Chapter 11: General Competitive Equilibrium

Outline and Conceptual Inquiries

Determining Efficiency in Production

Allocation Condition 1 (Opportunity Cost Condition)
What is the cost of being inefficient?
What do oil changes and brake repairs have in common?

Application: Economies of Scope in Endangered-Species Protection

Allocation Condition 2 (Marginal Product Condition)

Allocation Condition 3 (Comparative Advantage Condition)
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Application: Comparative Advantage and China’s Export Patterns

Determining Economic Efficiency

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Deriving Pareto Efficiency with More than One Type of Household Preferences

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What is the problem when Friday arrives?

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Efficiency in Production

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Optimal Reallocation of Endowments

Why is a government required?

Application: Distribution and Efficiency Resolved Interdependently

Confronting Imperfect Markets

What is the problem with imperfect markets?

Summary

1. An allocation of resources is production-efficient when no reallocation of resources will yield an increase in one commodity without a sacrifice in output from other commodities.

2. The necessary conditions for efficiency in production are the three allocation conditions concerning the opportunity cost of production (Condition 1), the marginal product condition (Condition 2), and comparative advantage in production (Condition 3).

3. Allocation Condition 1 (the opportunity cost condition) states that for production efficiency no more of one commodity can be produced without having to cut back on the production of other commodities.

4. The production possibilities frontier is the locus of Pareto-efficient output levels for a given set of inputs and production technology. The negative of the slope of the production possibilities frontier is the marginal rate of product transformation (MRPT). MRPT measures the rate at which one output can be substituted for another, holding the level of inputs constant.

5. In the short run, concave production possibilities frontiers result in the short run from the Law of Diminishing Marginal Returns. In the long run, specialized input and factor intensities will result in concave production possibilities frontiers.

6. Economies of scope, yielding a concave production possibilities frontier, exists when one firm jointly producing a set of products results in a higher level of output than a set of separate firms each uniquely producing one of the products.

7. Allocation Condition 2 (the marginal product condition) states that for production efficiency, resources should be allocated to the point where the marginal product of any resource in the production of a particular commodity is the same no matter which firm produces the commodity.

8. Allocation Condition 3 (the comparative advantage condition) states that for production efficiency, if two or more firms produce the same outputs, they must operate at points on
their respective production possibilities frontier where their marginal rates of product transformation are equal.

9. The necessary conditions for economic efficiency are the three production-efficiency conditions, with the additional condition that what firms produce is what consumers’ desire (output efficiency). For Pareto-efficient allocation to result in the right commodities being produced, the marginal rate of substitution must be equal to the marginal rate of product transformation.

10. A perfectly competitive market will yield economic efficiency. Market prices are signals for agents to allocate their resources efficiently. Society’s problem of efficient allocation of resources is decentralized and solved at the individual-agent level. The only information communicated among agents is market prices.

11. Free markets take the distribution of initial endowments as given, so unless some optimal initial distribution of endowments is mated with free markets, social welfare may not be maximized. One role for government is to reallocating the initial endowments in an effort to enhance social welfare. This requires knowledge of agents’ preferences. Many public-assistance programs designed to reallocate endowments require an application to reveal the household’s preferences and endowments.

Key Concepts

| absolute advantage | economic efficiency |
| Allocation Condition 1 | economies of scope |
| Allocation Condition 2 | increasing returns to scope |
| Allocation Condition 3 | marginal product condition |
| comparative advantage | marginal rate of product transformation |
| comparative advantage condition | opportunity cost condition |
| constant returns to scope | output efficiency |
| decreasing returns to scope | production contract curve |
| diseconomies of scope | production possibilities frontier |

Key Equations

\[ \text{MRTS}_1 = \text{MRTS}_2 = \ldots = \text{MRTS}_k \]
Allocation Condition 1.

\[ \text{MRPT}(q_2 \text{ for } q_1) = \text{MC}_1/\text{MC}_2 \]
The ratio of the marginal costs of producing two outputs with a given level of resources is equal to the marginal rate of product transformation.

\[ \text{MP}_L|_{\text{firm } 1} = \text{MP}_L|_{\text{firm } 2} = \ldots = \text{MR}_L|_{\text{firm } n} \]
Allocation Condition 2.

\[ \text{MRPT}_{\text{firm } 1} = \text{MRPT}_{\text{firm } 2} = \ldots = \text{MRPT}_{\text{firm } n} \]
Allocation Condition 3.

\[ \text{MRS}_1 = \text{MRS}_2 = \ldots = \text{MRS}_n = \text{MRPT} \]
For output efficiency, how much consumers are willing to pay for an additional unit of a commodity is equal to the cost of supplying this additional unit.
TEST YOURSELF

Multiple Choice

1. Allocation Condition 1 (the opportunity cost condition) requires that
   a. $\text{MP}_L|_{\text{firm } 1} = \text{MP}_L|_{\text{firm } 2} = \ldots = \text{MP}_L|_{\text{firm } n}$
   b. $\text{MRTS}_1 = \text{MRTS}_2 = \ldots = \text{MRTS}_k$
   c. $\text{MRS}_1 = \text{MRS}_2 = \ldots = \text{MRS}_k$
   d. $\text{MRPT}_{\text{firm } 1} = \text{MRPT}_{\text{firm } 2} = \ldots = \text{MRPT}_{\text{firm } n}$.

2. The production contract curve is comprised of commodity bundles that are all
   a. On the production possibilities frontier
   b. Levels of output that maximize social welfare
   c. Efficient input allocations
   d. Both a and c.

3. If an economy is producing at a point on the production possibilities frontier,
   a. It is not possible to increase the production of one commodity without decreasing the production of the other
   b. The production of the two commodities is production-efficient
   c. The MRPTs for each commodity are equal
   d. The requirements for Allocation Conditions 1 and 2 hold.

4. Consider the following graph:

   ![Graph](image)

   What is the opportunity cost of increasing the output of $q_1$ from 6 to 10?
   a. 1 units of $q_2$
   b. 2 units of $q_2$
   c. 3 units of $q_2$
   d. 4 units of $q_2$. 
5. The slope of the production possibilities frontier is equal to
   a. $-\text{MRTS}$
   b. $-\text{MRP}$
   c. $-\text{MU}_1/\text{MU}_2$
   d. $-\text{MRPT}$.

6. With economies of scope, the marginal rate of product transformation of $q_2$ for $q_1$
   a. Decreases as $q_1$ increases
   b. Increases as $q_1$ increases
   c. Increases $q_2$ increases
   d. Increases as both $q_1$ and $q_2$ decrease.

7. The production possibilities frontier will be concave if
   a. There are diminishing marginal returns
   b. There are decreasing returns to scale
   c. If the opportunity cost of producing one commodity increases as more of it is produced
   d. All of the above.

8. Economies of scope occurs when
   a. LAC declines as output increases
   b. One firm produces a greater amount of output by producing outputs jointly than two or more firms producing the outputs
   c. LMC declines as output increases
   d. MRPT($q_1$ for $q_2$) declines as $q_2$ increases.

9. Allocation Condition 2 (the marginal product condition) requires that
   a. $\text{MP}_L|_{\text{firm 1}} = \text{MP}_L|_{\text{firm 2}} = \ldots = \text{MP}_L|_{\text{firm }n}$
   b. $\text{MRTS}_1 = \text{MRTS}_2 = \ldots = \text{MRTS}_k$
   c. $\text{MRS}_1 = \text{MRS}_2 = \ldots = \text{MRS}_k$
   d. $\text{MRPT}_{\text{firm 1}} = \text{MRPT}_{\text{firm 2}} = \ldots = \text{MRPT}_{\text{firm }n}$.

10. Given $\text{MP}_L|_{\text{firm 1}} > \text{MP}_L|_{\text{firm 2}}$, which of the following is correct?
    a. Firm 1 will produce all the output
    b. Output would rise if labor was reallocated from firm 1 to firm 2
    c. $\text{MP}_{K|\text{firm 1}} < \text{MP}_{K|\text{firm 2}}$
    d. Output would rise if labor was reallocated from firm 2 to firm 1.

11. Allocation Condition 3 (the comparative advantage condition) requires that
    a. $\text{MP}_L|_{\text{firm 1}} = \text{MP}_L|_{\text{firm 2}} = \ldots = \text{MP}_L|_{\text{firm }n}$
    b. $\text{MRTS}_1 = \text{MRTS}_2 = \ldots = \text{MRTS}_k$
    c. $\text{MRS}_1 = \text{MRS}_2 = \ldots = \text{MRS}_k$
    d. $\text{MRPT}_{\text{firm 1}} = \text{MRPT}_{\text{firm 2}} = \ldots = \text{MRPT}_{\text{firm }n}$.

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12. The following table illustrates the quantity of cars and airplanes that can be produced in the United States and Japan with the same amount of labor:

<table>
<thead>
<tr>
<th></th>
<th>Cars</th>
<th>Airplanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>48</td>
<td>16</td>
</tr>
<tr>
<td>Japan</td>
<td>60</td>
<td>15</td>
</tr>
</tbody>
</table>

a. The United States has a comparative advantage in cars and Japan has a comparative advantage in airplanes
b. The United States has a comparative advantage in airplanes and Japan has a comparative advantage in cars
c. The United States has a comparative advantage in cars and airplanes

d. Japan has a comparative advantage in cars and airplanes.

13. Production efficiency implies that

a. $MP_{L,firm_1} = MP_{L,firm_2} = \ldots = MP_{L,firm_n}$
b. $MRTS_1 = MRTS_2 = \ldots = MRTS_k$
c. $MRPT_{firm_1} = MRPT_{firm_2} = \ldots = MRPT_{firm_n}$
d. All of the above.

14. Which of the following conditions must be met for maximizing social welfare?

a. Allocation Condition 1
b. Allocation Condition 2
c. Allocation Condition 3
d. All of the above.

15. Consider the following graph:

Which of the following is correct?

a. Points A and B are Pareto-efficient but not output-efficient
b. Point A is both Pareto-efficient and output-efficient
c. Points A and B are both output-efficient
d. Point B is output efficient but is not Pareto-efficient.

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Short Answer

1. The necessary conditions for production efficiency may be stated in three allocation conditions. List and describe these three conditions.

2. Graph an Edgeworth box diagram. Illustrate the points that satisfy Allocation Condition 1. Also illustrate how these points can be transformed into a production possibilities frontier.

3. How is the slope of the production possibilities frontier measured? Why is it negative?

4. Explain why we might expect the production possibilities frontier to be concave in both the short and the long run.

5. Define what is meant by economies of scope. How does this differ from economies of scale?

6. Given \( MP_L |_{\text{firm 1}} < MP_L |_{\text{firm 2}} \), explain how labor can be reallocated to increase the output from these two firms.

7. Demonstrate Allocation Condition 2 using an Edgeworth box diagram.

8. In a one-household economy, graphically illustrate a point that is production-efficient but is not output-efficient and another that is both production-efficient and output-efficient. Are both of these points economically efficient? Is social welfare maximized at these points? Explain.

9. Explain why, even with economic efficiency, there may be a role for government in improving social welfare.

10. In Chubbieville, the common marginal rate of substitution of French fries for potato chips is \( \frac{1}{2} \) and the marginal rate of product transformation is 2. Is this allocation of resources economically efficient? If not, how should resources be reallocated?
**Problems**

1. At Sports Company the production functions for bats $B$ and gloves $G$ are $B = K^{1/2}L^{1/2}$ and $G = K^{2/5}L^{3/5}$. Calculate MRTS($K$ for $L$) for each of these commodities. Suppose Sports allocates an equal amount of labor and capital to the production of each commodity. Does this satisfy Allocation Condition 1? Explain. If not, in which direction can Sports reallocate labor and capital to increase the output of both bats and gloves?

2. Suppose an economy has two firms (A and B) producing two outputs ($q_1$ and $q_2$). Each firm employs only labor in its production process and has 20 units of labor available. Firm A’s production functions are $q_1^A = 5L_1^4$ and $q_2^A = 3L_2^4$. Firm B’s production functions are $q_1^B = 2L_1^6$ and $q_2^B = 4L_2^6$. Derive and graph the production possibilities frontier.

3. Suppose an economy has two firms (A and B) producing one output ($q$). Each firm uses only labor in its production process and the firms have a total of 10 units of labor available. The firms’ production functions are $q_A = 10L_A - 3L_A^2$ and $q_B = 7L_B - 4L_B^2$. Determine the optimal levels of labor for the two firms and the quantity of output each firm will produce.

4. Fred and Barney are the only households who live in the Stone Age. They each have 8 hours to use for producing meat $M$ and vegetables $V$. The production functions for each commodity are $M = 3L_M$ and $V = \frac{3}{2}L_V$. Fred’s utility function is $U^F = M^2V$ and Barney’s is $U^B = MV^2$.
   a. What is the equilibrium price ratio, $P_V / P_M$?
   b. How much meat and vegetables will each consume?
   c. How should labor be allocated?

5. The following table lists the quantities of soybeans and corn (in bushels) that can be produced in Argentina and the United States with the same level of resources:

<table>
<thead>
<tr>
<th></th>
<th>Soybeans</th>
<th>Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>100</td>
<td>25</td>
</tr>
<tr>
<td>United States</td>
<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

   a. Which country has an absolute advantage in the production of soybeans and corn?
   b. Which country has a comparative advantage in the production soybeans? Of corn?