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International Trade
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Problem set 1

The point of this exercise is to practice using algebraic and geometric methods to analyze the international effects of a change in one country.

1. Suppose, as in the notes, that Canada has a comparative advantage in the production of corn. The two countries trade, and there is a small improvement in US umbrella technology. (The amount of labor required to produce one umbrella decreases in the US.) Assume that the exogenous change in technology is small enough that the equilibrium regime does not change; that is, a country produces a product after the change if and only if it also produced the product before the change. Show what happens to world price and to the countries' welfare under the three possibilities for the trade equilibrium: a) only the US is specialized; b) both countries are specialized; and c) only Canada is specialized.

Answer this question using the 0 profit conditions to determine equilibrium prices and real wages under the three possibilities.

The only (slightly) tricky part of this question concerns the situation where both countries are specialized in equilibrium. In this case, you need to know how the technological change alters the equilibrium relative price of umbrellas. The answer to this question is unambiguous. Begin with a common sense answer. (Think: improving the technology will cause supply to increase/decrease, and that change will cause the price of the commodity to increase/decrease.) Now convince yourself that this common-sense answer is correct. You can do this by using the world excess demand curve for umbrellas (or corn) studied in Chapter 2 of the notes. Find out how the technological change alters this excess demand curve. Using the assumption that the initial equilibrium was stable (see Chapter 2), you then know the direction of change in the equilibrium relative price of umbrellas. Once you have determined how the initial change in technology changes the equilibrium relative world price, you are in a position to say something about the change in welfare, using the definition of "real return to labor".

2. Suppose that in Bolivia four labor hours are required to produce a bottle of llama milk and six labor hours are required to produce a salteña. In Chile, ten labor hours are required to produce a bottle of llama milk and "A" labor hours are required to produce a salteña.

(a) Under what conditions on A will:

i) Bolivia have a comparative advantage in llama milk?

and ii) The post trade wages possibly be equal in the two countries?

Briefly explain your answer.

(b) Chile and Bolivia have decided to also trade with Peru who can produce a bottle of llama milk with six labor hours and a salteña with six labor hours. Suppose $A = 8$, and each country has 240 units of labor. Discuss the pattern of the trade between these countries. Draw the world PPF explaining each region on the frontier.

(c) Consider again only Bolivia and Chile, and let $A = 8$. Suppose Bolivia experiences a technological improvement so it can now produce a bottle of llama milk in two labor hours. How will this alter trade?

3. Everyone in the world has Leontieff preferences, and for all price ratios each person consumes 2 beers for each slice of pizza. The world price of a slice of pizza is \$4.00 and the world price of beer is \$1.00. Venezuela, a small country, produces 3 slices of pizza per hour and 6 beers per hour.

a. If Venezuela has 5000 hours of labor, how much beer and pizza does it produce, import, and export?

b. What is the wage under free trade?

c. In autarky what does Venezuela produce?

d. How do the answers to a, b, and c change if a technological innovation doubles productivity in the beer sector?

4. Fill in the blanks. The following table gives the number of units of labor required to produce one ipod or one milkshake in a Ricardian world with two commodities and three countries:

commodity\country	Vietnam	Paraguay	Chad
ipod	1	0.5	1
milkshake	1	2	4

units of labor required to produce commodity

Assume that in equilibrium both commodities are consumed. There is free trade.

a) (Fill in the blank with the commodity name) Vietnam has a comparative advantage in _____, compared to Paraguay. Vietnam has a comparative advantage in _____ compared to Chad.

Paraguay has a comparative advantage in _____ compared to Vietnam. Paraguay has a comparative advantage in _____ compared to Chad.

b) For what (if any) pattern(s) of production are the wages in Vietnam and Paraguay possibly equal?

c) For the pattern(s) of production in part (b), are the wages necessarily equal? [Yes/No]

d) For what (if any) pattern(s) of production are the wages in Vietnam and Chad possibly equal?

e) For what (if any) pattern(s) of production are the wages in Paraguay and Chad possibly equal?

5) Prove Remark 1 in Chapter 1 of the notes. The budget constraint is $w = n(p_1a + p_2b)$, where w is the wage (equal to the income of a person who sells one unit of labor, and n is the number of consumption bundles, (a, b)). Solve the budget constraint for n , the equilibrium number of consumption bundles that the person buys, and rewrite the expression as a function of the relative prices $\frac{w}{p_i}$. Totally differentiate the resulting equation to obtain the differential for dn . Use this equation to prove the claim.

6) Prove Remark 2 in Chapter 1 of the notes using the indirect utility function, defined as

$$\begin{aligned} V(p_1, p_2, y) &= \max U(x_1, x_2) \\ \text{subject to } p_1x_1 + p_2x_2 &\leq y, \end{aligned}$$

where y is the individual's income and U is the utility function. The Lagrangian is

$$\mathcal{L} = U(x_1, x_2) + \lambda(y - p_1x_1 - p_2x_2)$$

where the constraint multiplier λ is the shadow value of income. The indirect utility function is

$$V(p_1, p_2, y) = \mathcal{L}^*(p_1, p_2, y) = \max_{x_i} \min_{\lambda} \mathcal{L},$$

where a superscript $*$ denotes the value of a function evaluated at the optimum.