

# Homework 1

## Gains from Trade and The Ricardian Trade Model

ECO-13101 Economía Internacional I (International Trade Theory)\*

Question 5 must be submitted in class. The other questions are for your practice.

### Question 1: Gains from Trade Theorem

Consider an economy that can produce two goods,  $X$  and  $Y$ .

1. Show, graphically, that the gains from trade increase the more the world price ratio,  $p^*$ , deviates from the autarky price ratio,  $p^a$ .
2. Show, graphically, that the *gains from trade theorem* does not hold if the production possibility frontier is convex to the origin.

### Question 2: Basics of Ricardian Model

Consider a world with two countries - home ( $h$ ) and foreign ( $f$ ). The two countries can produce two goods - cheese ( $C$ ) and wine ( $W$ ) - with one factor of production - labor ( $L$ ) - using constant returns to scale production functions. The units of labor required to produce one unit of a good, also called unit labor requirement, are as follows:

1. What is the opportunity cost of cheese in terms of wine in each country?
2. If the two countries trade and the equilibrium world price ratio is  $p_C^*/p_W^* = 1$ , what is going to be the pattern of specialization? How is this dependent on the opportunity costs you calculated in the previous part? Is specialization complete?

---

\*Rahul Giri. Contact Address: Centro de Investigacion Economica, Instituto Tecnologico Autonomo de Mexico (ITAM).  
E-mail: rahul.giri@itam.mx

Table 1: Unit Labor Requirement

	Cheese	Wine
<b>Home</b>	$a_{LC}^h = 1$ hour per kilogram	$a_{LW}^h = 2$ hours per litre
<b>Foreign</b>	$a_{LC}^f = 6$ hours per kilogram	$a_{LW}^f = 3$ hours per litre

3. If the world prices of cheese and wine are given by  $p_C^* = p_W^* = 12$ , then what is the wage of home workers relative to the wage of foreign workers, i.e.  $w^h/w^f$ ? Compare it with the productivity of home relative to that of foreign in each sector. Using this comparison re-interpret the pattern of specialization derived in the previous part.

### Question 3: Incomplete Specialization Due to Trade Costs

Consider a world with two countries - home ( $h$ ) and foreign ( $f$ ) - which can produce and trade 5 goods - guns, wheat, cotton, cars and diamonds. There is only one factor of production - labor (L). Suppose country  $j \in \{h, f\}$  requires  $\alpha_i^j$  units of labor to produce one unit of good  $i$ ,  $i \in \{guns, wheat, cotton, car, diamonds\}$ .  $\alpha$  is often called the unit labor requirement. Suppose the cost of shipping one unit of a good from one country to another is  $D$  percent of the cost of producing one unit of the good. Wage in home is  $w_h$  and that in foreign is  $w_f$ .

1. *Derive and interpret* a general rule to determine whether good  $i$  is
  - (a) Imported by country  $h$ .
  - (b) Imported by country  $f$ .
  - (c) Not traded.

*(Hint - you import a good if importing it is cheaper than producing it in your country)*

2. Suppose  $w_h = 3$  and  $w_f = 1$  and  $D$  is 100 (percent). Using the rule derived in (1) and the information provided in Table 2 determine the pattern of trade for each good.

Table 2: Unit Labor Requirement

Good ( $i$ )	$\alpha_i^h$	$\alpha_i^f$
Guns	1	10
Wheat	5	40
Cotton	3	12
Cars	6	12
Diamonds	12	9

#### Question 4: Multiple Goods and Pattern of Trade

Consider a world with two countries - home ( $h$ ) and foreign ( $f$ ). There is only one factor of production - labor. Assume that both countries have equal endowment of labor. Wage in home is  $w_h$  and that in foreign is  $w_f$ .

- Let us start with the case where the two countries can produce and trade one good. Suppose country  $j \in \{h, f\}$  requires  $\alpha^j$  units of labor to produce one unit of the good, often also called the unit labor requirement. What is the relationship between the ratio of wage rates ( $w_h/w_f$ ) and the ratio of unit labor requirements ( $\alpha^f/\alpha^h$ ) under which:
  - Home country exports the good.
  - Foreign country exports the good.
- Let us now consider the case where there are 99 goods that the two countries can produce and trade. The unit labor requirement of good  $i$  in the home and in the foreign country is given by:

$$\alpha_i^h = \frac{i}{Z_h} \quad ,$$

$$\alpha_i^f = \frac{(100 - i)}{Z_f} \quad ,$$

where  $i = 1, 2, 3, \dots, 97, 98, 99$ .  $Z_h$  is the level of productivity with which home country can produce any good and  $Z_f$  is the level of productivity with which foreign country can produce any good. An increase in  $Z$  reduces the unit labor requirement of all goods in a country. Note that with these functional forms of the unit labor requirements we have that

$$\frac{\alpha_1^f}{\alpha_1^h} > \frac{\alpha_2^f}{\alpha_2^h} > \frac{\alpha_3^f}{\alpha_3^h} > \dots > \frac{\alpha_{97}^f}{\alpha_{97}^h} > \frac{\alpha_{98}^f}{\alpha_{98}^h} > \frac{\alpha_{99}^f}{\alpha_{99}^h} \quad ,$$

i.e. the goods are arranged in a decreasing order of relative unit labor requirement. Suppose  $Z_h = Z_f = 1$  and  $w_h = w_f = 1$ . Based on your answer to the previous part which goods will be exported by the home country and which goods will be exported by the foreign country? (*Hint: find the good for which  $\alpha^f/\alpha^h = w_h/w_f$  and then use the fact that goods are arranged in a decreasing order of relative unit labor requirement.*)

3. Suppose, due to an increase in the labor supply of the foreign country, the wage in the foreign country decreases to  $w_f = 0.25$ .  $Z_h = Z_f = 1$  and  $w_h = 1$ . Now, which goods are exported by the home country and which goods are exported by the foreign country? Interpret your answer.
4. Suppose, due to technological improvements, the productivity level of the home country increases to  $Z_h = 3$ .  $w_h = w_f = 1$  and  $Z_f = 1$ . Now, which goods are exported by the home country and which goods are exported by the foreign country? Interpret your answer.

**Question 5: Importance of Trade in Mexican Economy (Must be submitted in class)**

Go to the World Bank's World Development Indicators database -

<http://databank.worldbank.org/ddp/home.do?Step=12&id=4&CNO=2>.

For Mexico, download data on GDP (current US \$), Merchandise exports (current US\$), Merchandise imports (current US\$), Exports of goods and services (current US\$), and Imports of goods and services (current US\$).

1. Plot the ratio of Merchandise exports to GDP, Merchandise imports to GDP, and ratio of Merchandise trade (sum of merchandise exports and merchandise imports) to GDP on the same graph. How does the impact of NAFTA show up in this graph?
2. Compute the average of the three ratios above for 1960-1993 and 1994-2011. How large is the 1994-2011 average relative to the 1960-1993, i.e. how has the importance of merchandise exports, imports and trade changed between these two time period?

3. Compute (i) Exports of services as Exports of goods and services minus Merchandise exports to GDP, (ii) Imports of services as Imports of goods and services minus Merchandise imports, and (iii) Trade of services as Trade of goods and services (sum of exports of goods and services and imports of goods and services) minus Merchandise trade (sum of merchandise exports and merchandise imports). Plot Exports of services to GDP ratio, Imports of services to GDP, and Trade of services to GDP? Explain how export, import and trade in services relative to GDP has changed over time? What does this tell you about importance of services in Mexico's trade with the world? Is there something odd going in the graph?