

PC1: Globalization and comparative advantages

Exercise #1: Gains of trade in general equilibrium

Consider a small economy where firms operate under perfect equilibrium. There are two industries: aircraft ('A') and textile ('T'), and two production factors: capital and labor, which are available in total amounts K and L and allocated between the two industries. Both production functions are of the Cobb-Douglas type:

$$Y_A = L_A^{\alpha_A} K_A^{1-\alpha_A} \text{ and } Y_T = L_T^{\alpha_T} K_T^{1-\alpha_T}, \text{ with: } L = L_A + L_T, K = K_A + K_T, \text{ and } 0 < \alpha_A, \alpha_T < 1$$

We focus on the short-term equilibrium, where capital allocation is rigid because airplane and clothes plants are difficult to restructure. We can therefore safely suppose that $K_A = K_T = 1$. Labor can be reallocated across industries and as a consequence, nominal wages equalize in the two industries: $w_A = w_T = w$. Let $p = P_T/P_A$ be the relative price of airplanes and clothes.

1) Autarky

The country is closed to international trade.

- Calculate the marginal rate of transformation (MRT), *i.e.* the forgone production of aircraft involved by the production of one marginal unit of textile. How does the MRT vary with Y_A and Y_T ? Plot the production-possibility frontier (PPF) in the (Y_T, Y_A) space. What does the PPF look like if $0 < \alpha_A < \alpha_T < 1$? Which sector is the most labor-intensive?
- Show that in the competitive equilibrium, the slope $\partial Y_A / \partial Y_T$ of the PPF is equal to $-p$.
- Choose any point of the PPF and plot the isovalue line, *i.e.* the locus of all sectoral combinations (Y_T, Y_A) which yield an identical *value* of total production.
- Suppose the consumer utility function is Cobb-Douglas: $U(C_A, C_T) = C_A^\beta C_T^{1-\beta}$ where C_i stands for consumption of good i ($i=A, T$). Write the first-order condition of utility maximization. Find the general equilibrium point on the previous figure. Let \hat{p} be the equilibrium relative price in autarky.

2) The open economy

The economy opens to international trade but capital remains immobile, both domestically and internationally. Since the economy is small, the relative price $p^* = P_T/P_A$ is exogenous and set by international competition, thus not necessarily at its autarkic level \hat{p} .

- Write the first-order optimality conditions on the supply and demand sides, and the trade balance equation.
- Represent graphically the equilibrium in the case where $p^* < \hat{p}$. Comment this outcome.

Exercise #2: Comparative advantages

There are two countries in the world named 'North' and 'South', each producing two goods '1' and '2' out of labor L .

Let y_{ij} be the production of good i in country j and y_j be the output of country j as measured in units of good 1, which is used as numéraire. p is the relative price of good 2 in terms of good 1.

The unit labor cost in each country is constant, *i.e.* the production function is linear: $L_{ij} = a_{ij}y_{ij}$ where L_{ij} is the amount of labor used in country j to produce good i . The corresponding numerical values are: $a_{1N}=2$, $a_{2N}=4$, $a_{1S}=3$ and $a_{2S}=12$.

The labor endowments of the two countries are $L_N = 4000$ and $L_S = 9000$. The consumption function is the same in the two countries: $c_{1j} = y_j/2$ and $c_{2j} = y_j/2p$ where c_{ij} is the volume-consumption of good i in country j .

1. The 'production-possibility frontier' (PPF) of country j is the locus of all production couples (y_{2j}, y_{1j}) that are feasible when labor L is fully employed. Plot the PPF in the space (y_{2j}, y_{1j}) . Compute the relative price p and the quantities of each good produced and consumed in each country in autarkic equilibrium.
2. What is the comparative advantage of each country? The two countries decide on a free trade agreement and exchange freely both goods. What are the new equilibrium prices?
3. Compute the production, consumption, exports and imports of each good in the free-trade equilibrium. Provide a graphical representation. How can the gains of trade be measured?