

If there is an equiproportional change in the wage rate and the rental rate, the slope of the isocost line will be unchanged. If wage rates rise, the demand for capital will rise. If rental rates rise, the demand for labor will rise.

Assuming that there are constant returns to scale in the production process gives us two important simplifications for:

1. The structure of the isoquants. If we know one isoquant and we know that there are constant returns to scale, we can determine all isoquants.
2. The cost minimization. The slope of the isoquant is the same in all the intersects of the isoquant and the isocost line. The line from the origin through all these intersects is called the *expansion path*.

Factor price equalization proposition (FPE): In a neoclassical framework with two final goods and two production factors, there is a one-to-one correspondence between the prices of the final goods and the prices of the production factors, provided both goods are produced. It states that if factor rewards (ω, r) are known, the price p can be derived and vice versa.

The FPE proposition has been extended by the statement of corollary, which states that prices of goods in two nations will be equalized by international trade. The same holds for rewards of production factors in two countries. We have to assume that the state of technology in the two nations is the same.

Lerner diagram: A diagram with the unit value isocost line and the unit value isoquant. So that:

- $\omega L + r K = 1$
- $p(m)LM = 1$ and $P(f) = 1$

If a good is produced under perfect competition then the price of the good is equal to the costs of producing the good. So there are no profits. If the price of manufactures rises, the unit value isoquant of manufactures will shift inward because fewer goods are needed to achieve one unit of value.

Stolper-Samuelson proposition: An increase in the price of a final good increases the reward to the factor used intensively in the production of that good and reduces the reward to the other factor of production.

Assuming that the relative capital intensity for manufactures is higher than for food, this leads to the conclusion that if the price of manufactures rises, the rental rate will rise and the wage rate will fall. The same applies for a rise in food prices rise, then the wage rate will rise and the rental rate will fall.

On the occasion of the Stolper-Samuelson result, a debate has started. The bases of this debate are different empirical observations in Europe and America, namely two different types of labor; high-skilled labor and low-skilled labor. OECD countries are relatively abundant in high skilled labor, while low-wage countries are relatively abundant in low-skilled labor.

- If trade of OECD countries with low-wage countries rises, the price of high-skilled intensive goods will increase.
- The OECD countries will then begin to produce more high-skilled intensive goods and less low-skilled intensive goods. The fall in low-skilled intensive goods is seen as a de-industrialization in the OECD countries.

Using the assumption made before that the production of manufactures is relatively capital intensive, we can conclude the following:

- If the available amount of labor rises, the output of the relatively labor intensive good, food, will rise.
- If the available amount of capital rises, the output of the relatively capital intensive good, manufactures, will rise.

Edgeworth Box: A tool used to analyze the relation between amount of output and amount of available production factors. The isoquants for both food and manufactures are used in this tool. The origin and axes of one of the isoquants rotates 180 degrees. (See p.120)

In economic equilibrium all available inputs must be used so that the labor and capital market are both in equilibrium;

$$K(m) + K(f) = K \quad \text{and} \quad L(m) + L(f) = L$$

The isoquant lines of manufactures intersect with the isoquant lines of food. These intersections are the points where the combination of inputs is efficient. The curve that connects all these points and crosses two origins is called the *contract curve*.

The basic reasoning of Rybczynski consists of three main steps:

- If we know the prices $p(f)$ and $p(m)$, we can determine the wage rate and the rental rate.
- If we know the wage rate and rental rate, we can derive the capital-labor ratios for both goods.
- From these two points above we can derive the equilibrium allocation of labor and capital in the two sectors.

If the available amount of labor rises, the isoquant for food will shift down. However, the wage-rental ratio will not change. The intersection of the expansion paths of food and manufactures is now closer to the origin than before. (See p.123) We can conclude this theory in a formula, where $\lambda(m)$ is the share of labor force in manufactures:

$$\frac{K}{L} = \lambda(m) \frac{K(m)}{L(m)} + (1-\lambda(m)) \frac{K(f)}{L(f)}$$

An increase in the total capital-labor ratio means that there is relatively more capital available. This must lead to a diversion of labor to the capital intensive sector.

The results of Rybczynski were used to understand the immigration from Russia into Israel in the 1990s. The enormous migration of Russians to Israel was a result of the changing skill composition in the labor force. The Russian immigrants had a high education level that was higher than the education level of the people in Israel. Even though many high-skilled Russians were leaving the country, the wage of the high-skilled workers in Russia increased. In Israel the production in high-skilled intensive sectors increased.

The Heckscher-Ohlin proposition leads to the following conclusions:

- A country that is relatively capital abundant will export the capital intensive good, manufactures, and will import the labor intensive good, food.
- A country that is relatively labor abundant will export the labor intensive good, food, and will import the capital intensive good, manufactures.

To understand everything about international trade flows we have to look both at the supply and the demand. Exports to a country can be seen as an excess supply of this country.

$$\text{Exports} = \text{Production} - \text{Consumption}$$

The supply curve determines the production level of goods and services and the demand curve determines the consumption level of goods and services. The assumption that has to be made is that all consumers in the countries have identical homothetic preferences. On the

occasion of this assumption we derive a utility function for all consumers. All consumers want to buy as many goods and services as they can, but they have to consider the prices of the goods and their income level. If we let C be the consumption level, I the income level and $\delta(m)$ the share of income spent on manufactures then the *budget constraint*;

$$I = p(m)C(m) + p(f)C(f)$$

And the *utility function*;

$$U = C(m)^{\delta(m)} C(f)^{1-\delta(m)}$$

Iso-utility curve: A curve that shows all consumption combinations to the same level of utility.

The intersects of the iso-utility curve and the budget constraint are the utility maximizing points. All these points together form the *income expansion path* starting from the origin. The slope of the income expansion path depends on the price ratio ($p(m)/p(f)$). An increase in the income level leads to an equiproportional increase in the consumption of goods.

Marginal Rate of Substitution (MRS): The absolute value of the slope of an iso-utility curve. Measures how a consumer can substitute one good for another good remaining the same utility level. Utility maximization when $MRS = p(m)/p(f)$
The iso-utility curve is then tangent to the income line.

Marginal Rate of Transformation (MRT): The absolute slope of the production possibility frontier (PPF). Profit maximization when $MRT = p(m)/p(f)$
The PPF is then tangent to the income line
In the Ricardian model the PPF is a straight line, but in the neoclassic model the PPF is a curve. The PPF curve in the neoclassic model is responsive to changes in the capital input and in the labor input. If capital stock rises the PPF will shift outwards. This outward shift is more in the direction of the manufactures because the production of manufactures is capital intensive. Similarly for a rise in labor input, then the PPF curve will also shift outwards but now more in the direction of food because the production of food is labor intensive. If the markets of production factors are perfectly competitive, and MC are the marginal costs, then: $MRT = MC(m) / MC(f)$

There are five types of economics agents involved in the international trade flows in equilibrium:

1. Laborers
2. Capital owners
3. Consumers
4. Producers of manufactures
5. Producers of food

A person can be two types at the same time. For instance, if a laborer buys something he/she is also a consumer. In the trade there is also distinguish between two trade flows namely, flows of goods and services and money flows. These flows are always moving in opposite direction.

An economy is in equilibrium if six conditions are satisfied:

1. Consumers maximize utility
2. Producers maximize profits
3. All laborers are employed
4. All capital is used
5. Supply of manufactures equals demand for manufactures
6. Supply of food equals demand for food

In the economy we distinguish between two different equilibriums:

- *The autarky equilibrium*; satisfies conditions at national level.
Utility maximizing and profit maximizing result in the following condition:
 $MRT = p(m) / p(f) = MRS$
The domestic demand equals domestic supply in this equilibrium.
- *The international trade equilibrium*; satisfies conditions at global level for final goods markets and at the national level for production factors.
In the international trade equilibrium we have the same condition as in the autarky equilibrium, namely;
 $MRT = p(m) / p(f) = MRS$
If the international trade equilibrium price for food is higher than the price in the autarky equilibrium, then production of food increases and the production of manufactures decreases. So that world demand equals world supply. The trade leads to trade gains and higher welfare for both countries.

If a country is a capital abundant, its PPF is more in the direction of manufactures. In autarky this country will specialize on manufactures. Similarly, if a country is a labor abundant, its PPF is more in the direction of food and in autarky it will specialize on food.

In autarky the price ratio ($p(m) / p(f)$) is higher in the country that is relatively labor abundant.

In international trade a commission can impose restrictions to protect a certain country or sector. A commission that can do this is the European Commission (EC). Some options for the EC are:

- Specific tariff: An specific amount to be paid per unit imported
- Ad valorem tariff: A percentage to be paid per unit imported
- Quota: Restrict the number of units imported
- Subsidize European production
- Subsidize the export of Europe
- Require a minimum content before the good may be labeled European
- Prohibit sale or import of a good

Over the years, the number of trade restrictions has fallen. This is a result of the work of the General Agreement on Tariffs and Trade (GATT) that now is transformed in the World Trade Organization (WTO). The decrease of the number of trade restrictions led to an increase in international trade and capital flows.

If a country is not involved in international trade the equilibrium is where domestic supply equals domestic demand, with price p_2 and quantity q_2 .

Suppose the world price is lower than the domestic price, then the price will be at p_0 . In this situation there is an excess demand. Therefore the amount $q_4 - q_0$ has to be imported to satisfy the demand.

The home country can decide to impose an ad valorem tariff t . The world price p_0 will be unchanged but the domestic price will rise to $p_0(1+t)$. Because of the fall in demand and the increase in the supply, the excess demand is reduced. This means that amount they have to import decreases, the amount imported is then $q_3 - q_1$. So the tariff leads to a reduction in the trade volume.

- The welfare for domestic producers, the producer surplus, has increased. This gain is shown by the area a.
- The welfare for the government, the government revenue, has increased. The government revenue equals imports x tariff. This gain is shown by the areas c.
- The welfare for consumers, the consumer surplus, has decreased. This loss is shown by the areas a, b and c.
- The areas b form the net welfare loss, this areas are called the Harberger triangles.