Edgeworth Box Analysis: Two Consumers

Lecture 25
November 19 2002

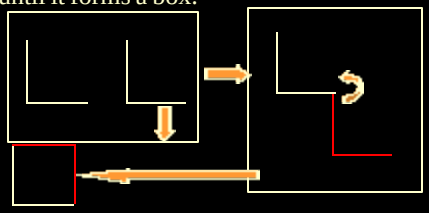
Slides adapted from slide set for *Microeconomics* by Pindyck and Rubinfeld, Prentice Hall, 1998.

The Edgeworth Box Analysis

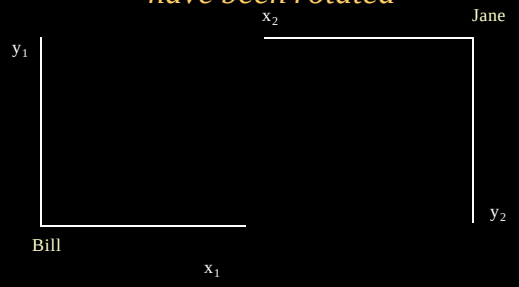
- Francis Edgeworth developed this method of analysis in the last portion of the 19th century.
- Provides a powerful way of graphically studying exchange and the role of markets.
- Understanding the Edgeworth Box is critical to understanding exchange and markets.

To Form and Edgeworth Box

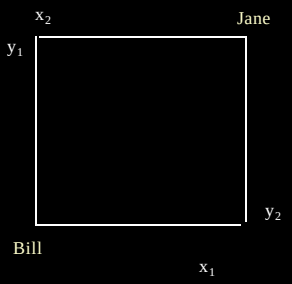
- Rotate one of the graphs onto the other one until it forms a box.



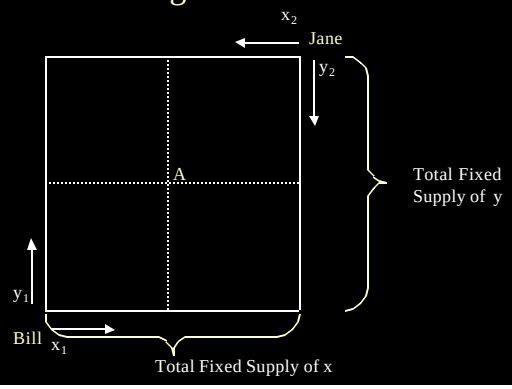
Here the axes for Jane have been rotated



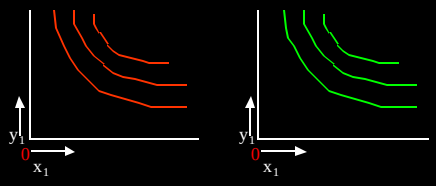
Move axes for Jane to close box



The Edgeworth Box

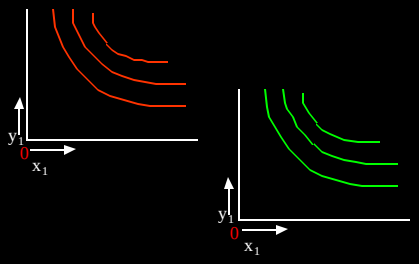


Consider two consumers and two products

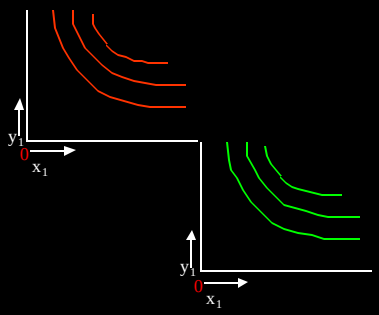


Bill Jane

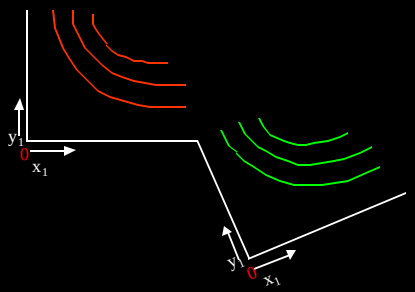
The Edgeworth Box



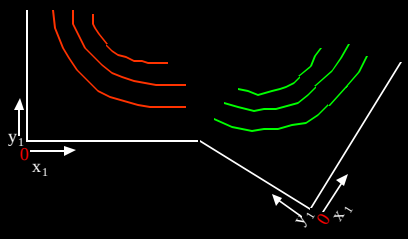
The Edgeworth Box



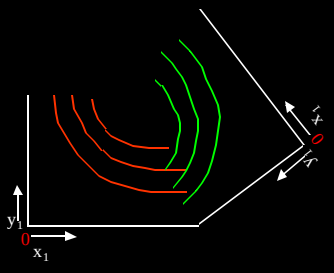
The Edgeworth Box



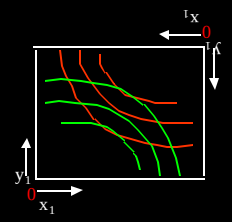
The Edgeworth Box



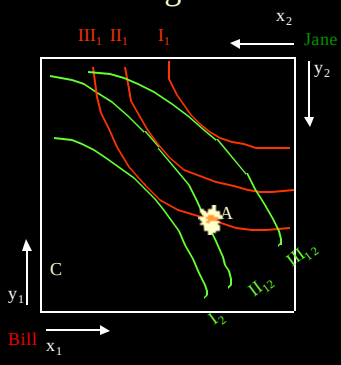
The Edgeworth Box



The Edgeworth Box

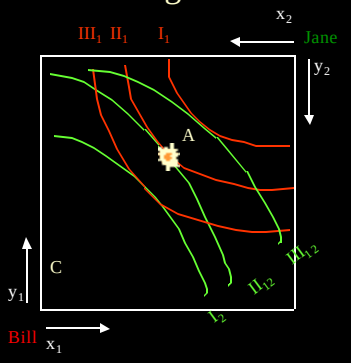


The Edgeworth Box



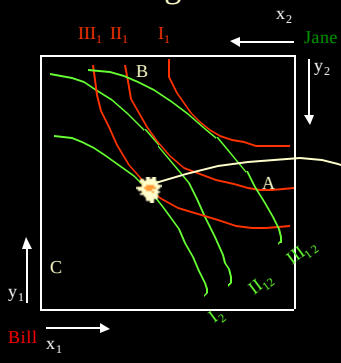
Trading area?

The Edgeworth Box



What about A here?

The Edgeworth Box

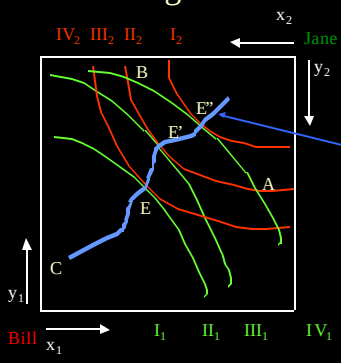


PARETO OPTIMAL

Pareto Optimal

- When no change can make one better off without making the other worse off.

The Edgeworth Box

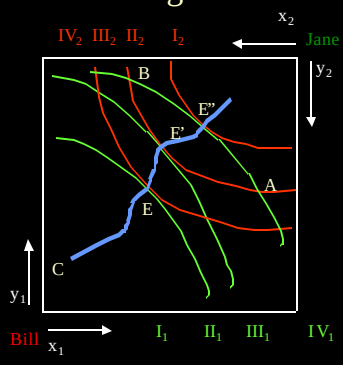


Contract line

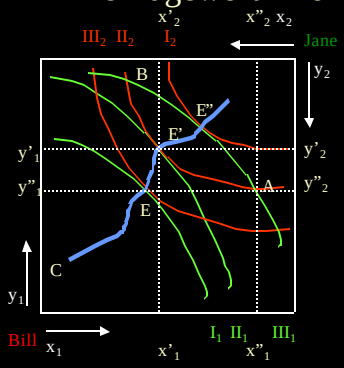
Contract Line

- Is the locus of Pareto optimal points

The Edgeworth Box

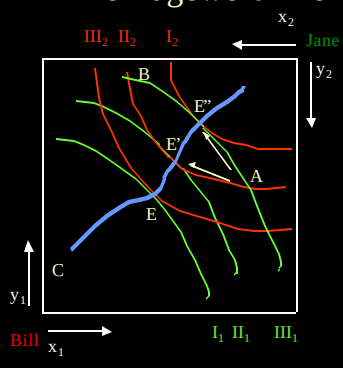


The Edgeworth Box



Pareto improving--from A or B to E or E"

The Edgeworth Box



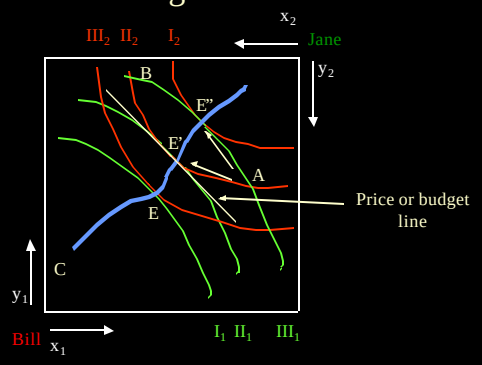
Understanding the Picture

- Any point in the Edgeworth box indicates a particular distribution of the two goods among the two individuals, e.g., Bill and Jane.
- Each individual has an indifference curve going through that point.
- If the distribution is Pareto optimal, those two indifference curves are tangent at that point.

Prices that are consistent with the Pareto optimal point

- At that tangency of the two indifference curves, the slope of the tangency line--the straight line drawn through the point of tangency--represents the relative prices for the two goods. Hence, there are relative prices that will be consistent with the Pareto optimum.

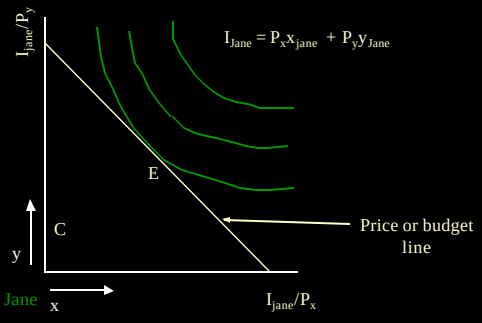
The Edgeworth Box



Tangent line is really a budget line for both individuals

- If one extends the tangent line to each axis, we now have a budget line.
- For example, the budget line for Jane is $I_{Jane} = P_x x_{jane} + P_y y_{Jane}$ where I is the income Jane could get from selling the X and Y she holds at the Pareto optimum point.

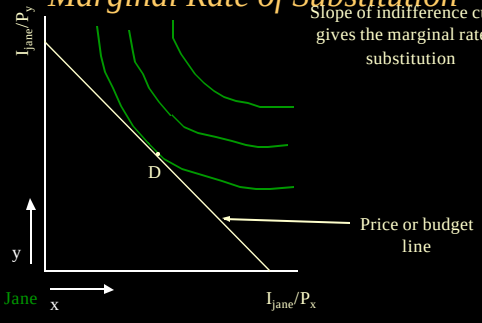
Budget Line for Jane



Marginal Rate of Substitution

- MRS_{xy} = the number of units of y one is willing to give up per unit of x and stay on same indifference curve.
- Slope of indifference curve gives the marginal rate of substitution.

Marginal Rate of Substitution



MARGINAL RATE OF SUBSTITUTION

$$MRS_{xy} = \frac{marginal\ utility\ of\ x}{marginal\ utility\ of\ y}$$

At point D

- Slope of indifference curve equals the slope of the budget line or
- $MRS_{xy} = -P_x / P_y$

NOW RETURN TO EDGEWORTH BOX ANALYSIS

- At point E', the indifference curve for Jane is just tangent to the indifference curve for Bill, and the price line is the tangency line at E. In other words,
  Slope(Indifference curve for Jane)
  = Slope(Indifference curve for Bill)
  = Slope of price line

The prices (ratio of prices) can produce the optimum

$$MRS_{xy}^{Jane} = -\frac{P_x}{P_y} = MRS_{xy}^{Bill}$$

The Edgeworth Box