3. Specific Factors and Heckscher-Ohlin Models

Learning Objectives

- Become familiar with formal economic models, including their limitations, that can be used to analyze "within country" distributional effects of international trade.
- Use these models to continue a formal analysis of common objections to free trade.
- Become familiar with empirical evidence relevant to factor proportions models and to issues such as "north-south" trade.

Readings

Paul Krugman and Maruice Obstfeld, International Economics, Theory and Policy, 8th ed. (2009). chapter 4, "Resources, Comparative Advantage, and Income Distribution".

Students interested in original sources may wish to see:

- Bertil Ohlin, Interregional and International Trade (1933)
- Paul Samuelson, "International Trade and the Equalization of Factor Prices", *Economic Journal* 58 (1948).
- Wolfgang Stolper and Paul Samuelson, "Protection and Real Wages," *Review of Economic Studies* 9 (1941).

Outline

1. The specific factors model may be viewed as an intermediate model between the simple Ricardian model and the more complex Hecksher-Ohlin model. It introduces the notion that distributional effect of trade liberalization within countries may be formally analyzed. Follow Krugman and Obstfeld's treatment for key insights.

2. The Hecksher-Ohlin(-Samuelson) model is a second "workhorse" model of international trade (the Ricardian model being the first). It assumes two production inputs, and thus has been used to examine the dynamics of distribution of gains from trade *within* a trading economy. Heckscher, Ohlin (1933), and Samuelson (1948) provide the core components of the model. It is also known as a *factor-proportions theory*. The basic assumptions are:

    a. Two economies, two goods, two factors of production

    b. Fixed coefficient, constant returns to scale technology. Differential factor intensities between the two output sectors. Identical technologies in both economies.

    c. Differential endowments of the production inputs between the two economies.

    d. Within each economy, each factor is homogenous and perfectly mobile between sectors, but immobile between economies.

e. No market distortions; competitive markets.

f. Identical tastes and preferences for the two goods in the two economies.

3. Basic model setup. Assume that two factors of production are used to produce two goods under conditions of constant returns to scale and competitive markets for inputs. For example, assume that the two factors of production is labor or land, *l*, and capital, *k*, and the two output goods are *x* and *y*.

a_{lx} = number of labor (or land) units required to produce one unit of good *x* in country1

a_{ly} = number of labor (or land) units required to produce one unit of good *y* in country1

a_{kx} = number of capital units required to produce one unit of good *x* in country1

a_{ky} = number of capital units required to produce one unit of good *y* in country1

Q_x = amount of good *x* produced

Q_y = amount of good *y* produced

L = number of labor (or land) units available in country1 (its labor "endowment")

K = number of capital units available in country1 (its capital "endowment")

Asterisks will denote parameters for country 2. Thus, a_{lx}^* = number of labor (or land) units required to produce one unit of good *x* in country 2. Given this setup, country one faces two input constraints:

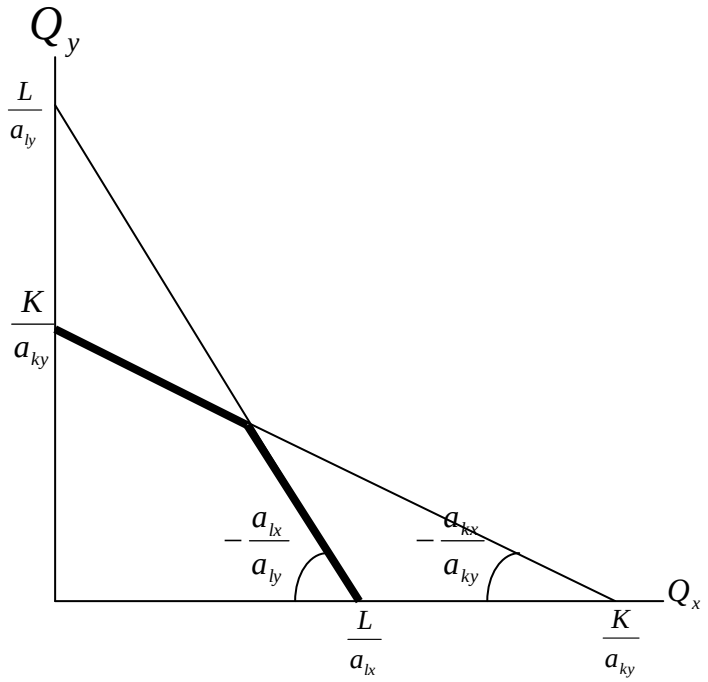
$$a_{lx}Q_x + a_{ly}Q_y \le L$$
$$a_{kx}Q_x + a_{ky}Q_y \le K$$

Efficiency in production implies that these input constraints are binding – that the economy produces on the "efficient frontier" of its production possibilities curve, which in this case is a linear function of the two input constraints. Thus,

$$Q_y = \frac{L}{a_{ly}} - \frac{a_{lx}}{a_{ly}}Q_x \qquad Q_y = \frac{K}{a_{ky}} - \frac{a_{kx}}{a_{ky}}Q_x$$

This input constraints and resulting production possibilities frontier is illustrated in Figure 1:

Figure 1



4. Output and factor prices. Determination of the production allocation depends on relative prices – the public valuation of the goods *x* and *y*. Define the wage rate for labor as *w*, and the rental rate for capital as *r*. The assumption of competitive markets and the normal profit conditions imply the following:

$$\pi_x = P_x Q_x - w a_{lx} Q_x - r a_{kx} Q_x = 0$$
$$\pi_y = P_y Q_y - w a_{ly} Q_y - r a_{ky} Q_y = 0$$

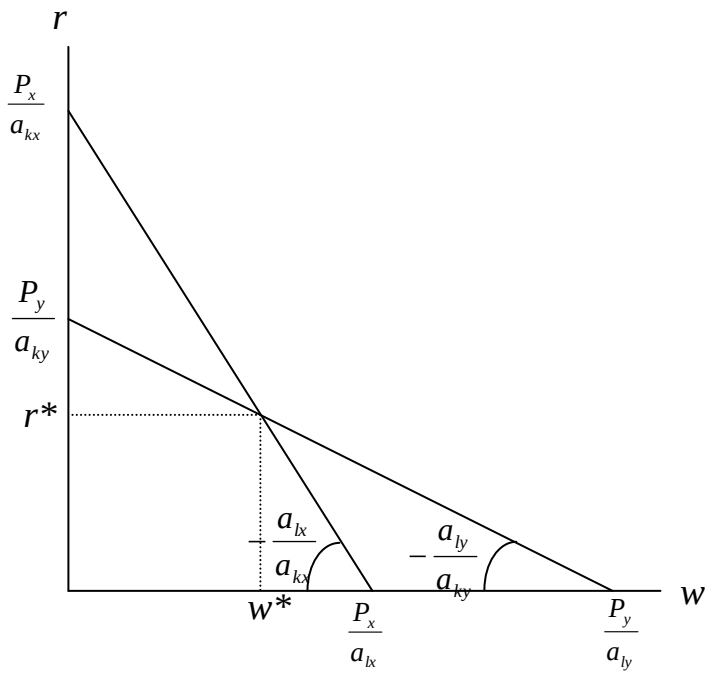
Simplifying …

$$P_x = w a_{lx} + r a_{kx}$$
$$P_y = w a_{ly} + r a_{ky}$$

This "price equals marginal cost" condition specifies equilibrium in the market for labor and capital. Figure 2 illustrates this factor price equilibrium.

$$r = \frac{P_x}{a_{kx}} - \frac{a_{lx}}{a_{kx}} w \quad r = \frac{P_y}{a_{ky}} - \frac{a_{ly}}{a_{ky}} w$$

Figure 2



The figure illustrates a situation in which good x is labor intensive,

$$\frac{a_{lx}}{a_{kx}} > \frac{a_{ly}}{a_{ky}}$$

5. Some key implications arising from this analysis:

   a. Pattern of trade. A country will have comparative advantage in goods which use its abundant factor intensively, and in general, a country will tend to export the good that uses its abundant factor intensively. (The "*Rybczynski Effect*".)

      The *Leontief Paradox* refers to empirical evidence that contradicts this prediction of the Hecsher-Ohlin model.

   b. Distributional effects. Under these conditions, any change that leads to an increase in P_x (or an increase in the price ratio $\frac{P_x}{P_y}$) results in an increase in the wage rate, *w*, and a decrease in the returns to capital, *r*. This result may be summarized as follows:

      > The benefits of an increase in the price of a good flow to those in possession of the factor used intensively in production of that good. (The "*Stolper-Samuelson effect*".)

   c. *Factor price equalization*. Under conditions of free trade, factor prices will tend to equalize across trading countries.

In reality, factor price equalization may not occur because:

1) Differences in technology and productivity rates may persist.

2) Transportation costs, the existence of non-tradable goods, and other barriers to trade may inhibit the process of factor price equalization.

3) Specialization may not occur because of extreme factor abundance.

Assignment 3

Discussion Questions

1. Assume that vis-à-vis France, the U.S. is land-abundant and that the production of food is land intensive. Use insights from the Hecksher-Ohlin model to explain why French farmers might oppose free trade with the United States.

2. State whether you agree or disagree with the following statements, and explain why.

   a. "The world's poorest countries cannot find anything to export. There is no resource that is abundant."

   b. Generally speaking, all trade between countries can be explained as a result of differences in technology or resources that give rise to comparative advantage.

   c. As low wage countries acquire modern technology and capital, their productivity will rise, giving them even more of a competitive edge against developed economies.

   d. Economic growth can never be a bad thing for a country's economic welfare.

   e. The factor price equilibrium theorem of the Hecksher-Ohlin model implies that American wages must fall to the level of those found in the least developed countries of the world.

3. The U.S. labor movement has traditionally favored limits on imports from less-affluent countries. Is this a shortsighted policy or a rational one in view of the interests of union members? How does the answer depend on the model of trade being used to analyze the question?

Problem Set

1. Suppose that at current factor prices cloth is produced using 20 hours of labor for each acre of land, and food is produced using only 5 hours of labor per acre of land.

   a. Suppose that the economy's total resources are 600 hours of labor and 60 acres of land. Use a diagram to determine the allocation of resources.

   b. Now suppose that the labor supply increases first to 800 and then 1,000, and then 1,200. Use a diagram similar to Figure 4-6 in Krugman and Obstfeld to trace out the changing allocation of resources.

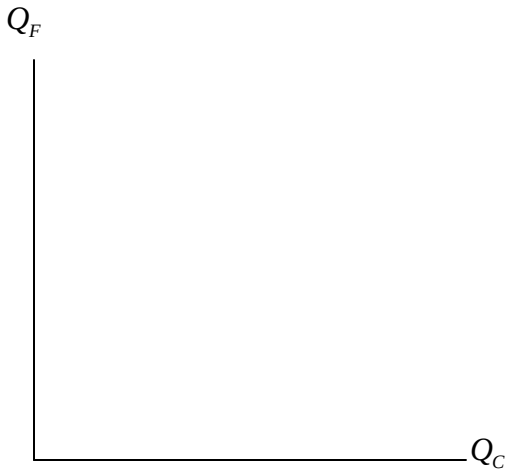
2. Assume the following information about a simple two-good, two factor economy. The two goods, food (F) and clothing (C), are produced with Land (T) and Labor (L), using technology described by these parameters:

   $a_{LF} = 4$ $a_{TF} = 8$ $a_{LC} = 20$ $a_{TC} = 5$ L = 200 T = 200

   a. Food is _____-intensive because _____.

      Clothing is _____-intensive because _____.

b. Write out and then graph the labor and land constraints on the economy's production possibilities.



c. Clearly label this economy's production possibility frontier.

d. Suppose that the labor supply were increased to 240. Show and explain why the expansion is biased toward one of the output goods. Which good?

3. Maintaining the technology and endowment assumptions from question #1, suppose that initially prices for the output goods are:

$$P_F = 8 \qquad\qquad P_C = 15$$

a. Write out the appropriate equations and graph the lines along which the price and production costs are equal for food and clothing. Determine the equilibrium wage rate for labor (w) and the rental rate on land (r).

b. Demonstrate graphically and show algebraically the effect if the opening of trade leads to a decrease in the price of clothing to 10 $P_C' = 10$