefore, select that price which brings more profits to itself.

Assumptions

This is based on the following assumptions :

1. The oligopolistic industry consists of a large dominant firm and a number of small firms.
2. The dominant firm sets the market price.
3. All other firms act like pure competitors, which act as price takers. Their demand curves are perfectly elastic for they sell the product at the dominant firm's price.
4. The dominant firm alone is capable of estimating the market demand curve for the product.
5. The dominant firm is in a position to predict the supplies of other firms at price set by it.

Explanation. Given these assumptions, when each firm sells its product at the price set by the dominant firm, its demand curve is perfectly elastic at that price. Thus its marginal revenue curve coincides with the horizontal demand curve. The firm will produce that output at which its marginal cost equals marginal revenue. The MC curves of all the small firms combined laterally establish their aggregate supply curve. All these firms behave competitively while the dominant firm behaves passively. It fixes the price and allows the small firms to sell all they wish at that price.

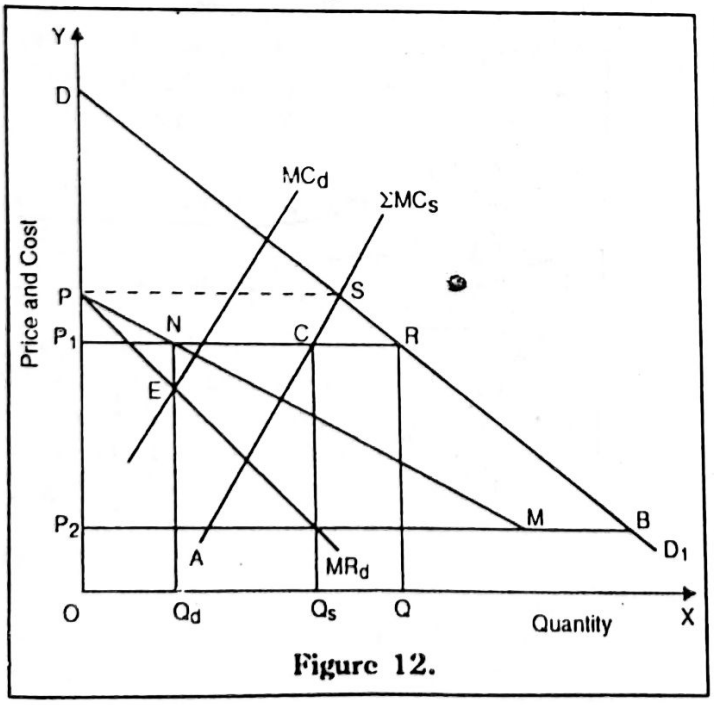


Figure 12.

The case of price leadership by the dominant firm is explained in figure 12. DD_1 is the market demand curve. ΣMC_s is the aggregate supply curve of all the small firms. By subtracting ΣMC_s from DD_1 at each price, we get the demand curve faced by the dominant firm, $PNMBD_1$ which can be drawn as follows. Suppose the dominant firm sets the price OP. At this price, it allows the small firms to meet the entire market demand by supplying PS quantity. But the dominant firm would supply nothing at the price OP.

Point P is, therefore, the starting point of its demand curve. Now take a price OP_1 less than OP. The small firms would supply P_1C (= OQ_s) output at this price OP_1 when their SMC_s curve cuts their horizontal demand curve P_1R at point C. Since the total quantity demanded at OP_1 price is P_1R (= OQ) and the small firms supply P_1C quantity, CR (= Q_s Q) quantity would be supplied by the dominant firm. By taking P_1N = CR on the horizontal line P_1R, the dominant firm's supply becomes P_1N (= OQ_d) Thus we derive point N on the dominant firm's demand curve by subtracting the horizontal distance from point P_1 to N from the demand curve DD_1. Since the small firms supply nothing at prices below OP_2 because their ΣMC_s curve exceeds this price, the dominant firm's demand curve coincides with the horizontal line P_2B over the range MB and then with the market demand curve over the segment BD_1. Thus the dominant firm's demand curve is $PNMBD_1$

The dominant firm will maximise its profits at that output where its marginal cost curve MC_d cuts its MR_d, the marginal revenue curve. It establishes the equilibrium point E at which the dominant firm sells OQ_d output at OP_1 price. The small firms will sell OQ_s output at this price for ΣMC_s, the marginal cost curve of the small firms equals the horizontal price line P_1R at C. The total output of the industry will be $OQ = OQ_d + OQ_s$. If OP_2 price is set by the dominant firm, the small firms would sell P_2A and the dominant firm AB. In case a price below OP_2 is set the dominant firm would meet the entire industry demand and the sales of the small firms would be zero. The above analysis shows that the price- quantity solution is stable because the small firms behave passively as price-takers.