Pareto Optimality

2. Efficiency in Production:

We may derive the marginal condition for Pareto-efficiency in production with the help of Fig. 21.1 which is called an Edge-worth box diagram. The dimensions of the rectangle in Fig. 21.1 represent the total available quantities, and x^0_2, of the inputs X_1 and X_2 that would all be used to produce the consumer goods Q_1 and Q_2. Any point in the box represents a particular allocation of the inputs over the production of the two goods.

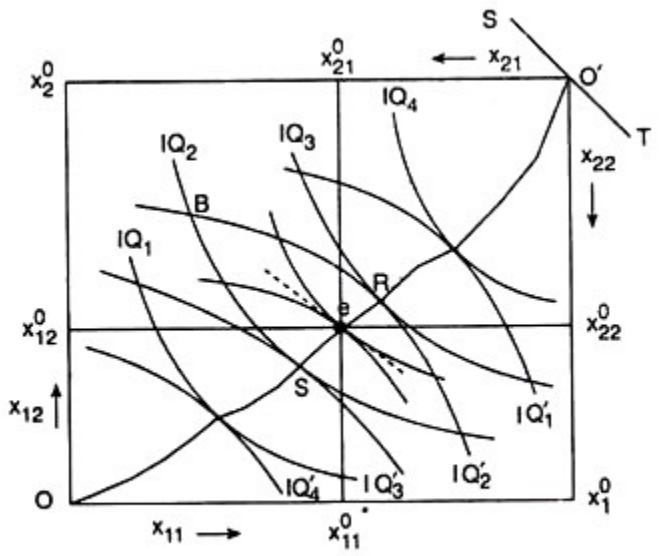

Fig. 21.1 Edgeworth contract curve for production

For example, if the allocation of the inputs is given by the point B, the quantities of X_1 and X_2 used in the production of good Q_1 are measured by the coordinates of B with reference to the origin O, and the quantities of X_1 and X_2 used in the production of good Q_2 are measured by the coordinates of point B with reference to the origin O'.

The isoquant (IQ) maps for goods Q, and Q_2 are given in Fig. 21.1 with reference to the points of origin O and O', respectively.

Now, the marginal condition for Pareto efficiency in production would be obtained if we maximise the output of good Q_1 subject to a

given output level of good Q_2. Such maximisation would occur at a point of tangency between the IQs for the two goods.

For example, maximisation of output of Q_1 subject to the quantity of Q_2 as given by IQ3, would occur at the point of tangency S between the IQs for the goods. Similarly, maximisation of output of Q_2 subject to the quantity of Qi as given by IQ_3, would occur at the point of tangency R between the IQs for the two goods.

However, at the point of tangency between the IQs for the two goods, we have numerical slope of IQ for good Q_1 = numerical slope of IQ for good Q_2

$MRTS_{X1,\ X2}$ or, in the production of Q_1 = $MRTS_{X1,X2}$ in the production of Q_2 (21.1)

Thus, the marginal condition for Pareto efficiency in production is given by (21.1) which states that the marginal rate of technical substitution (MRTS) between the two inputs should be the same in the production of the two goods.