International Trade Problem Set #5
The Footloose Factor Model

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SETUP

Footloose Factor model

Remember: We have an immobile factor that is fixed to a country and a mobile factor that can move across boarders.

▶ Two countries: A and B. Both participate in the world market.

▶ They produce two goods: Food and clothing.
  ▶ Food requires labour as input factor
  ▶ Clothing requires both labour **and** capital as input factors.

▶ Labour is not mobile, while capital is mobile across countries (*footloose*).

▶ Technology is given by the following:
  ▶ Country A: Food requires $\alpha_{LF}^A = 2$, Clothing requires: $\alpha_{LC}^A = 4$, $\alpha_{KC}^A = 0.8$
  ▶ Country B: Food requires $\alpha_{LF}^B = 5$, Clothing requires: $\alpha_{LC}^B = 6$, $\alpha_{KC}^B = 1$

▶ Prices are denoted in units of food (or equiv. world price of food is given gy $P_F = 1$)

EXERCISE 1

> Country A: Food: $\alpha_{LF}^A = 2$ Clothing $\alpha_{LC}^A = 4, \alpha_{KC}^A = 0.8$
>
> Country B: Food: $\alpha_{LF}^B = 5$ Clothing $\alpha_{LC}^B = 6, \alpha_{KC}^B = 1$

a) Determine the maximal capital rental rate (denoted R) that each country can pay in dependence of the world price of clothing P_C?

- ▶ Let's look at Country A: Firms can at most pay a rental rate that will set their marginal benefits equal to their marginal costs: $P_C = \alpha_{LC}^A W_A + \alpha_{KC}^A R_A$
- ▶ Because labour can be employed in both sectors the wage must be equivalent. Thus we can determine the wage by looking at the Food sector: $P_F = \alpha_{LF}^A W_A \Rightarrow W_A = 0.5$
- ▶ Therefore the maximal rental rate that a firm in country A can pay is given by:
  $P_C = 2 + 0.8 R_A \Rightarrow R_A^{\max} = \frac{5}{4} P_C - 2.5$
- ▶ The solution for country B can be obtained in a similar fashion: $\Rightarrow R_B^{\max} = P_C - 1.2$

EXERCISE 1

> Country A: $R_A^{\max} = \frac{5}{4}P_C - 2.5$
>
> Country B: $R_B^{\max} = P_C - 1.2$

b) At which world price of clothing can country A offer a higher capital rental rate, at which world price country B?

▶ Country A can offer a higher capital rental rate if $R_A^{\max} > R_B^{\max}$.

$$R_A^{\max} > R_B^{\max}$$

$$\frac{5}{4}P_C - 2.5 > P_C - 1.2$$

$$P_C > 5.2$$

▶ Thus country A can offer a higher capital rental rate if $P_C > 5.2$ and country B can offer a higher rental rate if $P_C < 5.2$

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EXERCISE 1

> Country A: Food: $\alpha_{LF}^A = 2$ Clothing $\alpha_{LC}^A = 4, \alpha_{KC}^A = 0.8$
>
> Country B: Food: $\alpha_{LF}^B = 5$ Clothing $\alpha_{LC}^B = 6, \alpha_{KC}^B = 1$

c) Suppose that the world price of clothing is given by $P_C = 3\$$ and the world price of capital is given by $R = 1\$$. Which country produces which good(s)? What is the wage rate in each country?
  ▶ Due to perfect competition it must hold that marginal revenue equals marginal costs:
  ▶ Country A: Clothing sector: $P_C = 4W^A + 0.8R \Rightarrow W^A = 0.55$
  ▶ In question a) we have seen that in the food sector the firms can pay a wage at most equal to 0.5, which is below the wage in the clothing sector and hence the food sector will not be able to employ any labour. Therefore country A will produce only clothing.
  ▶ Country B: Clothing sector: $P_C = 6W^B + R \Rightarrow W^B = \frac{1}{3}$
  ▶ By the same argument as for country A, country B will only produce clothing because the wage in the clothing sector ($W^B = \frac{1}{3}$) is higher than the wage in the food sector ($\hat{W}_F^B = 0.2$).
  ▶ Both countries will only produce clothing.

EXERCISE 1
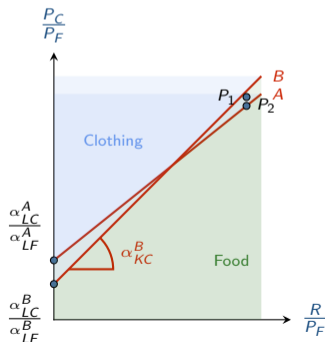
d) Draw a diagram with the rental rate on the X-axis and the price of clothing on the Y-axis, such as the one given in the lecture notes. The world price of food is given by $P_F = 1\$$. Draw a point (i.e. a combination of the world rental rate and the world price of clothing) at which country A produces only clothing and country B only food. Draw another point at which country A produces both food and clothing, and country B only food.

▶ To find the required points we need to find the lines at which both countries are indifferent between producing either good.

▶ Country A: $\frac{P_C}{P_F} = \frac{\alpha_{LC}^A}{\alpha_{LF}^A} + \alpha_{KC}^A \frac{R}{P_F}$

▶ If $\frac{R}{P_F}$ is below the value that satisfies this expression, i.e. if $\frac{R}{P_F} < \frac{P_C}{P_F} \frac{1}{\alpha_{KC}^A} - \frac{\alpha_{LC}^A}{\alpha_{LF}^A \alpha_{KC}^A}$ then A will produce only clothing.

▶ Equivalently if it is above the value it will only produce Food.

EXERCISE 1

d) Draw a diagram with the rental rate on the X-axis and the price of clothing on the Y-axis, such as the one given in the lecture notes. The world price of food is given by $P_F = 1\$$. Draw a point (i.e. a combination of the world rental rate and the world price of clothing) at which country A produces only clothing and country B only food. Draw another point at which country A produces both food and clothing, and country B only food.

- Country B: $\frac{P_C}{P_F} = 1.2 + 1 \cdot \frac{R}{P_F}$
- If $\frac{R}{P_F}$ is below the value that satisfies the previous equation, i.e. if $\frac{R}{P_F} < \frac{P_C}{P_F} - 1.2$ then B will produce only clothing.
- Equivalently if it is above the value it will only produce Food.
- If the rental rate is such that the expression holds with equality than the country is indifferent between producing either good
- Therefore at P_1 country A will produce only clothing and country B only Food, where as at P_2 country A will produce both goods and country B only food.