CHAPTER 41*

PARETO CRITERION AND ECONOMIC EFFICIENCY : GENERAL EQUILIBRIUM APPROACH

Introduction

In the last chapter we explained Pareto efficiency (also called economic efficiency) in the framework of partial equilibrium analysis. Since in the achievement of economic efficiency we are concerned with more than one consumer, and one firm and also more than one good and one factor, it is better to use general equilibrium analysis. As explained in an earlier chapter, in general equilibrium analysis, prices and quantities of all goods and factors are considered as variables and explain simultaneous determination of equilibrium of these in all product and factor markets.

In fact when we look at the economic system as a whole, there is a great deal of inter-relationship and inter-dependence among various markets for commodities and factors and there are a large number of decision making agents—consumers, producers, workers, (who supply labour) and other resource owners. All these agents are self-interested and would behave to maximise their goals; consumers would maximise their utility, and producers would maximise their profits. A comprehensive analysis of the economic system when prices and quantities of all commodities and factors are considered as variable and which would take into account all inter-relationships and inter-dependence could be made only through general equilibrium analysis. The general equilibrium would occur when markets for all commodities and factors and all decision-making agents, consumers, producers, resource owners are simultaneously in equilibrium. Thus in *general equilibrium analysis deals with explaining simultaneous equilibrium in all markets when prices and quantities of all products and factors are considered as variables.*

In explaining conditions of Pareto efficiency, the general equilibrium analysis is explained in terms of two individuals, two goods and two factors and the *Edgeworth Box* diagram is used to explain this. Therefore,m before explaining Pareto criterion and Pareto or economic efficiency we explain what is Edgeworth box diagram and how genral equilibrium is explained with this. With Edgeworth box. 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*, a specific bundles of which have been made available to the individuals for consumption; and (2) there are *two individuals* between which exchange of goods has to take place and equilibrium reached with regard to the distribution of the specific amounts of these two goods.

Edgeworth Box and General Equilibrium of Exchange

In this two goods, two individuals (2x2) model of pure exchange, the famous Edgeworth Box

*This chapter is meant for B.A. (Honours) classes in Economics and Commerce.

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 Edgeworth Box and then analyse the general equilibrium in this pure exchange system. Consider Figure 41.1 where a box with a certain fixed dimensions has been drawn. Along the X-axis we measure the commodity X and along the Y-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 X 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 O_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.

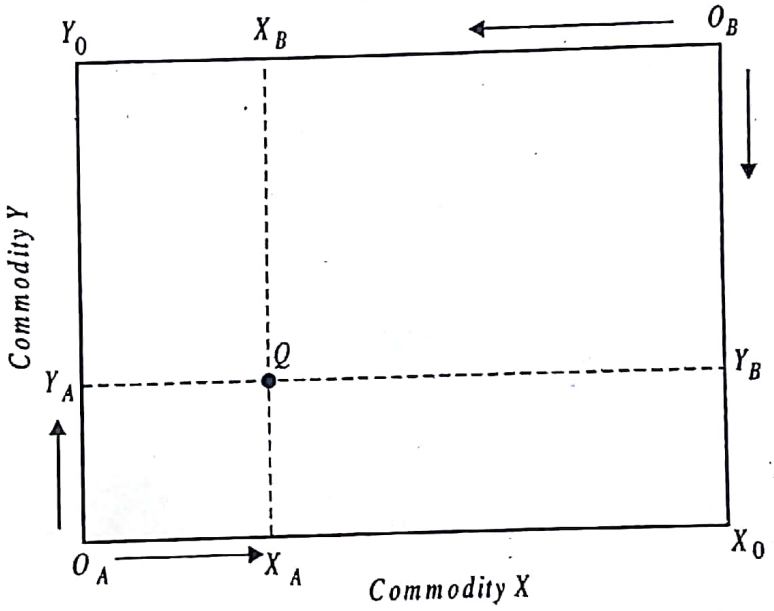

Fig. 41.1. *Edgeworth Box*

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. 41.2 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 :-

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

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 41.2. If the *initial distribution* of two goods between the two individuals is represented by point C where individual A has X_{AI} amount of good X and Y_{AI} amount of good Y. The remaining quantity of good X, that is, $X_0 - XA_1 = X_{BI}$ *would be allocated to* individual B and the remaining Y_{BI} amount of good Y would go to individual B. At this initial distribution of goods X 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 others. As long as they think there are possibilities of becoming better off, they will exchange goods and end up at the contract curve.

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

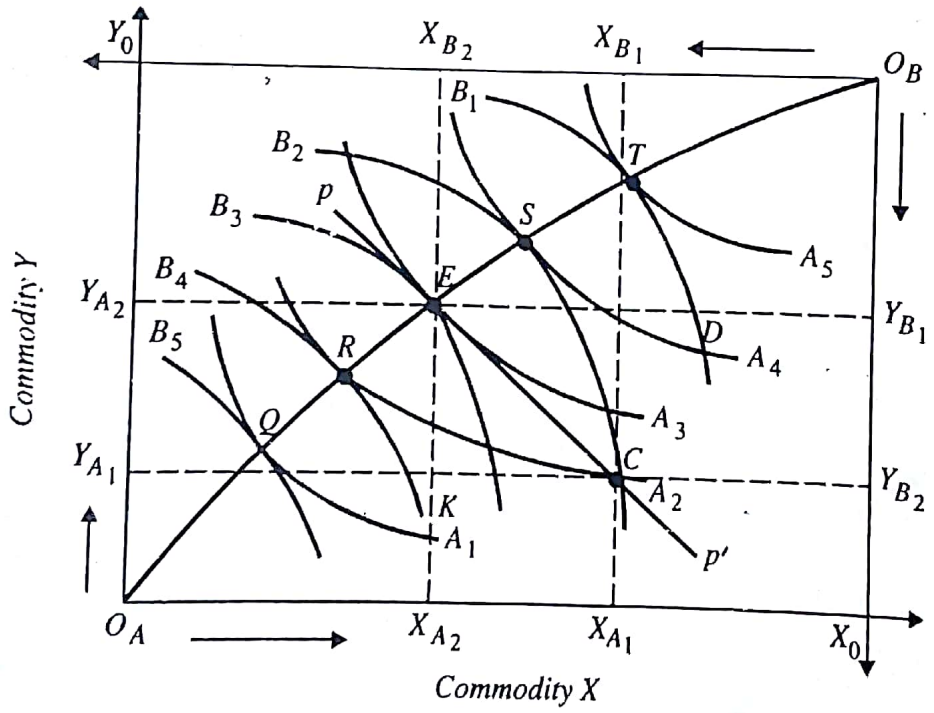

Fig. 41.2. *General Equilibrium of Exchange*

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*

point of view of social welfare. But unfortunately Pareto criterion does not help us in evaluating the changes in welfare if the movement as a result of redistribution is from the point Q to a point outside the segment RS; such as point E on the utility possibility curve CV. As a result of the movement from point Q to E, the utility of A decreases while that of B increases. In such circumstances, Pareto criterion can not tell us as to whether social welfare increases or decreases.

CONDITIONS OF PARETO EFFICIENCY

Pareto concluded from his criterion that competition leads the society to an optimum position but he had not given any mathematical proof of it, nor he derived the marginal conditions to be fulfilled for achievement of the optimum position. Later on, Lerner and Hicks derived the marginal conditions which must be fulfilled for the attainment of Pareto optimum. These marginal conditions are based on the following important assumptions :

1. Each individual has his own ordinal utility function and possesses definite amount of each product and factor.
2. Production function of every firm and the state of technology is given and remains constant.
3. Goods are perfectly divisible.
4. A producer tries to produce a given output with the least-cost combination of factors.
5. Every individual wants to maximise his satisfaction.
6. Every individual purchases some quantity of all goods.
7. All factors of production are perfectly mobile.

Given the above assumptions various marginal conditions (first-order conditions) required for the achievement of Pareto optimum or maximum social welfare are explained below :

1. Efficiency in Exchange: The Optimum Distribution of Products among the Consumers

The first condition relates to the optimum distribution of the goods among the different consumers composing a society at a particular point of time. The condition says : "*The marginal rate of substitution between any two goods must be the same for every individual who consumes them both.*"[2] The marginal rate of substitution of one good for another so as is the amount of one good necessary to compensate for the loss of a marginal unit of another so as to maintain a constant level of satisfaction. So long as the marginal rate of substitution (MRS) between two goods is not equal for any two consumers, they will enter into an exchange which would increase the satisfaction of both or of one without decreasing the satisfaction of the other.

This condition can be better explained with the help of the Edgeworth Box diagram. In Figure-41.5, goods X and Y, which are consumed by two individuals A and B composing a society are represented on the X and Y axes respectively. O_A and O_B are origins for A and B respectively. I_{a1}, Ia_2, Ia_3 and Ib_1, Ib_2, Ib_3 are the indifference curves showing successively higher and higher satisfaction of consumers A and B respectively. CC' is the contract curve passing through various tangency points Q, R, S of the indifference curves of A and B. The marginal rates of substitution (MRS) between the two goods for individuals A and B are equal on the various points of the contract curve CC'. Any point outside the contract curve does not represent the equality of MRS between the two goods for two individuals A and B of the society.

Let us consider point K where indifference curves I_{a1} and I_{b1} of individuals A and B respectively intersect each other instead of being tangential. Therefore, at point K marginal rate of substitution between two goods X and Y (MRS_{xy}) of individual A is not equal to that of B. With the initial

2. M.W. Reder, *Studies in the Theory of Welfare Economics*, Columbia University Press, New York, 1947, p. 24.

distribution of goods as represented by point K, it is possible to increase the satisfaction of one individual without any decrease in that of the other or to increase the satisfaction of both by redistribution of the two goods X and Y between them. A movement from K to S increases the satisfaction of A without any decrease in B's satisfaction. Similarly, a movement from K to Q increases B's satisfaction without any decrease in A's satisfaction. The movement from K to R increases the satisfaction of both because both move to their higher indifference curves. Thus, a movement from K to Q or to S or to any other point on the segment SQ of the contract curve will, according to Pareto criterion, increase the level of social welfare.

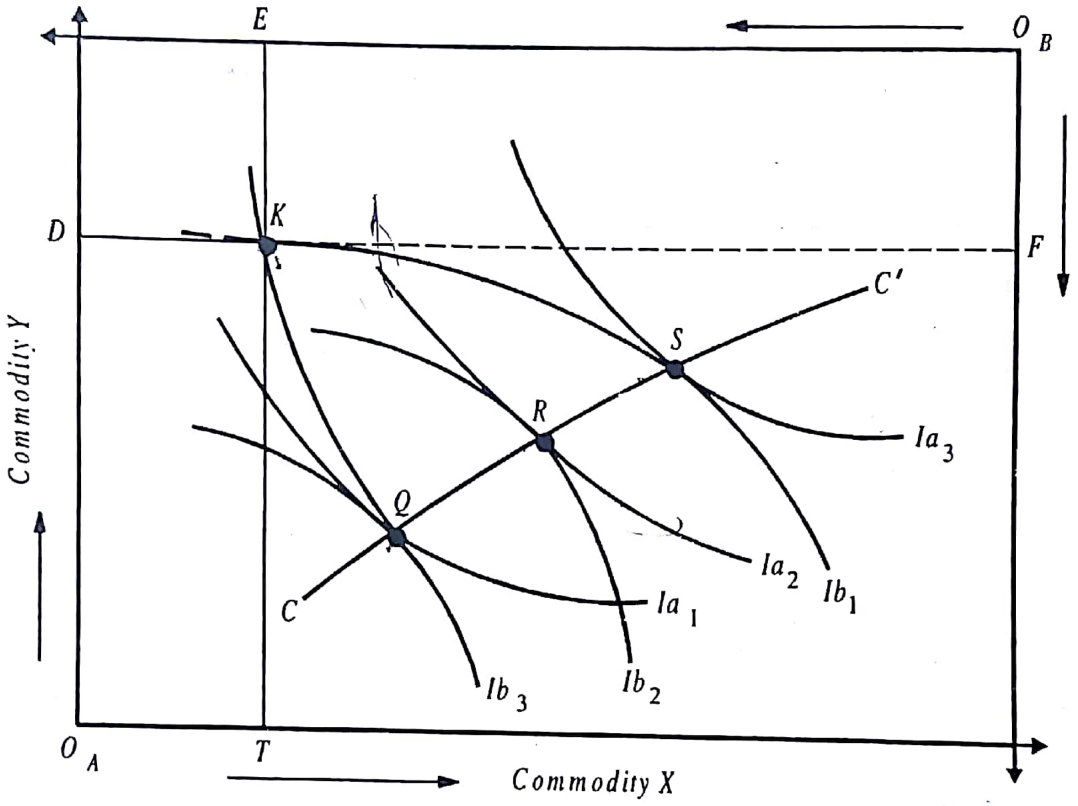

Fig. 41.5. *Exchange Efficiency : The Optimum Distribution of Products among Consumers*

From above it follows that movement from any point away from the contract curve to a point on the relevant segment of the contract curve will mean increase in social welfare. At any point away from the contract curve in the Edgeworth box, the indifference curves of the two individuals will intersect which will mean that MRS_{xy} of two individuals is not the same. And, as explained above, this indicates that through exchange of some units of goods between them, they can move to some point on the contract curve where the social welfare (that is, welfare of two individuals taken together) will be higher.

Since the slope of an indifference curve represents the marginal rate of substitution (MRS_{xy}) at any point of the contract curve, which represents tangency points of the indifference curves, MRS_{xy} of the two individuals are equal. Therefore, points on the contact curve represent the maximum social welfare. However, a movement along the contract curve in either direction will make one individual better off and the other worse off since it will put one individual on his successively higher indifference curves and the other on his successively lower indifference curves. Thus, every point on the contract curve denotes maximum social welfare in the Paretian sense but we can not say anything about the best of them with the help of Pareto criterion.

2. Production Efficiency : The Optimum Allocation of Factors among Firms

The second condition for economic efficiency or Pareto optimum requires that the available

bargaining power of each individual. With their almost equal bargaining power, their equilibrium position of exchange on the contract curve may lie at point E 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 any unique position of exchange equilibrium; all points on the contract curve between R and S on the contract curve are possible equilibrium positions.*

Notion of Pareto Optimality and Economic Efficiency

We saw in the previous chapter that neo-classical and earlier economists defined social welfare as a sum total of cardinally measurable utilities of different members of the society. An optimum allocation of resources was one which maximised the social welfare in this sense. V. Pareto was the first to part with this traditional approach to social welfare in two important respects. First, he rejected notion of cardinal utility and its additive nature and, second, he detached welfare economics from the inter-personal comparisons of utilities. Pareto's concept of maximum social welfare which is based upon ordinal utility and is also free from value judgements occupies a significant place in modern welfare economics. Pareto optimum may not be sufficient condition for attaining maximum social welfare but it is a necessary condition for it. We have already explained the concept of Pareto optimality in chapters in 38. To repeat, *Pareto optimum (often called Economic Efficiency) is a position from which it is impossible to make anyone better off without making someone worse off by any reallocation of resources or distribution of outputs.* Thus, in the Pareto "optimum position the welfare of any individual of the society can not be increased without decreasing the welfare of another member. Before explaining the conditions of achieving Pareto optimality, we shall explain Pareto criterion of evaluating changes in social welfare because the concept of Pareto optimality or maximum social welfare is based upon Pareto criterion of welfare.

PARETO CRITERION OF SOCIAL WELFARE

The concept of Pareto optimum or economic efficiency stated above is based on a welfare criterion put forward by V. Pareto. Pareto criterion states that if any reorganisation of economic resources does not harm anybody and makes someone better off, it indicates an increase in social welfare. If any reorganistaion or change makes everybody in a society better off, it will, according to Pareto, undoubtedly mean increase in social welfare. Thus, in the words of Prof. Baumol "any change which harms no one and which makes some people better off (in their own estimation) must be considered to be an improvement."[1] Parto criterion can be explained with the help of Edgeworth Box diagram which is based on the assumptions of ordinal utility and non-interpersonal comparison of utilities. Suppose two persons A and B form the society and consume two goods X and Y. The various levels of their satisfaction by consuming various combinations of the two goods have been represented by their respective indifference curves.

In Figure 41.3 O_a and O_b are the origins for the utilities of two persons A and B respectively. I_{a1}, I_{a2}, I_{a3}, I_{a4} and I_{b1}, I_{b2}, I_{b3}, I_{b4} are their successively higher indifference curve. Suppose the initial distribution of goods X and Y between the members of the society, A and B, is represented by point-K in the Edgeworth Box. Accordingly, individual A consumes O_AG of $X + GK$ of Y and is at the level

of satisfaction represented by indifference curve I_{a3}. Similarly, individual B consumes KF of KE of Y and gets the satisfaction represented by indifference curve Ib_1. Thus the total given volume of goods X and Y is distributed between A and B. In this distribution, individual A consumes relatively larger quantity of good Y and individual B of good X. Now, it can be shown with the aid of Pareto's welfare criterion that a movement from the point K to a point such as S or R or any other point in the shaded region will increase social welfare.

Any movement from K to S through redistribution of two goods between two individuals increases the level of satisfaction of A without any change in the satisfaction of B because as a result of this A moves to his higher indifference curve I_{a4}, and B remains on his same indifference curve I_{b1} (K and S lie on B's same indifference curve I_{b1}). In other words, as a result of the movement from K to S, individual A has become better off whereas individual B is no worse off. Thus, according to Pareto criterion, social welfare has increased following the movement from K to S and therefore K is not the position of economic optimum. Similarly, the movement from K to R is also desirable from the point of view of social welfare because in this individual B becomes better off without any change-in-the satisfaction of individual A. Therefore, both the positions S and R are better than K. The tangency points of the various indifference curves of the two individuals of the society are the Pareto optimum points and the locus of these points is called '*contract curve*'.

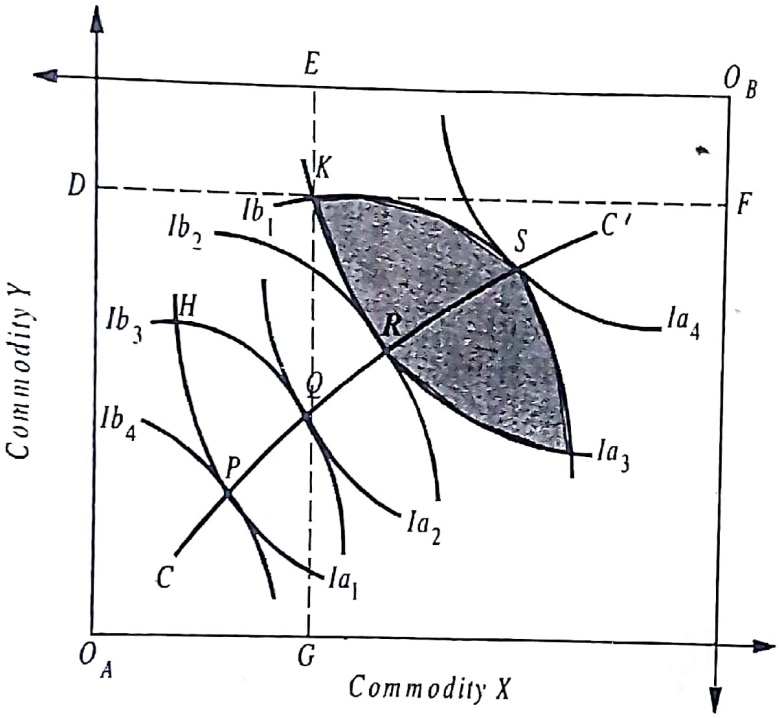

Fig. 41.3 *Pareto Criterion and Pareto Optimality.*

Pareto criterion can also be explained with the help of Samuelson's utility possibility curve. *Utility possibility curve is the locus of the various combinations of utilities obtained by two persons from the consumption of a particular bundle of goods.* In Figure 41.4, CV is a utility possibility curve which shows the various levels of utilities obtained by two individuals A and B of the society resulting from the redistribution of a fixed bundle of goods and its consumption by them. According to Pareto criterion, a movement from Q to R, or Q to D, or Q to S represents the increase in social welfare because in such movements the utility of either A or B or both increases. A movement from Q to R implies that the utility or welfare of B increases, while that of A remains the same. On the other hand, a movement from Q to S implies that while A has become better off, B is no worse off. And a movement from Q to D or any other point on the segment between R and S will mean increase in welfare or utility of both the individuals. Thus points R, D and S are preferable to Q from the

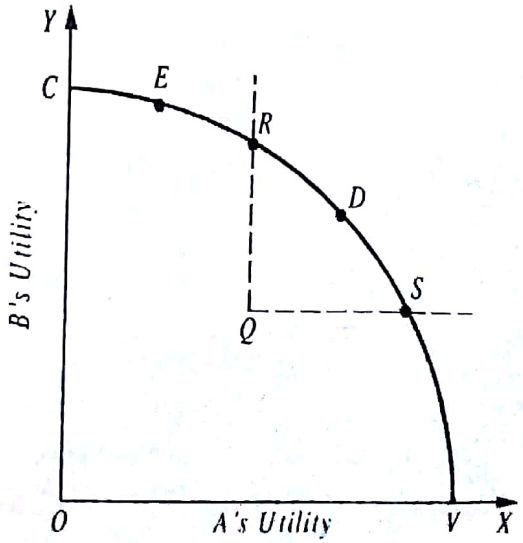

Fig. 41.4. *Pareto Criterion Explained with Utility Possibility Curve*

1. W.J. Baumol, *Economic Theory and Operations Analysis*, Prentice Hall, 4th edition, 1978, p. 527.

factors of production should be utilised in the production of products in such a manner that it is impossible to increase the output of oen firm without a decrease in the output of another or to increase the output of both the goods by any re-allocation of factors of production. *This situation would be achieved if the marginal technical rate of substitution between any pair of factors must be the same for any two firms producing two different products and using both the factors to produce the products.*[3]

This condition too can be explained with the help of Edgeworth Box diagram relating to production. This is depicted in Fig. 41.6. Let us assume two firms *A* and *B* producing the same product by using two factors labour and capital. The available quantities of labour and capital are represented on *X* and *Y* axes respectively. O_A and O_B are the origins for firms *A* and *B* respectively. Isoquants I_{a1}, I_{a2}, I_{a3} and I_{b1}, I_{b2}, I_{b3} of firms *A* and *B* respectively represent successively higher and higher quantities of output which they can produce by different combinations of labour and capital. The slope of the iosquants, which are convex to the origin, represents the marginal rate of technical substitution (*MRTS*) between two factors. *MRTS* of one factor for another is the amount of one factor necessary to compensate for the loss of the marginal unit of another so that the level of output

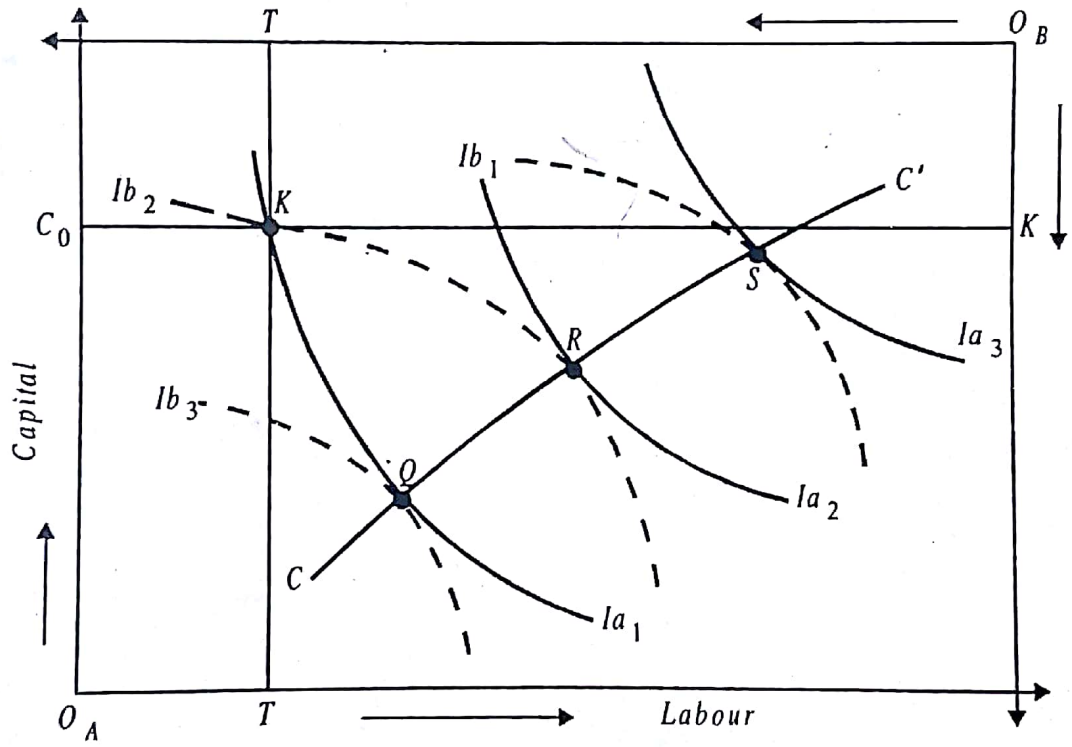

Fig. 41.6. *Production Efficiency : The Optimum Allocation of Factors among Firms*

remains the same. So long as the *MRTS* between two factors for two firms is not equal, total output of a product can be increased by transfer of factors from one firm to another.

In terms of the above diagram any movement from *K* to *S* or to *Q* raises the output of one firm without any decrease in the output of the other. The total output of the two firms increases when through redistribution of factors between the two firms, a movement is made from the point *K* to the point *Q* or *S* on the contract curve. A glance at Figure 41.6 will reveal that movement from point *K* outside the contract curve to the point *R* on the contract curve will raise the output of both the firms individually as well as collectively. Therefore, it follows that corresponding to a point outside the contract curve there will be some points on the contract curve production at which will ensure greater total output of the two firms. As the contract curve is the locus of the tangency points of the isoquants of two firms, the marginal rate of substitution of the two firms is the same at every point of

the contract curve CC'. It, therefore, follows that on the contract curve at every point of which $MRTS$ between the two factors of two firms is the same, the allocation of factors between the two firms is optimum. When the allocation of factors between the two firms is such that they are producing at a point on the contract curve, then no re-allocation of factors will increase the total output of the two firms taken together.

But it is worth mentioning that there are several points on the contract curve and each of them represents the optimum allocation of labour and capital as between the two firms. But which one of them is best cannot be said on the basis of Pareto criterion because movement along the contract curve in either direction represents such factor reallocation which increases the output of one and reduces the output of another firm.

3. Efficiency in Product-Mix : Optimum Allocation of Resources among Products

This condition relates to the pattern of production. The fulfilment of this condition determines the optimum quantities of different commodities to be produced with the given factor endowments. This condition states that "*the marginal rate of substitution between any pair of products for any person consuming both must be the same as the marginal rate of transformation (for the community) between them.*"[4] According to this condition, for the attainment of maximum social welfare goods should be produced in accordance with consumer's preferences. Let us explain this with the help of Fig. 41.7.[5]

In Fig. 41.7 commodities X and Y have been represented on the X and Y-axes respectively. AB is a community's transformation curve between any pair of goods X and Y. This curve represents the maximum amount of X that can be produced for any quantity of Y, given the amounts of other goods that are produced and fixed supplies of available resources. IC_1 and IC_2 are the indifference curves of a consumer the slope of which at a point represents the marginal rate of substitution between the two goods of the consumer. The MRT_{xy} of the community and MRS_{xy} of the consumer are equal to each other at point R at which the community's transformation curve is tangent to the indifference curve IC_2 of a representative consumers, Point R represents optimum composition of production in which commodities X and Y are being produced and consumed in OM and ON quantities. This is because of all the points on the community's transformation curve, point R lies at the highest possible indifference curve IC_2 of the consumer. For instance, if a combination of goods X and Y represented by S is being produced and consumed, the consumer would be at a lower level of welfare because S lies on his lower indifference curve IC_1 which intersects the community's transformation curve instead of being tangential to it. As a result, at point S, MRS_{xy} of the consumer is not equal to the MRT_{xy} of the community. With the situation at S there is a possibility of moving the consumers to a higher indifference curve

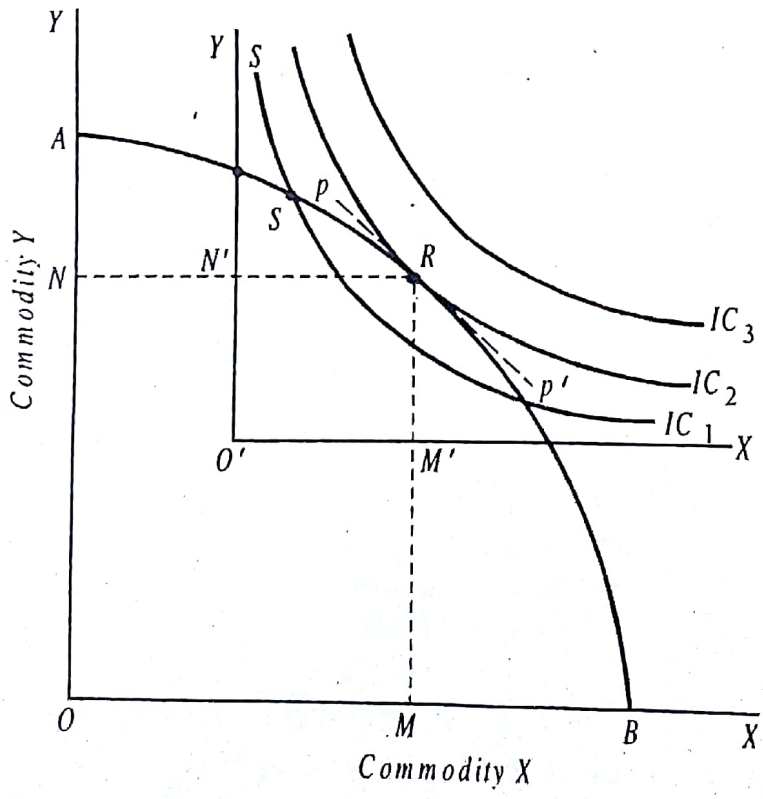

Fig. 41.7. *Allocative Efficiency : Optimum Product Mix.*

4. Reder, *op. cit.*, p. 30.

by changing the direction (*i.e.* composition) of production *i.e.* by increasing the production of *X* and reducing the production of *Y*. Thus, the optimum direction of production is established at point *R* where community's transformation curve is tangent to the indifference curve of a consumer in the society.

The Second-Order and Total Conditions of Pareto Optimality

The marginal or the first order conditions explained above are '*necessary*' but not sufficient for the attainment of maximum social welfare because the marginal conditions by themselves do not guarantee maximum welfare. The marginal conditions can be fulfilled even at the level of minimum welfare. To attain the maximum social welfare position second-order conditions together with the marginal conditions must be satisfied. *The second order conditions require that all indifference curves must be convex to the origin and all transformation curves concave to it in the neighbourhood of any portion where marginal conditions are satisfied.*

But even the satisfaction of both (first and second order conditions) does not ensure the largest maximum welfare because even when marginal conditions (first and second order) are fulfilled, it may still be possible to move to a position where social welfare is greater. To attain the maximum social welfare, another set of conditions which are called by J.R. Hicks as the '*total conditions*' must also be satisfied. The total conditions state, "that if welfare is to be a maximum, it must be impossible to increase welfare by producing a product not otherwise produced or by using a factor not otherwise used."[5] If it is possible to increase welfare by such activities the optimum position is not determined by marginal conditions alone.

Therefore, welfare will be really maximum if the marginal as well as total conditions are satisfied. *But such a social optimum too is not a unique one. It is one of a large number of optima.* The whole analysis of conditions of Pareto optimality *assumes a given distribution of income.* With a change in the distribution of income Pareto optimality will be achieved with different output-mix of various products and different allocation of various factors among products. Thus, a new optimum will emerge due to redistribution of income and there are no criteria to judge whether the new optimum is better or worse than the previous social optimum. This can be known only with the help of some value judgements regarding income distribution which has been ruled out by the Pareto criterion.

A CRITICAL EVALUATION OF PARETO CRITERION AND PARETO EFFICIENCY

Pareto criterion and the concept of Pareto optimality and maximum social welfare based on it occupies a significant place in welfare economics. To judge the efficiency of an economic system, the notion of Pareto optimality has been used. It has also been used to bring out the gains of trading or exchange of goods between individuals. But even Pareto criterion which rules out comparing those changes in policies which make some worse off has been a subject of controversy and has been criticised on several grounds.

First, it has been alleged that *Pareto criterion is not completely free from value judgements.* The supporters of Pareto criterion claim that it provides us with an 'objective' criterion of efficiency. However, this has been contested. Against Pareto criterion it has been said that to say that a policy change which makes some better off without others being worse off increases social welfare is itself a value judgement. This is because *we recommend such changes which pass Pareto criterion.* The implication of this assertion will become obvious when the persons who gain as a result of policy change are the rich and those who remain where they were before are poor. Therefore, to say on the basis of Pareto criterion that whenever any policy change which, without harming anyone, benefits some people regardless of whoever they may be, increases social welfare is a value judgement which may not be accepted by all.

Second, an important limitation of Pareto criterion is that *it cannot be applied to judge the social desirability of those policy proposals which benefit some and harm others.* Such policy changes are quite rare which do not harm at least some individuals in the society. Thus, Pareto criterion is of limited applicability as it cannot be used to pronounce judgements on a majority of policy proposals which involve a conflict of preferences of two individuals. Thus, according to Prasanta K. Patnaik, "Pareto criterion fails seriously when it comes to comparing alternatives. *Whenever there is conflict of preferences of two individuals with respect to two alternatives, the criterion fails to rank those two alternatives no matter what the preferences of the rest of individuals in the society might be*".[6] To evaluate social desirability of those policy changes which benefit some and harm others, we need to make interpersonal comparison of utility which Pareto criterion refuses to do. Thus, "Pareto criterion works by sidestepping the crucial issue of inter-personal comparison and income distribution, that is, by dealing only with cases where no one is harmed so that the problem does not arise".[7]

Another shortcoming of Pareto criterion and notion of maximum social welfare based on it is that *it leaves a considerable amount of indeterminacy in the welfare analysis* since every point on the contract curve is Pareto-optimal. For instance, in Fig. 41.3, every point such as P, Q, R, S on the contract curve is Pareto-superior to any point such as K and H which lies outside the contract curve. Movement from one point on the contract curve to another as a result of change in economic policy, that is, through re-allocation of resources that makes one individual better off and the other worse off, that is, one gains at the expense of the other. This means that on the basis of Pareto criterion, social alternatives lying on the contract curve cannot be compared since with any movement on the contract curve one individual gains and the other loses, that is, it involves redistribution of income or welfare. Therefore, to compare various alternatives lying on the contract curve and to choose between them, inter-personal comparison and value judgements regarding proper distribution of income need to be made. However, Pareto refused to make value judgements and sought to put forward a value-free or objective criterion of welfare.

It, therefore, follows that on the basis of Pareto criterion where the change from an alternative lying outside the contract curve to an alternative on the contract curve is judged to increase social welfare but this cannot be said of the change from one position on the contract curve to another on it. But as there are infinite number of points on the contract curve all of which are Pareto optimal, no choice can be made out of them on the basis of Pareto criterion. To remove this indeterminacy and to choose among the alternatives lying on the contract curve one needs to make some additional value judgements beyond what is implied in the Pareto criterion. Henderson and Quandt hold a similar view when they assert, "*The analysis of welfare in terms of Pareto optimality leaves a considerable amount of indeterminacy in the solution : there are infinite number of points which are Pareto optimal.*" They further remark that, 'The indeterminacy is the consequence of considering an increase in welfare to be unambiguously defined only if an improvement in one individual's position is not accompanied by a deterioration of the position of another. The indeterminacy can only be removed by further value judgements."[8]

Above all, *a chief drawback of Pareto-optimality analysis is that it accepts the prevailing income distribution and no attempt is made to find an optimal distribution of income*, since it is thought that there does not exist any objective, value-free and scientific way of finding optimal distribution of income. Thus, Pareto optimality analysis remains either silent or biased in favour of status quo on the issue of income distribution. Further, Pareto optimality analysis may lead to

6. Prasanta K. Patnaik, Some Aspects of Welfare Economics, *The Indian Economic Journal*, Conference Number, 1974, p. 68C.
7. W. J. Baumol, *Economic Theory and Operations Analysis*, 4th edition, 1977 Prentice Hall, p.527.
8. J. M. Henderson, and R. E. Quandt, *Microeconomic Theory*, 2nd edition, 1971, p. 265.
9. Baumol, *op.cit.* p. 503.

$$MRT_{xy} < \frac{P_x}{P_y}$$

But the consumers in order to be in equilibrium will equate their marginal rate of substitution between two commodities (MRS_{xy}) with the price ratio of the two commodities $\left(\frac{P_x}{P_y}\right)$. This is because each individual consumer will take the prices of commodities as given and constant for him. Thus, for consumers,

$$MRS_{xy} = \frac{P_x}{P_y} \qquad \ldots (ii)$$

From (i) and (ii) above it follows that under conditions of monopoly in the production of X

$$MRT_{xy} < MRS_{xy}$$

or $$MRS_{xy} > MRT_{xy}$$

That is, when monopoly exists in the production of a commodity marginal rate of substitution between commodities will be greater than the marginal rate of transformation. In other words, consumers would like the commodity under monopoly production to be produced more but monopolists would not be producing the desired quantity of the commodity and will, therefore, be causing loss of satisfaction and misallocation of resources.

That monopoly causes loss of welfare and misallocation of resources will become very clear by considering Figure 42.1. It will be seen from this figure that the transformation curve of the community AB is tangent to the community indifference curve IC_3 at point E. Therefore, at point E marginal rate of transformation (MRT_{xy}) of the community between two commodities is equal to the marginal

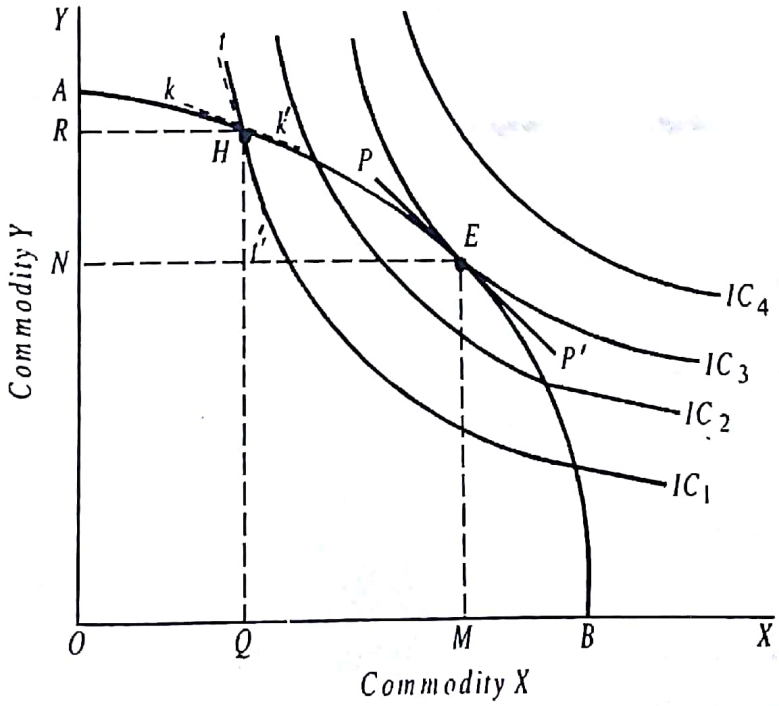

Fig. 42.1. *Monopoly as a Cause of Market Failure*

rate substitution (MRS_{xy}) of the community. Thus E represents maximum possible level of social welfare and the combination of two commodities being produced (*i.e.* OM of X and ON of Y) represents optimum allocation of resources.

But when the commodity X is being produced under conditions of monopoly, the equilibrium

will not be at point E, but instead it will be at point H. This is because, under monopoly, producers would be equating marginal rate of transformation (MRT) or ratio of marginal costs $\left(\frac{MC_x}{MC_y}\right)$ with the ratio of marginal revenues $\left(\frac{MR_x}{MR_y}\right)$ and not with the ratio of prices of two goods $\left(\frac{P_x}{P_y}\right)$. Since consumers would be equating marginal rate of substitution (MRS_{xy}) with the price ratio of two goods, the marginal rate of transformation in the equilibrium position at point H will not be equal to the marginal rate of substitution. This is quite obvious from Figure 42.1 where at point H transformation curve AB and consumers' indifference curve IC_1, are intersecting each other. This implies that slopes of transformation curve at point H, which indicates marginal rate of transformation, and the slope of consumers' indifference curve IC_1, which indicates marginal rate of substitution, are not the same. It will be observed from Figure 42.1 that at point H marginal rate of substitution between two goods ($MRSxy$) is greater than the marginal rate of transformation ($MRTxy$) between them as tangent tt', *drawn at point H* on the indiffrence curve IC_1 is greater than the slope of the tangent kk' drawn at point H on the transformation curve AB. This means that consumers' preferences require that good X should be produced more but because of the existence of monopoly in the production of commodity X, it is not being produced equal to the desired quantity. As a result, the level of satisfaction or welfare of the consuming community is at a lower level than possible under the given production conditions. Consuming community's satisfaction will be greater at point E which lies on indifference IC_3 but under conditions of monopoly in the production of X, equilibrium is at point H which lies on the lower indifference curve IC_1.

Thus monopoly causes loss of satisfaction or welfare. This loss of satisfaction or welfare is due to the fact that monopoly is not optimally allocating its resources between the production of two commodities according to the consumers' preferences. Given the transformation curve and consuming community's indifference map, the optimal production pattern is represented by the point E where OM amount of commodity X and ON amount of commodity Y are being produced. But under conditions of monopoly in the production of X, the equilibrium is established at point H where smaller quantity OQ of commodity X and larger quantity OR of commodity Y are being produced. Thus *monopoly has caused misallocation of resources has failed to achieve economic efficiency.*

EXTERNALITIES AND MARKET FAILURE

The existence of externalities is an important factor which prevents the achievement of Pareto-optimality (or maximum social welfare or economic efficiency) even when perfect competition prevails. *Externalities refer to the beneficial and detrimental effects of an economic unit (a firm, a consumer or an industry) on others.* The beneficial or positive externalities created by a consumer or a firm for others are known as external economies and detrimental or negative externalities imposed on others by a productive firm or a consumer are known as external diseconomies. To be more precise, *when an economic unit creates benefits for others for which he does not receive any payment, there exist external economies. On the other hand, external diseconomies occur when an economic unit inflicts costs on others for which he is not required to pay.*

It is noteworthy that the term "externalities" covers both the external economies and external diseconomies. When for a productive firm there exist external economies, that is, beneficial external effects, then the private marginal cost of the firm will be higher than the social marginal cost, since the firm will not take into account benefits external to it (*i.e.* benefits created for others). And the market price fixed on the basis of private marginal cost will not reflect the social marginal cost which will be lower when external economies occur. Similarly, when with the expansion of a firm external diseconomies occur, then the private marginal cost will be lower than the social cost, since the firm will not take into account the disadvantages caused to others by its activity. Thus, when external

diseconomies occur, price fixed on the basis of private marginal cost will be lower than that determined on the basis of social cost.

It follows from above that *in the absence of externalities*, all costs incurred and all benefits received by producers and consumers will be reflected in market prices and that there will not be any divergence between private and social costs (or benefits). But, *when externalities (external economies and diseconomies) occur, market prices determined on the basis of private costs and benefits will not truly reflect social costs and therefore divergence is caused between private and social costs (or benefits)*.

It follows from above that externalities arise primarily due to the fact that the effects regarding costs, output, employment, labour skills, technological capabilities of the activities of a producer or consumer on others or society as a whole are not reflected in market prices and therefore *market prices do not truly reflect social costs*. We shall give below a few examples of externalities, that is, external economies and diseconomies in production and consumption. The basic idea behind the belief that a competitive price system is optimal is based on the fact that a producer benefits himself only by benefitting the society because he makes available certain goods and services to the society. In other words, by promoting his own interests he promotes the interests of society as well. But there are so many cases in production and consumption "when members of the economy do things which benefit others in such a way that they can receive no payment in return or where their actions are detrimental to others and involve no commensurate cost to themselves."[1] Thus, due to externalities there arises the divergence between social and private costs and benefits.

1. External Economies (Positive Externalities) in Production

As the firm expands its scale of production, it becomes possible for the firm to produce a unit of product at a relatively lower cost due to internal economies of large-scale production. On the other hand, external economies occur when the expansion of a firm's output creates benefits, part of which goes to others. A firm may create external benefits for others in two ways : (*a*) By expanding its production, the firm may render a direct service to others such as training the labourers by its manpower training programme and thus benefit the other firms by making available skilled and trained labourers when they have to pay no cost or only nominal cost. (*b*) By expanding its production a firm may make the supply of some inputs cheaper for all the firms in the industry.

For example, an expansion in the production of an engineering firm may increase the demand for steel. And if the steel production is subject to internal economies of large-scale production, the expansion of steel industry following the increase in its demand will lower its cost and price. Another example of external economies is provided by the construction of a bridge or a highway which reduces transport cost and increases the land values in the neighbouring areas. Still another example of external economies of production is provided by the pumping of water from a mine. If a firm pumps out water from mine '*A*', it will lower the cost of pumping water from mine '*B*' owned by another firm. Similarly, bees of producers of honey create benefits for the owners of nearby orange groves, for the bees help pollinate oranges in the groves. On the other hand, orange groves create external economies for the honey producers since the orange groves provide nectar for the bees producing honey.

In all these cases, a firm incurs cost in its expansion but the benefits arising out of it are also reaped by others who pay no price for them.

External Diseconomies or Negative Externalities in Production

Let us explain some external diseconomies of production. There are a good number of external diseconomies which may be created by the productive activity of a firm. *The pollution of air* by the factories through emitting smoke and the wastes of factories poured into streams or ocean create

1. W.J. Baumol, *op. cit.* p.517

health hazard for men, especially those who live in the surrounding areas. For these external harms caused to the other members of the society, the firms are not required to pay any price. A factory owner pays nothing to the residents of the neighbouring colony who happen to be the victims of pollution by the factory. Another example of external diseconomies is provided by a firm or industry which has to keep more trucks on the road to do its business. This will overcrowd the road which will increase the transportation costs of other firms or industries which had to carry their own goods by trucks. The expanding firm or industry does not pay any price for the higher transport cost incurred by others.

Externalities in Consumption

External economies in consumption arise when the consumption of a person creates beneficial effects on others. Many examples of external economies can be given. For example, the satisfaction of a telephone owner increases with the increase in the number of telephone owners because he can now contact a larger number of persons on telephone. Likewise, if a person maintains a beautiful garden or lawn, he not only increases his own satisfaction but also that of others, especially his neighbours who also enjoy the look of his garden or lawn. Similarly, when a person maintains his car in such a way that it is quite safe to drive it and also does not emit any smoke, it will also improve others' safety and health and therefore welfare. In this category, we may also include the expenditure incurred by the parents on educating their sons. This will not only benefit them and their sons but also other members of the society. This is because the education makes a person civilised and a better citizen and therefore whoever comes in contact with him, derives satisfaction from him. Thus in the presence of external economies in consumption the social utility exceeds the private utility and therefore divergence between social and private benefits is caused when external economies in consumption prevail.

On the contrary, external diseconomies of consumption occur when a person's consumption creates unfavourable impact on other consumers. A good example of it is provided by the *conspicuous consumption* of a person who through demonstration effect causes a lot of dissatisfaction to friends and neighbourers who now feel themselves inferior to him. Likewise, when a person purchases candy bars for his children, it will make his neighbour's children unhappy because their parents cannot afford. Likewise, loud music played by your neighbour may disturb you and cause a lot of dissatisfaction. Also falls in this category the purchasing of a new Maruti Esteem by your friend because now your Maruti car 800 in your own eyes becomes outdated. More examples of such external diseconomies of consumption can be given.

HOW EXTERNALITIES CAUSE MARKET FAILURE ?

The existence of external economies and diseconomies explained above plays a significant role in determining the activities of production and consumption in the economy. A pertinent question is how these externalities can lead to the misallocation of resources and thereby act as on obstacle to the attainment of Pereto optimality or maximum social welfare. When externalities in production and consumption prevail and as a result divergence is caused between private and social costs and benefits, the economy guided by the market prices alone, even in the presence of perfect competition, will fail to achieve optimum allocation of resources (or, in other words, maximum social welfare). When external economies of production occur private marginal cost will be greater than the social marginal cost and when external diseconomies in production are present, private marginal cost will be lower than social marginal cost.

Under these circumstances, therefore, a firm which creates external benefits for others will not produce *its product* to the extent social interest requires. This is because equating price with the private marginal cost, which is higher than the social marginal cost, will result in *under-production of the product*. Thus in this case of the existence of external economies in production, output of the product determined on the basis of private marginal cost will be less than the socially optimal level of

output. This is illustrated in Figure 42.2 where *SS* represents the supply curve for the product of the industry which has been obtained by summing up the private marginal cost curves of firms. Due to the existence of external economies, social cost will be smaller than the private costs. Therefore, the supply curve *S'S'* (dotted) of the product reflecting social cost will be lower than the supply curve *SS* based on private marginal cost. The supply curve reflecting social cost is lower because it takes into account external economies generated by the production in the industry, while private cost does not take into account these external economies. It will be seen from the Figure 42.2 that the given demand curve and the supply curve *SS*, based upon the private cost of production, intersect at point *E* and thus determine *OQ* as the actual amount of the product produced. But the socially optimum output is *OM* at which the supply curve *S'S'* reflecting social cost intersects the given demand curve. It is thus evident that the product is being produced in smaller quantity than the socially optimum output *OM*. Thus, *the existence of external economies results in under-production and loss of social welfare equal to the area EKT.*

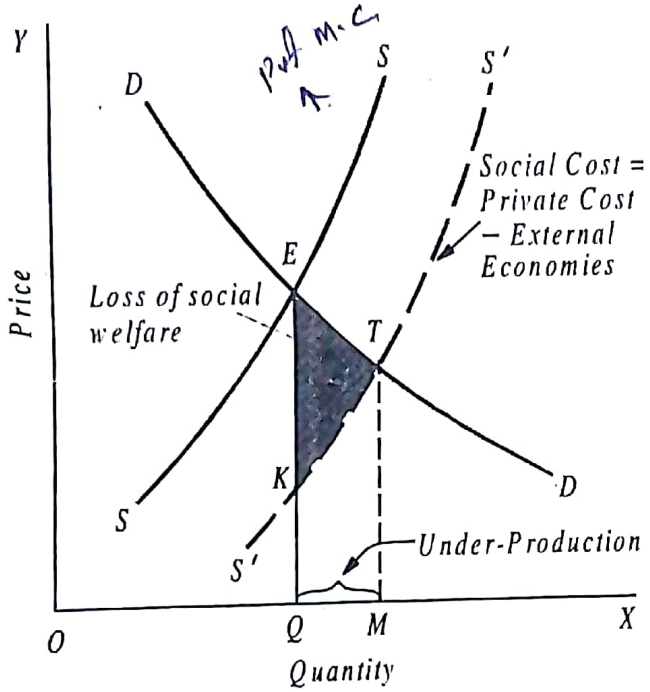

Fig. 42.2. *Under-Production in Case of External Economies in Production*

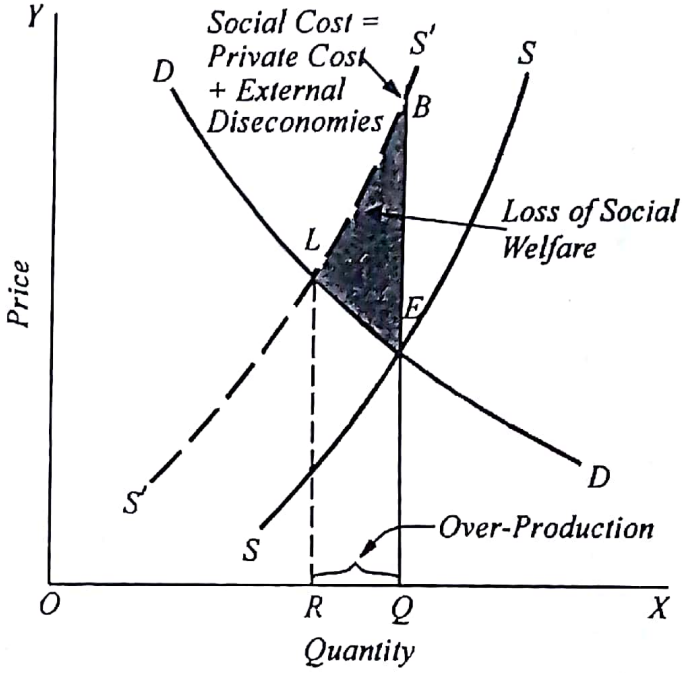

Fig. 42.3. *Over-Production in Case of External Diseconomies in Production*

On the other hand, when there exist external diseconomies in production, private marginal cost will be lower than the social marginal cost, since the former will not take into account costs or harms imposed on others. Therefore, when external diseconomies are present, equating price with marginal cost will result in over-production of the product, that is, more than socially optimum output will be produced. This is illustrated in Figure 42.3. It will be seen that the supply curve *SS* based on private marginal costs intersects the demand curve at point *E* and thus determines *OQ* amount of output. Supply *S'S'*) (dotted) which takes into account external diseconomies and therefore reflects social cost lies at a higher level and intersects the demand curve at point *L* and therefore socially optimum output will be *OR*. Thus, it follows *when external diseconomies are present, equating price with private marginal cost will result in over-production of the product, that is, more than socially optimum output will be produced and will cause a loss of social welfare equal to the area ELB.*

When there are external economies in consumption, then the demand curve for the product determined on the basis of private marginal utility will be lower than that based on social marginal utility, because the former will fail to reflect the external economies in consumption being generated. Therefore, in this case too, output determined on the basis of private marginal utility and demand will result in lower output than the socially optimum level. On the other hand, when there exist external diseconomies in consumption the private marginal utility will be higher than the social marginal

utility, since the former will not take into account the external diseconomies. As a result, when external diseconomies in consumption are present, the output determined on the basis of private marginal utility (benefit) will be more than the socially optimum level.

PUBLIC GOODS AND MARKET FAILURE

The existence of public goods provides us another important source of market failure. It should be noted that public goods are not necessarily produced by the public sector. It is due to the possession of certain properties that some goods are called public goods and has nothing to do with whether they are produced in the public sector or private sector. It is thus very nature of some goods that makes it difficult if not impossible for the markets to achieve Pareto optimality or economic efficiency. Two essential characteristics of public goods are that they are *non-rival* and *non-exclusive* in consumption. Let us explain these characteristics of public goods in some details.

Non-Rivalry in Consumption

In order to explain what are non-rival goods, it is better to know first what are *rival goods*. A rival good is one of which when one unit is consumed by an individual, that very unit cannot be consumed by another. For example, if Rekha consumes an apple, any other person, say Karishma cannot eat the same very apple. Of course, Karishma can get another apple for her consumption from the market by paying a price for it. Similarly, if Amit drinks Pepsi Cola, Bela cannot drink the same very pack of Pepsi Cola, that is, two individuals cannot consume the same very Pepsi Cola; its consumption by one individual excludes others to consume it. Thus goods like, apples, Pepsi Cola, shirts, machines and several such other goods, the consumption of which reduce their availability for other persons are called rival goods. Rival goods cannot be public goods, they are private goods.

On the other hand, *public goods are non-rival in consumption*. National defence, parks, television signals, flood control project, pollution control project, light house in the sea are some examples of public goods. Thus persons of a nation can enjoy (consume) equally the security provided by the national defence system. 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. National defence, 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 individuals does not reduce its amount available for others to consume. To conclude, public goods are non-rival.

Non-Excludiability

The other essential characteristic of a public good is non-excludiability in distribution of their consumption benefits. This non-exclusive nature of a public goods 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. We will explain later that it is due to the feature of non-excludiability of public goods that accounts for the failure of market in case of these goods to ensure Pareto 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 light house. 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 and Public Goods

It is easy to show how non-excludiability of a public good can lead to the market failure, that is, failure of market to achieve pareto efficiency. As explained above, non-excludiability 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, light house 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-excludiability 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, pollution abatement projects would not be extended to the socially desirable level in view of the non-excludiability and incentive to free ride.

Public Goods and Pareto Efficiency

Before explaining further how the free-rider problem results in less than socially optimal production of public goods, it is important to understand how Pareto optimal level of production of public good is determined. Because public goods are non-rival in consumption, some modifications are required in formulation of Pareto optimality conditions. To illustrate the conditions of Pareto - optimality in case of public goods we take the case of a society composed of two persons A and B and the public good is the pollution control project aimed to clean air which if produced would benefit both of them. But the two persons may not perceive to receive the same amount of marginal benefits from this pollution control measure. In other words, they may have different evaluation of the marginal benefits of pollution control measure. Each person will place some value on the pollution control. The marginal benefits they obtain or values they place on the different quantities of pollution abatement are depicted in Figure 42.4.

Due to differences in tastes or perceptions of two individuals, the curve showing marginal benefits from the pollution-free air are different, the curves MB_A and MB_B depict the marginal benefits obtained by individual A and B respectively from the varying quantities of pollution-free air. *The marginal benefit curve can also be interpreted as the price which the individuals are willing to pay for the different quantities of pollution free air.* Thus, it will be seen from the marginal benefit curves that individual A will be willing to pay price Q_1A_1 for OQ_1 quantity of pollution-free air, whereas individual B is willing to pay Q_1B_1 for the same OQ_1 quantity of the pollution-free air. Similarly, for OQ_2 quantity of the pollution-free air, the individual A is wiling to pay price equal to Q_2A_2 and individual B is willing to pay price equal to Q_2B_2. Therefore, the marginal benefit curves can be interpreted as the demand curves of the individuals for pollution-free air. It should also be noted that

the marginal benefits or the price which the individuals are willing to pay depend on the values they place on the different quantities of the pollution-free air.

In order to determine the Pareto-optimal quantity of pollution-free air we need the total market demand curve or the aggregate marginal benefit curve of the individuals comprising the society. Market demand curve for a public good cannot be obtained in the way market demand curve is obtained in case of private goods. Since a private good is rival in consumption, the market demand curve of it is obtained by adding up sideways (*i.e.* horizontal addition) of the demand curves (*i.e.* marginal benefit curves) of the two individuals. But, as explained above, public goods are non-rival in consumption, that is, in case of public goods same units of output can be consumed by various people at the same time. Therefore, different individuals can pay for the same units of a public good at the same time. Thus, a pollution control project renders the air of a town free of pollution to some degree from which everybody in the town is benefited and should pay for it.

Consider Figure 42.4, where it will be seen that individual A is prepared to pay price Q_1A_1 for OQ_1 quantity of pollution-free air and the individual B is prepared to pay price Q_1B_1 for the same OQ_1 quantity of pollution-free air which he enjoys or consumes at the same time as individual A. Thus, for OQ_1 quantity of clean air, the total price which the two individuals are willing to pay equals $Q_1A_1 + Q_1B_1 = Q_1M$. Similarly, for the same OQ_2 quantity of pollution-free air, individual A is prepared to pay price equal to Q_2A_2, and individual B is prepared to pay price equal to Q_2B_2. Thus, the total price which the individuals together are willing to pay for the same OQ_2 quantity of the good is equal to the sum of these two prices, *i.e.* $Q_2A_2 + Q_2B_2 = Q_2N$. It therefore follows that in case of a public good market demand curve is derived by *summing up vertically* the demand curves of the individuals

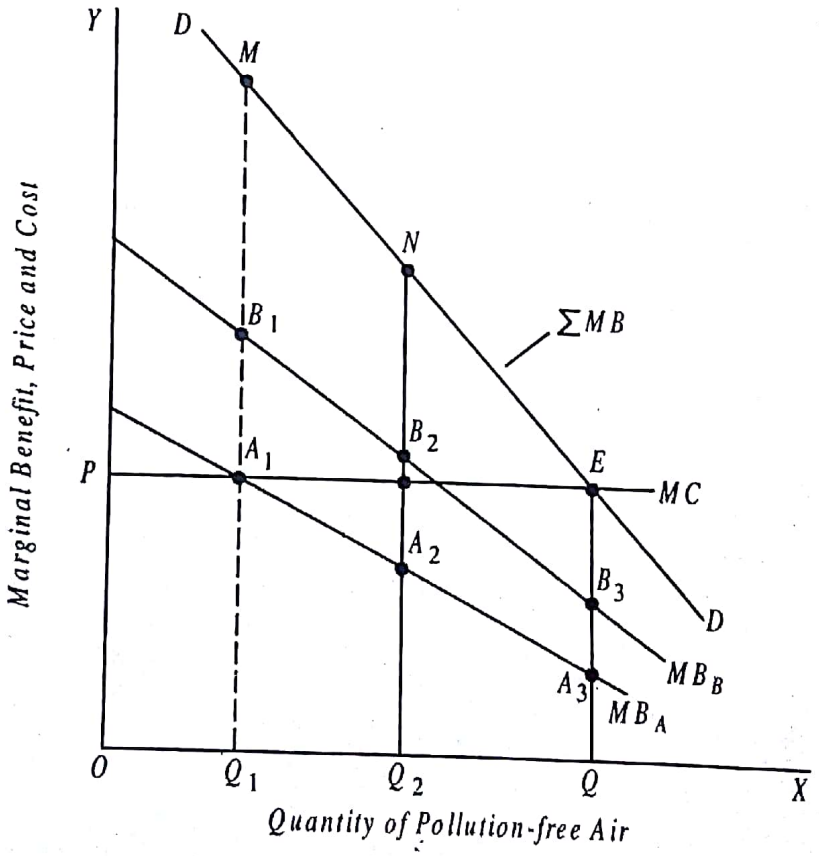

Fig. 42.4 *Public Goods and Pareto Optimality*

because each individual consumes the same units of the good at the same time.

Having now obtained the market demand curve of a public good we can now show what will be the Pareto-efficient output of a public good. In this connection it should be noted that a society has to bear the costs it incurs on labour and materials to produce pollution-free air. Pareto efficient level of output is determined at which the price, which the individuals together are willing to pay for the good

(that is, aggregate benefit), equals the marginal cost of production. Suppose the marginal cost of production is equal to *OP* per unit and remains constant. In Figure 42.4, with *OP* as the constant marginal cost, *MC* is the marginal cost curve. It will be observed from the figure that price which the two individuals together are willing to pay equals marginal cost (*MC*) at *OQ* quantity of pollution free air. As said above, price which the persons are willing to pay indicates the aggregate marginal benefit. Thus, aggregate marginal benefit and marginal cost of production are equal at *OQ* level of output of pollution-free air. If resources are allocated to the pollution control project to the extent that *OQ* quantity of pollution-free air is produced at which price (marginal benefit) equals marginal cost incurred the social welfare (*i.e.*, the aggregate benefits of the two individuals) will be maximum. Thus *OQ* is Pareto-efficient level of output of the public good.

Public Goods and Market Failure

But a private firm will produce Pareto optimum output *OQ only if each individual pays a price equal to the marginal benefit*. At *OQ* output marginal benefit of pollution free air is QA_3 for individual *A* and QB_3 for individual *B*. If both are willing to pay prices equal to these marginal benefits, the aggregate price per unit which they together will pay for Pareto efficient quantity *OQ* amounts to *OP* or $QE = QA_3 + QB_3$. In this way total revenue collected by the private firm will cover the cost of pollution control project which cleans the air and therefore will be worthwhile for the private firm to undertake the pollution control project.

But, as explained above, due to inability of the producer of a public good to exclude those who do not pay and want to be free-riders, the costs of optimal level of output cannot be covered by a private producer. Therefore, in this situation too little or even none of the public good will be produced though the marginal benefits of additional units (*i.e.*, the value the individuals place on these additional units) exceeds the social marginal costs of producing these units. Thus, private production and functioning of market in case of public goods do not lead to Pareto efficiency in the provision of public goods. Hence it is the maturity of a private firm to exclude who do not pay for it and want to be free riders that is responsible for private firms not producing them.

It may be further noted that in case of two individuals composing a society, there may not be much problem for an individual trying to be a free rider because of his being constantly watched and pressured by the other, but in the real world a society consists of *many* persons. There is incentive to the persons for misrepresenting the values they place (*i.e.* the benefits they receive) on public goods such as national defence, pollution control project, flood control programme, television signals, and apparently claiming that they have little interest in the provision of these public goods. Since a large number of individuals are involved, each one is likely to think that his not paying for the public good will not make much difference to the overall revenue and the amount of the public good that will be produced and he will be able to enjoy its benefits without making any contribution. This, of course, would be true if one individual tries to be a free rider. But, as is likely the case, if many individuals and may even all of them thinking in a similar way try to be free riders, then as explained above in Figure 40.4, enough revenue cannot be collected to cover the cost of production of a public good. In this situation there will be no production of a public good at all, at least its Pareto optimal quantity would not be produced. Thus the production of highly important and useful public goods such as national defence, pollution control project, flood control project, television signals may not be undertaken at all if we rely on private sector and market. This is glaring example of the market failure.

An interesting way of explaining market failure to achieve Pareto efficiency in case of public goods is to emphasise that marginal cost of allowing a person to consume the public good is zero *once it is produced*, even if it is possible to prevent him from consuming the commodity. Thus, parks, television signals, flood control projects etc. having been produced, the cost of letting additional consumers to consume these goods or their services is zero. For example, within good limits a visitor to a public park who has not paid is not to affect the enjoyment of the park by those who have paid for it, and it costs the society or a private producer nothing for this additional person visiting the park and

enjoying (consuming) it. In fact he would be made better off and no one would be worse off because no more resources of the society are used when the additional person is allowed to enjoy the park (i.e. marginal cost is zero). Now, if the marginal cost of permitting additional persons to consume the good is zero, then Pareto-efficiency requires that price of the public good should be zero. But the total cost of production of public goods is not zero; to produce public good is indeed very expensive. To meet these total costs of production private producer sets a positive price to cover cost. Consequently, price set will be higher than marginal cost and less than Pareto-optimal quantity will be consumed. *Thus production of a public good by the private sector does not lead to Pareto-optimality in allocation of the good.* In other words, market fails to achieve Pareto efficiency in the production of public goods.

QUESTIONS FOR REVIEW

1. What is meant by optimum allocation of resources ? Show that monopoly leads to misallocation of resources.
2. What are the major sources of competitive market failure ? Explain briefly in each case why the competitive market does not always operate efficiently. *B.Com (Hons) D.U. 1998*
3. What are public goods ? What limits the possibility of the private supply of public goods ? *B.A. (Hons) D.U. 1998*
4. (*a*) What are the characteristics of a pure public good ?
   (*b*) What do you understand by the *free rider problem*
5. What is public good ? What are the economic implications of public goods ? *B.Com (Hons) D.U. 2002.*
6. Write a note on the role of externalities and public goods in causing market failure ?
7. Competitive markets fail due to market power, incomplete information, externalities and presence of public goods. Explain these concepts in support of your answer ? *B.Com (Hons) D.U. 1998*
8. When external costs are associated with the production of some goods, should the outputs of the goods on efficiency grounds are limited to a level at which the external costs are zero? Why or why not *B.A. (Hons) D.U. 1997*
9. Show that when there is externality in consumption, the equality of marginal rate of substitution across individuals may not provide a Pareto optimum outcome. *B.A. (Hons) D.U. 1996*
10. What is asymmetric information ? How does it prevent the achievement of Pareto efficiency.
11. How does asymmetric information in the market for lemons lead to market failure ?
12. Explain the problem of adverse selection and moral hazard in the insurance a market.

ment intervention is needed to improve market efficiency. However, it does not *necessarily* mean that government intervention will definitely improve efficiency. *Just as there are market failures, there are government failures too.* However, in our view, role of government is essential in the economy to achieve social objectives of efficiency, improvement in distribution of income, reducing unemployment and to provide public goods. Various market failures are explained in detail in a later chapter.

QUESTIONS FOR REVIEW

1. In welfare economics attempt is made to establish criteria or norms to judge the social desirability of economic policies. Explain.
2. What is meant by social welfare ? Is it possible to measure social welfare without interpersonal comparison of utility ?
3. What is meant by economic efficiency ? Is it right to ignore equity in distribution when it clashes with the objective of economic efficiency ?
4. What is new welfare economics ? Explain its approach to social welfare.
5. Explain three concepts of social welfare mentioning in each case the approach to the interpersonal comparision of utility.
6. What is meant by value judgements ? Explain their role in welfare economics
7. "Welfare economics and ethics cannot be separated.... Getting rid of value judgements would be throwing the baby away with the bath water" (I.M.D. Little). Examine critically.
8. What is meant by economic efficiency ? Does competitive market ensure economic efficiency ?
9. Explain exchange efficiency and production efficiency. How do competitive markets succeed in achieving them ?
10. What is meant by allocative efficiency ? A perfectly competitive economy ensures allocative efficiency and government intervention is not required. Discuss.
11. What are market failures ? Can government intervention correct them ?