

# Chapter Summaries

## Chapter 3: The Fundamental Theorems of Welfare Economics

Chapter 3 demonstrates the First and Second Fundamental Theorems of Welfare Economics using the simplest 2-person (#1 and #2), 2-good (X and Y), and two-factor (capital (K) and labor (L)) general equilibrium model. The model has the following structural components and features.

1. K and L are supplied in absolutely fixed amounts by the two people, so that they are not a decision variable for them.
2. The markets for both goods and both factors are perfectly competitive and all the technical assumptions necessary for the economy to function as well as it possibly can are assumed to hold. These assumptions were described in Chapter 2.
3. The production functions for X and Y are assumed to be constant returns to scale. This implies that the revenues the firms receive from selling X and Y equal the payments by the firms to the capital and labor that they use. There are no pure economic profits to keep track of.
4. The three fundamental relationships in the economy are: the preferences of the consumers over X and Y, represented by their indifference curves; the production functions for X and Y, represented by their isoquants; and the equilibrium requirement of market clearance of each good, X and Y, and each factor, K and L.

The First Fundamental Theorem of Welfare economics says that if all the technical assumptions hold, then the perfectly competitive market economy is efficient or Pareto optimal. It automatically brings the economy to its utility possibilities frontier. The demonstration of the theorem consists of the following two propositions.

5. There are three conditions for the economy to be on its utility possibilities frontier:
  - a. *Consumption condition:* The marginal rate of substitution between X and Y ( $MRS_{X,Y}$ ) must be equal for both people.

- b. *Production condition*: The marginal rate of technical substitution between K and L ( $MRTS_{K,L}$ ) must be equal for the X and Y firms.
- c. *Consumption/Production condition*: The (equal) marginal rate of substitution between X and Y in consumption must be equal to the marginal rate of transformation between X and Y in production (the slope of the production possibilities frontier).  $MRS_{X,Y} = MRT_{X,Y}$ .

These three conditions are called the Pareto optimal conditions because if they hold then it is impossible to make someone better off without making someone else worse off. The economy is on its utility possibilities frontier.

- 6. These three conditions are satisfied if markets are perfectly competitive, because then the people and the firms are price takers and face the same prices for each good and factor:
  - a. *Consumption condition*: Each person equates the price ratio,  $P_X/P_Y$  to his  $MRS_{X,Y}$  to maximize utility. Therefore, with each person facing the same prices, their  $MRS_{X,Y}$  are equal.
  - b. *Production condition*: Each firm equates the price ratio  $P_L/P_K$  to its  $MRTS_{K,L}$  to produce its chosen output with the least amount of expenditure on K and L. Therefore, with each firm facing the same prices, their  $MRTS_{K,L}$  are equal.
  - c. *Consumption/Production condition*: The  $MRT_{X,Y}$  is the ratio of the marginal costs of producing X and Y,  $MC_X/MC_Y$ . In perfectly competitive markets, the firms supply X and Y such that  $P_X = MC_X$  and  $P_Y = MC_Y$ . Therefore  $P_X/P_Y = MRT_{X,Y}$ . But individuals set  $P_X/P_Y = MRS_{X,Y}$  to maximize their utility. Therefore,  $MRS_{X,Y} = MRT_{X,Y}$ , as required.
- 7. The economy reaches one point on the utility possibilities frontier when all three Pareto-optimal conditions hold. The Second Fundamental Theorem of Welfare Economics says that a perfectly competitive economy can reach all other points on the utility possibilities frontier with a suitable distribution of initial resources, in this case with all the different possible distributions of the fixed capital and labor between the two people.

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## VARIABLE FACTOR SUPPLIES

The Appendix to the chapter considers the case of *variable factor supplies*, in which the supplies of capital and labor become decision variables for the two people.

8. Variable factor supplies give rise to five more Pareto-optimal conditions that are necessary for the economy to be on its utility possibilities frontier, consisting of all the different possible combinations of goods and factors. For example, the  $MRS_{X,L}$  must be equal for both people, and equal to the  $MRT_{X,L}$  (the marginal product of labor in the production of X). These additional Pareto-optimal conditions do hold if the people and the firms are price takers and face the same prices for the goods and factors.