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For The Students of (M.Com IInd semester)

EDGEWORTH BOX

Edgeworth box , named after F.Y. Edgeworth, is a powerful tool of economic analysis used for representing various distributions of resources. In its elementary form it was presented by Edgeworth in 1881, improved upon by Pareto and Bowley. The modern version is referred to as Edgeworth-Bowley box. This tool is used in general equilibrium analysis and also is an indicator of Pareto optimal distribution of resources, showing78 the level of social welfare. Here the explanation is in terms of a simple case of exchange of given quantities of the two commodities, X and Y between two individuals, A and B. The analysis can be extended to two groups and two countries too.

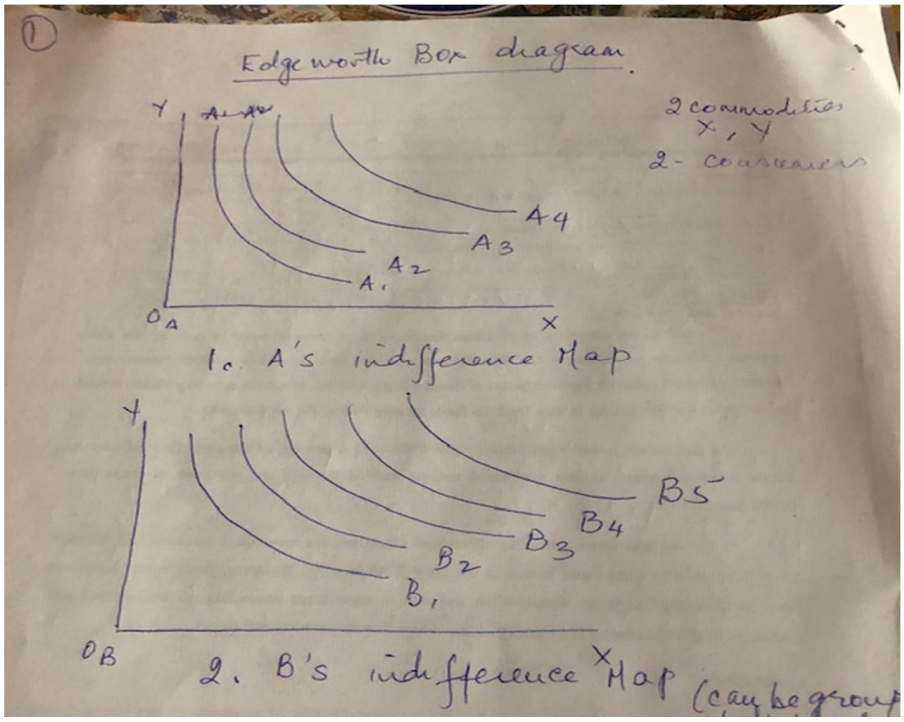

Figure 1: The indifference maps of A and B

The above diagram shows the indifference maps of two individuals representing their scale of preferences, with slope of indifference curves showing MRSy,x and

higher curve meaning higher utility and so on. Edgeworth box can be utilized to show that exchange between two individuals may lead to an increase in the welfare of an individual without causing a reduction in the welfare of the other, leading to an increase in the overall social welfare from a given bundle of resources. This is a Pareto improvement. A Pareto optimum exists when it is not possible to improve an individualôs welfare without reducing the welfare of the other individual (details in the chapter on welfare economics).

Coming to our analysis, to understand the optimum distribution of the given quantities of x and y between A and B, we superimpose indifference map of B over that of A to get a box like structure shown below.

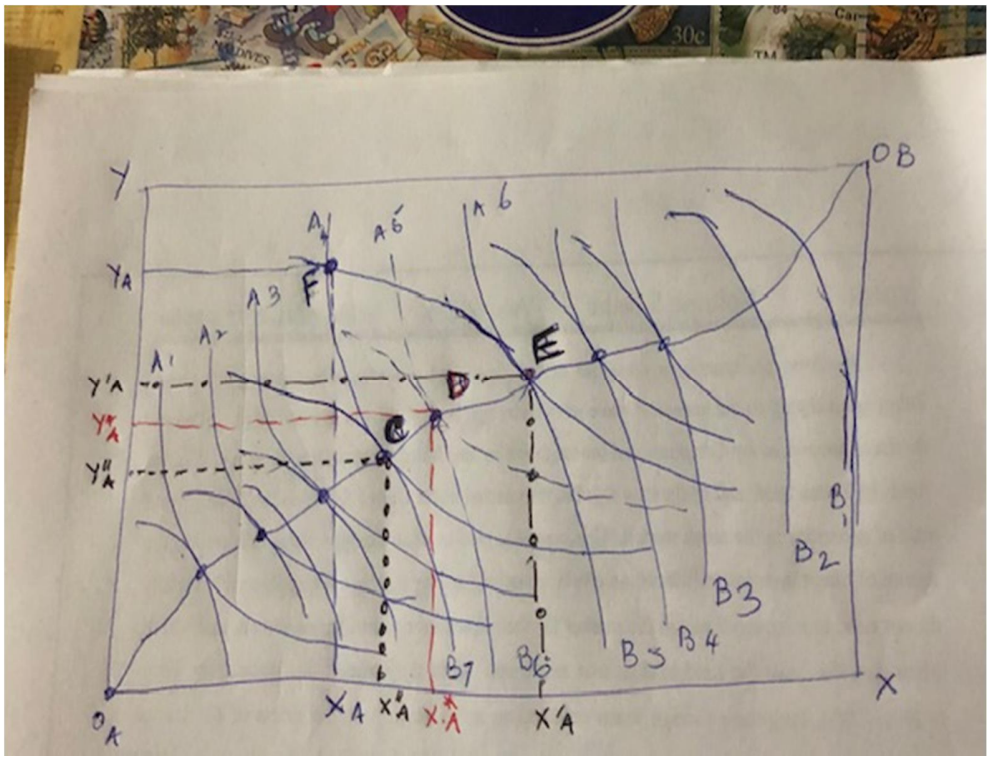

Figure 2: Edgeworth Box(refer to H.L.Ahuja / Koutsoyiannis)

O_A-origin point of A and O_B ï origin point of B. The horizontal axis shows given quantity- O_Ax of commodity x and vertical axis shows given quantity O_By of

commodity y. As indifference curves are labeled as A_1, A_2 and so on and Bs as B1, B2 and so on.

Any point of the Edgeworth box shows a certain distribution of the two commodities between the two individuals. The indifference curves of A and B are of opposite curvature and thus are tangential to each other. The locus of these points of tangency is Edgeworth contract curve, shown as O_A O_B in the figure above. Any point on the contract curve shows the equality of marginal rate of substitution between the two commodities for the two individuals (if it is not true for certain distribution then the indifferences curves tangency does not occur, as can be seen in certain cases). Thus at the points of tangency of the two indifference curves of A and B respectively, the following condition will hold:

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

Only the distribution on the contract curve represents an optimal distribution of resources, as any distribution off this curve represents lesser welfare for at least one individual. In figure 2 point F does not lie at the contract curve. At this point consumer A is having $O_A X_A$ of x and $O_A Y_A$ of y leaving X_A X of x and Y_AY of y for individual B. The level of welfare of A is given by IC A_4 and for B by IC B_5. This is a suboptimal distribution because any exchange which causes them to move at a point on the contract curve will result in the increase in welfare of either one of them or of the both.

If the individuals move to point E on the contract curve-with A having additional $X_A X\hat{o}_A$ of x and giving up $Y_A Y\hat{o}_A$ of y, his level of utility increases as he moves from IC A_4 to A_6 whereas B remains on the same level of welfare as points E and F lie on the same IC B_5. Thus the exchange which involves movement from a point off the contract curve to a point on the contract curve has improved the welfare of one individual without worsening the condition of the other. This is a case of Pareto improvement, resulting in an increase in social welfare- if we assume society to be made up of two individuals only.

Similarly a movement from F to C on the contract curve improves the welfare of B, as can be seen by his movement from IC B_5 to B_7 as a result of this exchange in which he is having Y_A and $Y\grave{o}_A$ additional units of y in Exchange of giving up $X\grave{o}_A$

X_A of x. If they move to point D then both are gainers as A moves from A_4 to A_5 and B moves from B_5 to B_6. So any distribution of resources in which the two individuals move on the segment denoted by segment CE on the contract curve leads to improvement in social welfare.

Ultimately which individual will be a greater beneficiary in this exchange process depends on the non economic factors, such as bargaining power of the two. But it is clear from this analysis that the distribution denoted by a point on contract curve represents an optimal distribution of resources as either one of them or both are beneficiaries by moving from a point off the contract curve to a point on it.

Edgeworth box is also a tool which can be used in the analysis of general equilibrium. In general equilibrium of production, the vertical and horizontal axes represent the two factor inputs and instead of ICs we have isoquants for products x and y. please refer to the General Equilibrium content already given and text book by H.L. Ahuja.
