

# Midterm Exam

## International Trade

Economics 6903, Fall 2008

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Directions: You have 120 minutes and the exam has 120 points, split up among the problems as indicated. If you finish early, go back and check your answers. Spend your time wisely; partial credit is given for clear insight even if the question is not completed.

Answer all questions.

You may not consult any books, notes, students, or other materials. You do not need a calculator. If you have questions, ask the professor.

### I. Short Questions: 5 Points Each

1. Provide a simple statement of the Law of Comparative Advantage. Prove for the 2-good case. What is the general N-Good version of the Law of Comparative Advantage?
2. Use the revenue function and its derivatives to establish a link between a "generalized Stolper- Samuelson" relation, and a similarly "generalized Rybczynski" relation.
3. Use "Hat Calculus" to demonstrate the Stolper-Samuelson relation in the two-good case, including magnification effects. Justify each step.
4. Let country A have a comparative advantage in X relative to country B (which has a comparative advantage in Y) in a Ricardian world. Can we place any bounds on the relative wages of A and B? Prove your result.
5. Consider a Ricardian world with two countries and three goods. Good x is produced only at home, good y (the numéraire) in both, and good z only abroad. Suppose the home country has technical progress in good x. Who gains? (You may assume that the set of goods produced in each country does not change). Suppose the technical progress at home had been instead in good y -- who gains in this case? Prove your assertions.

6. In the monopolistic competition model, demand for a producer of a good  $i$  is given as:

$$x_i = \frac{p_i^{-\sigma}}{P^{1-\sigma}} I$$

- A. Explain the meaning of each of the variables  $p_i$ ,  $P$  and  $I$ .
- B. Draw a diagram illustrating the producer's optimal choices of output and price. Label all key variables, including an explicit expression for the equilibrium price.
- C. What is the elasticity of demand as perceived by the producer?
- D. Consider two standard monopolistically competitive economies of sizes  $L > L^*$  and equilibrium number of varieties  $n > n^*$ . Assume that they can trade with iceberg costs of  $\tau > 1$ .
  - (i) Write down explicit expressions for the aggregate price indices for the two countries, where the typical prices of locally produced goods are  $p$  and  $p^*$  respectively.
  - (ii) Does welfare differ for residents of the two countries? Demonstrate.

## II. Longer Questions: 20 Points Each

7. Consider a simple Heckscher-Ohlin-Vanek model. There are two goods,  $X$  and  $Y$ . The factor intensities are extreme, so that  $X$  uses only capital  $K$  and  $Y$  uses only labor  $L$  with production functions  $X = K$  and  $Y = L$ . Let preferences for the goods be Cobb-Douglas so that  $U(D_X, D_Y) = D_X^{1/2} D_Y^{1/2}$ . Let world endowments be  $(K^W, L^W) = (10, 10)$ . Let good  $Y$  be the numéraire.

- A. What is the relative price of  $X$  in the integrated world economy?
- B. What are the wage and rental rates?
- C. Draw a graph illustrating the FPE set for this world economy.
- D. If we divide the world endowments into two countries, so that the endowments of the countries are  $(K^1, L^1) = (7, 3)$  and  $(K^2, L^2) = (3, 7)$ , is this consistent with FPE?
- E. What is the pattern and magnitude of net goods trade for country 1? For net factor trade?

8. Consider a small open economy with a fixed endowment of capital and labor. It produces three goods. X and Y are tradable, while Z is non-tradable. All production functions are constant returns with substitutability between capital and labor. X is the most capital intensive and Z the most labor intensive. Demand is a function of income and relative prices. All markets are competitive. Assume that all goods are produced in positive quantities throughout. Let Y be the numéraire.

- A. Show determination of the general equilibrium.
- B. Consider if this economy alone experiences a Hicks-neutral technical advance in the X sector (i.e. a uniform inward shift of the isoquant, such that the cost minimizing capital to labor ratio for each factor price ratio is unaltered). Determine the equilibrium effect on:
  - i. The price of good Z relative to the traded goods prices.
  - ii. Output of good Z.
  - iii. Rental of capital and the real wage.
  - iv. Capital to labor ratios in the sectors.
  - v. Outputs of goods X and Y.

9. Use revealed preference arguments to compare two possible policy regimes in a competitive economy. The initial regime (policy A) is autarky. The government is thinking about moving to a regime that departs from autarky to policy B. This new policy B would replace autarky with a system of tariffs  $\tau$  but, under pressure from some powerful interests in the business community, would also include a vector of production subsidies (and taxes) given by  $\beta$ . Let M, C, and X respectively be net imports, consumption, and production (where you should distinguish to which regime the quantities pertain, A or B). Let r, p, and q be the respective “international” prices, prices that consumers face, and prices that domestic producers face.

- A. State a sufficient condition for gains from moving from regime A to regime B and then simplify this to the extent possible explicitly in terms of the production subsidy and trade tax vectors and associated quantities.
- B. Justify any steps you take in simplifying the expression.
- C. Interpret the condition you have derived. How does it differ from the condition if we considered only trade taxes ( $\beta = 0$ ) or if we had only production subsidies ( $\tau = 0$ ).

### III. Long Question: 30 Points

10. Consider the following problem based on the continuum Ricardian model of Dornbusch, Fischer, and Samuelson (AER 1977).

- $z \in [0, 1]$  is an index of goods. The symbol \* indicates the foreign variables.
- Let home and foreign productivities in each good  $z$  be given as  $A(z) = 12 - 10z$  and  $A^*(z) = 1$  respectively when each produces only with their own technologies in their own countries.

- As in DFS, there is a key equation that equates home income to total world spending on goods produced at home.
- Let the expenditure share  $b(z)$  follow the uniform distribution on its support.
- Let  $L = L^* = 1$ .
- Define a “**product wage**” for good  $z$  as the ratio of the wage in the consuming country under consideration (home or foreign) divided by the price of that good (which is here always common to both markets when they trade).

A. In a **free trade** equilibrium, solve for the equilibrium relative wage,  $\left(\frac{w}{w^*}\right)_0$ , and

the boundary good produced at the same cost in both countries,  $\tilde{z}_0$ . [Hint: You should be able to solve for this by inspection, without resorting to solving the quadratic.]

- B. Draw a diagram illustrating the determination of the free trade equilibrium. [Hint: Pay attention to the end points of curves.]
- C. Do both countries experience gains from trade as a result of a move from autarky to free trade? Demonstrate in terms of the product wage.
- D. The home government is trying to devise a unilateral policy of globalization that will most benefit its own labor. It is contemplating two alternatives to free trade:

- a. Allow for **multinationals** from the home country to go to the foreign country. The home technology implemented at home is assumed to be unaffected. In the case considered, these multinationals are competitive, but by going to the foreign country, they can employ foreign labor there with a technology specific to the multinationals, which is denoted  $A^M(z)$ ,

with the characteristic that  $\frac{A(z)}{A^M(z)} = 3$ . [In case of ties, assume that home

always produces low index goods.]

- i. Draw a diagram illustrating how the equilibrium changes with multinationals relative to the free trade equilibrium. [Hint: Pay attention to the end points.]
- ii. In the case considered, do multinationals fail to enter the foreign market, co-exist with foreign firms there, or entirely displace foreign firms in the foreign market?

iii. Does the new equilibrium relative wage,  $\left(\frac{w}{w^*}\right)_1$ , go up or down relative to the free trade relative wage?

iv. Is the new boundary good,  $\tilde{z}_1$ , above or below the free trade boundary good,  $\tilde{z}_0$ ? How has the pattern of production changed?

v. Does this move all product wages for home labor in the same direction? (You may leave aside any cases where the product wage may not have changed.) Give examples to prove your claim.

vi. Can we be sure if foreign labor wins or loses in terms of the product wages? Prove.

- b. Alternatively the government is considering opening the country to **free immigration**, where it is understood that foreign labor in the home country is equally productive to home labor when it is in the home market. We also assume that full employment is always assured by competitive labor markets.
- i. Describe the nature of equilibrium with free migration.
  - ii. Can we be sure if a free immigration policy benefits or injures home labor relative to the equilibrium with free trade? Why or why not?
  - iii. Does it benefit or injure foreign labor?
  - iv. Is total world income in the cases described higher with free trade, multinationals, or free immigration? Why?
  - v. Can you give intuition about why the cases of immigration and multinationals differ here in terms of their impact on home labor?
  - vi. Which of the policies can be definitively ranked? Explain why.