

Problem Set 2 – Due September 28, 2011

1. **(Ricardian Model, Chapter 2)** Consider a Ricardian model of comparative advantage. There are two countries, the U.S. and India. Each country can produce two goods, shirts (S) and food (F). Assume the US has 1000 workers and India has 4000 workers. Labor productivity in each country is:

Labor Productivity by Country and Good

	United States	India
Shirts	8 shirts/day	4 shirts/day
Food	16 bushels/day	2 bushels/day

a) Which country has the absolute advantage in shirts?; in food? Explain.

- i What is the opportunity cost of producing food in the U.S.?; in India? What is the opportunity cost of producing shirts in the U.S.?; in India?

b) Derive and sketch the production possibility frontier for each country.

- i Assume that, prior to trade, the U.S. produces 4,000 shirts and 8,000 bushels of food, while India produces 8,000 shirts and 4,000 bushels of food. **Show** how it is possible, by altering production in each country, to increase total world output of both goods.
- ii Derive the world production possibility frontier (*i.e.*, find the maximum possible output of shirts, for each level of output of food).

c) In the absence of trade, what would autarky (no trade) **relative** prices be in each country? What would the real wage (in terms of each good) be in each country?

d) If trade is allowed between the two countries, what will the pattern of trade be (*i.e.*, what good will the US export and what good will it import), how does trade affect the real wage in each country and what can you conclude about the post-trade relative price of shirts?

e) Suppose the US and India, which already had an agreement to allow trade between them, agree to add China to their trade agreement (and assume none of these countries trades with any other country). Rewriting the earlier table, the productivity of all 3 countries is given by:

	United States	India	China
Shirts	8 shirts/day	4 shirts/day	9 shirts/day
Food	16 bushels/day	2 bushels/day	3 bushels/day

- i How will the addition of China to this agreement affect which good the US exports and which good India exports? Can you tell which good China will export? (a verbal, not a quantitative, answer is expected here).
- ii How will the addition of China to the US-India trade agreement affect the (free trade) equilibrium relative price of shirts (in terms of food)? A verbal answer suffices.
- iii How will the addition of China to the US-India trade agreement affect welfare (real wages) in the US and in India? Will both countries necessarily benefit by allowing China to join? Will China benefit by joining this free trade zone? Explain carefully.

2. **(Extension of Ricardian model to many goods)** To illustrate how the model can be extended to more than two goods, consider the following example:

Labor Productivity by Country and Good

	Cell Phones	Food	Motorbikes	Shirts	TVs
United States	4 phones/day	16 bushels/day	1 bike/day	8 shirts/day	3 TVs/day
India	1 phone/day	2 bushels/day	1 bike/day	4 shirts/day	6 TVs/day

- In which good(s) does the U.S. have an absolute advantage? In which good(s) does India have an absolute advantage?
- In which country is the opportunity cost of producing shirts lower? If the answer is ambiguous, explain why.
- Find autarky *relative* prices in each country (express the price of each good in terms of food).
- If trade were allowed, what can you predict about the pattern of trade? (*i.e.*, which goods the U.S. exports and which it imports)? Explain.
- Let W denote the U.S. wage and \bar{W} the Indian wage. Show where each good is produced based upon the ratio of wages (W/\bar{W}) between the two countries.
- Given relative labor supplies for each country, draw a graph to show how the equilibrium relative wage (US wage to Indian wage) is determined. Explain the graph.
- Use the graph to *discuss* how a increase in the Indian working population will affect: (1)US real wages; (2)the set of goods the US exports; (3)the relative prices of goods; and (4)Indian real wages.

3. **(Specific Factor Model, Chapter 3)** In the “simple” version of the specific factor model, there are two sectors (goods), one factor (labor) that is perfectly mobile between the two sectors, and one fixed – or specific – factor in each sector. To be concrete, suppose the two goods are food and clothing, the specific factor in food is “land” – represented by “T”, and the specific factor in clothing is “capital”, represented by “K”. The production functions for each sector are given by:

$$C = \beta(K)^{2/3}(L_c)^{1/3}; \quad F = (T)^{2/3}(L_f)^{1/3}; \quad \beta > 0; \quad \text{resource constraint: } L_c + L_f = L$$

where C, F are the outputs of clothing and food, L_c, L_f are labor employed in clothing and food, respectively, and “ L ” is the total available labor available in the economy. “ β ” is a productivity factor, so an increase in β represents an increase in productivity in clothing production.

- Derive the production possibility frontier for this economy (that is, express C as a function of F , and also of the resources available: K, T, L , and productivity “ β ”). Is it linear?
- Consider a market economy with labor mobility so that wages are equalized across the two sectors. Let P_c, P_f represent output prices and W the wage rate. Labor demand in each sector comes from profit maximization – **which entails equating the marginal value product of labor to the wage.**

- i Given output prices, show **graphically** how the equilibrium wage rate and the allocation of labor between the two sectors is determined.
 - ii Using the production functions, show **mathematically** how the equilibrium wage rate and the supply curve for each good (C , F) is determined (as a function of output prices and productivity β). Also, discuss how the returns to land and capital are determined.
 - iii Using your result in part ii, **given output prices**, show how an increase in the amount of land (T) available for production affects: (1)the quantity supplied of each good; (2)the real return to land; (3)the real return to capital; and (4)the real wage rate.
 - iv Given output prices, show how an increase in productivity in the clothing sector (an increase in “ β ”) affects the supply (output) of each good and the real return to each input.
- c) Now assume there are two countries, Canada and Italy, that are almost identical. They have the same tastes (the same demand curves), the same technology, and the same amount of capital and labor; **however**, Canada has more land than Italy.
- i Based upon your results from part (b), what predictions would you make concerning the autarky (no trade) relative price of clothing in Italy as compared to Canada? (a verbal answer suffices)
 - ii If trade is allowed between the two countries, what will the pattern of trade be and how will the relative price of clothing change in each country?
 - iii Finally, discuss how trade affects the real return to each factor (capital, land and labor) in each country. Does each **country** as a whole *potentially* gain from trade? Does each **interest group** (factor owner) in each country also gain? Be as precise as possible (a verbal answer suffices).