

## 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?