14.01 Principles of Microeconomics, Fall 2007
Chia-Hui Chen
October 29, 2007

Lecture 19

Efficiency in Exchange, Equity and Efficiency, and Efficiency in Production

Outline

1. Chap 16: *Exchange Economy*

2. Chap 16: *Contract Curve*

3. Chap 16: *General Equilibrium in a Competitive Market*

4. Chap 16: *Utility Possibilities Frontier*

5. Chap 16: *Production in Edgeworth Box*

1   Exchange Economy

In the Edgeworth box (see Figure 1) given endowment E, the area between A's and B's utility curves contains all beneficial trades, but not all are efficient; that is to say, both A and B are better off in this area, but they will keep trading until they cannot make both of them better. Then the possible efficient allocation given the endowment E should satisfy that:

- there is no more room for trade,

- thus $MRS_A = MRS_B$.

2   Contract Curve

Contract curve shows all possible efficient allocations; it contains all points of tangency between A's and B's indifference curves (see Figure 2).

3   General Equilibrium in a Competitive Market

Assume that consumers are price-takers. There are two consumers, A and B, and two goods, X and Y, in the market. The total endowment of X is x units,
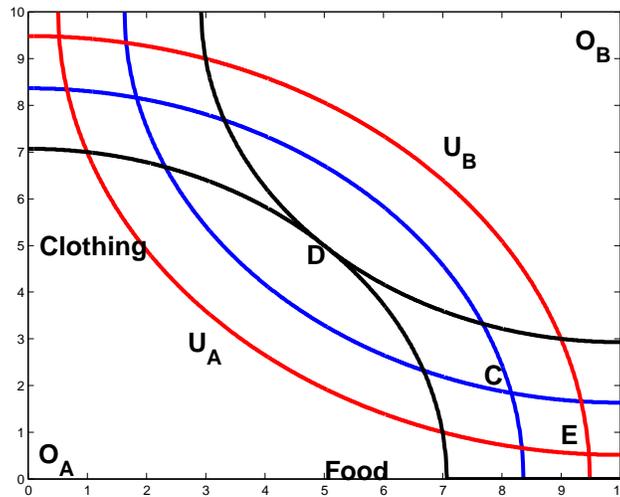
Figure 1: Finding the Efficient Allocation in Edgeworth Box.
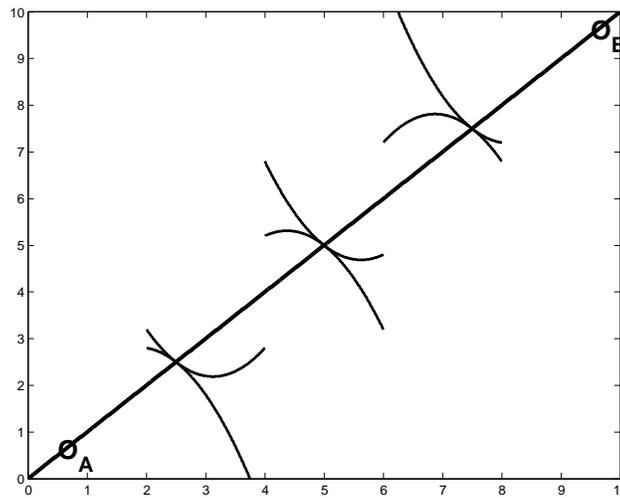
Figure 2: Contract Curve.

and the total endowment of Y is y units. Obviously, demand equals supply at equilibrium. We denote the equilibrium state by

$$(P_x^*, P_y^*, (x_A^*, y_A^*), (x_B^*, y_B^*)).$$

If we suppose A has one unit of X and two units of Y initially, the budget constraint is

$$x_A P_x + y_A P_y = P_x + 2P_y,$$

and divide it by P_y,

$$x_A \frac{P_x}{P_y} + y_A = \frac{P_x}{P_y} + 2;$$

so we only care about the price ratio $\frac{P_x}{P_y}$. For convenience, we usually set P_y^* to 1 so that the expression above has five unknowns. To find the equilibrium, several conditions should be satisfied:

- (x_A^*, y_A^*) maximize A's utility subject to the budget constraint, then we obtain two equations;

- (x_B^*, y_B^*) maximize B's utility subject to the budget constraint, likewise we can obtain another two equations;

- the quantity is conserved, or $x_A^* + y_A^* = x$ and $x_B^* + y_B^* = y$ (actually one of these equations is redundant because it is automatically satisfied given the preceding four and another from these two equations).

Finally, we obtain five equations. Therefore, the problem can be solved (see Figure 3). Assume that $y_A + y_B > Y$ and $x_A + x_B < X$; it is not at equilibrium, because $P_x > P_x^*$, so price of X will decrease. At equilibrium, we must have the right price ratio. For example, if the price for X is P_x, $P_x > P_x^*$, then $y_A + y_B > y$ and $x_A + x_B < x$. Y has excess demand, and X has excess supply.

4   Utility Possibilities Frontier

Utility possibilities frontier shows the utility levels when the two individuals have reached the contract curve (see Figure 4). Choosing a point below the frontier, for example, A, the allocation is inefficient; choosing a point above the frontier, for example, B, the allocation is unobtainable.

5   Production in Edgeworth Box

Now we discuss the producer's problem. There are two industries. One produces food and the other produces clothing. The isoquant curves are shown in the Edgeworth box (see Figure 5). E is their initial endowment of inputs. An
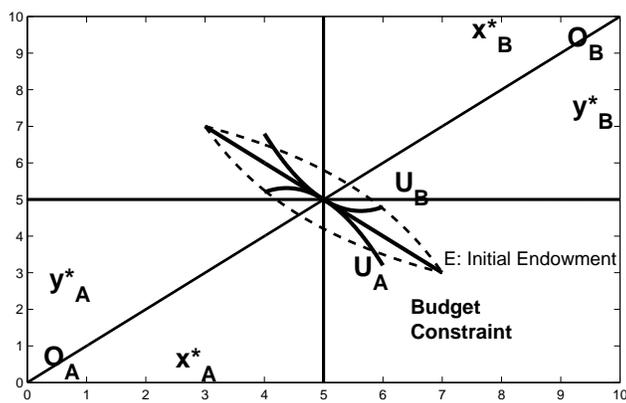
Figure 3: Contract Curve.
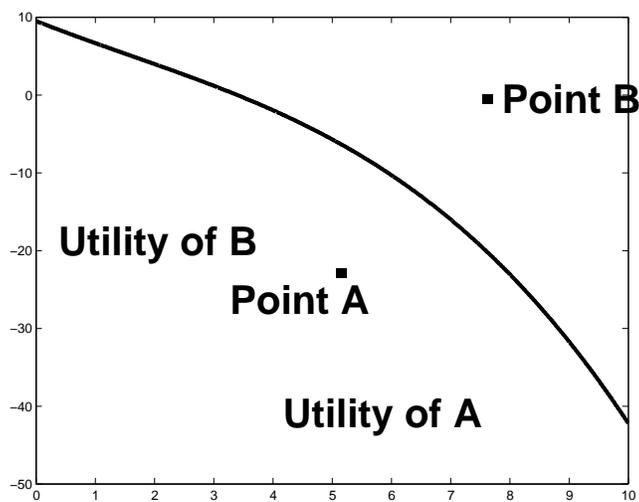
Figure 4: Utility Possibilities Frontier.

allocation of inputs is technically efficient if the output of one good cannot be increased without decreasing the output of another, so

$$MRTS_F = MRTS_C.$$

At competitive equilibrium in the input market,

- wage and rent are equal for all industries;

- total L and K in all industries are equal to aggregate available supplies.

Similar to the consumers' problem, the general equilibrium can be characterized by

$$(w, r, (L_F, K_F), (L_C, K_C)).$$

Production possibilities frontier shows various combinations of two goods that can be produced with fixed quantity of input demanded from production contract curve.
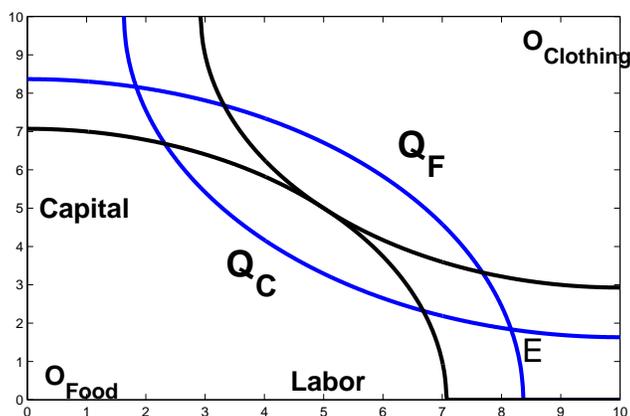

Figure 5: Production in a Edgeworth Box.