Manonmaniam Sundaranar University

Directorate of Distance and Continuing Education
Tirunelveli – 627012, Tamil Nadu.

B.A.ECONOMICS
(First Year)

Micro Economics – II

(JMEC21)

Prepared by

Dr.K.AJITHA
Assistant Professor of Economics
Manonmaniam Sundaranar University
Tirunelveli – 627 012.

MICRO ECONOMICS – II

Unit I: Perfect Competition

Features of Perfect Competition – Equilibrium of the firm and the Industry in the Short Run – Long Run Equilibrium in Perfect competition – Time Element Analysis.

Unit II: Monopoly and Price Discrimination

Definition of Monopoly – Demand and Marginal Revenue – Equilibrium under Monopoly – Dead Weight Loss – Policies to Control Monopoly – Price Discrimination – First Degree, Second Degree and Third Degree Price Discrimination – Dumping.

Unit III: Monopolistic and Oligopoly Competition

Monopolistic Competition – Features – Product Differentiation – Market Equilibrium and Short Run and Long Run – Barriers to Entry – Group and Industry Equilibrium – Excess Capacity – Oligopoly – Kinked Demand Curve - Collusion – Cartels and Price Leadership – Game Theory – Minimax – Maximin – Nash Equilibrium.

Unit IV: Distribution Theory

Functional and Personal Distribution – Marginal Productivity Theory of Distribution – Product Exhaustion Theorem – Concepts of VMP and MRP.

Unit V: Welfare Economics and General Equilibrium

Welfare Criteria – Adam Smith – Edge Worth – Pareto – Kaldor – Market Failure – Externalities – Walrasian General Equilibrium – Static properties for Consumption, Production, and Distribution.

Text Books

1. Robert Pindyck and Daniel L. Rubinfield, (2001) Micro Economics, Macmillan.

2. Paul Krugman and Robin Wells, Micro Economics, Worth Publisher, 2020.

3. Walter Nicholson and Christopher Snyder, Micro Economics Theory – Basic Principles and Extensions, Cengage Learning India Private Limited, 12th Edition, 2016.

4. Timothy Taylor, Steven A Green Law and David Shapiro (2017) Principles of Economics, 12th Media Service.

Table of Content

UNIT - I

PERFECT COMPETITION

1.1. Introduction

Perfectly competitive is the name given to a market for a commodity in which a large number of unorganized buyers and sellers compete with one another in the purchase and sale of a commodity without having any individual influence over the market price of the commodity. So it is a market structure in which there are large numbers of buyers and sellers, exchanging homogeneous product without any interference by the government.

According to Leftwitch, "Perfect competition is a market in which there are many firms selling identical products with no firm large enough relative to the entire market to be able to influence market price". This definition tells us that perfectly competitive market is without any kind of monopoly element or any control from the buyers and sellers side.

Mrs John Robinson has defined perfect competition in terms of price elasticity of demand. According to her, "Perfect competition prevails when the demand for the output of each producer is perfectly elastic".

In nutshell we can say that, perfectly competitive market is a situation where large number of buyers and sellers are buying and selling products. Products produced all producers are homogeneous. All producers under perfectly competitive market have to accept price which is settled by two forces namely, demand and supply in the market. Golden principle, 'one market, one price' operates completely and continuously under perfect competition.

1.2. Features or Conditions for Perfect Competition

Koutsiyiannis has used the word assumptions instead of characteristics or features. But the other economists have used the word features. A perfect competitive market has the following features:

1) Large number of buyers and sellers: Under perfect competition numbers of buyers and sellers are in a large numbers but each seller and buyer sells or buys a small quantity of the output. Individual sellers or buyers cannot influence the supply or demand individually. Individual sellers is price taker, price is settled with the two forces of demand and supply by an industry in perfect competition.

2) Identical products of different sellers: The sellers in the perfectly competitive market are supposed to sell completely homogeneous products. There products must be considered to be identical by all the buyers in the market. There should not be any differentiation of products by sellers by way of quality, variety, colour, design, packing or other selling conditions of the product. Thus, in a perfectly competitive market, buyers have no other basis of attaching to one seller or the other and purchasing a sellers product on any basis other than price.

3) Free entry and exit of firms: In perfectly competitive market every firm is free to join or leave the industry. There is free entry and exit of the firms in industry under perfect competition. Firm may enter to share profit and may leave to avoid losses. Firms are not legally or socially bound to enter or exit the industry. This condition must be satisfied especially for long period equilibrium of the industry.

4) Profit maximization: Under perfect competition, all the firms have a common goal of profit maximization. No other goal is being pursued by any firm.

5) Perfect knowledge among buyers and sellers about market conditions: Both buyers and sellers must be having perfect knowledge about the market conditions in which they are operating. Sellers must know the prices being quoted by other sellers in the market. Similarly, the buyers must know the prices being charged by different sellers so that they try to purchase from a seller charging the lowest price. Technically, it means neither the buyers nor the sellers can exploit of the party through misguiding.

6) Perfect mobility of goods and factors: There is perfect mobility of goods and factors under perfect competition between industries, one can sell goods at those places where these goods can fetch high prices, and similarly a factor can move to any industry where he can be paid more. No firm has a monopoly over price or factor of production.

7) Lack of transportation costs: Under perfect competition transportation costs will not influence the price of the product. There will not be any change in the price due to location of different sellers.

8) Lack of selling costs: There is no selling cost under perfect competition. A seller does not spend on advertisements to sell his product because all firms are producing homogeneous products.

9) No government intervention: There is absence of state or government in the market. It means government is not imposing any type of tariffs, subsidies on the demand of a commodity. So firm is a price taker.

10) Difference of firm and industry: A firm is a single unit which is engaged in the production of identical product where as an industry is a group of different firms producing same product. A firm is a price taker whereas industry is a price maker under perfect competition. In short, a perfectly competitive market is that model market in which there is only one price of the product for all the buyers and sellers. Nobody can do anything on his own to change the market determined price.

1.3. Pure and Perfect Competition

An American Economist Prof. E-Chamberlin has used the term pure competition. Pure competition is a narrow whereas perfect competition is a wider term. Prof. Chamberlin has included five features under pure competition that is, large number of buyers and sellers, homogeneous products, free entry and exit of firms, lack of selling costs and lack of transportation costs.

Prof. R.A.Bilas also distinguished perfect and pure competition as, "Perfect competition implies pure competition but also consider other characteristics. Pure competition implies one degree of perfection- the complete absence of monopoly. Generally, perfect competition will introduce the notion of perfect resources mobility and perfect knowledge".

Thus, when we include two more features i.e. perfect knowledge and perfect mobility of factors of production along with the features of pure competition then it would be called perfect competition.

1.4. Is Perfect Competition is a Reality or Myth

It is questioned sometimes whether perfect competition is a reality or myth? Some economists said that it may be found in the case of agricultural commodities. Farmers compete with each other quite unconsciously because none of them is able to influence the price of products in the market. But we

cannot say that the market for other commodities is also anywhere near perfect competition. We commonly find that in actual market conditions of perfect competition are being violated in one way or the other. This gives us the impression that perfect competition is a myth. The different violations of perfect competition are:

- Products are differentiated through packing, colour, method of selling and advertisement.
- Some buyers or sellers even in the competitive market may be having individual influence.
- There are many problems to the mobility of labour.
- Demand and supply of many commodities are regulated by the government.
- Entry to many industries is blocked by economic, legal or institutional factors. So keeping in view the above factors, we can say that perfect competition is only a theoretical concept. It has no relevance to reality. Now the important question arises, if it has nothing to do with the reality then, why we study this market and its determination? Here are some reasons for the study of perfect competition.
- Perfect competition is an ideal organization of the market that can serve as a good perspective to compare the actual allocation of resources with the ideal, what is and what ought to be. Study of perfect competition pricing has given birth to much of the present day welfare economics.
- It is good simplification to start teaching price theory. Having done this we can go on to study more complicated and presumably more realistic analysis of price determination.
- There is indeed some practical utility in the study of perfect competition. Perfect competition was a standard model of a market with the classical economists. Although some classical economists were aware of the non-existence of some of the assumptions of pure and perfect competition in the actual markets, they thought it better to take the standard form of the market and built up a theoretical structure on it rather than being held up in building economic theory by the existence of a few imperfections.

1.5. Price Determination under Perfect Competition

Market price in a perfectly competitive market is determined by the interaction of the forces of market demand and market supply. Market demand means the sum of the quantity demanded by individual buyers at different prices. Similarly, market supply is the sum of quantity supplied by the individual firms in the industry. Each seller and buyer takes the price as determined. Therefore, in a perfectly competitive market, the main problem for a profit-maximizing firm is not to determine the price of its product but to adjust its output to the market price so that profit is maximized.

The price determination under perfect competition can be explained under three situations:

- Market period price
- Short period price
- Long period price

1). Market Period Price

Market period is very short period in which supply cannot be increased or decreased. Market period demand is affected by temporary factors. In market period supply is perfectly inelastic. In case of perishable goods, whatever the supply is available that cannot be changed even with the increase or decrease in demand in the quantity. In case of durable goods, supply can be increased or decreased by bringing from the store. In case, demand decreases, some quantity can be put into stock whereas in case, demand decreases, supply can be increased by bringing the quantity from the store. Market price is the price of a good which prevail at any given time. To study price determination in such a market, goods are divided into two parts i.e. perishable goods and durable goods.

 Perishable Goods: Perishable goods are those goods which perish very quickly and cannot be stored or kept back such as fish, vegetables, milk etc. they will go waste if stored. Therefore, the whole of the given stock has to be sold in the market at whatever price is available. So in market period supply curve is perfectly inelastic. It is parallel to Y-axis. It can be shown by following figure:

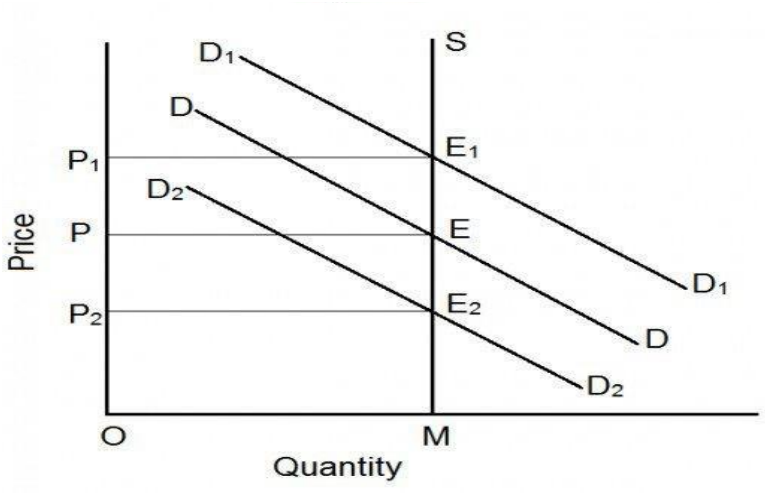


Fig.1.1 Perishable Goods

This diagram depicts the price determination of market period price. MS is the supply curve, DD is the initial demand curve which intersects the supply curve MS at E. The equilibrium price is OP and the quantity demanded and supplied is equal to OM. Now due to a sudden rise in the demand for product shifted DD to D1D1, now the new equilibrium is at point E1 and the price increases to OP1. If demand decreases, the demand curve shifted D2D2, and the new equilibrium price becomes OP2. This shows that in case of perishable goods, price increase or decrease with change in demand, supply being perfectly inelastic.

 Durable Goods: In case of durable goods, supply up to some extent can be increased or decreased from stock but afterwards becomes perfectly inelastic. Supply of these goods can be increased even in market period but supply is restricted till the stock ends. In this case firm has some 'minimum reserve price' below which these firms would not be ready to sell these products. When price start to decrease below the 'minimum reserve price' firms stock the goods and wait till demand rises and price start to increase more than the level of minimum price. So supply can be increased and decreased even in market period but only up to the quantity lying in the stock. Market price of durable goods is determined with the forces of demand and supply. This can be shown in the following figure:

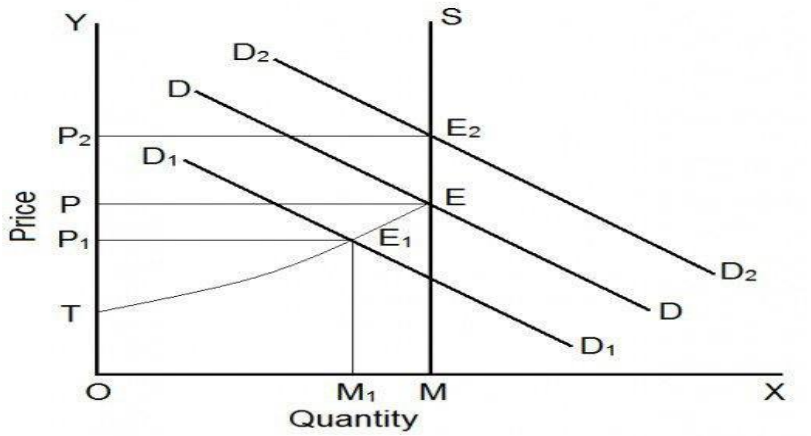


Fig.1.2. Durable Goods

In this figure quantity is measured on 'OX' axis and price is taken on 'OY' axis. DD is the demand curve and TS is the total supply of durable goods in the market period. OM is the total supply of durable goods minimum price is set at OT. If the demand curve is D1D1, and it intersects the supply curve TES at point E1, the equilibrium price is OP1. A shift in the demand curve from D1D1 to DD shows an increase in demand, and along with it the new equilibrium price rises from OP1 to OP. Thus, the further increase in demand beyond DD will have only the effect of raising the price, and the quantity supplied remains unchanged.

2). Short Period Price

Short period is that period in which supply is adjusted to the limited extent. It means supply is adjusted up to the existing production capacity. With the increase in demand, supply can be increased through overworking factors of production. In short period a producer can change only variable factors of production while fixed factor remain fixed.

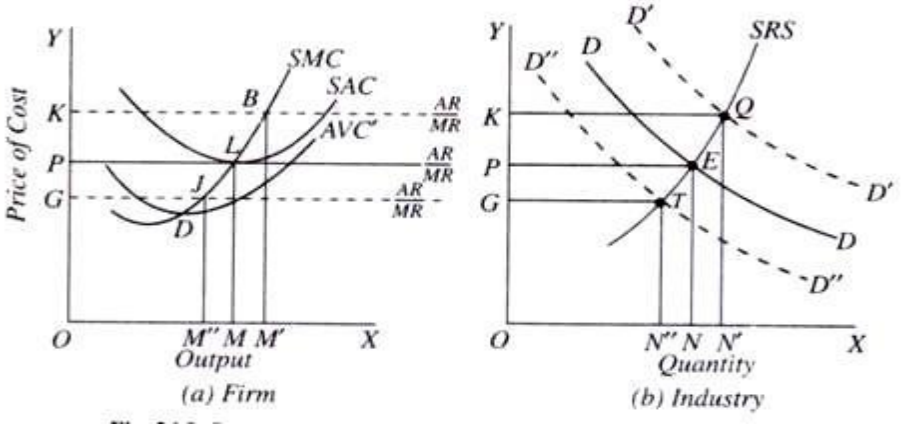


Fig.1.3. Short Period Price

This diagram shows equilibrium of industry. Initially, demand and supply equalize on point E, determining OP price which will be taken y the firm as given and firms earn just normal profits. In case demand increases, demand curves shift upward to D′D′ resulting into change in equilibrium on point Q. accordingly, firm's average revenue and marginal revenue curve shift upward and firm will attain equilibrium on point Q earning excess profit. In case demand decreases, demand curve shift downward to D″D″ resulting into equilibrium in the industry on point T. Accordingly, AR/MR of the firm shift downward. The firm attains equilibrium in (a) diagram. The firm undergoes loss but will continue as it fulfills the variable cost. Hence, it is proved that in short period, firm faces three possibilities: (a) earn excess profit, (b) earn normal profit, (c) loss.

3). Long Period Price

Long period is that period when fixed factor of production becomes variable. So in long run all factors of production become variable. The price which is settled in long period is known as normal price. In long period supply is fully adjusted to demand. In this period, equipment, plants, old machines can be replaced with new ones. There is free entry and exit of firms in long period under perfect competition. In long period, neither excess profit nor loss can occur. Only normal profits will occur. And price thus determined called, Normal price. So, normal price is a price which tends to prevail in the market. It is a probable but not a real price. In long period supply are in equilibrium at that point normal price will be determined.

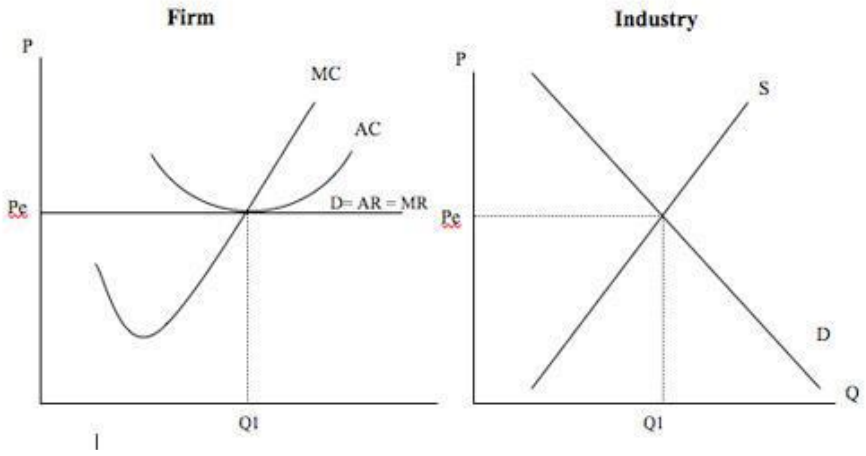


Fig. 1.5. Long Period Price

In the long period, there is no tendency of new firms to enter into market and old firms to leave the industry. Industry attains equilibrium as usual where demand equalizes supply. In case of firm, if there is excess profit, new firms will enter into the market. If there is loss, some firms will leave the market. Only those firms will attain equilibrium which earns just normal profit. It means in a long period firm will attain equilibrium where three conditions satisfied. Firstly MC=MR, secondly MC cut MR from below and lastly MC=MR=AR=AC

In this diagram industry attain equilibrium where demand and supply are equal to each other. Firm attain equilibrium where all the three conditions are applicable. Firm earn just normal profit.

1.5.1. Normal Price and Laws of Increasing Return: Normal price is also influenced by laws of returns. Whenever there is a change in demand, then there will also be a change in the supply of the product in long period. When there is a change in the supply, it affects the cost of production of a firm due to the operation of laws of returns to scale. Change in supply will bring a change both in long run marginal and long run average cost. Whenever cost change it will bring a change in the normal price. So in long period price is always equal to minimum average cost.

Law of Increasing Return and Normal Price: It is also called law of diminishing cost. Under the law of Increasing Return they per unit cost that is average cost will start to fall with the increase in the volume of production. Marginal cost will also fall under this law.

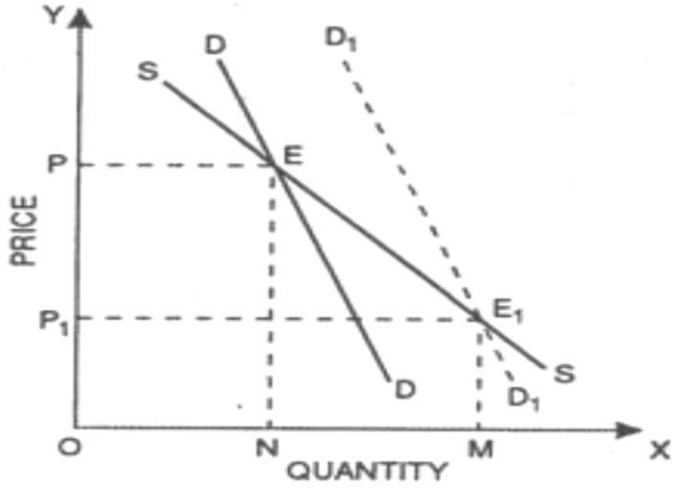


Fig.1.6. Law of Increasing Returns

In this diagram SS is supply curve which slopes downward. It shows that when producer increases the production, cost decreases. DD is a demand curve which intersects supply curve SS at point E. and OP is the equilibrium price, ON is a equilibrium output. When demand increases, demand curve shifted to D1D1 and intersects supply curve SS at point E1. With increase in demand, prices will fall to OP1. So, we can say that under law of increasing returns, normal price would fall when demand increases and normal price would rise if demand falls.

1.5.2. Normal Price and Law of Constant Return: Under the law of constant return long period supply curve is parallel to 'OX' axis or it is horizontal. This shows that per unit cost of production will remain the same as the volume of output id increased or decreased. When industry is operating under law of constant returns price will remain unaffected by an increase or decrease in demand. This can be shown by following diagram.

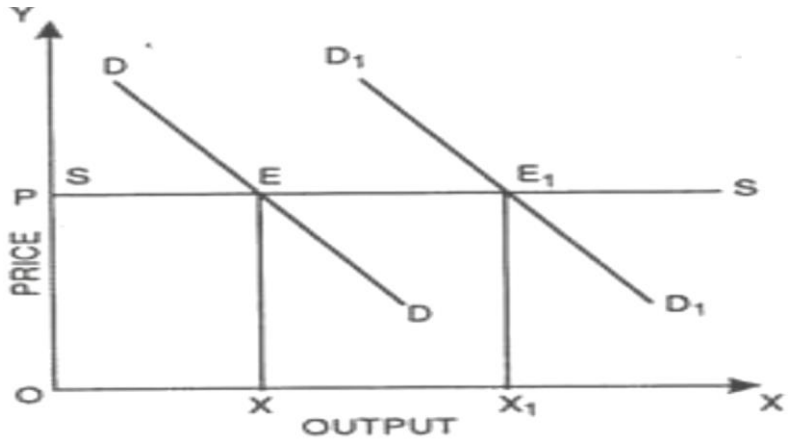


Fig.1.7. Law of Constant Returns

In this diagram quantity and price are measured on 'OX' and 'OY' axis. SS is the long period supply curve of constant cost industry. DD and SS intersect at point E. at OX quantity price is determined at OP. when demand increases demand curve shift upward but price will remain unaffected. There will be no change in price under law of constant return.

1.5.3. Normal Price and Law of Diminishing Return: It is also known law of increasing cost. An increasing cost industry is one in which external diseconomies are more powerful than external economies. Long period supply curve slopes upward when law of diminishing return or increasing cost operate. Per unit cost will increase as more output is produced. To meet the

extra demand, cost of production increases. With the increase in cost of production, price also increases. This shows that price varies directly as the amount supplied varies. It can be shown by following diagram.

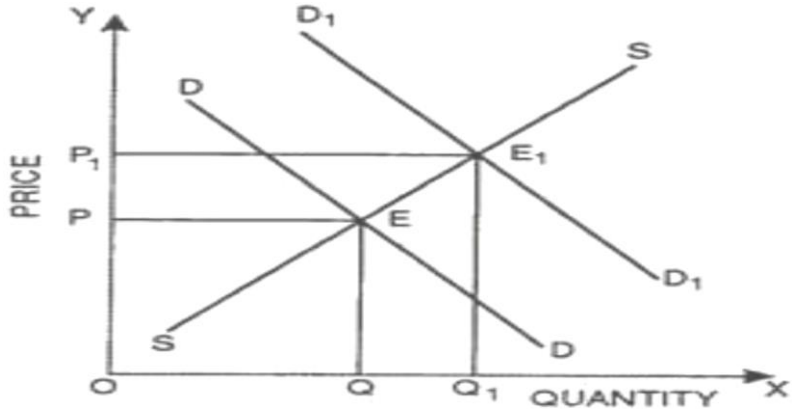


Fig.1.8. Law of Diminishing Returns

In this diagram SS is supply curve and DD is a demand curve. Both intersect at E and OP price is determined. When demand curve shifts to D1D1 with the increase in demand. It coincide supply curve at E1. To produce OQ1 more quantity, cost increases, price is raised to OP1 from OP. So it is observed that under law of Diminishing Returns with the rise in demand, price rises and with the fall in demand price falls.

Summary:

Perfect competition is an ideal market structure where the same price is quoted by every seller and accepted by all the buyers. The firm in the market is price taker. There is a perfect mobility of factors of production and is no barrier, legal or market related, on the entry of new firms into or exit of existing ones from the industry. There is no government intervention with the working of the market system. In short run, a firm in a perfectly competitive market may be in a position to earn economic profit. In long run no firm is in a position to earn economic profit, nor does any firm make losses. So there is only normal profit in long run.

****

UNIT - II

MONOPOLY AND PRICE DISCRIMINATION

2.1. Introduction

Earlier it was observe that there was no monopoly market. It was just exceptional case but now a day we can see many examples in real world of this market. There are two extreme cases of market one is perfect competition where there are large number of sellers selling homogenous product and other extreme end is pure monopoly when there is only single seller for example Indian railway.

2.2. MEANING

Monopoly is a market having single seller of a product which has no close substitutes. Literally Monopoly implies 'Mono' means One and 'Poly' means seller. Thus monopoly means 'One Seller' or 'One Producer' exist in a market. There are three main important points regarding monopoly

i. There must be single seller of a product. The single producer can be in the form of individual owner, a single partnership or a joint stock company.

ii. No substitutes of the product in the market.

iii. There must be strong barriers to entry of new firms into the market.

2.3. DEFINITION

According to Koutsoyiannis "Monopoly is a market situation in which there is a single seller, there are no close substitutes for commodity it produces there are barriers to entry"

According to Lerner "Monopoly as any seller who is confronted with a falling demand curve for his product"

2.4. ASSUMPTIONS/ FEATURES OF MONOPOLY

The following are the main features or assumptions of monopoly market:

i. Single Seller & Large number of Buyers: This is the main feature of monopoly that there must be single seller of the product and there are strong barriers to entry for new firms. And there is an existence of large number of buyers.

ii. No Close Substitutes: There must be no close substitutes of the product in the market otherwise monopoly will break.

iii. Barriers to Entry: There must be barrier to entry for the new firms into the market. It can be through licence, limit pricing policy, economies of production etc.

iv. Price Maker: A monopolist is the whole seller of the product with no close substitutes. So it is industry itself. It is price maker as well as price taker also.

v. Price Discrimination: When a monopolist charges different prices for the same product from different buyers it is case of price discrimination. In monopoly seller can practised price discrimination as he is single producer of the product.

REASONS OF EMERGEMCE OF MONOPOLY POWER

There are many causes due to which monopoly generates

- Patent rights for a product or for a process of production of the product.
- Exclusive ownership of raw material and exclusive knowledge of production technique.
- Sometime government provide gnat for franchise to a firm.
- Monopoly may be generate due to scale of production which give economies of scale.
- Monopoly can be generated through limit pricing policy.

2.5. EQUILIBRIUM UNDER MONOPOLY:

A monopolist, like other producers, is also guided by the chief consideration of the maximisation of net gains or the minimisation of losses. For determining the optimal output, he is required to make a comparison between marginal cost and marginal revenue. The output of the monopolist will be set at the point at which marginal revenue is equated with marginal cost. If marginal revenue were any higher it would pay the monopolist to increase production because the additional costs generated would be lower than the revenue, and profits would rise. The reverse would be true if marginal revenue were any lower than marginal cost. The price of the monopolist is determined by demand as the firm cannot set both output and price. For its chosen output, the monopolist can read price off a market demand curve, which will lie above the marginal revenue curve. The total profits of a monopolist become, as in other cases, the maximum at the output where marginal cost becomes equal to marginal revenue.

If marginal revenue is greater than marginal cost, the monopolist will be able to increase his total profits by producing more. If, on the other hand, marginal cost is greater than marginal revenue at any level of output, he gets losses and so will reduce the output, where MC=MR. By fixing his output at the optimal level, he will fix the price of his product, which he determines from his average revenue curve. The equilibrium position of a monopolist in the short run is shown in Fig. 2.1, where he produces OQ_0 output because at the output MC=MR. for OQ_0 equilibrium output he charges Q_0P_0 price—the monopoly equilibrium price.

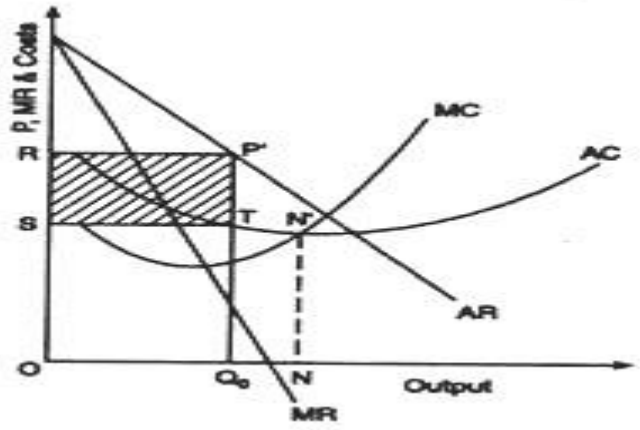


Fig 2.1. The equilibrium position of a monopolist in the short run

His supernormal or excess profit is represented by the area $RSTP_0$. This excess profit does not disappear in the long run due to entry restrictions. So there is no fundamental difference between the short-run and the long-run in a monopoly as situation, imperfect competition. But the fact remains that if a monopolist operates a profit in the short run, he will operate on a much larger scale in the long run. In other words, a single plant monopolist prices become a multi-plant one in the long run. However, there is an important point to note in this context. Since increasing of scale becomes relevant in the long run a monopolist may operate under alternative cost conditions.

Long-Run Monopoly Equilibrium:

In the long run a monopolist may produce under increasing cost or under decreasing cost or under constant cost. Equilibrium situations of a monopolist under three such cost situations can be shown in Fig. 2.2 (a,b,c).

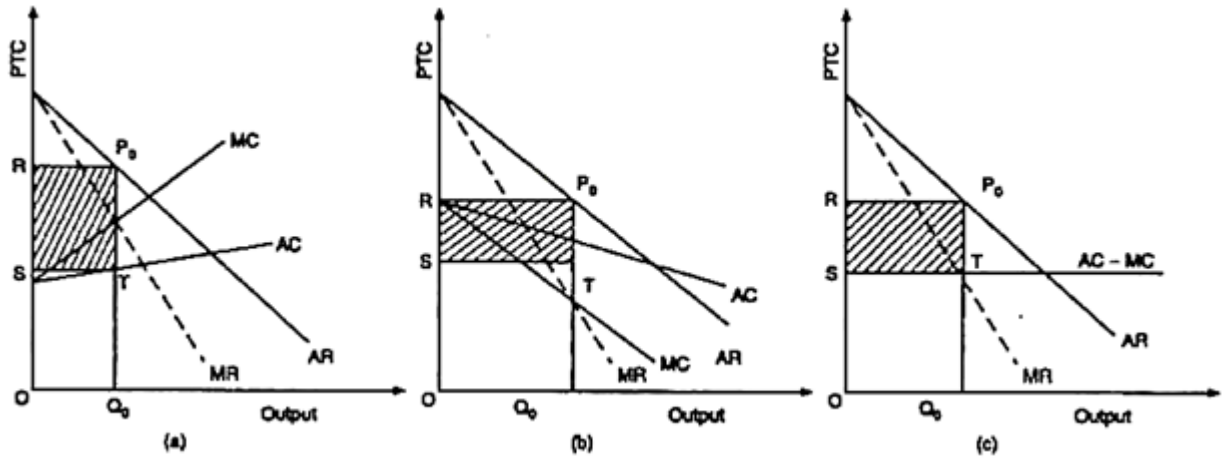


Fig.2.2: Long run monopoly equilibrium

Fig. 2.2 (a) illustrates the equilibrium under increasing cost and so both AC and MC curves are rising here. Fig. 2.2 (b) illustrates the equilibrium under decreasing cost and so both AC and MC curves have been falling. Fig. 2.2 (c) shows the equilibrium under constant cost when AC-MC. In all the three figures the equilibrium output is OQ_0 and the equilibrium price is Q_0P_0. The area OQ_0P_0R is total revenue and O_0TS is total cost of the monopolist. So, the area $RSTP_0$ in all the three figures indicates the excess profit of the monopolist in the long run. It shows that a monopolist is required to take into account some more factors in fixing output and price. These factors are as under:

(a) Short-run and long-run pricing:

In the short run, the monopolist, like the completive firm, is to keep an eye on the variable costs. The equation MR = MC is the condition of the short-run equilibrium for the monopolist as it is for the competitive firm. But with a low short-run demand, the monopoly price may fail to cover total costs; it may equal variable cost or exceed it to some extent, but it cannot go below the average variable cost. But in the long run the monopolist can change the size of the plant in response to a change in demand or in costs. In such a situation the marginal revenue equals the long run marginal cost. In the long run a monopolist does not sell at losses. This mean that his price will be greater than or at least equal to average cost. He makes excessive profits through his power to restrict output.

(b) Demand conditions or the elasticity of demand for the product:

A monopolist is to consider the demand conditions while fixing the price of his product. If the demand for his product is elastic, he will not charge a

high price, because at such time the demand for his product will be low. In such a situation he will fix the price at a low level for maximising his total profits by selling as larger a quantity of his product as possible. If, on the other hand, the monopolist's product has an inelastic demand, he will fix the price at a high level; because the sale of such a product will not fall in spite of its high price. In such a situation he will help to maximise profits by selling less units but getting larger profit per unit sold.

(c) Cost conditions:

A monopolist has also to take into consideration the cost conditions of the industry. If he produces under decreasing cost, he can reduce the average cost by producing more; so here he will produce more and sell at a low price. But, if he produces under increasing cost, he will be compelled to restrict the output to keep down the average cost: in this case he will charge a high price.

(d) Other factors:

Besides, a monopolist is to take into account other factors like the prices of the substitutes of his product, potential competition, consumers' resistance, government's regulations and interference, etc. in fixing his price, so as to be able to maintain his monopoly position.

2.6. DEAD WEIGHT LOSS

Dead-weight welfare loss (or, in other words, social cost of monopoly) due to reduction in output and hike in the price by a monopolist as compared to the perfectly competitive equilibrium, it has been assumed that marginal cost curve is a horizontal straight line. When marginal cost curve is a horizontal straight line, the loss in welfare occurs only in consumer surplus. But when marginal cost curve is rising, the loss in welfare due to reduction in output by the monopolist will occur not only in reduction in consumer surplus but also in producer surplus. Producer surplus, it will be recalled, is the total revenue earned over and over all the opportunity costs (explicit and implicit) represented by the marginal cost curve. It may be noted that maximum social welfare or economic efficiency is achieved when the sum of consumer surplus and producer surplus is the maximum.

In a perfectly competitive equilibrium where quantity demanded equals quantity supplied or price equals marginal cost, the sum of consumer surplus

and producer surplus is maximum and therefore perfect competition ensures maximum social welfare or economic efficiency. But to maximize profits monopolist does no' equate price with marginal cost. Instead, he equates marginal revenue with marginal cost and therefore reduces output and raises price and thereby causes loss of welfare. Loss in welfare as measured by the reduction in the sum of consumer surplus and producer surplus is illustrated in Figure 2.3.

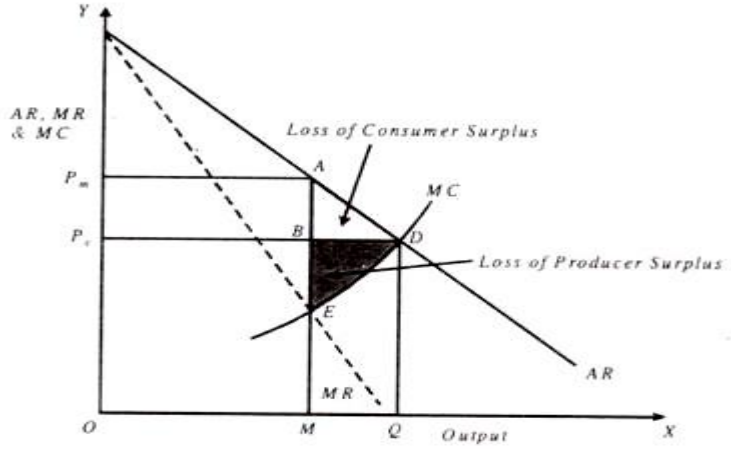


Fig.2.3.Dead Weight Loss

It will be seen that, under perfect competition, equilibrium will be at point D where price is equal to marginal cost (MC) and OQ output is being produced and P_c price list being charged. Now, if monopoly comes into existence, the monopolist-producer will maximize profits by producing lower output OM and will charge higher price P_m. It will be observed that the loss in consumer surplus suffered by the buyers is equal to area P DAP_m. Due to the higher price charged by the monopolist, his gain in profits or producer surplus equals the rectangle P_cBAP_m. (It may be noted that this gain in producer surplus by the monopolist occurs at the expense of consumers who suffer a loss in consumer surplus and is equal to the price differential $P_m - P_c$ or AB multiplied by the monopoly output OM). Thus the gain in producer surplus represented by the area P BAP is just a transfer of income from the consumers to the monopolist. Net loss of consumer surplus or welfare is therefore the area of the triangle ABD. However, in the situation depicted in Figure 2.3 where marginal cost is rising, apart from the net loss of consumer surplus, there is also a loss of producer surplus due to reduction in output by OM amount under monopoly. It will be seen from Figure 2.3 that under perfect

competition with price equal to OP or QD, the extra profits or producer surplus earned over and above the marginal costs in the region of MQ output equals the area BDE which is lost due to the reduction in output equal to QM by the monopolist. This loss in producer surplus BDE is also a dead weight loss caused by the inefficiency or lower production due to monopoly because this has not benefited any other. Thus, the total dead weight loss of welfare caused by the monopoly is equal to the whole area AED which is the sum of net loss of consumer surplus (ABD) and the loss of producer surplus equal to BDE represents social cost of monopoly. It follows from the partial equilibrium approach to the measurement of loss of welfare that monopoly is economically inefficient and causes misallocation of resources as it does not extend production of a product to the level at which the sum of consumer surplus and producer surplus is the maximum.

2.7. POLICIES TO CONTROL MONOPOLY

Monopoly is always in an advantageous position to fix the price of a commodity in a way it likes another exploit the society. It is very essential that the society should be saved from exploitation. This can be done only when the state interferes and for this some measures are always taken by the state.

Some of important measures are:

1. Control over Prices:

Monopoly will always try to fix the highest possible price which it can obtain from the customers, so as to earn minimum profit. The state can control the monopoly by fixing the profits and the prices and ensure that the industry does not earn undue profit. But it is also not very effective and cannot be put into actual practice.

We know that it is very difficult to determine the cost of production, because the monopoly will never give a correct picture. Similarly, it will also not like to leak out trade secrets. Then it is also difficult to have some margin of profit uniformly for all commodities, all over the country.

2. Organised Consumer's Associations:

The monopoly fixes high prices because it knows it fully well that the consumer is not well organised and will take time to organise himself and till then suffer. One effective method of checking and controlling monopoly is that

the Government should help in the formation of consumers associations. It should give them some reasonable powers and patronage. It should be vested with the responsibility of bringing to the notice of the Government on the one hand and the society on the other, high handedness of the monopoly. But this proposal too is complex and complicated. The monopoly will always try to see that the consumers associations are not formed. They will always try to put many hurdles on the way, even if the association comes up, the monopoly will see that it is not forceful arid powerful. Then another difficulty is that the consumers are spread all over the country and it is usually very difficult to bring them nearer and closer to each other and that too in an effective manner.

3. Effective Publicity:

Monopoly works with some serious irregularities, which usually do not come to the notice of the people. It is therefore, desirable that proper publicity should be given to these defects. There should be provision for public supervision of monopoly houses.

In the words of Prof. Pigou, "Under any form of state control over private monopoly a considerable gap between the ideal and the actual is likely to remain. The method of control whether positive or negative is in short, an exceedingly imperfect means of approximating industry towards the price level and output proper to simple competition. Moreover, it is apt to prove a costly method."

4. Creating Fair Competitions:

Monopoly can continue only as long as there is no real competition. This competition must be effective, if monopoly conditions are to be checked. But the difficulty is that the monopoly will never allow any competition, because that will mean sharing in profits on the one hand and check on arbitrary fixation of prices on the other.

Monopoly check competition in more than one way e.g.:

(a) It will see that those who come in competition are discouraged. Their resources of supply are cut, and the suppliers are bribed and so on.

(b) When the rivals come in the market, the prices of the commodity are drastically reduced in the name of efficiency and economic production and for

benefiting the consumers; this will force the newly emerging competitors to go out of the market.

(c) The monopoly will try to set up new firms to compete the new rival at all levels. The firms will be allowed to suffer losses for some time. These will be wound up only after the competitor has gone out of the market.

(d) The suppliers of raw material, distributors and dealers will be given better terms for some time.

5. Nationalisation:

The last resort of the Government is that it should nationalise the business, in which monopoly exists and which the society is not willing to tolerate. But again the difficulty with this system is that the Government has limited economic resources and can nationalise only a few industries. Similarly while nationalising it is to take into consideration nature of the commodity. If it is of public utility then it may go in for nationalisation immediately otherwise it may be forced to wait for nationalisation, till such time, as the resources are available. Thus it is very difficult to really effectively either check or control the monopoly. The only effective method is creation of fair competitions. The task is quite difficult, but once that has been created, monopoly can be most effectively checked.

2.8. PRICE DISCRIMINATION

The monopolist charges the same price for the product from all customers. But in several cases, monopolist sells the same product at different prices to different customers even though the cost of producing is same. This practice of charging multi price is known as price discrimination. For example, if the producer of a camera of a given variety sells it to customer A for Rs 2500 and to customer B for Rs 3000 then he is practicing price discrimination. It is also known as multi part pricing.

2.8.1. Definitions:

“Price discrimination exists when the same product is sold at different prices to different buyers.” -Koutsoyiannis

“Price discrimination refers to the sale of technically similar products at prices which are not proportional to their marginal cost.” -Stigler

"Price discrimination is the act of selling the same article produced under single control at a different price to the different buyers." -Mrs. Joan Robinson

2.8.2. Types of Price Discrimination:

Four types of price discrimination are:

(i) Personal Price Discrimination: Price Discrimination is said to be personal when a seller charges different prices from different persons.

(ii) Local Price Discrimination: Price Discrimination is said to be local when a seller charges different prices from people of different places. For example, a seller may sell a commodity at one price at home and at different price abroad.

(iii) Price Discrimination According to Use: When a seller charges different prices for different uses of product then it is called price discrimination according to use.

(iv) Price Discrimination According to Time: When seller charges different prices for the same product at different times then it is called price discrimination according to time.

2.8.3. Degree of Price Discrimination:

Prof. A. C. Pigou has distinguished between the following three types of price discrimination. These are:-

(i) First Degree Price Discrimination

(ii) Second Degree Price Discrimination

(iii) Third Degree Price Discrimination

(**i) First Degree Price Discrimination**:

Under first degree price discrimination, a monopolist charges different prices from different customers. If a monopolist charges each customer the maximum price he or she is willing to pay then this practice is known as first degree price discrimination. In this case consumer will not be able to have surplus because the price he is willing to pay is equal to the price which he is actually paying. Under this, the monopolist can extract all the surplus from the buyer which he is getting by threatening him with the alternative of getting none of the good. Thus consumer surplus is zero (i.e. maximum exploitation of consumer) under first degree price discrimination.

(ii) Second Degree Price Discrimination:

According to Professor Pigou, if a monopolist charges different prices per unit for different quantities of the same good then this practice is known as second degree price discrimination. In second degree price discrimination, buyers are divided into different groups and from each group a different price is charged which is the lowest demand price of that group. This price discrimination would occur if each individual buyer had perfectly inelastic demand for the good below and above a certain price. For example, electric power companies charge lower rates for the initial units demanded by the customer and higher rates for subsequent consumption. In this case, consumer surplus is not zero.

(iii) Third Degree Price Discrimination:

If a seller divides his buyers into two or more than two groups or submarkets and charges different prices in each sub market then this practice is known as third degree price discrimination.

When is Price Discrimination Possible?

In order to practice price discrimination, two necessary conditions that need to be fulfilled are:-

(i) The market is to be divided into submarkets and each submarket has different price elasticity of demand. A monopolist can practice price discrimination only when he is selling in different markets in such a way that goods sold by him in the cheaper market cannot be resold in the dearer market.

(ii) The market is to be divided into submarkets so that no reselling can take place from a cheaper market to a dearer market.

Equilibrium under Price Discrimination:

We are starting with the simple case of a monopolist who sells his commodity in two submarkets at two different prices. Each of the submarkets has demand curves with different price elasticity.

The price discriminating monopolist has to decide (i) how much total output he must produce. (2) How should the total output be allocated between the submarkets so as to maximise the total revenue and profits.

Suppose initially the seller is selling 100 units in each market. We also assume that with this allocation, marginal revenue in market 1 denoted by

MR1 is Rs 10 and marginal revenue in market 2 denoted by MR2 is Rs 8. In this case reallocation of units from cheaper markets to dearer markets is possible and monopolist could increase its total revenue by increasing the number of units sold in market 1 and reducing the number of units sold in market 2. By selling one more units in market 1, the total revenue increases by Rs 10 and by selling one unit less in market 2, the total revenue reduces by Rs8. So by reallocating the monopolist is getting a net increase in total revenue of Rs 2 (Rs10-Rs 8). So:

(i) The total output produced by the monopolist should be divided between the two sub markets so that marginal revenue in each sub market is equal i.e. MR1=MR2.

(ii) For a price discriminating monopolist to be in equilibrium, total output must be such that marginal revenue in each sub market is equal to the marginal cost of production i.e. MR1=MR2=MC.

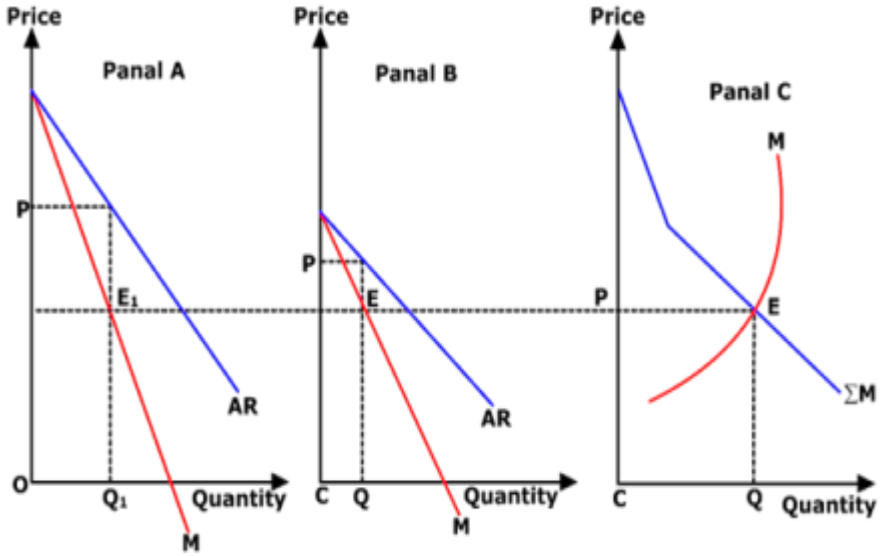


Fig. 2.4. Price Discrimination

In Fig 2.4, Panel A shows submarket 1 where AR1 and MR1 are the corresponding average revenue and marginal revenue curves. Panel 2 shows Submarket 2 where AR2 and MR2 are the corresponding average revenue and marginal revenue curves. Panel C shows the aggregate marginal revenue curve which is derived by horizontal summation of marginal revenue curves of sub market 1 and 2. MC is the marginal cost of production. For a price discriminatory monopolist to be in equilibrium, the total output is such that MC is equal to aggregate MR curve. The equilibrium point shows that ∑MR is

equal to MC i.e. the addition to total revenue arising from additional unit of output when is allocated to the submarkets optimally is equal to MC i.e. addition to total cost arising from additional unit of output. The equilibrium output is OC as shown in Panel C. Now draw a line from point C towards MR1 and MR2. The point where this line crosses the marginal revenue curves determine the output sold in the two submarkets. So OQ1 units of output are sold in market 1 at OP1 price and OQ2 units of output are sold in market 2 at OP2 price and OQ1+OQ2=OQ.

The profit is maximised in each market by equating MC to the corresponding MR. So,

In Market 1: MR1=MC

In Market 2: MR2=MC.

The total profit is maximised when MC is equal to individual marginal revenues.

$$MR1 = MR2 = MC$$

The monopolist can profitably practice price discrimination if the market can be divided into submarkets and each submarket has different price elasticity.

2.9. DUMPING

Dumping is a special case of price discrimination where a firm is a monopolist in a domestic country but sells a commodity at a lower price in a foreign country. Dumping is possible because:

- The firm is protected from foreign competition by tariffs and other import restrictions.
- There are no export restrictions. So firm cal also sell the good in the foreign market.
- There exists a difference in the price elasticity of demand among the markets.

Here we are studying a special case where a firm is a monopolist in the domestic market and faces international competition in the foreign market. It is graphically shown in Fig. Panel A shows the firm domestic monopoly, which faces a downward-sloping average revenue curve AR1 and marginal revenue curve MR2.

Panel B shows the case of a firm in a foreign market where it faces perfect competition and a perfectly elastic horizontal demand curve. MR2 and AR2 are the marginal revenue and average revenue curves faced by a firm in the foreign market.

Panel C shows the aggregate marginal revenue, which is the horizontal summation of MR1 and MR2. MC is the marginal cost of production.

The equilibrium output will occur where aggregate marginal revenue is equal to MC at point E, and the equilibrium output is OQ. The total output OQ is to be distributed in the foreign and domestic markets in such a way that marginal revenue in each market is equal to each other and to the marginal cost, i.e. MR1=MR2=MC.

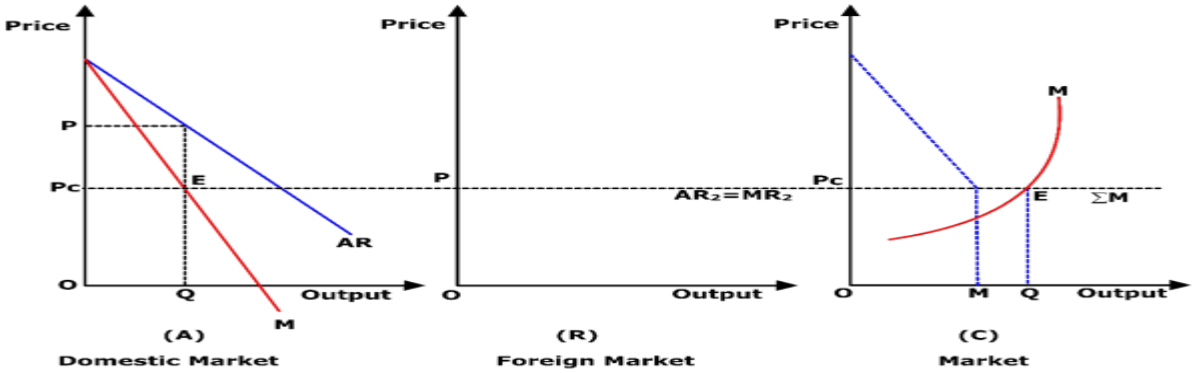


Fig.2.5. Dumping- Price Discrimination

In fig, for any output OM or less than OM, all the output will be sold in the domestic market, and the firm has no leftover output to be sold in the foreign market. And for any output more than OM, the firm has output left over after completing domestic demand OM; it will sell in a foreign market at a perfectly Competitive price Pc. The equilibrium is determined at point E where aggregate MR is equal to MC and equilibrium output is OQ. The equilibrium output OQ is more than the output OM, i.e. seller is selling some output in the foreign market as well. Out of OQ units of output, OM is sold in the domestic market at a price PM, and MQ is sold in the foreign market at price Pc, i.e. OQ=OM+MQ. If and price in the foreign market is less than the price in the domestic market, this is said to be dumping in the foreign market.

****

UNIT - III

MONOPOLISTIC AND OLIGOPOLY COMPETITION

3.1. Introduction

Monopolistic competition is a market structure which lies in between perfect competition and monopoly and thus it has the features / characteristics of the both. The concept of monopolistic competition is more realistic than perfect competition and monopoly and we can even relate this type of market structure with the one which is prevailing in our current markets. In this module we will thus study the model given by Professor E. H Chamberlin in his book "The theory of monopolistic competition" in 1933.

3.2. Definition

By definition, monopolistic competition refers to a market structure in which a large number of sellers sell differentiated products, which are close substitutes for one another. Here, a close substitute is one whose cross-elasticity is close to unity or greater. Monopolistic competition combines the basic elements of both perfect competition and monopoly. The element of monopoly in monopolistic competition arises from the fact that each firm has an absolute right to produce and sell a branded or patented product. Other firms are prevented by laws from producing and selling a branded product of other firms. This gives a firm monopoly power over production, pricing and sale of its own-branded product. For example, consider toilet soap industry. There are a number of brand names available in the market, e.g., Lux, Liril, Palmolive, Fairglow, Pears, Fa, Rexona, Lifebuoy, Carmel, Godrej, Cinthol, Ponds, Dove, Dettol and so on. Each of these branded toilet soaps is produced and sold by a company having monopoly power over the product. Similarly, Maruti Udyog Limited has monopoly power for producing and selling cars under the brand name Maruti. No other car manufacturing company can produce and sell cars under this brand name. So is the case with all other car manufacturing companies.

3.3. Features of Monopolistic Competition

Large number of buyers and sellers: In monopolistic competitive market, there exist large number of both the buyers and sellers of the product. This is the same feature as of the perfect competition. However there is one difference

that competitive firms are very small relative to the size of the market whereas in monopolistic competition, the firms are not so small in relation to the size of the market.

- **Product differentiation**: Since various firms under monopolistic competition compete with each other, thus, they compete by selling differentiated products that are either similar or close substitutes of each other. Hence the prices of the products are not too much different from each other. Moreover the cross price elasticity of demand for the products is large but not infinite.
- **Freedom of entry and exit**: It is relatively easy for the new firms to enter a monopolistic competition market industry and for the existing firms to leave the industry. If the industry is profitable, new firms will enter the industry and similarly any firm can leave the industry if it incurs losses. This feature of free entry and exit is based on the low start-up costs and no exit cost.
- **Market power**: Firms under monopolistic competition face downward sloping demand curve (AR) and marginal revenue (MR) curve lies below it because the firms sell differentiated products (which are and can be close substitutes), and any reduction in the price by the seller would attract the customers of the other product towards it. Therefore, fall in the price of one product will increase the demand of that product; hence, firms under monopolistic competition have some influence on the price. Moreover, the demand curve is comparatively more elastic in this market structure but it is not perfect elastic.
- **Non price competition**: Firms under monopolistic competition compete not only in terms of prices but also on other non-price variables which the firm spends on advertising like marketing cost, sales promotion expenses etc.
- **Absence of interdependence among firms**: In monopolistic competition, each firm acts more or less independent and have their own price policies regarding price and output. Hence, the change in the pricing policy of one firm does not have a significant effect on the price and output of the other firm.
- **Concept of industry under monopolistic competition**: Industry is defined as the number of firms selling homogeneous / identical products. However with product differentiation, the definition of industry becomes

ambiguous. Hence, Professor Chamberlin has replaced the concept of industry with “group of firms” producing differentiated products which are close substitutes of each other and have high cross price elasticity of demand.

3.4. Short Run Equilibrium of the Monopolistic Competitive Firm

Chamberlin has made the following explicit and implicit assumptions to develop his theory of monopolistic competition.

1. There are a large number of firms selling slightly differentiated products, which are close substitutes for one another.
2. The number of firms in a product group is so large that their activities, especially, maneuvering of price and output, go unnoticed by the rival firms.
3. Demand and cost curves for all the products and for all the firms of the group are uniform, i.e., firms face identical demand (including perceived one) and cost curves.
4. Consumer's preferences are evenly distributed among the different products and product differentiations are not such that they make a difference in cost.

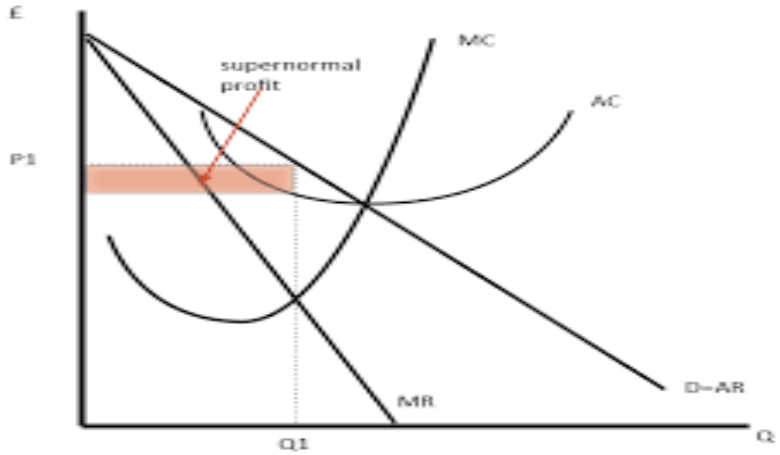


Fig.3.1. Short Run Monopolistic Competition

Since monopolistically competitive firms have downward sloping demand curve, so they have some market power and can influence the price as each firm sells differentiated product which is not exactly similar to the product of the other firm but yes somewhat substitute to the product of the other firms. Moreover there exist no major barriers to entry or exit in monopolistic competition, thus, this feature puts a limit on the profits of the firms. Now because of the free entry, the new firms will keep entering a monopolistic competition market until economic profits are driven to zero.

Short run equilibrium of monopolistically competitive firm Here, AR is the demand curve of the monopolistic competitive firm which is downward sloping because they sell differentiated products. MR is the corresponding marginal revenue curve. MC is the marginal cost curve and AC is the Average cost curve of a monopolistic competitive firm. A profit maximizing firm will produce where it's MR = MC. In this case, P>AC so firms earn super normal profits, as indicated by the rectangle area in fig 1. Here the second order condition is also satisfied at the equilibrium i.e. dMR/dQ < dMC/dQ.

3.5. Long run Equilibrium of a Monopolistically Competitive Firm

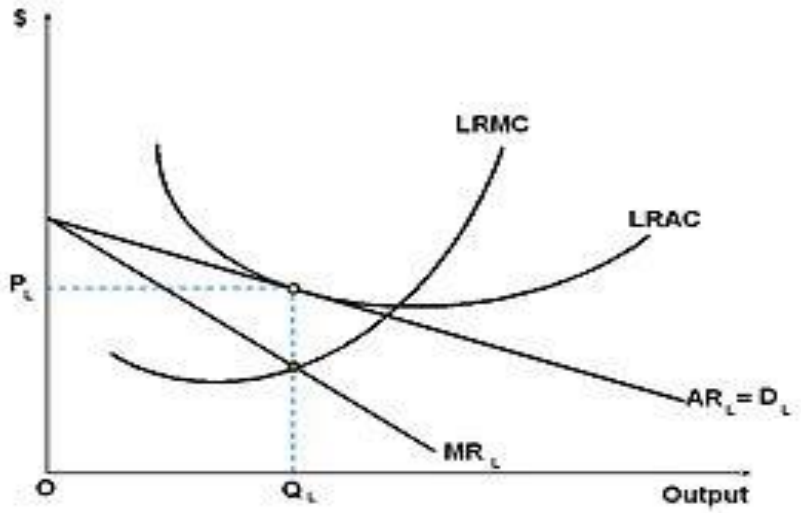


Fig.3.2. Long Run Monopolistic Competition

The long-run conditions differ from the short-run conditions because in the long run:

(i) New firms enter the industry, (ii) firms indulge in price competition, (iii) changes (i) and (ii) take place simultaneously and (iv) Firms advertise their product more vigorously. When monopolistically competitive firms earn positive or supernormal profits in short run, then this attract new firms to enter the market and hence new potential firms start producing their own differentiated product in the market. This reduces the economic profit of the market as the existing firms lose their market share and their demand curve shifts down. This will go on till all the firms earn only normal profits and the economic profits comes to zero.

In order to maximize profits, firms will produce where MR = MC. Here one point to note is that the demand curve is tangent to the firms AC curve which implies P = AC and economic profits = 0. Hence we can write the following long run equilibrium conditions under monopolistic competition:

1. MR = MC
2. dMC/dQ < dMR/dQ
3. P = AC

3.6. Group and Industry Equilibrium

Group equilibrium relates to the equilibrium of the "industry" under a monopolistic competitive market. The word "industry" refers to all the firms producing a homogeneous product. But under monopolistic competition the product is differentiated. Therefore, there is no "industry" but only a "group" of firms producing a similar product. Each firm produces a distinct product and is itself an industry. Chamberlin lumps together firms producing very closely related products and calls them product groups.

So in defining an industry, Chamberlin lumps together firms in such product groups as cars, cigarettes, breweries, etc. According to Chamberlin, "Each producer within the group is a monopolist, yet his market is interwoven with those of his competitors, and he is no longer to be isolated from them." In the product group, the demand for each product has high cross elasticity so that when the price of other products in the group changes, it shifts the demand curve.

Theory of Group Equilibrium:

Chamberlin develops his theory of long-run group equilibrium by means of two demand curves DD and dd, as shown in Figure 3.3 the demand curve facing the group is DD. it is drawn on the assumption that all firms charge the same price and are of equal size, dd represents an individual firm's demand curve. The two demand curves reflect the alternatives that face the firm when it changes its price. In the figure, the firm is selling OQ output at OP price. As a member of the group with product differentiation, the firm can increase its sales by reducing its price for two reasons.

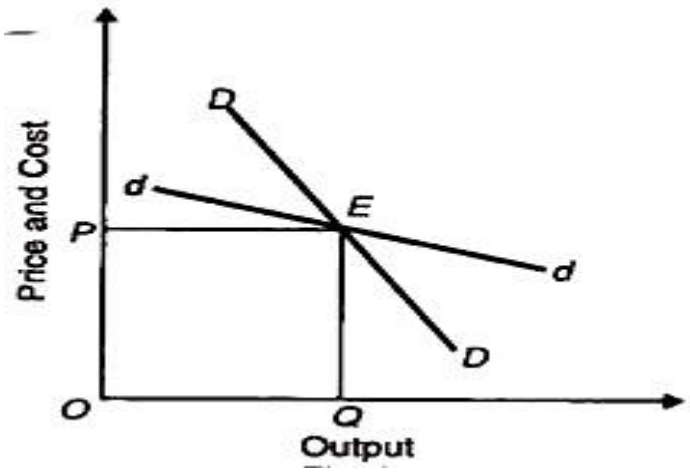


Fig. 3.3.

First, because it feels that the other firms will not reduce their prices; and second, it will attract some of their customers. On the other hand, if it increases its price above OP, its sales will be reduced because the other firms in the group will not follow it in increasing their prices and it will also lose some of its customers to the others.

Thus the firm faces the more elastic demand curve dd. But if all firms in the product group reduce (or increase) their prices simultaneously, the firm will face the less elastic demand curve DD.

Assumptions of Chamberlin's Group Equilibrium:

Prof. Chamberlin's group equilibrium analysis is based on the following assumptions:

(1) The number of firms is large.

(2) Each firm produces a differentiated product which is a close substitute for the other's product.

(3) There are a large number of buyers.

(4) Each firm has an independent price policy and faces a fairly elastic demand curve, at the same time expecting its rivals not to take any notice of its actions.

(5) Each firm knows its demand and cost curves.

(6) Factor prices remain constant.

(7) Technology is constant.

(8) Each firm aims at profit maximisation both in the short-run and the long- run.

(9) Any adjustment of price by a single firm produces its effect on the entire group so that the impact felt by any one firm is negligible. This is the symmetry assumption.

(10) As put forth by Chamberlin, there is the "heroic assumption" that both demand and cost curves for all the 'products' are uniform throughout the group. This is the uniformity assumption.

(11) It relates to the long-run.

(12) No new firm can enter the group.

Explanation of Chamberlin's Group Equilibrium:

Given these assumptions and the two types of demand curves DD and dd, Chamberlin explains the group equilibrium of firms. He does not draw the MR curves corresponding to these demand curves and the LMC curve to the LAC curve to simplify the analysis. Figure 3.4 represents the long-run equilibrium of the group under monopolistic competition. Adjustment of long-run equilibrium starts from point A where dd and DD curves intersect each other so that QA is the short-run equilibrium price level at which each firm sells OQ quantities of the product. At this price- output level, each firm earns PABC super-normal profits.

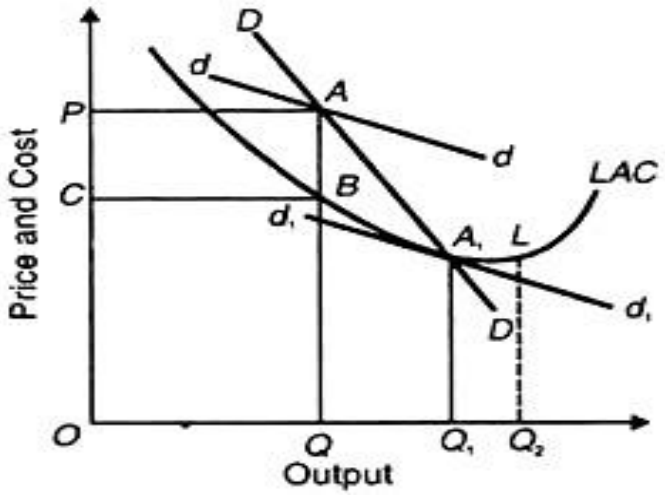


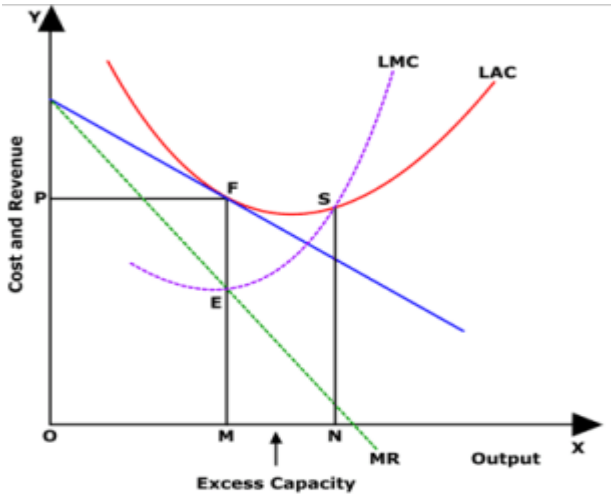
Fig. 3.4.

Regarding dd as its own demand curve each firm applies a price cut for the purpose of increasing its sales and profits on the assumption that other firms will not react to its action. But instead of increasing its quantity demanded on the dd curve, each firm moves along the DD curve.

In fact, every producer thinks and acts alike so that the dd curve "slides downward" along the DD curve. This downward movement continues until it takes the shape of the d_1d_1 curve and is tangent to the LAC curve at A_1. This is the long- run group equilibrium position where each firm would be earning only normal profits by selling OQ_1 quantities at Q_1A_1 price. If the d_1d_1 curve slides below the LAC curve, each firm would be incurring losses (not shown in the figure to keep the analysis simple). Such a situation cannot continue in the long-run and price would have to be raised to the level of A_1 to eliminate losses. Thus each firm will be of the optimum size and operate the optimum scale plant represented by the LAC curve and produce ideal or optimum output OQ_1.

3.7. EXCESS CAPACITY

Excess capacity is defined as the difference between the ideal output and the actual output attained in the long run, where ideal output is the output which is produced by the firms where the long-run average cost is at its minimum. Under monopolistic competition, the firms though earn zero economic profits but there always exists the problem of excess capacity because the monopolistically competitive firms' output does not coincide with the output at the minimum of the LAC curve.



As we can see in the figure, a monopolistic firm produces M output which is less than the ideal output N. This difference is termed as excess capacity because each firm is producing its output at an average cost that is higher than it could achieve by producing its capacity output. Excess capacity is a

kind of inefficiency of the firms which reduces social welfare and makes the consumers worse off.

Excess Capacity under Chamberlin Model

Prof. Chamberlin's explanation of the theory of excess capacity is different from that of ideal output under perfect competition. Under perfect competition, each firm produces at the minimum on its LAC curve, and its horizontal demand curve is tangent to it at that point. Its output is ideal, and there is no excess capacity in the long run. Since under monopolistic competition, the demand curve of the firm is downward sloping due to product differentiation, the long-run equilibrium of the firm is to the left of the minimum point on the LAC curve.

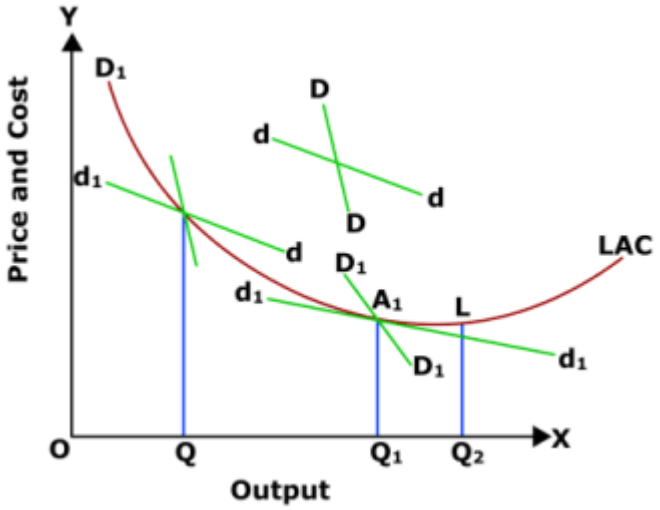


Fig.3.5. Excess Capacity under Chamberlin Model of Monopolistic Competition

According to Chamberlin, so long as there is freedom of entry and price competition in the product group under monopolistic competition, the tangency point between the firm's demand curve and the LAC curve would lead to the "ideal output" and no excess capacity. When there is no price competition due to the prevalence of these factors, the curve *dd* is of no significance, and the firms are only concerned with the group DD curve. Suppose the initial short-run equilibrium is at S where the firms are earning supernormal profits because the price OP corresponding to point S is above the LAC curve. With the entry of new firms in the group, super-normal profits will have competed away. The new firms will divide the market among themselves, and the DD curve will be pushed to the left as d1d1 in Figure,

where it becomes tangent to the LAC curve at point A1. This point A1 is of stable equilibrium in the absence of price competition for all firms in the group, and they are earning only normal profits. Each firm is producing and selling OQ output at QA (= OP) price. In Chamberlin's analysis, O1 is the 'ideal output'. But each firm in the group is producing OQ output in the absence of price competition. Thus OQ1 represents excess capacity under non-price monopolistic competition.

3.8. OLIGOPOLY

Oligopoly means a market in which there are few sellers competing with each other. It is that situation of imperfect competition in which there are only a few firms in the market which are producing either homogeneous product or close substitutes for one another which result into close competition among them. The number of firms is more than one but is not so large that one seller is in a position to take decisions regarding his price, product and selling effort without taking any note of the reactions which his rivals may have to his actions. In case there are only two sellers in the market. It may be called Duopoly, but this is also a special form of oligopoly because from the point of view of price theory the nature of problem is the same whether there are two or a few sellers.

3.8.1. DEFINITIONS:

According to P.C. Dooley "An oligopoly is a market of only a few sellers, offering either homogeneous or differentiated products. There are so few sellers that they recognize their mutual dependence."

According to J.Stigier "Oligopoly is that situation in which a firm bases its markets policy in part on the expected behaviour of a few close rivals."

In simple words Oligopoly is that market situation in which there are so few sellers that each of them is conscious of the results upon the price of the supply which he individually places upon the market.

3.8.2. CAUSES OF POPPING UP OF OLIGOPOLY

There are certain reasons which have led to the blossoming of oligopoly. These are:

- **Historical factors:** Historically, oligopolies in industry have come into existence in two ways. Firstly, the industry may have been atomistic in structure but in the course of time a few firms may have expanded either with the overall market for the industry or at the cost of other smaller firms into large firms. These large firms may have been motivated y the desire to keep a dominant part of the market with them. Secondly, the industry may have been controlled from the beginning by a few firms who had the power to keep potential competitor out. In the industrially advanced economies, oligopoly may have emerged in both these ways.
- **Mergers:** Many oligopolies have been created by combining two or more independent firms. The combination of two or more firms intone firm is called merger. The main motives of mergers include increasing market powers, more resources, economies of scale and market extension etc.
- **Patents and Legal Restrictions:** in public utility sector, the entry of new firms is closely regulated through the grant of certificate by the state. This policy of exclusion of rivals may be due to diseconomies of small scale or of duplication of services. Another factor for the popping up of oligopoly is the patent right which a few firms acquire in matter of some commodities. Patents have led to many of the most important industrial monopolies in America and elsewhere.
- **Superior Entrepreneurs:** Another factor responsible for the emergence of oligopoly is the existence of superior entrepreneurs who, motivated y the desire for large gains or power, prestige or leadership, follow aggressive policy of ruthless competition against weaker rivals to force them to either go out or merge with them.
- **Economies of scale:** As the size of production increases, firm enjoys internal and external economies of scale. Naturally, large firm enjoys internal economies of scale due to which such oligopoly arises. In certain areas, some firms dominate due to their old establishments.
- **Control of resources:** In certain areas, oligopoly emerge because of hold of resources by a manufacturer, especially, when the substitute of resources are very costly. In such cases, the controllers of resources emerge as oligopolist.
- **Large Investment of Capital:** The number of firms in an industry may be

small due to the large requirements of capital. No entrepreneur will like to venture to invest large sums in an industry in which addition to output to the existing one may likely to depress prices. Further, the new entrant may also fear of provoking a price-war by the established firms in the industry. This is always true that in the midst of differentiated product, it is difficult to make a new product.

- **Difficulty of entry into the industry:** Oligopoly may come into existence due to the difficulty of entry into industry. The main difficulty in the developing countries is the requirements of capital which is the cause of existence of oligopoly.

3.8.3. FEATURES/CHARACTERISTICS OF OLIGOPOLY

- **Few sellers:** In oligopoly, there are few sellers in the market, selling homogeneous or differentiated products. Due to small number of firms, policy of one firm influences the policy of other firm.
- **Advertising:** In oligopoly a major policy change on the part of a firm is likely to have immediate effects on the other firms in the industry. So, the rival firms remain all the time vigilant about the moves of the firm which takes initiative and makes policy changes. Thus, advertising is a powerful instrument in the hands of an oligopolist. A firm under oligopoly can start an aggressive advertising campaign with the intension of capturing a large part of the market. Other firms in the industry will obviously resist its defensive advertising.
- **Competition:** Under oligopoly there are a few sellers, a move by one seller affects the other sellers too. So each seller is always on the alert and keeps a close watch over the moves of its rivals in order to have a counter move.
- **Interdependence:** The most important feature of oligopoly is the interdependent on each other. The oligopoly firm has to take into consideration the action and reaction of his rivals while determining its price and output policy. It is therefore clear that the oligopolistic firm must consider not only the market demand for the industry's product but also the reactions of the other firms in the industry to any action or decision it may take.
- **Selling cost:** Due to interdependence among the firms selling cost becomes an important instrument in the hands of the firm to influence and attract

buyers of each other. Under oligopoly, advertise can become a life and death matter where a firm which fails to keep up with the advertising budget of its competitors may find its customers drifting off to rival product.

- **Price rigidity:** Since, any change in the price of one oligopolistic firm leads to change in the price of other firms. Every firm tries to maintain price rigidity. The behaviour of the oligopolistic firm is such that if one firm reduces the price, others will immediately follow it and if one increases the price, other will not follow. This type of attitude creates price rigidity. Hence, the firm would not like either to reduce or raise the price.
- **Indeterminateness of demand curve:** Mutual interdependence of firms create an atmosphere of uncertainty for all the firms. No firm under oligopoly is in a position to visualize the consequences of its price-output policy with any degree of certainty. This result into indeterminateness in the demand curve.
- **Lack of uniformity:** Lack of uniformity in the size of firms is the important feature of oligopoly. Firms are different in size. Some may be small or other may be large. Such a situation is asymmetrical. This is very common in the American economy. A symmetrical situation with firms of a uniform size is rare. Classification of oligopoly
- **Pure and Differentiated oligopoly:** If the product produced by the competing firm is identical or same, it is pure oligopoly. Pure oligopoly model approximated in some of the capital goods industries, such as a cement production companies. On the other hand, if the product produced by competing firm is different, it is called differentiated oligopoly. Differentiated oligopoly is characteristics of a very large portion of the economy including most consumer goods manufacturing industries, and retail trade in most areas.
- **Partial and complete oligopoly:** When the industry is dominated by one firm, is called Partial oligopoly. In this market situation, large firm acts as a leader and the other firms of the industry follow the price policy determined by their leader. In simple words other firms adopt that price which is set by leader firm. Complete oligopoly is that situation where there is no firm who act as leader or price maker or there is no leader and no followers.

- **Open and Close oligopoly:** Open oligopoly is that market situation where the new firms are free to enter the industry. There is no restriction of any kind for the desiring firms to enter into the market. Closed oligopoly is that market situation where the new firms are not allowed free entry into the industry.
- **Collusive and non-collusive oligopoly:** Collusive oligopoly refers to that market situation when the firms of the industry follow a common policy of pricing. In simple words when all the firms decide mutually to share the market on the fixed price, is collusive oligopoly. On the other hand, lack of any understanding or agreement among the firms is called as non-collusive oligopoly. In this type of oligopoly firms act independently.
- **Syndicate and Organized oligopoly:** When the firms sell their product through a centralized syndicate or on the basis of degree of co-ordination, it is called syndicate oligopoly. In organized oligopoly, the firms organize themselves into a centre association for fixing price output quota.

3.8.4. Price and output determination under oligopoly

The existence of various forms of oligopoly 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.

Although there are number of models of pricing under oligopoly yet the common models of oligopoly are of two types:

1) Classical oligopoly Models: Classical Models include:

- The Cournot Model
- Bertant Model
- Edgeworth Model

2) Modern Models: Modern Models includes:

- Price Leadership Model
- Independent Pricing Model
- Collusive Oligopoly Model
- Kinky Demand Oligopoly Model
- First Cost Pricing Model
- Boumol's Sales Maximization Model

As said earlier there are various models of oligopoly. Here we only discuss the most common models of oligopoly. These are:

A. Price Leadership:

Price leadership is, when the price at which most or all of the firms in the industry offer to sell is determined by the leader. So it refers to the market situation in which price is determined by one firm and then accepted by all the firms. This method was formulated by German Economist Prof. H. Stackelberg. This is also known as Leadership Solution or Followership Solution. **Types of price leadership is as follow**:

- **Price leadership of exploitative or aggressive nature:** This is the firm when dominating big firms fixes the price and forces other firms that either to accept that price or go out of business. It is also called exploitative price leadership.
- **Price leadership of barometric nature:** This is the firm follows a price fixed by the wisest producer. • Price leadership of the dominant firm: This is the firm when the largest firm fixes a price and other follow.
- **Effective Price leadership:** This is the price which is accepted by the all firms who have same cost conditions and less elastic demand. This intends to eliminate wasteful competition.

Price and Output determination under Price Leadership

Many Economists have developed various models concerning price and output determination under-price leadership taking different perceptions like low cost firm leadership, dominant firm leadership etc. But, the low cost leadership is more accepted on economic consideration as shown under:

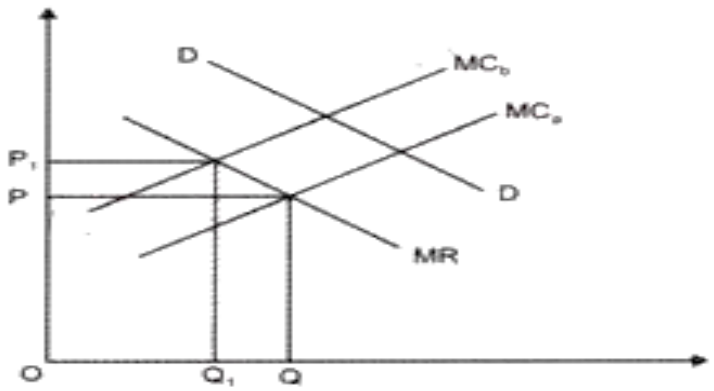


Fig.3.6. Price Leadership Model

In above diagram, DD' is the demand curve of total market being faced by all the firms.MR is marginal revenue curve. Marginal cost of firm A is MCa and marginal cost of firm B is MCb. B is a high cost firm and attains equilibrium on point F where MC of firm B equalizes MR of market. The firm will sell ON output at NK price. Firm A is a low cost producing firm and attains equilibrium on point E and determines to sell OM output setting price MP. So firm A being low cost becomes a leader firm and B firm is to follow his price in the market. Hence, the firm B will be compelled to follow the leader firm A. The firm B will also charge MP Price per unit as set by the firm A. The firm B will also produce QM output like the firm A. Thus both the firms will charge the same price MP and sell each of them OM output. The total output will thus be twice of OM. The firm A being the low cost firm will maximize profits by selling OM output at MP price. The profits of the firm B are lower than of firm A because it's cost of production is higher than of firm A. Price leadership by dominant firm: Most of the times, 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.

B. Independent Pricing Model

As the name suggests, under Independent Pricing Model, all oligopolistic firms follow its independent price. The price fixed by each firm may be a more or less monopoly price because each firm produces a differentiated product. The price of all firms varies between upper limit and lower limit. There is not a single theory which can explain where the actual price is determined.

There are certain possibilities:

- There may be complete price instability and thus price war accrues between the two firms.
- The price may come to settle at an indeterminate level as a result of the working of the market force
- The oligopolistic firm may accept the prevailing price. Under this pricing model of oligopoly, the firms due to competition among them may come down to the lowest level for setting price. Generally, under Independent pricing

policy, especially under differentiated oligopoly, lot of uncertainty and insecurity prevails in the market. So it cannot last for a long time in the market.

C. Collusive Pricing Model

The modern economists are of the view that independent price determination cannot exist for long time in oligopoly. It leads to uncertainty and insecurity and to overcome them there is a tendency among oligopolists to act collectively by tacit collusion. Under this model, the high cost firm may accept leadership of the low cost firm but unworldly he may plan to revolt or resist the leader firm. Collusion means an agreement under which all the firms jointly keeping in mind the cost of all the firms fix price and sell the output in the market. The firm may have collusion through various types of formal agreements. There may be a cartel under a centralized agency which is similar to monopoly. So collusive oligopoly is a situation under which all the firms jointly determined the price and share the market in view of their cost conditions with the intension to maximize the joint profits of the industry as a whole. The determination of price and output which will maximize the joint profit can be explained with the help of following diagram.

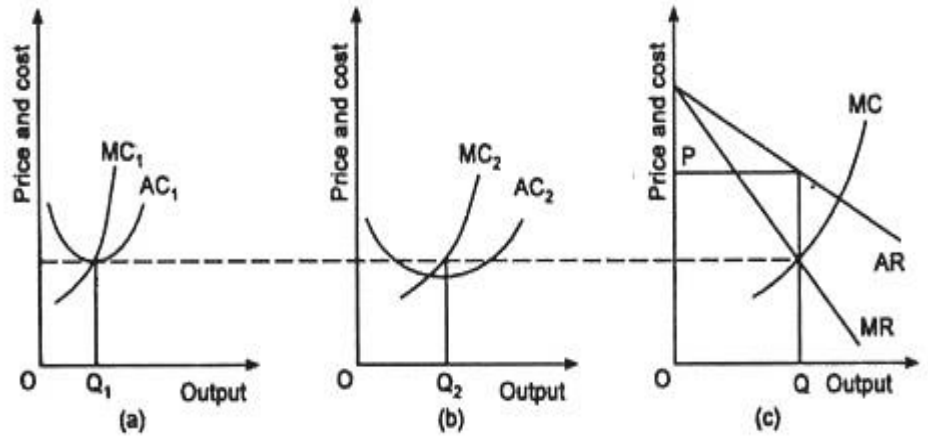


Fig.3.7 Price/Output determination of a Cartel

AR is the aggregate demand curve of both the organizations and MC curves are the addition of MC1 and MC2 curves of firms A and B, respectively. The total output of industry is determined according to MR and MC of the industry. In this figure, OQ and OP are the equilibrium price and output of the industry. Now, this output will be allocated among the firms. This can be done by drawing a horizontal line from equilibrium point E of industry,

towards MC curves of firms A and B. The points of intersection E1 and E2 are the equilibrium levels of the firms, A and B, respectively. OQ1 is the equilibrium output of firm A and OQ2is the equilibrium output of firm B. Thus, OQ1 + OQ2 = OQ. These levels of outputs ensure the maximum joint profits of member firms. Collusive oligopoly is a modified form of monopoly under which consumers are being exploited by the seller and government may not permit the firm to form collusion.

D. Kinked Demand Curve

Kinky Demand Oligopoly Model The kinky demand curve model was developed by Prof. Paul M. Sweezy of America to explain price rigidity under oligopoly. The kinky demand curve represents the pattern of business behaviour of a firm which has no incentive either to raise or to lower its price. The firm thinks it best to adhere to the existing price unless some factors like cost compels him to change the price.

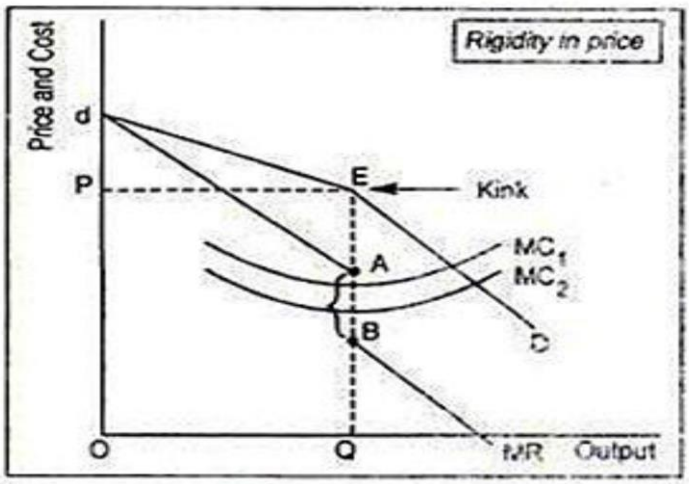


Fig.3.8 Kinked Demand Curve

In this figure AR is a kinky demand curve of a firm. Accordingly, MR has gap. MC equalizes MR in the gap determine OP price and OQ output to be sold. If due to increase in cost, marginal cost curve shift upward from MC2 to MC1, it again intersected MR within the gap resulting into no change in price or quantity. It means entire increased cost burden falls on the seller and his total cost decreases. In case, cost decreases, marginal cost shifted to MC3 downward. Again MC3 intersect MR in the discontinued gap. Price and output remains the same. The profit of the firm will increase. It becomes clear that if change in cost conditions affects the MC1 within the gap of MR, it does not

bring any change in price and output. It is evident that price under oligopoly tends to be rigid unless drastic changes takes place in the cost conditions or demand.

3.9. COLLUSIVE OLIGOPOLY

Economists have developed a large number of models by taking different assumptions regarding the behaviour of the oligopolistic firms (that is, whether they would cooperate or compete with each other), regarding the objective they seek to achieve (that is, whether they seek to maximize profit, joint profit, sales etc.) and regarding different reaction patterns of the rival firms to price and output changes by one firm. Collusive oligopoly is a form of the market, in which there are few firms in the market and all of them decide to avoid competition through a formal agreement. They collude to form a cartel, and fix for themselves an output quota and a market price.

There are two types of models advanced by economists are as follows:

Collusive Models

- Cartel: Profit Sharing and Market Sharing
- Price Leadership

(i) Cartel: OPEC- A Case Study of a Cartel

Cartel is an organization created from a formal agreement between groups of producers of a good or service to regulate the supply in an effort to regulate prices. Cartel, producers or countries act together as a single producer and by controlling production and marketing influencing the prices. The cartel is successful in creating an oligopoly. Though cartel has market power but not as like in monopoly. OPEC-Organization of Petroleum Exporting Countries was set up in 1973. The behaviour of OPEC provides an example of cartelization of an industry that contained a large number of competitive firms most of which were price- takers. Before 1973, the oil industry was not perfectly competitive. There was several oil producing countries, so no country by withholding his output in the market influences the prices. But OPEC attracted attention in 1973 when its members voluntarily agreed to restrict their outputs by negotiating quotas for the first time. During 1973, OPEC countries accounted for about 70 percent of the world oil exports. As a result

of this output restriction, OPEC countries succeed in raising prices of oil in the world market.

OPEC as a Successful Cartel

How OPEC was successful in restricting output and influencing prices is shown in Figure 3.9. Price is measured on y-axis and quantity on x - axis. Sw is the world supply curve. SN is the non OPEC supply curve of oil. S'w is also the world supply curve after fixation of production by OPEC. PW is the world price and DD is the world's demand curve for oil. Now suppose OPEC by fixing its production quota, OPEC shifted the world supply curve to S'W and the horizontal difference between SN and S'W shows the production by OPEC. Now the new world supply curve S'W intersects demand curve DD at E1. The new world higher price is now P'W. At price P' W, the total quantity of oil produced is OQ2 out of which OQ3 is produced by non-OPEC and Q3 Q2

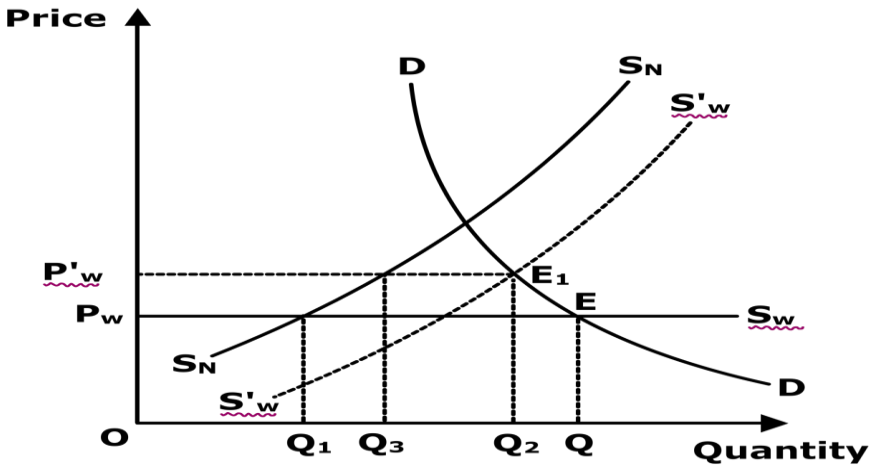


Fig.3.9. Cartel

[OQ2-OQ3] by OPEC. When the OPEC countries were prepared to supply all that was demanded at the world price PW, the world supply curve was SW. The world's supply cuts the world's demand curve for oil DD at point E. At price PW, the total quantity of oil produced is OQ out of which OQ1 was produced by non- OPEC countries and Q1Q [OQ- OQ1] by OPEC. As a result, with higher prices OPEC increased its oil revenues. Though there was decline in the sale by the OPEC countries but price rises more than a fall in sales. Non-OPEC countries also gain because they were also selling at new higher world price.

ii) Price Leadership

Price leadership is an important form of Collusive oligopoly. Under price leadership, the leader firm sets the price and other firms follow it. The price leader firm has major share of total sales, and a group of smaller firms supply the remainder of the market. The large firm acts as a dominant firm which sets a price that maximizes his own profit. The other firms have no option but to take the price set by the dominant firm as given and maximize their profits accordingly. These other firms have very small share of total sales, so individually other firms would have very little influence over the price. Thus, other firms act as perfect competitors and take price decided by dominant firm as given. When leader firm maximizes its profit it takes into account how the output of the other firms depends on the price it sets. It is shown in figure 3.10.

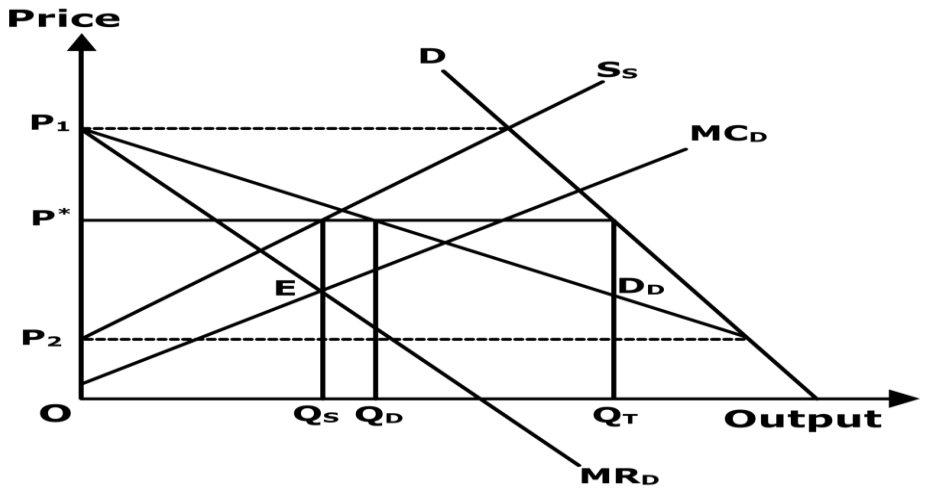


Fig.3.10. Price Leadership

In the figure, price is measured on Y-axis and quantity on X- axis. D is the market demand curve which is negatively sloped. SS is the supply curve. DD is the demand curve of dominant firm. The demand curve of the dominant firm is the difference between market demand and the supply curve of followers firm. At price OP1, the market demand is equal to the supply by the followers firm, so the dominant firm can sell nothing at this price. At price OP2 or less, the follower firm will not supply any good. So, at price OP2 or less the dominant firm faces the market demand curve D. And between prices OP2 and OP1, the dominant firm faces the demand curve DD. Corresponding to demand curve DD faced by the dominant firm, the dominant's firm is facing

marginal revenue MRD. MCD is the marginal cost faced by the dominant firm. The dominant firm in order to maximize profit should produce a level of output where marginal revenue is equal to marginal cost. The dominant firm is maximizing profit at point E where marginal revenue is equal to marginal cost. The equilibrium price is OP* and the equilibrium quantity produced by the dominant firm is OQD. At this price, follower firms sell a quantity OQS. The total quantity that is sold at price OP* is OQT which is the sum of the quantity produced by dominant firms (OQD) and the quantity produced by the small firms (OQs).

3.9.1. Types of Price Leadership:

Price leadership helps in stabilizing prices and maintaining price discipline. There are three major types of price leadership, which are present in industries over a passage of time.

These three types of price leadership are explained as follows:

i. Dominant Price Leadership

ii. Barometric Price Leadership

iii. Aggressive Price Leadership

i. Dominant Price Leadership:

Dominant price leadership in which only one organization dominates the entire industry. Under dominant price leadership, other organizations in the industry cannot influence prices. The dominant organization uses its power of monopoly to maximize its profits and other organizations have to adjust their output with the set price. The interests of other organizations are ignored by the dominant organization. Therefore, dominant price leadership is sometimes termed-as partial monopoly. Price leadership by the leading organization is most commonly seen in the industry.

ii. Barometric Price Leadership:

Barometric price leadership in which one organization declares the change in prices at first and assumes that other organizations would accept it. The organization does not dominate others and need not to be the leader in the industry. Such type of organization is known as barometer. This barometric organization only initiates a reaction to changing market situation, which other organizations may follow it if they find the decision in their interest. On

the contrary, the leading organization has to be accurate while forecasting demand and cost conditions, so that the suggested price is accepted by other organizations.

Barometric price leadership takes place due to the following reasons:

a. Lack of capacity and desire of organizations to estimate appropriate supply and demand conditions. This influences organizations to follow price changes made by the barometric organization, which has a proven ability to make correct forecasts.

b. Rivalry among the organizations may make a leader, which can be unacceptable by other organizations. Thus, most of the organizations prefer barometric price leadership.

iii. Aggressive Price Leadership:

Implies a leadership in which one organization establishes its supremacy by threatening the organizations to follow its leadership. In other words, dominant organization establishes leadership by following aggressive price policies and forces other/organizations to follow the prices set by it.

3.9.2. Drawbacks of Price Leadership:

i. Makes it difficult for the price leader to assess the reactions of followers.

ii. Leads to malpractices, such as charging lower prices by rival organizations in the form of rebates, money back guarantees, after delivery free services, and easy installment facility. The prices charged by rival organizations are comparatively less than the prices set by the price leader.

iii. Leads to non-price competition by rival organizations in the form of aggressive promotion strategies.

iv. Influences new organizations to enter into the industry because of price rise. These new organizations may not follow the leader of the industry.

v. Poses problems if there are differences in cost of price leaders and price followers. In case, if cost of production of price leader is less, then he/she would fix lower prices.

3.10 GAME THEORY

The theory of games is one of the most outstanding recent developments in economic theory. It was first presented by Neumann and Morgenstern in their classic work, Theory of Games and Economic Behaviour, published in 1944

which has been regarded as a "rare event" in the history of ideas. Game theory grew as an attempt to find the solution to the problems of duopoly, oligopoly and bilateral monopoly. In all these market situations, a determinate solution is difficult to arrive at due to the conflicting interests and strategies of the individuals and organisations. The theory of games attempts to arrive at various equilibrium solutions based on the rational behaviour of the market participants under all conceivable situations. "The immediate concept of a solution is plausibly a set of rules for each participant which tells him how to behave in every situation which may conceivably arise."

The underlying idea behind game theory is that each participant in a game is confronted with a situation whose outcome depends not only his own strategies but also upon the strategies of his opponent. It is always so in chess or poker games, military battles and economic markets. We shall be concerned mainly with the various solutions of the duopoly problem where the bargaining process is between two parties. But before we start the analysis of the theory of games, it will be useful to digress on certain fundamentals of game theory.

A game has set rules and procedures which two or more participants follow. A participant is called a player. A strategy is a particular application of the rules leading to specific result. A move is made by one player leading to a situation having alternatives. A choice is the actual alternative chosen by a player. The result or outcome of the strategy followed by each player in relation to the other is called his pay-off. The saddle point in a game is the equilibrium point. There are two types of games: constant- sum and non-constant-sum. In a constant-sum game what one player gains the other loses. The profits of the participants remain the same, whereas in a non-constant-sum game, profits of each player differ and they may co-operate with each other to increase their profits.

Two-Person Constant-Sum or Zero-Sum Game:

In a constant-sum or zero-sum game between two players, the gain of one player is exactly equal to the loss of the other player. "There is, for each player, a strategy…. which gives him the mathematical expectation of a gain not less than, or of a loss not greater than, a certain particular value. It also shows

that, if the players actually behave in this way, then those expected gains and losses are actually realised and the game has a determinate solution."

Assumptions:

The two-person constant-sum game is based on the following assumptions:

(i) A duopolistic market situation exists with firms A and B, each trying to maximize its profits,

(ii) Each is engaged in a constant-sum game so that what one firm gains, the other loses,

(iii) One firm's interest is diametrically opposed to the others,

(iv) Each firm is in a position to guess the strategy of the other as against its own strategy so as to construct the pay-off matrix for both. Lastly, each firm assumes that its opponent will always make a wise move and it would try to countermove that to protect itself from any possible loss.

Pay-off Matrix and Strategies:

Suppose firm A has three strategies for maximizing its profits. They are to improve the quality of its product, to advertise it and to reduce its price. Its rival firm B has also the same alternative strategies to profit more. A's pay-off is shown in Table 1. Since we are concerned with constant-sum games, the strategies of both A and B are depicted in one pay-off matrix, as A's gain is B's loss and vice versa.

Table 1 : Pay-off Matrix

A's Strategy →	↓ *B*'s Strategy			Row Min.
	1	2	3	
1	5	7	4	4
2	2	3	6	2
3	10	9	8	8
Col. Max.	10	9	8	8=8

In order to show how A and B will choose the various strategies consider the numerical example given in Table I. If A chooses strategy 1 with a pay-off of 5, it estimates that B will choose strategy 3 with a pay-off 4, thereby reducing A's profit to its minimum value or security value 4. This is recorded at the end of row 1 and beginning of column 5. If A chooses strategy 2 with a value of 3, B will employ its strategy 1 to counteract A's move so that A will gain a

minimum profit of 2. Finally, when A chooses strategy 3 having a value of 9, A's pay-off is reduced to 8 by B as he employs strategy 3. In employing each strategy, firm A moves cautiously and assumes that whatever strategy it employs, its rival B will always adopt that counter-strategy which will provide A with the minimum pay-off. Thus each time A adopts a technique, its profit is reduced to the minimum by B's counterstrategy. Therefore, A will choose that strategy which gives it the minimum out of the three maximum pay-offs in each row. Thus A is interested in the "Row Min" pay-offs 4, 2, 8 shown in the last column of Table 1. It will choose strategy 3 because it provides it with the maximum-minimum or better known as maximin gain of 8 which is the highest among the row minima. This is called maximin or dominant strategy which is defined as "the worth of the game to the maximizing player because his opponent cannot prevent him from realising it."

Firm B is also cautious about the counter-strategy of its rival A. B knows that whatever move it will make in adopting a particular strategy, A will counteract it by adopting a counter-strategy, thereby leaving B with a worse pay-off. B's worse pay off means that A receives very large profit and B is left with a very little residual. This is what B thinks about the strategy of A. Therefore, B chooses the maximum pay-off in each strategy because it thinks that by so doing it cannot prevent A from gaining that much in each column of the three strategies. If B adopts strategy 1, A will choose strategy 3, so that the worst pay-off level for B is 10. Similarly, by adopting strategy 2, the worst move gives B the maximum pay-off 9; whereas strategy 3 gives it the pay-off 8. The maximum pay-off from each strategy is thus 10, 9 and 8 shown in "Col. Max" (column maxima) in Table 1, last row. The best of these pay-offs from B's point of view is the minimum of the column maxima, 8. It is called the minimax, and the method employed by the minimiser is the minimax strategy. This is B's dominant strategy.

The Saddle Point:

The saddle point is the equilibrium point. In the pay-off matrix of Table 1, A's pay-off from its maximin strategy 3 exactly equals B's pay-off from its minimax strategy 3 (8=8). When the minimax and the maximin in a pay-off matrix are equal, it is a strictly determined game. Both the players (firms) are

guaranteed a common amount of win (profit). They cannot win more because there is a saddle point in the pay-off matrix which occurs both in the "Row Min", and "Col. Max". It is the equilibrium point 8, common to both A and B. Thus a constant-sum-two-person game is strictly determined only if it has a saddle point arrived at with pure strategy. The determinate solution of the duopoly situation discussed above is entirely based on pure strategy whereby each firm reasons out which of the several possible courses of action are the most favourable to it. In a uniquely determined game with pure strategy, there is no need for recognising mutual interdependence on the part of the duopolists. The minimax strategy followed by B cannot be improved upon by the maximin strategy adopted by A, if the pay-off matrix has a saddle point. Therefore, the duopoly situation becomes strictly determinate. The minimax strategy is an alternative to profit maximization. Through this strategy a firm minimizes the chances of the maximum loss.

Solution without Saddle Point:

However, a more realistic solution to the duopoly problem is wherein a pay-off matrix has no saddle point. Such a situation is indeterminate for there is no equilibrium point in the "Row Min", and "Col. Max." In this solution, when A chooses a strategy with a high pay-off, B chooses some other strategy with a still higher pay-off. The pay-off matrix in Table 2 illustrates this.

Table 2 : Pay-off Matrix

A's Strategy →	*B's Strategy* ↓			*Row Min.*
	1	2	3	
1	5	7	4	4
2	2	3	5	2
3	10	6	8	6
Col. Max.	10	7	8	$6 \neq 7$

If A chooses strategy 1 to have a pay-off of 7, there is nothing to prevent B from choosing strategy 3 obtaining the pay-off 8. If A selects strategy 3 for the pay-off 5, B might adopt strategy 1 to profit more by having 10, and so on. In this pay-off matrix there is no equilibrium (saddle) point. If any one of the two

firms employs its own strategy, it will be counteracted by the other's strategy if A sticks to its maximin strategy 3, B will gain by selecting the non- minimax strategy 1. It will have a pay-off 10 against A's 6. The only solution to such a problem is to employ the maximin- minimax strategies. When A employs the maximin strategy, it gains 6 while B gains 7 by employing the minimax strategy. Each fears that the other might discover its choice of strategy and so wants to play it safe to be sure of a certain minimum of profit 1, the difference between 7 and 6 measures the extent of indeterminacy. This is because the maximin and the minimax are unequal. The solution is not stable. One fundamental conclusion follows that where the pay-off matrix has no saddle point, minimax always exceeds the maximin, as is apparent from Table 2. The reason being that player (firm) A in the game always selects the maximum of the minimum rows, whereas B always chooses the minimum of the maximum columns. The minimax is thus bound to exceed the maximin. This can also be proved algebraically. Suppose aij is the maximin and aik the minimax. Since aij is a "Row Min.", it is either less than or equal to all elements in its row, including aih. However, aih cannot exceed aik of the "Col. Max." which is the maximum in its column. Thus aij < aih < aik.

Mixed Strategies:

But the duopoly problem without a saddle point can be solved by allowing each firm to adopt mixed strategies. A mixed strategy refers to the introduction of an element of chance in choice making on a probabilistic basis. It "is a probability distribution that assigns a definite probability to the choice of each pure strategy in such manner that the sum of the probabilities is unity for each participant." It is just giving a player a set of dice to throw and determine the strategy to be chosen. Each player has a pair of mixed strategies that leads to an equilibrium position.

Each tries to have the most desirable expected value of the game (or pay-off) as against his rival; and is therefore, in search of a set of probabilities for his mixed strategy so as to have the highest expected pay-off. This is known as the optimal mixed strategy. If the game has value V, A till try to have the highest expected pay-off V by playing his mixed strategy; playing the same mixed strategy, B will try to keep A's expected pay-off to the minimum V.

To illustrate, the pay-off matrix in Table 3 is used where each duopolist has two strategies 1 and 2. This Table has no saddle point. Both resort to the game of dice to arrive at a solution. The rule is that if A throws the dice and the result is 1 or 2, he will choose strategy 1 and if the result is 3, 4, 5 or 6, he chooses strategy 2. Following this rule, the probability of A choosing strategy 1 is 1/3, and of choosing strategy 2 is 2/3. B will employ the same strategies but with opposite probabilities in order to keep A's expected pay-off to the minimum.

Pay-off Matrix

A's Strategies	A's Probabilities	B's Strategies → / B's Probabilities ↓ 1 (2/3)	2 (1/3)
1	1/3	6	4
2	2/3	2	6

The probability of B choosing strategy 1 is 2/3, and of choosing strategy 2 is 1/3. Thus each must choose both the probabilities. The expected value of the game V for A = 1/3×2/3×6+1/3×1/3×4+2/3×2/3×2+2/3x 1/3×6=36/9=4. Similarly, the expected value of the game V for B = 2/3×1/3x 6+2/3×2/3×2+1/3×1/3×4+1/3×2/3×6 = 36/9 = 4. Each duopolist will try to maximise the "mathematical expectation of his profit" rather than the profit itself. The expected pay-off or the mathematical expectation of profit for each of the duopolists equals the value of the game, (F=4) when both adopt their optimal probabilities. If A uses his optimal mixed strategy, his expected pay-off cannot be less than V, whatever B's choice of strategies may be. Similarly, if B uses his optimal strategy, his expected loss cannot be greater than V, whatever A's choice of strategies may be. Thus the problem is always determinate when mixed strategies are employed.

Non-Constant-Sum Games:

In constant-sum game no player is able to affect the combined pay-off. But in non-constant-sum game if player A employs an optimal mixed strategy, player B can increase his expected pay-off by not following the same mixed strategy.

The solution lies in either collusion or non-collusion between the two players. The former is known as cooperative non-constant-sum game and the latter as non-cooperative non-constant-sum game.

3.11. Nash Equilibrium:

In the cooperative non-constant-sum game, the most rational thing for the two players is to collude and thus to increase their combined pay-off without reducing any one's pay-off. But the problem is not as simple as it appears. It is too much to expect the players to act rationally, especially when the problem is one of distributing their joint profit equitably. The Nash Equilibrium tries to arrive at a "fair division" by evaluating the pay-off for both players. In Nash equilibrium, each player adopts a strategy that is his best choice, given what the other player does. To explain Nash equilibrium, take two players who are involved in a simple game of writing words. The game assumes that each player writes two words independently on a paper. Player A writes 'top' or 'bottom' and player B writes 'right' and 'left'. Then the scrutinization of their papers reveal- the pay-off got by each is, as shown in Table 4.

Suppose player A prefers the top and player B prefers the left from the Top-Left box of the matrix. It is seen that the pay-off to player A is 2 as the first entry in the left box, and pay-off to player B is the second entry, 4 in this box. Next if the player A prefers bottom and player B prefers right then the pay-off to player A is 2 and to player B is 0 in the Bottom-Right box. From the above, we can infer that player A has two strategies; he can choose either the top or the bottom. From the point of view of player A, it is always better for him to prefer the bottom because the choices 4 and 2 are greater than the figures at the top. Likewise, it is always better for player B to prefer left because the choices 4 and 2 are greater than the figures at the right i.e. 2 and 0. Here the equilibrium strategy is for player A to prefer the bottom and for player B to prefer the left.

The above matrix reveals that there is one optimal choice of strategy for a player without considering the choice of the other player. Whenever player A prefers the bottom, he will get a higher pay-off irrespective of what player B prefers. Similarly, player B will get a higher pay-off if he prefers left

irrespective of what player A prefers. The preferences bottom and left dominate the other two alternatives and hence we get equilibrium in dominant strategies. But the dominant strategy equilibrium does not occur often. The matrix in Table 5 shows an example of this particular phenomenon.

Table 5 : Pay-off Matrix

		Player B	
		Left	*Right*
Player A	*Top*	[4] 2	[0] 0
	Bottom	[0] 0	[2] 4

In the above matrix when player B prefers the left, the pay-offs to player A are 4 and 0 because he prefers the top. Likewise when player B prefers the right, the pay-offs to player A are 0 and 2 because he prefers the bottom. When player B prefers the left, player A would prefer the top, and again when player B prefers the right, player A would prefer the bottom. Here the optimal choice of player A is based on what he imagines player B will do. A Nash equilibrium can be interpreted as a pair of expectations about each player's choice such that when the other player's, choice is revealed in the above matrix, the strategy Top-Left is a Nash equilibrium. In a Nash equilibrium, no player has an incentive to depart from it by changing his own behaviour.

Non-Cooperative Non-Constant Sum Games:

If collusion is ruled out, we enter the realm of non-cooperative non-constant-sum games where each player acts on his guesses about the other's choice of strategy. Non-cooperative non-constant- sum games may be of a variety of types. The two players guided by self-interest, as they are likely to be, may select strategies which may be mutually harmful. Prof. Tucker's "'prisoner's dilemma" is an interesting case of a non-constant-sum game where two prisoners are brought for interrogation separately.

Each is aware that both will be let off if neither confesses. But each is warned that if one who confesses will be let off and the other who does not confess will be awarded heavy punishment. Thus both, in trying to protect themselves, will confess and receive punishment. This example is important in pointing

out that the various measures like taxation, rationing, etc., adopted by the government are designed, at least in part, to achieve the cooperation which alone can prevent the loss to each player from his trying to protect himself when Vie has no assurance that others will behave as required by their mutual interest."

A non-cooperative non-constant-sum game may have several pairs of strategies with saddle points, but they may not have the same pay-off. Further, if a_{11} and b_{11}, and a_{2l} and b_{2l} are pairs of equilibrium strategies, it is not essential that a_{11} and b_{2l} or a_{21} and $b_{11}$are also equilibrium pairs. If the players do not choose equilibrium pairs of strategies, both may be losers.

It is also possible that one player in a non-constant-sum game may publicise his strategy as threat information or for providing information to his opponent for having some sort of quasi-collusion with him which may be mutually beneficial.

Limitations of Game Theory: Game theory has the following limitations:

Firstly, game theory assumes that each firm has knowledge of the strategies of the other as against its own strategies and is able to construct the pay-off matrix for a possible solution. This is a highly unrealistic assumption and has little practicability. An entrepreneur is not fully aware of the strategies available to him, much less those available to his rival. He can only have a guess of his and his rival's strategies.

Secondly, the theory of games assumes that both the duopolists are prudent men. Each rival moves on this presumption that his opponent will always make a wise move and then he adopts a countermove. This is an unrealistic assumption because entrepreneurs do not always act rationally. But it an entrepreneur is not prudent, he cannot play either the maximin or minimax strategy. Thus the problem cannot be solved.

Thirdly, the various strategies followed by a rival against the other lead to an endless chain of thought which is highly impracticable. For instance, in Table 1, there is no end to the chain of thought when A chooses one strategy and B adopts a counter-strategy and vice versa.

Fourthly, it is easy to understand a two-person constant-sum game. But as the analysis is elaborated to three or four person games, it becomes complex

and difficult. However, the theory of games has not been developed for games with more than four players. Most economic problems involve many players. For instance, the number of sellers and buyers is quite large in monopolistic competition and the game theory does not provide any solution to it.

Fifthly, even in its application to duopoly, game theory with its assumption of a constant-sum game is unrealistic. For it implies that the "stakes of interest" are objectively measurable and transferable. Further, the minimax principle which provides a solution to the constant-sum game assumes that each player makes the best of the worst possible situation. How can the best situation be known if the worst does not arise? Moreover, most entrepreneurs act on the presumption of the existence of favourable market conditions and the question of making the best of the worst does not arise at all.

Sixthly, the use of mixed strategies for making non-zero sum games determinate is unlikely to be found in real market situations. No doubt random choice of strategies introduces secrecy and uncertainty but most entrepreneurs, who like secrecy in business, avoid, uncertainty. It is, however, possible that an oligopolist may wish his rivals to know his business secrets and strategies for the purpose of entering into collusion with them in order to earn maximum joint profits.

Conclusion:

Thus like the other duopoly models, game theory fails to provide a satisfactory solution to the duopoly problem. "Although game theory has developed far since 1944," writes Prof. Watson, its contribution to the theory of oligopoly has been disappointing." To date, there have been no serious attempts to apply game theory to actual market problems, or to economic problems in general. Despite these limitations, game theory is helpful in providing solutions to some of the complex economic problems even though as a mathematical technique, it is still in its development stage.

****

UNIT - IV

DISTRIBUTION THEORY

4.1. Introduction

Distribution refers to the sharing of the wealth that is produced among the different factors of production. In the modern time, the production of goods and services is a joint operation. All the different factors of production i.e., land, labour, capital and enterprise are combined together in productive activity. Productive activity is thus the result of the joint effort of these four factors of production which work collectively to produce more wealth. These factors need to be paid or rewarded for their services for producing the wealth.

4.2. Definition:

- According to Prof. Nicholson – "Distribution refers to the sharing of wealth of a nation among the different classes."
- Prof. Chapman has said that – "The Economics of Distribution accounts for the sharing of the wealth produced by a community among the agents or the owners of agents which have been active in its production."

4.3. Components of Distribution:

In economics, the term 'distribution' has two components:

(i) Functional distribution,

(ii) Personal distribution.

1. Functional Distribution:

Functional distribution refers to the distinct share of the national income received by the people, as agents of production per Unit of time, as a reward for the unique functions rendered by them through their productive services. These shares are commonly described as wages, rent, interest and profits in the aggregate production. It implies factor price determination of a class of factors. It has been called as "Macro" concept.

2. Personal Distribution:

Personal distribution on the other-hand, is a 'Micro Concept' which refers to the given amount of wealth and income received by individuals in society through their economics efforts, i.e., individual's personal earnings of income through various sources. The concept of equality and inequality of

income distribution and social justice is basically concerned with the personal distribution of income. Taxation measures are designed to influence personal distribution of income and wealth in a community. The theory of distribution deals with functional distribution and not with personal distribution of income. It seeks to explain the principles governing the determination of factor rewards like—rent, wages, interest and profits, i.e., how prices of the factors of production are set.

4.4. IMPORTANCE OF DISTRIBUTION:

At present under the study of economics the study of 'Distribution' has occupied a very important place. The methods and systems of distribution has high effect on the economic life of the nation. Therefore, where the work of distribution is done with equity and justice the various channels of distribution are satisfied with its workings. The satisfied workers increases their efficiency and they increase the quality and quantity of production. Contrary to this if the methods of distribution are improper and a particular class is being exploited then there will be dis-satisfaction feeling will crop up among people. Therefore, with the study of the distribution, it is clear that in the country with scientific system of production, equity and scientific way of distribution method is also very essential. They are as follows:

(i) Marginal Productivity Theory of Distribution.

(ii) Modern Theory of Distribution.

4.4.1. Marginal Productivity Theory of Distribution:

Marginal productivity theory of distribution is the most celebrated theory of distribution. It is the neo-classical theory of distribution and is derived from Ricardo's "Marginal principle". J.B. Clark, Marshall and Hicks are the main pro-pounders of this theory. Initially, the theory was propounded as an explanation for the determination of wages (i.e., the reward for labour) but, later on, it was generalized as a theory of factor pricing for all the factors of production.

"The theory states that the price of a factor of production is governed by its marginal productivity. To support this hypothesis, it analyses the process of equilibrium pertaining to the employment of input of various factors by an individual firm under perfect competition. In a perfectly competitive factor

market, a firm can buy any number of units of factors of production, at the prevailing market price. Now, the question is: given the price of a factor, how much of each factor will he employ." According to this theory, an entrepreneur or a firm will employ a factor at a given price till its marginal productivity tends to be equal to its price. It thus follows that the reward (price) of a factor tends to be equal to its marginal productivity.

The summary of the marginal productivity theory may thus be laid down in terms of the following propositions:

"The marginal productivity of a factor determines its price. In the long-run, the price or reward of a factor tends to be equal to its marginal as well as average products. When the reward of each factor in the economy tends to be equal to its marginal productivity, there is optimum allocation of resources (factors) in different uses. Further, when all factors receive their shares according to their respective marginal products, the total product will be exhausted."

Assumptions of Marginal Productivity Theory:

The Marginal Productivity Theory of distribution is based on the following implicit and explicit assumptions:

(i) There is perfect competition, both in the product market as well as in the factor market.

(ii) There should not be any technological change. Therefore, the techniques of production should remain the same, though the scales and proportions of factors may change.

(iii) All units of a factor should be perfectly homogeneous i.e., they should be of equal efficiency. This means that all units of a factor should receive the same price. The homogeneity of factors of units should imply that they are perfectly substitutes of each other.

(iv) The firm aims at maximisation of profit. Therefore, it should seek and observe the most efficient allocation of resources.

(v) The economy as a whole, should operate at the full employment level.

(vi) There should be perfect mobility of factors of production.

(vii) The bargaining power of the seller and the buyers of a factor of production should be equal.

(viii) The marginal productivity of an individual should be measurable.

(ix) There should not be any government intervention in the fixation of factor price, such as minimum wage legislation or price control etc.

(x) The theory essentially considers long-run analysis in order to prove that the price of a factor will tend to be equal to both average and marginal productivity.

The Concepts of Productivity:

Productivity means the quantity of the output turned out by the use of factor or factors of production.

Productivity of a factor may be viewed in two senses:

(i) Physical productivity, and

(ii) Revenue productivity.

(i) Physical Productivity:

Physical productivity of a factor is measured, in terms of physical units of output of a commodity produced by it per unit of time. When physical productivity is expressed in terms of money it is called revenue productivity.

Again physical productivity has two concepts:

(a) Average Physical product, and

(b) Marginal Physical product.

(a) Average Physical Product:

The average physical product or the average product of a factor is the total product dividend by the number of units of the factor employed in the process of production. To put this in symbolic terms

$AP = TP/n$

(b) Marginal Physical Product:

The marginal physical product of a factor is the increase in total product resulting from the employment of an additional unit of that factor, other factors remaining constant. The physical product or the marginal product of a particular factor is thus measured as $MP = TP_n - TP_{n-1}$.

Once the average and marginal products are calculated it is easy to measure the respective revenue productivity of the factor concerned. Here, we measure the quantity of the product in physical terms.

For example:

We may express in terms of quintals of wheat or the number of chairs produced. But we are not concerned here with the total quantity of wheat or the average yield. We are concerned here with the marginal product which means an addition made to the total output of the commodity by the addition of one unit of a factor of production. Suppose 3 hectares of land yield 30 quintals of wheat and 4 hectares, 40 quintals. The use of the third hectare has added 10 quintals. This is the marginal physical product. The total product has been increased by 10 quintals by the employment of the third or the marginal hectare. That is why it is called marginal product. But it is the physical product and not product in terms of value.

Value of Marginal Product (VMP):

This is also called Value of Marginal Physical Product (VMPP) and is usually referred to as the marginal productivity of a factor, and is obtained by multiplying the marginal physical product of the factor by the price of output.

To put it symbolically:

Marginal Productivity of VMPP = MPP x P where, MPP stands for the marginal physical product of the factor, and P for the price of output. The marginal value product means the value of additional product obtained by the employment of another unit of a factor of production. We can get value product by multiplying the physical product i.e., the quantity of the commodity by its price in the market.

For example:

When we say that it is an addition to the total product by the addition of one more unit of a factor of production, say one hectare or one worker, or a unit of Rs. 1,000 in capital. When this marginal product is expressed not in physical terms but in terms of its value in the market, it is called Marginal Value Product.

Marginal Revenue Productivity:

The marginal revenue at any level of firm's output is the net revenue earned by selling another (additional) unit of the product. Algebraically, it is the addition to total revenue earned by selling n units of product. In other-words, Marginal Revenue Product (MRP) of a factor is the net addition to total revenue

made by the employment of an additional unit of that factor, assuming other factors to be fixed under a given state of technology. Thus, marginal revenue product is obtained by multiplying the marginal revenue.

To put it symbolically:

MRP = MPP x MR

Where, MRP indicates marginal revenue product,

MPP stands for the marginal physical product

and MR stands for the marginal revenue.

Thus, there is a conceptual difference between marginal revenue product (MRP) and value of marginal physical product (VMPP). In the former, we consider marginal revenue to be multiplied by the MPP and, in latter, we take price to multiply it by the MPP. In perfectly competitive market conditions for the product, however, MPP = VPP. This is because under Perfect Competition—Price = MR. But if the commodity-market has imperfect competition price or AR tends to be greater than the marginal revenue, then VMPP will be higher than MRP.

Marginal Productivity Theory of Distribution:

Marginal Productivity Theory of Distribution is the reward of a factor equals its marginal product. Marginal product, also known as marginal physical product, is the increment made to the total output by employing an additional unit of a factor, keeping all other factors constant. If the increase in the output is multiplied by the prevailing price of the product, the result is the marginal value product of that factor. But it is better to measure marginal product of a factor in terms of its marginal revenue product (MRP) which may be defined as the addition made to total revenue resulting from the employment of one more unit of a factor of production, other factors remaining unchanged.

In other words, by the marginal productivity of a factor of production we mean the addition made to total output by the employment of the marginal unit i.e., the unit which the employer thinks just worth-while employing. At the margin of employment, the payment made to the factor concerned is just equal to the value of the addition made to the total output on account of the employment of the additional unit of a factor.

For example:

If the prevailing wage is less than the marginal productivity, then more labour will be employed. Competition among employers will raise the wage to the level of marginal productivity. If on the other-hand, the marginal productivity is less than the wage, the employers are losing and they will reduce their demand for labour. As a result, the wage rate will come down to the level of marginal productivity. In this way by competition, wage tends to equal the marginal productivity. This applies also to the other factors of production and their rewards.

Thus, it must be noted that in a position of competitive equilibrium:

(a) The marginal productivity of a factor of production is the same in all employments,

(b) The marginal productivity of a factor of production is measured by the price of the factor of production; and

(c) Marginal productivities of various factors are proportional to their respective prices.

Further, over the whole field of employment, therefore, each factor of production tends to be paid in proportion to its marginal productivity. Thus, the distribution of national income or the total aggregate output of an economy is not a scramble as the strikes or lock-outs make it appear to be. It is governed by a definite economic principle viz. marginal productivity.

Criticisms of the Marginal Productivity Theory:

Most of the economists are of this opinion that though the marginal productivity theory is logically sound and perfect, it has many inherent shortcomings and they have criticised the theory on the following grounds:

1. The Basic Assumption Underlying the Theory is Unrealistic:

The theory is based on the assumption of perfect competition in the product as well as factor markets. Chamberlin have rightly pointed out that perfect competition is not a very large relative phenomenon. In reality, there is imperfect competition in the market. Further, other assumptions of the theory have also been criticised and they are as such:

2. All Units of Factor are not homogeneous:

The theory assumes that all units of a factor are homogeneous. In reality, however, all factor units can never be alike. Especially, the different labour units differ in efficiency and skill. Similarly, plots of land differ in fertility and so on.

3. Factors are not fully employed:

The theory assumes that all factors are fully employed. But, as Keynes pointed out, in reality there is a likelihood of under-employment rather than full employment.

4. Factors are not Perfectly Mobile:

Next, the theory assumes perfect mobility of factors. But in reality, factors are imperfectly mobile between regions and occupations. There is no automatic movement of factors units from one place to another. The greater the degree of specialisation in an industry, the less is the factor mobility from one industry to another.

5. All Factors are not Divisible:

The theory assumes the divisibility of factors. But lumpy factors like factory plant, machines and the manager are indivisible. In a large factory the addition or subs-traction of one factor units will have practically no effect on the total productivity. It may be true in domestic production. Thus, the equality between marginal productivity and price of a factor cannot be brought about by varying its quantities a little less or more.

6. This Theory not Applicable in the Short-run:

The theory is applicable only in the long-run, when the reward of a factor service tends to equal its marginal revenue product. But in reality, we are concerned with short-run problems. As said by Prof. Keynes—"In the long-run we are all dead." This assumption makes the problem of pricing the factor-services unrealistic.

7. This Theory is a Static Theory:

The marginal productivity theory is applicable only to a static economy as it regards no change in technology. Since the modern economy is dynamic and there are technological advances from time to time, the theory becomes in-applicable to modern conditions.

8. This Theory has been considered as One-sided:

Because it considers only demand for factors in terms of its Marginal Revenue Product but it fails to nalyse the conditions of supply in the factor market. The factor price may be high when the factor is relatively scarce.

9. Marginal Productivity of all Factors cannot be Measured Separately:

In this theory it has been assumed that the marginal physical product of an individual factor can be measured by keeping other factors unchanged. Critics have said that one cannot consider the specific marginal productivity of a factor in isolation, when production is not the result of only one factor. It is the outcome of collective efforts of all factors at a time. Therefore, it is difficult to measure the marginal productivity of each factor separately. Since variation in output cannot be attributed to a single factor alone, marginal productivity appears to be a make-believe concept.

10. The Theory is based on the Law of Diminishing Returns as Applied to the Organisation of a Business:

This means that a factor like capital with improved technology has increasing returns and it also enhances the productivity of other factors like labour. This theory misses this vital point of practical consideration.

11. Wage Determination Theory:

This Theory has been criticised by Keynes and he is of this Opinion that theory is Basically Explained for Wage Determination and is Loosely Extended for Pricing of the Other Factors of Production. But other factors like rent and capital have their distinctive factors like rent and capital have their distinctive characteristics, so their rewards are also fixed distinctly. Again, the entrepreneur earns profit which is a residual income, which can be negative as well. Then, is it not ridiculous to lack of negative marginal product of an entrepreneur to explain loss in the business, which is improper.

12. The Theory cannot apply to Personal Distribution:

The theory only explains functional distribution. It does not deal or explains anything of personal distribution of income and inequalities of earnings.

4.4.2. MODERN THEORY OF DISTRIBUTION DEMAND AND SUPPLY THEORY:

We have seen earlier that the marginal productivity theory only tells us that how many workers an employer will engage at a given level in order to earn maximum of profit. It does not tells us how that wage-level is determined. Further, the marginal productivity theory describes the problem of the determination of the reward of a factor of production from the side of demand only. It has not said anything from the supply side. Therefore, the marginal productivity theory cannot be said to be an adequate explanation of the determination of the factor prices. The modern theory of pricing which gives us a satisfactory explanation of factor prices in the Demand and Supply Theory. As we are aware that the price of a commodity is determined by the demand for and supply of, a commodity, similarly the price of a productive service also is determined by demand for and supply of that particular factor.

Demand for a Factor:

First we are going to consider the demand side of the factor. Here, we should remember that the demand for a factor of production is not a direct demand. It is on indirect or derived demand, It is derived from the demand for the product that, the factor produces. For example, we can say that labour does not satisfy our w ants directly. The demand for labour entirely depends upon the demand for goods. If the demand for goods increases, the demand for the factors which help to produce those goods will also increase.

The demand for a factor of production will also depend on the quantity of the other factors required for the process. The demand price for a given quantity of a factor of production will be higher, the greater the quantities of the co-operating productive services. If in production more of a factor of production is employed, the marginal productivity of the factor will fall and the demand price will be lower of the unit of a productive service. Further, the demand price of a factor of production also depends upon the value of the finished product in the production of which the factor is used. The demand price of a commodity is normally higher, if more valuable is the finished product in which the factor is used. Next, the more productive the factor is, the higher will be the demand price of a given quantity of the factor.

From the following diagram the given explanation given can be explained:

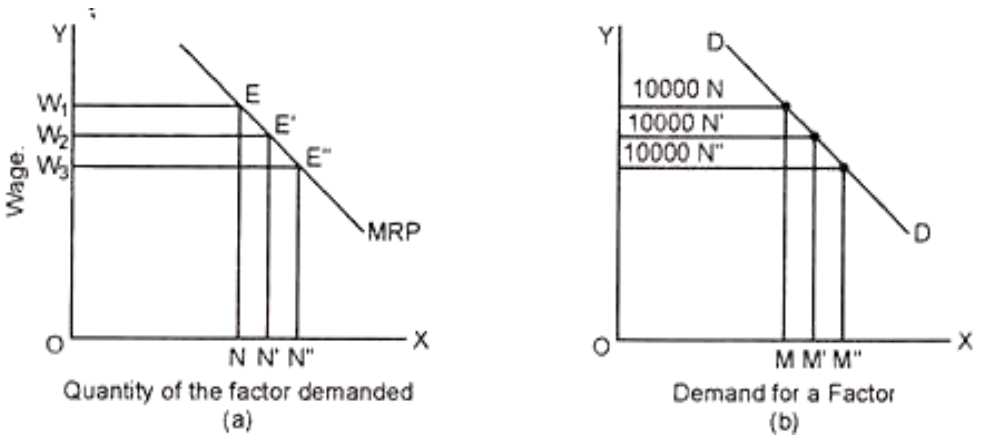


Fig. 4.1.

In the diagram given the wage is OW, the firm is in equilibrium at the point E and the demand for the factor is ON. Similarly at OW' wage the demand is ON' and at OW "the demand is ON ". MRP (Marginal Revenue Productivity) curve is the demand curve for a factor of production by an individual firm.

For determining the price of a factor, it is not the demand of the individual firm that matters but it is the total demand, i.e., the sum-total of the demands of all firms in the industry. The total demand curve is derived by the total summation of the marginal revenue productivity curves all the firms. This curve DD is shown in the figure. Thus, from this figure it can be ascertained that-according to the law of diminishing marginal productivity, the more a factor is employed, the lower is the marginal productivity.

Supply Side:

The supply curve of a factor depends on the various conditions of its supply.

For example:

The supply of labour entirely depends upon the size and composition of population, the occupational and geographical distribution, labour efficiency their training, expected income, relative preference for work and leisure etc. By considering all these relevant factors, it is possible to construct the supply curve of a productive service. Further, the supply of labour does not depend only on economic factors but many non-economic considerations also. Therefore, we can say that if the price of a factor increases, it supply will also increase and vice-versa. Hence, the supply curve of a factor rises from left to right upwards.

This can be shown by the figure given below:

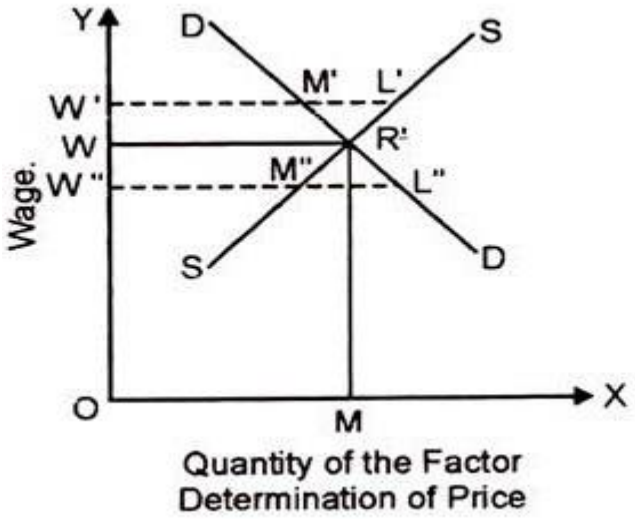


Fig.4.2.

Interaction of Demand and Supply:

We have studied up to this stage the demand curve and the supply curve of the factor of production while in price fixation both curves are needed. Therefore, the price will tend to prevail in the market at which the demand and supply are in equilibrium. This equilibrium is at the point of intersection of the demand and supply curves.

In the diagram above the demand and supply curves intersect at the point R and the price of the factor will be OW at OW' demand W' M' is less than the supply W L'. In this case competition among the sellers of the service will tend to bring down the price to OW. On the other hand, at OW "price the demand W "L" is greater than the supply W "M ", hence price will tend to go up to OW at which the demand and supply will be equal.

To conclude, this is how that the price of a factor of production in the factor market is determined by the interaction of the forces of demand and supply in connection with the factor of production. Thus eminent economists are of this opinion that this is the proper, correct and satisfactory theory of distribution.

4.5. PRODUCT EXHAUSTION THEOREM

The product exhaustion theorem states that if all the factors of production are paid equal to their marginal products, they will exhaust the total product. As soon as it was brought forward that all the factors of production are paid

equal to their marginal products, a difficult problem cropped up over, which raised a serious debate among the economists.

The difficult problem that has been put forward was that if all factors were paid equal to their marginal products, would the total product be just exactly exhausted?

The problem of proving that if all factors are paid rewards equal to their marginal products, they will exhaust the total product has been called the "*Adding- up Problem" or Product Exhaustion Problem. Philip Wicksteed* was the first economist who not only posed this problem but also provided a solution for it.

Solution of Product Exhaustion Theorem:

The three solutions proposed for the problem of the product exhaustion theorem were:

a) Philip Wicksteed Solution: Euler's Theorem

b) Wicksell, Walras and Barone's Solution

c) J.R. Hicks and R.A. Samuleson: Perfect Competition Model

a) Philip Wicksteed Solution: Euler's Theorem

Philip Wicksteed was the first economist who proposed this problem and provided a solution using Euler's Theorem. Euler's Theorem is a mathematical proposition which states that if a production function is homogeneous of degree one (i.e. Constant Returns to Scale) and the factors are paid equal to their marginal products, the total product is exhausted with no surplus and deficit.

Euler's Theorem:

Euler's Theorem was developed by Swiss mathematician Leonhard Euler. According to him, it is a mathematical relationship that applies to any homogeneous function.

A function f(x) is said to be homogenous of degree t (scalar), if and only if, for $(\lambda x) = \lambda^t(x)$, for all $\lambda > 0$ and $x = (x_1, x_2, \ldots\ldots, x_n)$.

Here, t is the parameter of returns to scale.

1. If the function f(x) is homogeneous of degree $\alpha = 1$, the function exhibits constant returns to scale.
2. If $\alpha > 1$, the function exhibits increasing returns to scale.

3. If α < 1, the function exhibits decreasing returns to scale.

Let f(x) be a production function with two factors of production of capital and labour. Then the homogeneous production function of degree t can be mathematically expressed as:

$\lambda^t Y = f$ [λK, λL]

Where,

Y is output

K is capital

t is the parameter of returns to scale.

If t = 1, the function exhibits constant returns to scale.

If t > 1, the function exhibits increasing returns to scale.

If t < 1, the function exhibits decreasing returns to scale.

If the production function is homogeneous of degree t, then

1. The Marginal Rate of Technical Substitution is constant along rays extending from the origin and
2. The derived cost function from the corresponding production function is homogeneous of degree $1/\alpha$.

Euler's Theorem

The theorem says that for a homogeneous function f(x) of degree t, then for all x

$x_1.\ (x)/\partial x_1 + x_2.\ (x)/\partial x_2 + x_3.\ (x)/\partial x_3 \cdots + x_n.\ \partial f(x)/\partial x_n = tf(x)$

Proof: For a homogeneous function f(x) of degree t,

$(\lambda x)/d\lambda = x_1.\ (\lambda x)/\partial \lambda x_1 + x_2.\ (\lambda x)/\partial \lambda x_2 + x_3.\ (\lambda x)/\partial \lambda x_3 \cdots + x_n.\ df(\lambda x)/\partial \lambda x_n$

$(x)/dt = t.\lambda^{t-1}(x)$

If setting λ=1, the theorem follows.

Euler's Theorem and Production Function:

It is based on some postulations. These are:

1. It assumes a standardized linear production of the first degree, which implies invariable returns to scale.
2. It assumes that the factors are complementary, i.e. if a variable factor increases, it increases the marginal productivity of the fixed factor.
3. It assumes that factors of production are perfectly divisible.

4. The relative shares of the factors are invariable and independent of the level of the product.
5. There is a stationary, reckless economy where there are no profits.
6. There is perfect competition.

It is applicable only in the long run.

Let us assume that the production function is homogeneous of degree 1. The homogeneous production function of the first degree can be written as:

$$\lambda Y = f\ [\lambda K, \lambda L]$$

And the Euler's Theorem can be written as:

$$Y = K.\ \partial Y/\partial K + L.\ \partial Y/\partial L$$

Where,

Y: Output

K: Capital

L: Labour

$\partial Y/\partial K$: Marginal Product of Capital

$\partial Y/\partial L$: Marginal Product of Labor

The marginal product of capital is the addition to the total output attributable to the addition of one more unit of capital. It is calculated by partially differentiating output with respect to capital, keeping labour constant.

Similarly, the Marginal product of labour is the addition to the total output attributable to the addition of one more unit of labour. It is calculated by partially differentiating output with respect to labour, keeping capital constant. Euler's theorem states that the marginal product of capital multiplied by the amount of capital plus the marginal product of labour multiplied by the amount of labour equals to the total product of the firm.

$Y = (K, L, A) = AK^{\alpha}L^{1-\alpha}$

$MP_K = \partial Y/\partial K = A\alpha K^{\alpha-1}L^{1-\alpha} = A\alpha\ (K/L)^{-1}$

$MP_L = \partial Y/\partial L = (1-\alpha)^{-\alpha} = A(1-\alpha)\ (K/L)^{\alpha}$

Putting the values in Euler's theorem, $Y=K.\ MP_k + L.\ MP_L$, we get

$Y = A\alpha K^{\alpha-1}L^{1-\alpha}K + (1-\alpha)^{-\alpha}$

$Y = A\alpha K^{\alpha}L^{1-\alpha} + (1-\alpha)^{1-\alpha}$

$Y = AK^{\alpha}L^{1-\alpha}$

If the production function is homogeneous of degree 1, then marginal products are homogeneous of degree zero.

$Y = K. MP_K + L. MP_L$ or $K. F_K + L. F_L$

Differentiate with respect to K,

$K. F_{KK} + L. F_{LK} + F_K = F_K$

$K. F_{KK} + L. F_{LK} = 0. F_K = 0$

Similarly, the same is true for labour.

We have seen that Wicksteed is able to explain the product exhaustion theorem with the help of Euler's theorem when the production function exhibits constant returns to scale. Wicksteed proved that if all the factors are paid equal to their marginal products, the total product will be exhausted.

Wicksteed's Solution and Criticism

i. First drawback of Wicksteed's Solution:

Wicksteed was able to explain the product exhaustion theorem with the help of Euler's theorem. But this solution was criticized by Walras, Edge worth, Barone and Pareto. According to them, returns to scale are not constant in the real world, i.e. production function is not homogeneous of degree one.

Economists pointed out that the production function is such that it yields a long-run average cost curve which is 'U' shaped. LAC curve is also known as the "envelope curve" as it envelopes short-run average cost curves.

The long-run average cost curve is U-shaped, i.e. it initially falls, reaches a minimum and rises thereafter. Initially, the long-run average cost of production falls as output increases because of increasing returns to scale and then rises beyond a certain level of output because of decreasing returns to scale. So, if a firm is working with increasing returns to scale and factors are paid equal to their marginal products, the total factor reward would exceed the total product.

And similarly, if a firm is working with decreasing returns to scale and factors are paid equal to their marginal products, the total factor reward would not fully exhaust the total product. As the total factor reward is less than the total product, it would result in a surplus. So, Euler's theorem does not apply when firms are working with either increasing returns to scale or decreasing returns to scale.

ii. Second drawback of Wicksteed's Solution:

If the production function exhibits constant returns to scale, then the shape of the long-run average cost curve would be a horizontal straight line parallel to the x-axis. The horizontal straight-line shape of the long-run average cost is not compatible with the perfectly competitive market structure, as the firm would not be able to determine the equilibrium position.

a. Wicksell, Walras and Barone's Solution to Product Exhaustion Problem:

After Wicksteed, the more satisfactory solution to the problem of the product exhaustion theorem was provided independently by Wicksell, Barone and Walras. They assumed that-

1. The production function was not homogeneous of degree one.
2. The production function was such that it yielded a long-run average cost curve to be of a 'U' shape.

They pointed out the applicability of the product exhaustion theorem in the long run in a perfect competition market. In a perfect competition market, the industry is in equilibrium in the long run when all the firms are in equilibrium and producing a price which is equal to a minimum of the long-run average cost. In the long run, all the firms are earning zero economic profit, and no firm has the incentive to enter or leave an industry.

Thus, the condition required for the product exhaustion theorem, i.e. production function exhibits constant returns to scale, was fulfilled at the minimum point on the long run average cost curve where returns to scale are constant within the range of small variations of output.

So, under perfectly competitive long-run equilibrium, if factors are paid rewards equal to their marginal product, the total product would be exactly exhausted.

b. Hicks and Samuelson Solution to Product Exhaustion Theorem:

We have seen that Wicksell, Barone, and Walras pointed out the applicability of the product exhaustion theorem in the case of a long-run perfectly competitive equilibrium. And Wicksteed provided a solution to the product exhaustion theorem with the help of Euler's theorem and assumed a linearly homogeneous production function.

But as all production functions are not linear homogeneous, the controversy remained unresolved. It does not make any difference whether we are under a perfectly competitive market structure and dealing with the usual 'U' shaped long-run average cost curve; the controversy remained unresolved.

Hicks and Samuelson resolved this controversy and showed that the solution of the product exhaustion theorem depends not on the property of production function but on the market conditions of perfect competition.

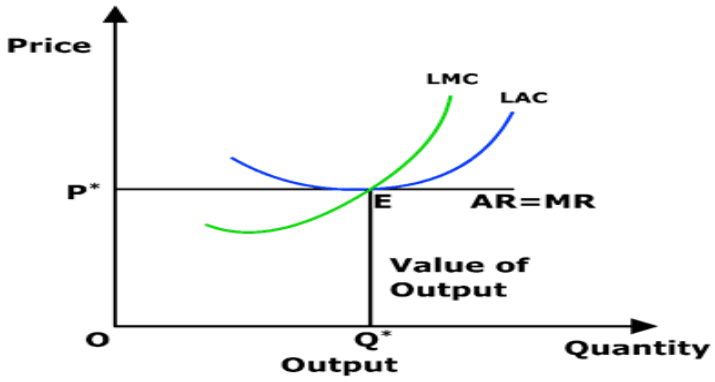


Figure 4.3: Long run Equilibrium: In perfect competition market structure, firms are earning zero economic profits

In a perfect competition market structure, firms are earning zero economic profits. Thus the solution to the product exhaustion problem in the case of perfectly competitive factor markets where factors are paid equal to their marginal products, the existence of perfect competition in the product market will ensure zero economic profits in the long run. The zero economic profit condition under perfect competition can also be explained mathematically. The zero economic profit condition implies that the value of total output is equal to the total cost of production.

Let capital (K) and labour (L) be the two factors of production used by perfectly competitive firms to produce output (Q). Let P be the price of the product. The value of output is AR multiplied by the output. And total cost is the sum of the amount spent on each to produce a given level of output.

So, Zero Economic Profit » Value of Output = Total Cost

$P.\ Q = L.\ w + K.\ r \ \ldots\ \ldots\ .\ (1)$

According to marginal productivity theory, each factor is paid equal to the value of their marginal products. Thus,

$w = VMP_L = PxMPP_L$

$r = VMP_K = PxMPP_K$

Where VMP is the value of the marginal product.

Now substitute these values of r and w equation (1), and we get

$P.\ Q = L.\ P.\ MPP_L + K.\ P.\ MPP_K$

It shows that for a given price, if the factors are paid equal to their marginal physical product, the total payments to factors would be equal to the total product Q, and thus total product would be exactly exhausted.

4.6. Concept of Value of Marginal Product and Marginal Revenue Product

Before turning to the detailed study of the various determinants of factor prices, it will be helpful for the proper understanding of the subject if we first explain the various concepts of productivity. The knowledge of these various concepts will greatly help in understanding the modern theory of factor prices. At the very outset it is desirable to make it clear why economists are interested at all in the productivity of a factor. We are concerned with productivity since the price which a factor will be able to get depends upon its productivity. Why? This is because the factors are demanded not because they directly satisfy the wants. The factors are purchased to put them to work for producing consumer goods which satisfy human wants. Other things being equal, the greater the contribution made to the production of goods by a factor unit, the greater the price which it will be able to command in the market. Thus productivity is an important determinant of the price of a factor.

Average physical product of a factor is the total production divided by the number of units of a factor employed.

Average physical product (APP) of a factor = Total output/Total No. of units of a factor used.

Marginal physical product (MPP) of a factor is the increase in total output caused by employing an additional unit of the factor, quantity of other factors remaining fixed. The fixed factors are, however, conceived to be adjusted or adapted in such a way that increased amount of the variable factor can be used with them.

Before the development of the theory of product pricing under imperfect competition (monopoly and monopolistic competition) by Joan Robinson and Chamberlin, the assumption of perfect competition in the product market was usually made while discussing the pricing of factors. Under perfect competition in the product market conversion of the marginal physical product into money terms merely involves multiplying the marginal physical product with the price of the product since the price of the product of an individual firm under perfect competition is a given and constant quantity. Money value of the marginal physical product under perfect competition thus means the marginal physical multiplied by the price of the product. However, with the development of imperfect competition theory in explaining product prices the two distinct concepts of marginal productivity have been evolved.

They are:

(i) Marginal Revenue Product (MRP)

(ii) Value of Marginal Product (VMP)

(i) Marginal Revenue Product (MRP):

Marginal revenue product is the increment in the total value product caused by employing an additional unit of a factor, the expenditure on other factors remaining unchanged. In other words, marginal revenue product is the marginal physical product of the factor multiplied by the marginal revenue

MRP = MPP x MR

It is the marginal revenue product which is often termed as marginal product or marginal productivity.

Table 4.1.

Value of Marginal Product (VMP) and Marginal Revenue Product (MRP) when there is Perfect Competition in the Product Market

I	II	III	IV	V	VI	VII
Units of a Factor	*Total output (Q)*	*Marginal Physical Product (MPP)*	*Price of Product (P)*	*Value of Marginal Product (VMP)*	*Total Revenue (PQ)*	*Marginal Revenue Product (MRP)*
1	25	25	2	50	50	50
2	70	45	2	90	140	90
3	110	40	2	80	220	80
4	145	35	2	70	290	70
5	172	27	2	54	344	54
6	191	19	2	38	382	38
7	199	8	2	16	398	16
8	199	0	2	0	398	0

(ii) Value of Marginal Product (VMP):

It means the marginal physical product of the factor multiplied by the price of the product (i.e. average revenue).

VMP = MPP x Price (or AR)

Since under perfect competition the demand curve of the product facing an individual firm is perfectly elastic and therefore price and marginal revenue are equal, the value of marginal product (VMP) and marginal revenue product (MRP) will be equal to each other as is shown in Table 4.1 and Fig. 4.4.

But since in monopoly or imperfect competition in the product market, average revenue (or demand curve) is falling downward and marginal revenue curve lies below the average revenue curve, price is not equal to marginal revenue.

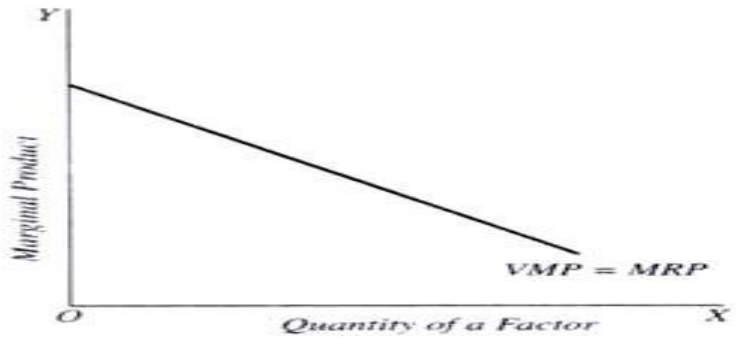


Fig.4.4 VMP and MRP under Perfect Competition in the Product Market

Therefore, in monopoly or in other forms of imperfect competition in the product market, marginal revenue product will not be equal to the value of marginal product. Since price is higher than marginal revenue under monopoly or monopolistic competition in the product market, the value of marginal product (VMP) will be larger than the marginal revenue product (MRP) and the marginal revenue product (MRP) curve will lie below the value of marginal product (VMP) curve as is shown in Fig. 4.5. Thus, in perfect competition MRP and VMP have identical meaning but in monopoly and imperfect competition in the product market they diverge.

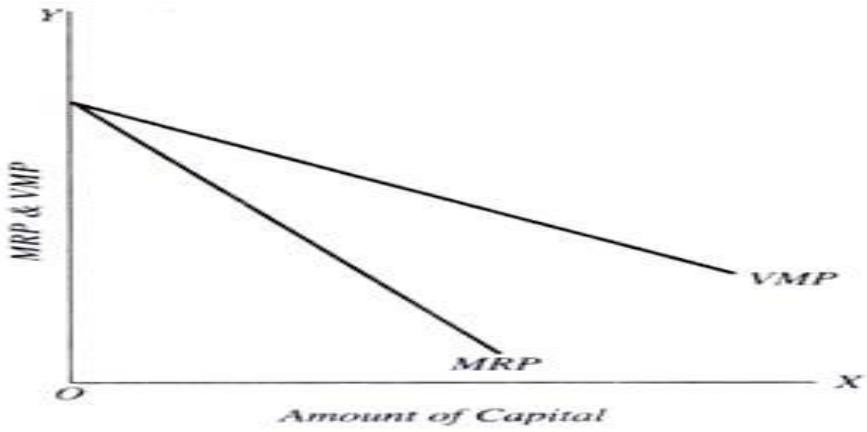


Fig.4.5: VMP and MRP under Imperfect competition in the product Market

The distinction between Marginal Revenue Product (MRP) and the Value of Marginal Product (VMP) can be better understood from Table 4.1. In the above Table 4.1 perfect competition has been assumed to be prevailing in the product market. Therefore, price of the product (Rs. 2) for an individual firm remains the same whatever the level of its output. As more units of labour are employed, total output is increasing but at a diminishing rate. That is to say, marginal physical product of the factor is declining (law of diminishing marginal returns has been assumed to be operating). Since VMP is equal to MPR x Price, VMP (Col. V) can be found by multiplying Col III by Col. IV.

Thus when one labour unit is employed the marginal physical product is 25. Since the price of the product is Rs. 2, the value of marginal product (VMP) will be equal to 25 x 2 = 50 and so for the subsequent units of labour. It shall be noticed from Col V that value of marginal product is declining as more units of labour are employed after the second unit. This is so because marginal physical product is declining due to the Operation of law of diminishing returns.

Since when there is perfect competition in the product market MR is equal to price (P), Marginal Revenue Product (MRP) also can be found out by multiplying the Col. Ill by Col. IV. Thus under perfect competition value of marginal product (VMP) will be equal to marginal revenue product (MRP) (compare Co. VII with Col. V).

Since marginal revenue product (MRP) of a factor can also be defined as the increment in the total revenue of a firm by employing an additional unit of a

factor, it can also be directly found out from Col. VI which shows the total revenue at the various levels of output. MRP can be obtained by taking out the difference between the two successive total revenues. The difference in the two successive total revenues occurs due to the employment of an extra unit of a factor.

Thus when two units of labour are employed, total revenue is Rs. 140 which is obtained by selling 70 units of output produced by 2 units of labour at price of Rs.2 per unit. When another labour unit is employed, the total output is 110 and total revenue obtained is Rs. 220. Thus this additional unit of labour has added Rs. 80 (Rs. 220 – Rs. 140) to the firm's total revenue MRP of labour at this stage is therefore Rs. 80. Likewise, MRP of the subsequent units of labour can be found out in two ways: firstly, by multiplying marginal physical product MPP by MR (in the present case MR is equal to price); and secondly by taking out the difference between the two successive total revenues caused by employing an additional unit of labour.

VMP and MRP when there is Imperfect Competition in the Product Market:

Whereas value of marginal product and marginal revenue product are equal under perfect competition, they differ if there is monopoly or imperfect competition in the product market. Under monopoly or imperfect competition in the product market, average revenue curve or demand curve facing an individual firm slopes downward. In other words, as the firm increases its output (and sales) by employing more units of labour, the price of the product declines (see Col. IV in Table 4.2).

Since the average revenue curve (i.e. price curve) falls downward under monopoly and imperfect competition in the product market, MR curve will lie below it. In other words, MR will be less than AR (i.e., price) of output. Since VMP is equal to MPP x Price and MRP is equal to MPP x MR, the two will not be equal to each other when monopoly or imperfect competition prevails in the product market.

VMP at various levels of labour employment which is shown in Col. V of Table 4.2 is obtained by multiplying MPP (Col. Ill) with price of the product which goes on falling (Col. IV). Thus when two units of labour are engaged,

marginal physical product (MPP) is 45 and price of the product is Rs. 1.80. By multiplying 45 with Rs. 1.80 we get VMP equal to Rs. 81 which we write in Col. V corresponding to two units of labour. Likewise, VMP for other levels of labour employment can be found out.

Table 4.2. VMP and MRP under Imperfect Competition

I	*II*	*III*	*IV*	*V*	*VI*	*VII*
Units of Labour	*Total output (Q)*	*Marginal Physical Product (MPP)*	*Price of Product (P)*	*Value of Marginal Product (VMP)*	*Total Revenue (II × IV) (Q.P.)*	*Marginal Revenue Product (MRP)*
1	25	25	2.00	50.00	50	50
2	70	45	1.80	81.00	126	76
3	110	40	1.50	60.00	165	39
4	145	35	1.30	45.50	188.50	23.50
5	172	27	1.20	32.40	206.40	17.90
6	191	19	1.15	21.85	219.65	13.25
7	199	8	1.13	9.04	224.87	5.22
8	199	0	1.13	0.00	224.87	0.00

In order to obtain MRP, we have first to find out the total revenue at various levels of employment. The total revenue (Col. VI) is obtained by multiplying total output (Col. II) with price of product (Col. IV). By finding out the difference between two successive total revenues, MRP can be obtained. Thus when two units of labour are employed, total revenue is Rs. 126 and when 3 units of labour are employed the total revenue is Rs. 165. Increment in total revenue caused by the third unit of labour is thus equal to Rs. 165-126 = Rs. 39.

Thus MRP of labour when three units of it are employed is Rs. 39. Similarly, MRP of other levels of labour employment is found out and recorded in Col. VII. By comparing Col. V and Co. VII, it will be clear that VMP and MRP are not the same and further that Marginal Revenue Product is less than Value of Marginal Product. This is so because, as explained above, price and MR are not equal (MR is less than the price) for a firm working under monopoly or imperfect competition in the product market. To sum up, under monopoly or imperfect competition in the product market, MRP and VMP will diverge and Marginal Revenue product curve will lie below Value of Marginal product curve.

****

UNIT - V

WELFARE ECONOMICS AND GENERAL EQUILIBRIUM

5.1. Introduction

Welfare economics is the branch of economics which deals with normative issues. It deals with the way various economic arrangements affect the welfare or well-being, of each and every members of society. A major concept in welfare economics is the notion of Pareto efficiency in evaluating economic allocations. But it must also be remembered that Pareto efficiency has nothing to say about the distribution of welfare across people. Consumer utility, production mixes, and factor input combinations consistent with efficiency come up with lots of combinations. In other words, there will usually be many Pareto efficient allocations. So how can society choose the most desirable among them? This decision is made when we specify the social welfare function, which embodies value judgments about interpersonal utility. Since the concept of efficiency plays a major role in welfare economics, we begin by discussing it in brief. After that, we will study the two fundamental theorems of welfare economics.

Welfare economics studies the conditions under which the solution to a general equilibrium model can be said to be optimal. This requires among other things, an optimal allocation of factors among commodities and an optimal allocation of commodities (i.e distribution of income) among consumers. In welfare economics attempt is made to establish criteria or norms, with which to judge or evaluate alternative economic states and policies from the view point of the society's wellbeing. In the words of Oscar Lange, "welfare economics establishes norms of behavior which satisfy the requirements of social rationality of economic activity." The term "Social rationality" of economic activity is to be interpreted as that activity which ensures optimum allocation of resources and therefore guarantees maximum social welfare. In this context Oscar Lange says, "The norms of behavior established by welfare economics are supposed to guarantee the optimal allocation of economic resources of the society." The inter-relationship among various parts of the economy implies that certain specific change in one past of the economy affects resource allocation in all other parts of the economy.

Thus, a central problem in welfare economics relates to whether a specific change in resource allocation will increase or decrease its social welfare.

5.2. Pareto-Optimality Criterion

Developed by the Italian economist, Vilfredo Pareto, the Pareto optimality criterion is the cornerstone of modern welfare economics. The criterion is used to determine whether the social welfare is higher in one economic situation than in another. According to the Pareto optimality criterion, a distribution of inputs among commodities and of commodities among consumers is Pareto optimal or pare to efficient if, no reorganization of production or consumption is possible by which some individuals are made better off (in their own judgement) without making someone else worse off. In other words, Pareto optimal is a situation in which it is impossible to make anyone better off without making someone else worse off. This situation is also called Pareto efficient. It follow that any change that improves the well- being of some individuals without reducing the well-being of others, clearly improves the welfare of society as a whole and should be undertaken. This will move the society from a Pareto non-optimal position to Pareto optimum. Once at Pareto optimum, no reorganization of production and exchange is possible that makes someone better off without, at the same time, making someone else worse off. In a Pareto optimal state of an economy, it is impossible to make any one better off without making someone worse off by any of the following three means;

1. Re allocation of the already available goods among consumers.
2. Re allocation of inputs among producers (in order to increase the output of some goods without reducing the output of any other good.)
3. Changing the composition of output that is, producing more of some and less of others.

Let us examine each of these three situations.

Allocation of goods among consumers: Efficiency in Exchange Pareto optimality (or efficiency) in exchange is achieved when allocation of commodities among the consumers is such that it is not possible to increase the satisfaction of any person without reducing the satisfaction of someone else Pareto optimality (or efficiency) in exchange can be achieved only when

all consumers have the same marginal rate of substitution between the same pair of goods. This marginal condition, with reference to two commodity and two consumer model, may be expressed as $MRS^{A}_{XY} = MRS^{B}_{X}$

1. In a situation, where this condition is not fulfilled, it is always possible to increase the total welfare by transferring some units of a commodity from a person who derives lower utility to the person who derives greater utility.
2. Optimal allocation of factors; Efficiency in production. Like efficiency of exchange, we can also explore the efficiency in production. Efficiency in production or Pareto optimality in allocation of resources requires that factors (L and K) are so allocated in the production of two commodities, x and y, that it is not possible to increase the output of one commodity, by reallocation factors, without causing a decrease in the production of the other. The marginal condition that must be fulfilled to achieve Pareto optimality in resource allocation is that marginal rate of technical substitution (MRTS) between L and K is the same for both x and y produced by two firms. That is, for all producers of x and y.
3. Optimal Composition of output; Efficiency in product Mix given fixed quantities of commodities, the consumption efficiency ensures their efficient exchange between individuals. Likewise, the production efficiency condition ensures efficient use of resources, given fixed amount of resources, in producing different commodities. The third condition for Pareto efficiency is product-mix efficiency. That is, the mix of commodities produced by the economy must reflect the preferences of those in the economy. The economy must produce along the production possibilities curve at a point that reflects the preferences of consumers. Intuitively this can be done by simply equating the rates of substitution between x and y on both production and consumption sides. Since MRT XY shows the rate at which x and y are transformed in production and MRS XY show the rate at which consumers are willing to exchange x and y the two ratios must be equal in the equilibrium. This gives the Pareto optimum condition for product- mix. That is, it requires equality between MRT in production and MRS in Consumption for every pair of commodities and for every individual.

5.3. Market Failure

Market failure generally occurs, when there is some misallocations or inefficient allocation of resources. When some misallocation or inefficient allocation of resources happens, it will be leading to loss in terms of waste or loss in terms of value. So, that is why this market failure is not accepted. And when you are saying that in market failure, we are having a case of misallocation or resources are not efficiently allocated. So, what is the meaning of this efficient allocation of resources? So, the allocation of resources can be termed as efficient so, that is under the perfectly competitive market. So, when the conditions that price equates the marginal cost of production, then if this condition is fulfilled, we are saying under the perfectly competitive market would you have this efficient allocation of resources. But when this allocation of resources do not fulfill this conditions, price equivalent to marginal cost then it will be leading to inefficient allocation of resources. So, here in this context, we will be discussing four important sources of market failure although we will be only talking about the externality itself. So, what are the different causes or different sources of market failure? So, the first one is, market failure can happen in case of imperfect competitions. So, apart from perfectly competitive market, the rest of the market systems like your monopoly, oligopoly or monopolistic, they are under this imperfectly competitive market. Under this imperfectly competitive market, this condition that is price equivalent to marginal cost is not fulfilled. So, because of which the resources are said to be inefficiently allocated. And the second source of this market failure is the case of public goods. So, that means, in case of privately private goods, where a market can dominate or markets can fix the price ah; but in case of public goods, it is very difficult to have this market price for these public goods. So, therefore, if in case of the public goods, this market failure may happen. And the third source of the market failure is the externality; that is presence of either the external costs or benefits external benefits. In either of the cases this market fails. And the last cause of this market failure is imperfect information which in microeconomics, we are saying asymmetries of information or lack of perfect information to everyone

engaged. But however, in this case, we will be only focusing one of the source of market failure that is the externalities.

Externalities as a source of inefficiency; how externalities is leading to inefficiency in the market or inefficiency in the resource allocations. So, let us start with the very meaning of externalities. So, you are here, we are trying to understand the externalities in terms of one example. So, suppose say when you are transacting or doing any kind of activity or taking any kind of decisions; obviously, the repercussion of this actions or activities or decisions is having is affecting the others right. So, when one's action is or one's decision is impacting others that is others means maybe it is second party or third party and we do not have any incentive to consider this impacts or consequences. So, in that case externalities may happen.

5.3.1. Types of Market Failure:

There are three types of market failure- externalities, public goods and common property.

i. Externalities:

Externality is the most important case of market failure and one most directly relevant to the use of environmental resources. Externalities refer to the beneficial and detrimental effects of the economic activity of an agent (a firm or a consumer or industry) on others. To be more precise, when an economic agent through his activity benefits others for which he does not receive any payment, there exist beneficial or positive externalities. On the other hand, detrimental or negative externalities occur when the activity of an economic agent harms others for which it is not required to pay.

It is important, to note that when there are y be made to the owner. However, when externalities occur and there are no individual property rights on goods, services or factors, market will not ensure optimum or socially desirable output due to the non-payment for the benefits or harms created for others. In case of positive externalities less will be Production (Causing pollution) produced and in case of negative (i.e., Fig. 57.1, in the presence negative externalities more detrimental) externalities more of a

good output is produced than is socially desirable is produced than is socially desirable.

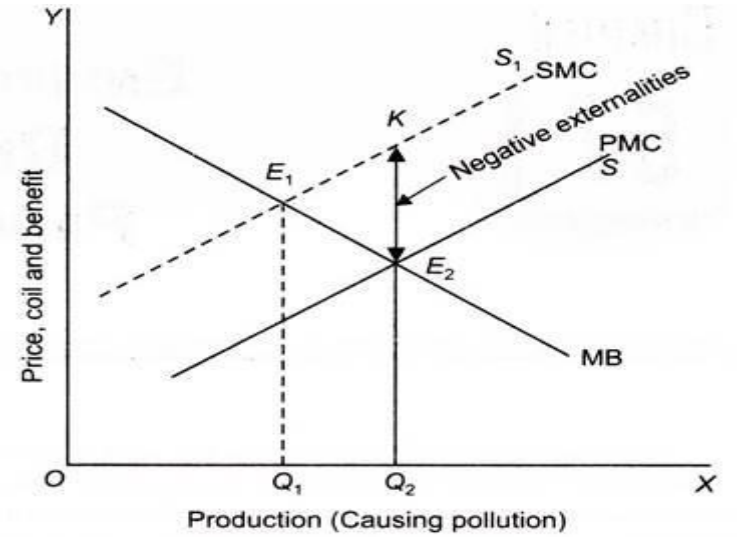


Fig.5.1. Negative externalities more output is produced than is socially desirable

Let us give an example of how negative externalities lead to more than socially desirable output. The chief example the negative externalities occurs in case of electricity producing firm which pollutes air which harm others but they are not paid for this by the firm. Note that no one has individual property rights over the air which is provided by the environment.

Therefore, the firm can extend its production to the level which maximises its profits or benefits for the industry – In the case of a firm, which pollutes air and does not pay those who suffer as a result of pollution, marginal private cost (MPC) will be smaller than the social marginal cost (SMC) as the latter will also include negative externalities of pollution. How, in this case, more of output of good will be produced than is socially desirable?

This is illustrated in Fig. 5.1 where MB is marginal benefit curve of the firm whose production pollutes the air and is sloping downward. This is because this marginal benefit curve depends on the demand curve of the product of the firm. As the firm produces and sells more of its product, its price falls. This price is the benefit for the firm.

Therefore, as it produces more, its marginal benefit (MB) declines. On the other hand, as more is produced by the firm its private marginal cost (PMC) will rise in accordance with the principle of diminishing returns of

traditional microeconomic theory, and rising private marginal cost (PMC) of the firm will cause the private marginal cost curve of the firm to slope upward as shown in Fig. 5.1 by PMC.

The firm does not take into account the harms done to others especially those living in the surrounding areas of air pollution generated by it. The question is how it is allowed to pollute the air to extend its production to the level beyond what is socially desirable? This is because, no one has the ownership rights over the air which is supplied by the environment (i.e., air is environmental good). It will be seen from Fig. 5.1 that considering only its private marginal cost the firm will equate private marginal cost (PMC) with its marginal benefit (MB) and produce output OQ_2 to maximize its profits.

Now, if negative externalities represented by creation of air pollution, which inflicts costs on others, are taken the account, we will add to private marginal cost, these negative externalities to get social marginal cost (SMC) curve which lies above the private marginal cost (PMC) curve. The socially desirable output which represents optimum allocation of resources is equal to OQ_1 at which social marginal cost (SMC) equals marginal benefits (MB). Thus, by producing OQ_2 output, the firm in case of the existence of negative externalities produces more than what is socially optimum output level OQ_1.

Another important example of negative external economies is found in case of a firm discharging its toxic effluent into the water of a lake which is used by the fishermen to catch fishes to make their living. The toxic effluent in the lake kills many fishes which reduces the number of fishes captured by the fishermen and thus harms them. The harms done to the fishermen by the firm dumping its toxic product into lake do not enter into the calculations of the polluting firm. As no one has ownership right over water of lake, the firm produces more product than is socially desirable. In this case also social marginal cost (SMC) curve will be above the private marginal cost (PMC).

ii. Public Goods:

Market failure also arises in the supply of goods known as public goods. Public good is one from which everybody benefits from it even when he does not pay for it. There are two features of a public good. First, it is non-rival in consumption. Second, in case of a public good even those who have not paid for it, cannot be excluded from enjoying its consumption.

A non-rival in consumption implies that consumption of a public good by one individual does not exclude its consumption by others. Public street lighting, television signals, parks, flood control project, pollution control project, lighthouse in the sea are some examples of public goods. Thus, when public street lighting is provided in a colony everyone living will benefit from it, even those who have not paid for it. Similarly, all persons of a city can benefit from the television signals and enjoy the programme telecast.

The enjoyment provided by a park, if there is free access to it, can be obtained by all who visit it. Public street lighting, parks, television signals and such other goods are non-rival goods as their consumption by one individual does not exclude its consumption by others. That is, the consumption of a non-rival good by an individual does not reduce its amount available for others to consume.

Non-Excludability:

The other essential characteristic of a public good is non-excludability in distribution of their consumption benefits. This non-exclusive nature of a public good implies that it is difficult if not impossible to exclude those from consuming them who are not willing to pay for them. In case of private rival goods such as shirts, cars, Pepsi Cola, apples those who do not pay for them can be easily prevented from consuming them or receiving benefits from them because the producer or seller simply does not provide them these goods, if they do not pay price for them. On the contrary, in case of public goods, either it is not possible or it is very costly to prevent those people from consuming them who do not pay for these goods. It is due to the feature of non-excludability of public goods that accounts for the failure of market in case of these goods to ensure economic efficiency.

For example, national defence is a public good and is provided to all members of a society and its benefits are available to all equally irrespective of whether some people pay for it or not. It is difficult if not impossible to exclude those people from receiving benefits of security provided by national defence system who do not pay for it.

Likewise, if a lighthouse is constructed in a sea, it provides light for all the ships whether any one of them pays for it or not and it is not possible to prevent those who do not pay from receiving light from the lighthouse. This inability to exclude those who do not pay from receiving benefits also applies in case of other public goods such as television signals, pollution control project to provide clear air, flood control projects, parks etc.

Free-Rider's Problem in Case of Public Goods and Market Failure:

It is easy to show how non-excludability of a public good can lead to the market failure, that is, failure of market to achieve Pareto efficiency. As explained above, non-excludability of public goods arises because producers are not able to prevent those from consuming these or enjoying benefits from these who do not pay their share of cost. There is a problem called a free-rider's problem which states that because people cannot be excluded from consuming public goods or enjoying benefits from them, there is incentive for persons in these situations to free ride and try to enjoy benefits from reduced pollution, parks, television signals, lighthouse without paying for them. These persons want to get something for nothing and rely on others to make payment for public goods whose benefits they will also automatically get.

Due to this free-rider problem or inability of the producers of public goods to prevent those who do not pay from receiving benefits from them, that a profit-maximising firm will either not produce a public good or produce too little of it. This creates economic inefficiency or Pareto non-optimality. Let us take an example of this free-rider's problem in case of public goods leading to economic inefficiency. Suppose the construction of a dam to check floods which cause a lot of damage in a city is required. This dam when built will protect equally all people of the city from the damages due to floods.

However, some people of the city would not like to pay for the dam with the hope that others would pay for it and they because of non-excludability would also enjoy its benefits. But in view of this incentive to free ride, adequate revenue to cover costs of building the dam cannot be provided, and therefore, no private entrepreneur would consider it worthwhile to construct the dam to control floods. Similarly, the production of other public goods such as lighthouse, television signals, and pollution abatement projects would not be extended to the socially desirable level in view of the non-excludability and incentive to free ride.

iii. Common Property Resources:

Common property resources are the resources to which everyone has free access, that is, anyone can use the property without making any payment. Parks, rivers, ocean, fisheries, public roads and highways are examples of common property resources. For example, anyone can have a free entry into the India Gate parks in Delhi and enjoy there. However, each person's use of common property reduces its value to others and thus creates negative externality.

Since people do not have to pay for the use of common property resources, they tend to be overused or overexploited. For example, parks with free entry often become overcrowded which results in lowering of enjoyment of parks by everybody. Further, the use of rivers Ganga and Yamuna in India is quite free and has become so much polluted because factories dump their waste products into them without paying any cost.

Even people in general throw all sorts of their wastes (even dead bodies, and their remains) into these rivers. Similarly, costless use of public common land for grazing of cattle or hunting, results in overuse of these common property resources. This overuse of common property resources where there is free access to them is often referred to as the tragedy of commons. This is also called the common problem.

An important common property resource is fisheries in which no fee is charged for catching fishes from them. Each fisherman wants to catch fish before others do the fishing. This results in overfishing which may

ultimately lead to the destruction of stock of fish in the fisheries for use in future years.

It is worth noting that lack of property rights over the common resources leads to their overuse. Fishermen when they have costless access to the use of common property resources have incentive to catch more fish than they would if the fisheries were private property, whose owner would charge fee or price for catching fishes by fishermen.

Suppose, now each fishery has been given exclusive private property right to a lake where fishes are caught by fishermen. Now, since there exist well-defined property rights, there are no externalities. Therefore, each owner of lake would not allow overfishing in any year so as to maintain the stock (i.e., the number) of fish for the future years.

On the other hand, most ocean fisheries are common property to which fishermen have free access. As in case of private manufacturers who create external diseconomy by polluting air or water, fishermen operating in ocean fisheries take into account only their private costs. Thus in calculating their costs they include in them the cost of boats, other complementary equipment, a crew etc. They do not take into account the costs they impose on future generation as their fishing in the present leads to the decrease in the stock of fish in the ocean in the future years.

Thus Professor Perloff writes, “The fewer fish there are, the harder it is to catch any, so reducing the population offish today raises the cost of catching fish in the future. As a result, fishers do not forego fishing now to leave fish for the future. The social cost is the private cost plus the externality cost from reduced future population of fish.” It may be emphasised again that it is the lack of clearly defined property rights of fisheries that leads to overfishing. Fishermen have an incentive to catch more fish than they would if the fishery was private property.

Roads and Highways:

Let us take another case of common property resources- roads and highways. Everyone has access to them for driving their cars and other vehicles. Since owner of a car has no exclusive right to use the highway on which he drives, he cannot exclude others from driving on the same

highway and must share it with others. This leads to the too many drivers using the highway for driving their vehicles which leads to congestion and often jams (i.e., a negative externality). This slows down driving on the highway. Thus this is another example of overuse of the common property resource.

Diagrammatic Illustration of Overuse of Common Property Resources:

Let us illustrate diagrammatically how in case of common property resources, there is overuse of them which is often referred to as 'tragedy of commons'. Let us take the case of a lake which is the common property of nearby town and this lake is used for fishing. Every fisherman has free (i.e., costless) access to catch fishes from the lake and then sell it in the market. But by catching fish from the lake, fishermen reduce the population of fish in the lake and thereby raise the cost of catching fishes for others. That is, by catching fishes from the lake, fishermen create external diseconomy for other fishermen.

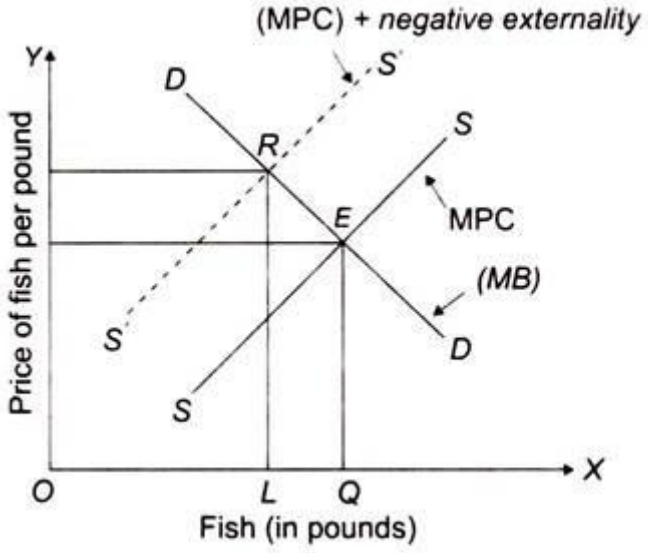


Fig.5.2. Overuse of common property resources

In Fig. 5.2 we have drawn a demand curve DD for fish (in pounds) in the market which reflect consumer's marginal benefits (MB) from fish and SS is the market supply curve of fish based on marginal private cost (MPC) of fishermen. If there is free access to lake, the number of fish caught and supplied in the market is OQ pounds. Since fishermen do not take into account the negative externality they create, the fishermen's marginal

private costs (therefore the supply curve SS based on them) will be less than the marginal social cost (MSC).

Therefore, the supply curve S'S' representing the marginal social costs intersects the market demand curve (i.e., marginal benefit curve) at point R and thus determine the OL quantity of fish caught and sold. (Note that the marginal social cost (MSC) equals marginal private cost (MPC) plus the negative externality created). Thus OL quantity of fish (in pounds) is the socially optimum output. But as fishermen do not take into account the external diseconomy or social marginal cost and operate on the basis of their marginal private cost (MPC), they catch more fish equal to OQ which thus leads to the overuse of the fishery. This is therefore called tragedy of commons.

Assigning Property Rights for Common Property Resources – Coase Theorem:

As explained above, that common property resources tend to be overused and therefore there is economically inefficient use of them. R. Coase, a Nobel Prize winner of 1991, has proposed a solution for this problem to ensure economically efficient use of common property resources. According to Coase, if costs of negotiating between the parties are quite small, the parties that create negative externality and the victims of their activity negotiate, they can arrive at a price which properly takes into account the negative external effect and thus ensures economic efficiency in the use of common property resources.

For example, if downstream water users are assigned the property right to obtain water of a particular quality, a firm that wants to pollute the stream will be prepared to give compensation to them (i.e., to downstream water users who have been given rights to obtain water of certain specified quality). Since the firm will now have to give compensation to the downstream water users, it will not find it worthwhile to pollute the stream beyond the economically efficient point. This is the gist of Coase theorem and its importance lies in its suggestion that assignment of well-defined property rights might help to promote economic efficiency.

It may be emphasised that Coase theorem assumes that transaction costs, that is, costs of negotiating and contracting by the interested parties are very small. For instance, in our above example, the downstream water users join together and then effectively negotiate with the polluting firm without much cost about the price to be charged from the latter for polluting the stream.

Besides, even if the transaction costs are small, negotiations with the polluting firm may not be practical because it is difficult to measure precisely the external cost (i.e., negative externality) of pollution imposed by the polluting firm on the downstream water users. Further, if the number of interested parties in negotiating a deal is large, it may not be possible to get unanimity required to make the negotiation effective.

To conclude in the words of Edwin Mansfield, Coase theorem suggests that "the assignment of well-defined property rights might help to promote economic efficiency. For example, to get around the difficulties caused by external diseconomies arising from waste disposal, society might find it useful to try to establish more unambiguous property rights for individuals and firms with respect to environment quality. Then, assuming that the relevant negotiations are feasible, the interested parties in a particular area might try to negotiate to determine how much-, pollution will occur."

5.4. WALRASIAN GENERAL EQUILIBRIUM

In general equilibrium analysis, put forward by French Economist Walras the price of a good is not explained to be determined independently of the prices of other goods. Since the changes in price of good X affect the prices and quantities demanded of other goods and in turn the changes in prices and quantities of other goods will affect the quantity demanded of the good X, the general equilibrium approach explains the simultaneous determination of prices of all goods and factors.

As stated above, partial equilibrium approach assumes that the effect of the change in price of a good A will be so diffused in the rest of the economy (i.e., over all other goods) so as to have negligible effect on the prices and quantities of other individual goods.

Therefore, where the effect of a change in the price of a good on the prices and quantities of some other goods is significant, as is there in the case of inter-related goods, that is, substitutes and complementary goods, the partial equilibrium approach cannot be validly applied in such cases and therefore there is need for applying general equilibrium analysis which should explain the mutual and simultaneous determination of their prices and quantities. General equilibrium analysis deals with inter-relationship and inter-dependence between equilibrium adjustments with each other. General equilibrium exists when at the going prices, the quantities demanded of each product and each factor are equal to their respective quantities supplied.

A change in the demand or supply of any good, or factor would cause changes in prices and quantities of all other goods and factors and there will begin the process of adjustment and readjustment in demand, supply and prices of other goods and factors till the new general equilibrium is established. Indeed, the general equilibrium analysis is solving a system of simultaneous equations.

In a general equilibrium system, the quantity demanded of each good is described by an equation in which its quantity demanded is a function of prices of all goods. Likewise, in general equilibrium analysis, quantity supplied of each good is considered to be the function of price of all factors of production. In a general equilibrium system the prices of all goods affect the quantity demanded of each good. Further, the prices of the all factors affect the quantity supplied of each good. Besides these crucial equations, there will be equations determining the price of each of the factors of production. As noted above, a change in any of the demand or supply equations would cause changes in all prices and quantities and as a result the system will tend to move to the new general equilibrium.

To explain the inter-relationship and interdependence among the prices and quantities of goods and factors and ultimately to explain the determination of the relative prices of all goods and factors, the proportion in which different goods are being produced and different factors are being used for the production of different goods is the essence of general equilibrium analysis.

However, in this book we shall mainly confine ourselves to the partial equilibrium approach to the determination of relative prices. In a separate part of this book we shall explain the general equilibrium analysis using Edge-worth Box diagram. The General Equilibrium of Exchange and Consumption: First, we shall explain general equilibrium in a pure exchange economy. In this pure exchange system, we assume that there is no production. That is, we consider the case when two goods are provided to the individuals in the economy from outside the system.

To keep our analysis simple we assume that there are:

(1) Two goods, specific bundles of which have been made available to the individuals for consumption; and

(2) There are two individuals between whom exchange of goods has to take place and equilibrium reached with regard to the distribution of the specific amounts of these two goods.

Edge-worth Box and General Equilibrium of Exchange:

In these two goods, two individuals (2×2) model of pure exchange, the famous Edge-worth Box diagram has been employed to explain the general equilibrium of distribution of two goods between two individuals. In what follows we first explain the concept of Edge-worth Box and then analyse the general equilibrium in this pure exchange system. Consider Figure 5.3 where a box with a certain fixed dimensions has been drawn.

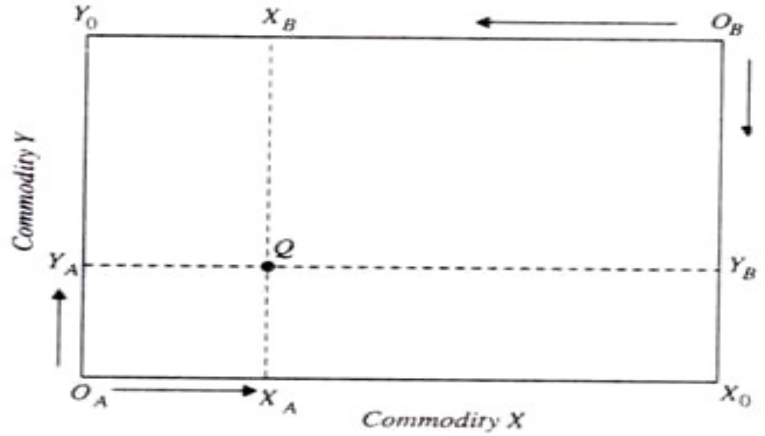


Fig.5.3. Edgeworth Box

Along the X-axis we measure the commodity X and along the X-axis, the commodity Y. The total available amount of commodity X is OX_0 and of commodity Y is OY_0. The available amounts of the two commodities, OX_0 and

OY_0 determine the dimension of the box. The quantity of A available with the individual A is measured from left to right along the X-axis with bottom left-hand corner O_A as the origin.

And, quantity of commodity Y available with the individual A is measured along the Y- axis from bottom upwards with the origin 0_A. For individual B, the top right hand corner O_B has been taken as the origin and with the given quantities of X and Y, the quantity of X available for consumption for individual B is measured, right to left, with the origin O_B and the quantity of Y available for B is measured, from top to bottom, from the origin O_B.

It follows from above that Edgeworth Box has fixed dimensions representing the maximum available quantities of X and Y to be distributed between the two individuals. We further assume that the two individuals between them will entirely consume all the available quantities of the two goods.

It may be noted that a point in the Edgeworth Box represents a particular distribution pattern of two goods between the two consumers. This implies that if the two individuals trade goods with each other and accordingly move from one point in the Edgeworth Box to another, the quantities purchased and sold of each good would be equal. Thus, with trade or exchange of goods, it is the distribution or consumption of two goods of the two individuals that will change, the total quantities of the two goods remaining constant.

In the Edgeworth Consumption Box we also draw the indifference curves of the two individuals A and B depicting their scale of preferences between the two goods. As we move upward from bottom-left to top right, the satisfaction of individual A increases and that of B decreases, that is, A- moves to successively higher indifference curves and individual B to successively lower indifference curves.

We can now show that the general exchange equilibrium would lie somewhere on the contract curve, that is, the curve QT in Fig. 5.4 which passes through the tangency points of indifference curves of two individuals. At these tangency points of indifference curves, MRS_{XY} of individual A equals that of individual B. Thus, the general equilibrium of exchange will occur when the following condition holds good:-

$MRS^A_{XY} = MRS^B_X$

Since a point on the contract curve lies within the Edgeworth box with the fixed quantities of the two goods, the equilibrium reached after exchange or trading between the two individuals implies that the distribution for consumption of the two goods between the two individuals would just exhaust the available quantities of the two goods. From the above it cannot be known at which specific point or location of the contract curve, the general equilibrium of exchange will be reached. This is because the equality of MRS_{XY} of the two individuals exists at all points of the contract curve.

However, if we know the initial distribution of two goods between the two individuals we can pinpoint the boundaries within which the general equilibrium of exchange would lie. Consider Figure 5.4. If the initial distribution of two goods between the two individuals is represented by point C where individual A has X_{A1} amount of good X and Y_{A1} amount of good Y. The remaining quantity of good X, that is, $X_0 – XA_1 = X_{B1}$ would be allocated to individual B and the remaining Y_{B1} amount of good Y would go to individual B. At this initial distribution of goods A and Y between the two individuals A and B the indifference curves of two individuals are intersecting. Now, this initial distribution at point C cannot be the position of equilibrium for the two individuals, since the two individuals can gain in welfare or, in other words, can become better off if they exchange some amounts of the goods possessed by them and move to the contract curve. If the individuals think that they can benefit from trading or exchange, they will trade with each other's. As long as they think there are possibilities of becoming better off, they will exchange goods and end up at the contract curve.

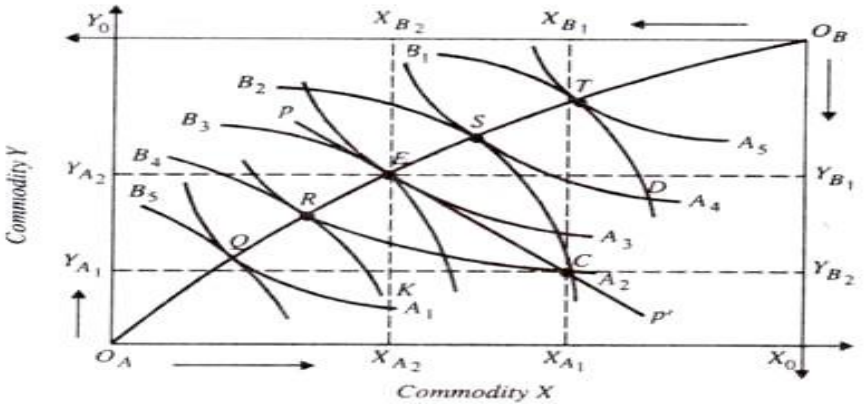


Fig.5.4. General Equilibrium of Exchange

With the initial distribution of two goods as implied by point C, if the two individuals through exchange of goods between them move to the point R on the contract curve, individual B reaches on his higher indifference curve B_4 and therefore becomes better off and A is no worse off as he remains on the same indifference curve A_2 as on the initial distribution point C.

On the other hand, if through exchange they move to point S on the contract curve, individual A becomes better off and individual B no worse off as compared to the initial position C. And if through exchange of goods they move to any point between R and S on the contract curve both the individuals will gain from exchange of goods as they will be reaching their respective higher indifference curves.

With initial distribution at point C and through exchange of goods nearer they move to point R on the contract curve, individual B will benefit more and nearer they move to point S on the contract curve, the individual A will gain more as compared to the initial distribution position C.

Where exactly on the contract curve, their equilibrium position of exchange will lie depends upon the bargaining power of each individual. With their almost equal bargaining power, their equilibrium position of exchange on the contract curve may lie at point £ where the two individuals gain almost equally as a result of exchange.

Thus, if the initial distribution of two individuals is not on the contract curve, there will be tendency on the part of individuals to trade or exchange goods between themselves and to move to a point on the contract curve because in doing so they will be increasing their satisfaction.

It is evident from the foregoing analysis that the position of exchange equilibrium can be somewhere between R and S on the contract curve. On all points between R and S, the exchange equilibrium can exist. Although equilibrium will exist at a point on the contract curve, there is no unique position of exchange equilibrium; all points between R and S on the contract curve are possible equilibrium positions.

If point E on the contract curve is the position of exchange equilibrium actually reached, then individual A has exchanged the amount of commodity X equal to CK for the amount of commodity K equal to KE Since point E lies

on the contract curve which is the locus of the tangency points of indifference curves of the two individuals, marginal rate of substitution between the two goods (MRS_{XY}) of individual A equals marginal rate of substitution between the two commodities (MRS_{XY}) of individual B. Thus exchange of CK of commodity X for KE of commodity Y has been settled between them at the equilibrium position E.

The general equilibrium of exchange attained at point E on the contract curve has the following important features:

1. Individuals maximise their satisfaction by equating their MRS_{XY} subject to their initial endowments of goods.

2. Since the equilibrium point E lies within the Edgeworth Box, drawn with the given amounts of two goods, the exchange of goods between the two individuals when they move to the equilibrium point E on the contract curve would imply that quantity sold of each good equals the quantity purchased of the good.

That is, markets for the two goods would clear. This implies that on moving to the equilibrium position E, individual A relative to his initial endowment of goods is selling good X and buying good Y. The opposite is true of individual B who buys good X and sells good Y. The quantity sold and purchased of each good must equal each other. If this does not happen the two markets will not clear and shortages or surplus would emerge.

3. The general exchange equilibrium determines not only the final distribution of two goods between the individuals but also a certain exchange rate (i.e. relative prices of the two goods). Thus at the equilibrium position E, the exchange rate CK of X for KE of Y has been settled between them. It is at this price ratio that exchange of goods takes place between the individuals.

4. The general equilibrium of exchange does not lead to the determination of absolute prices of goods but only relative prices of goods.

5. The general equilibrium of exchange must lie on the contract curve, and given the initial distribution implied by point C, it must lie between the point R and S on the contract curve. The general exchange equilibrium cannot be at a point in the Edgeworth Box which is not on the contract curve. This is because at a point which is not on the contract curve, indifference curves of

two individuals will intersect each other and therefore their MRS_{XY} not be equal to each other.

6. The equilibrium can lie anywhere between R and S on the contract curve, that is, general equilibrium of exchange in this bargaining is not unique.

5.5. STATIC PROPERTIES FOR CONSUMPTION, PRODUCTION, AND DISTRIBUTION:

Three static properties are observed in a general equilibrium solution, reached with a free competitive market mechanism:

(a) Efficient allocation of resources among firms (equilibrium of production).

(b) Efficient distribution of the commodities produced between the two consumers (equilibrium of consumption).

(c) Efficient combination of products (simultaneous equilibrium of production and consumption).

$$\begin{bmatrix}\text{slope of}\\ \text{isoquant}\end{bmatrix} = \begin{bmatrix}\text{slope of}\\ \text{isocost}\end{bmatrix}$$

or

$$MRTS_{L,K} = \frac{w}{r}$$

These properties are called marginal conditions of Pareto optimality or Pareto efficiency. A situation is defined as Pareto optimal (or efficient) if it is impossible to make anyone better-off without making someone worse-off. In the following paragraphs we discuss briefly the three optimality properties that are observed in a general equilibrium state.

(a) Equilibrium of production (efficiency in factor substitution):

Equilibrium of production requires the determination of the efficient distribution of the available productive factors among the existing firms (efficiency in factor substitution). We know that the firm is in equilibrium if it chooses the factor combination (for producing the most lucrative level of output) which minimizes its cost. Thus the equilibrium of the firm requires that where w and r are the factor prices prevailing in the market and MRTS is the marginal rate of technical substitution between the factors. The joint equilibrium of production of the two firms in our simple model can be derived by the use of the Edge-worth box of production. On the axes of this construct we measure the given quantities of the factors of production, K and L (figure

5.5). The isoquants of commodity X are plotted with origin the south-west corner and the isoquants of y are plotted with origin the north-east corner.

The locus of points of tangency of the X and Y isoquants is called the Edge-worth contract curve of production. This curve is of particular importance because it includes the efficient allocations of K and L between the firms.

Each point of the Edge-worth box shows a specific allocation of K and L in the production of commodities X and y. Such an allocation defines six variables the amounts of Y and X produced and the amounts of capital and labour allocated to the production of Y and X.

For example point Z shows that:

X_3 is the quantity produced of commodity X

Y_2 is the quantity produced of commodity Y

K_x is the amount of capital allocated to the production of X_3

K_y is the amount of capital allocated to the production of Y_2

L_x is the amount of labour allocated to the production of X_3

L_y is the amount of labour allocated to the production of Y_2

However, not all points of the Edge-worth box represent efficient allocations of the available resources. Given that K and L are limited in supply, their use should produce the greatest possible output. An allocation of inputs is efficient if the produced combination of X and Y is such that it is impossible to increase the production of one commodity without decreasing the quantity of the other.

From figure 5.5 we see that efficient production takes place on the Edge-worth contract curve. It is impossible to move to a point off this curve without

$$\begin{bmatrix}\text{slope of}\\ X\text{ isoquant}\end{bmatrix} = \begin{bmatrix}\text{slope of}\\ Y\text{ isoquant}\end{bmatrix}$$

or

$$MRTS^{x}_{L,K} = MRTS^{y}_{L,K}$$

reducing the quantity of at least one commodity. Point Z is a point of inefficient production, since a reallocation of K and L between the two commodities (or firms) such as to reach any point from a to b leads to a greater production of one or both commodities.Since the Edge-worth contract curve of production is the locus of tangencies of the X and Y isoquants, at each one of its points the slopes of the isoquants are equal:

In our simple general equilibrium model the firms, being profit maximizes in competitive markets, will be in equilibrium only if they produce somewhere on the Edgeworth contract curve. This follows from the fact that the factor prices facing the producers are the same, and their profit maximisation requires that each firm equates its $MRTS_{L\,k}$ with the ratio of factor prices w/r

$MRTS^{x}_{L,k} = MRTS^{y}_{L,k} = w/r$ (1)

In summary. The general equilibrium of production occurs at a point where the $MRTS_{L,k}$ is the same for all the firms, that is, at a point which satisfies the Pareto- optimality criterion of efficiency in factor substitution the general equilibrium of production is a Pareto-efficient allocation of resources. The production equilibrium is not unique, since it may occur at any point along the Edgeworth contract curve there is an infinite number of possible Pareto-optimal production equilibrium.

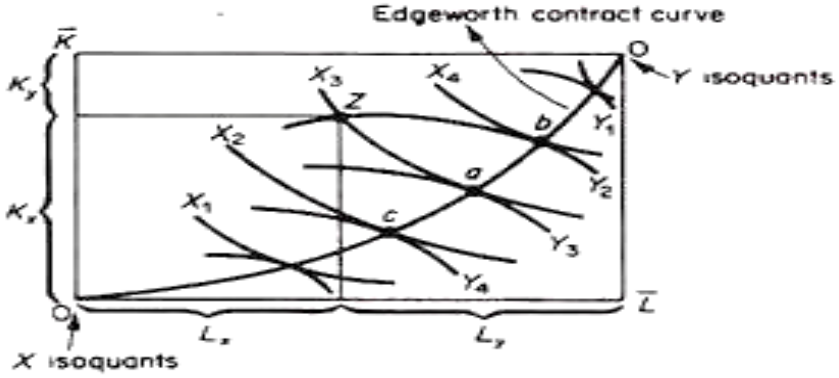


Fig.5.5 Edgeworth box of production

However, with perfect competition, one of these equilibria will be realized, the one at which the ('equalised' between the firms) $MRTS_{L,\,K}$ is equal to the ratio of the market factor prices w/r. That is, with perfect competition general equilibrium of production occurs where condition (1) is satisfied. If the factor prices are given, from the Edgeworth box of production we can determine the amounts of X and Y which maximise the profits of firms. However, in a general equilibrium, these quantities must be equal to those which consumers want to buy in order to maximise their utility. Consumers decide their purchases on the basis of the prices of commodities, P_x and P_y.

Thus, in order to bring together the production side of the system with the demand side, we must define the equilibrium of the firms in the product space, using as a tool the production possibility curve of the economy. This is

derived from the Edgeworth contract curve of production, by mapping its points on a graph on whose axes we measure the quantities of the final commodities X and Y.

From each point of the Edgeworth contract curve of production we can read off the maximum obtainable quantity of one commodity, given the quantity of the other. For example, point a in figure 5.5 shows that, given the quantity of X is X_3, the maximum quantity of Y that can be produced (with the given factors K and L) is Y_3.

In summary, the production possibility curve of an economy is the locus of all Pareto-efficient outputs, given the resource endowment (K and L) and the state of technology. This curve shows the maximum quantity of a good obtainable, given the quantity of the other good. At any point on the curve all factors are optimally (efficiently) employed. Any point inside the curve is technically inefficient, implying unemployed resources. Any point above the curve is unattainable, unless additional resources or a new technology or both are found. The production possibility curve is also called the product transformation curve because it shows how a commodity is 'transformed' into another, by transferring some factors from the production of one commodity to the other. The negative of the slope of the production possibility curve is called the marginal rate of (product) transformation, $MRPT_{xy}$ and it shows the amount of Y that must be sacrificed in order to obtain an additional unit of X. The economic meaning of the transformation curve is the rate at which a commodity can be transformed into another.

(b) Equilibrium of consumption (efficiency in distribution of commodities):

We must now show how each consumer, faced with the market prices P_x and P_y, reaches equilibrium, that is, maximises his satisfaction. From the theory of consumer behaviour we know that the consumer maximises his utility by equating the marginal rate of substitution of the two commodities (slope of his indifference curves) to the price ratio of the commodities. Thus the condition for consumer equilibrium is $MRS_{x,y} = P_x / P_y$

Since both consumers in perfectly competitive markets are faced with the same prices the condition for joint or general equilibrium of both consumers is $MRS^{A}_{x,y} = MRS^{B}_{x,y} = P_x / P_y$ (3)

This general equilibrium of consumption for the product mix Y^e, X^e is shown in figure 5.6 We construct an Edgeworth box for consumption with the precise dimensions Y^e and X^e by dropping from point T (on the product transformation curve) lines parallel to the commodity axes. We next plot the indifference curves of consumer A with origin the south-west corner, and the indifference curves of B with origin the north-east corner. Any point in the Edgeworth consumption box shows six variables: the total quantities Y^e and X^e, and a particular distribution of these quantities between the two consumers. However, not all distributions are efficient in the Pareto sense.

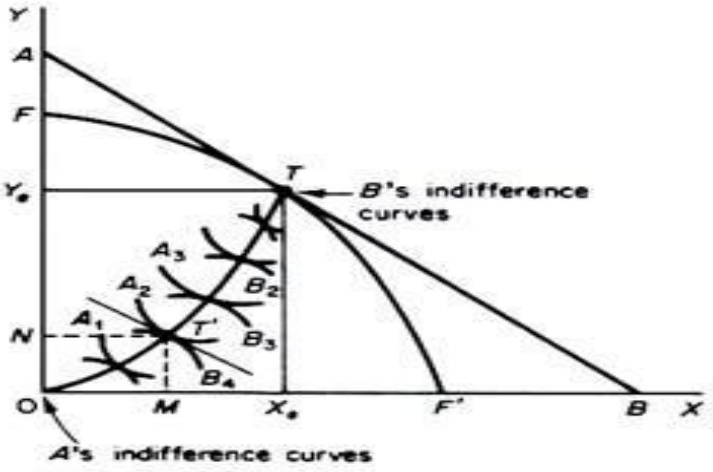


Fig.5.6

A Pareto- efficient distribution of commodities is one such that it is impossible to increase the utility of one consumer without reducing the utility of the other. From figure 5.6 it is seen that only points of tangency of the indifference curves of the two consumers represent Pareto-efficient distributions. The locus of these points is called the Edge- worth contract curve of consumption. It should be clear that at each point of this curve the following equilibrium condition is satisfied $MRS^{A}_{x,y} = MRS^{B}_{x,y}$

Thus for a given product-mix (such as T, which we are considering) there is an infinite number of possible Pareto-optimal equilibrium of distribution: the equilibrium of consumption is not unique, since it can occur at any point of the contract curve of consumption. However, with perfect competition, only

one of these points is consistent with the general equilibrium of the system. This is the point of the contract curve where the ('equalised') $MRS_{x,y}$ of the consumers is equal to the price ratio of the commodities, that is, where condition (3) is fulfilled. In figure 5.6 the equilibrium of the consumers is defined by point T. Consumer A reaches the utility level implied by the indifference curve A_2, buying 0M of X and ON of Y. Consumer B reaches the utility level implied by the indifference curve B_4, buying the remaining quantities MX_e of X and NY_e of Y.

(c) Simultaneous equilibrium of production and consumption (efficiency in product-mix):

From the discussion of the preceding two sections it follows that the general equilibrium of the system as a whole requires the fulfillment of a third condition, namely that the marginal rate of product transformation (slope of the PPC) be equal to the marginal rate of substitution of the two commodities between the consumers

$MRPT_{x,y} = MRS^{A}_{x,y} = MRS^{B}_{x,y}$

In perfect competition this condition is satisfied, since, from expression (2)

$MRPT_{x,y} = P_x/P_y$

and from expression (3)

$MRS^{A}_{x,y} = MRS^{B}_{x,y} = P_x/P_y$

so that

$MRPT_{X,\,y} = MRS^{A}_{x,y} = MRS^{B}_{x,y}$ (4)

This is the third condition of Pareto efficiency. It refers to the efficiency of product substitution (or optimal composition of output). Since the MRPT shows the rate at which a good can be transformed into another in production, and the MRS shows the rate at which the consumers are willing to exchange one good for another, the system is not in equilibrium unless the two ratios are equal. Only then the production sectors' plans are consistent with the household sectors' plans, and the two are in equilibrium.

Apparently firms produce a smaller quantity of Y and a larger quantity of X relative to the preferences of the consumers. Given the assumption of consumer sovereignty, firms must reduce X and increase the production of Y for the attainment of general equilibrium. The economic meaning of the third

efficiency criterion is that the combination of outputs must be optimal from both the consumers' and the producers' point of view.

In summary, with perfect competition (and no discontinuities and with constant returns to scale) the simple two-factor, two-commodity, and two-consumer system has a general equilibrium solution, in which three Pareto-efficiency conditions are satisfied:

1. The MRS between the two goods is equal for both consumers. This efficiency in distribution implies optimal allocation of the goods among consumers.
2. The MRTS between the two factors is equal for all firms. This efficiency in factor substitution implies optimal allocation of the factors among the two firms.
3. The MRS and the MRPT are equal for the two goods. This efficiency in product- mix implies optimal composition of output in the economy and thus optimal allocation of resources.

****