

## Midterm Exam 2

Answer Any **Two Questions**. Answer all parts to each question.

1. Consider a Heckscher-Ohlin (H-O) model with two countries (US, Mexico), two inputs (labor,  $L$ ; and land,  $T$ ) and two goods (clothing, food). Assume that both production functions exhibit constant returns to scale and that food is always the land-intensive good. Assume the US has more land per worker than Mexico but that the two countries have identical technology. For example, the production functions for the two countries may look like:

$$\text{Mexico: } Q_c = (T_c)^{1/3} (L_c)^{2/3}; Q_f = (T_f)^{2/3} (L_f)^{1/3}; \quad \text{US: } Q_c = (T_c)^{1/3} (L_c)^{2/3}; Q_f = (T_f)^{2/3} (L_f)^{1/3}$$

(you do **not need** to use these functions to answer the parts below but you may if you want).

In your answer, let  $W$  denote the wage rate,  $R$  the rental rate on land,  $p_c$  the price of clothing and  $p_f$  the price of food.

- (a) Given constant returns to scale, explain how input prices uniquely determine marginal costs of production and thus output prices. How does an increase in the wage-rental ratio ( $W/R$ ) affect the *relative* price of clothing ( $p_c/p_f$ )? Explain your answer. **(8 points)**
- (b) Given that technology and tastes (demands) are identical in the U.S. and Mexico, if the U.S. has more land per worker than Mexico, compare autarky equilibrium output prices and factor prices in the two countries. Be as specific as possible. **(10 points)**
- (c) Assuming free trade, which good will each country export? **(4 points)**
- Does free trade potentially benefit both countries? Will everybody in each country gain from free trade (e.g., what happens to real factor prices)? Be as specific as possible. **(6 points)**
  - What does it mean to say “free trade is a substitute for factor movements between the two countries”? Will free trade equalize factor prices between the two countries? **(3 points)**
- (d) Suppose Mexico imposes an import tariff. How will this tariff affect real factor prices in Mexico? Who gains and who loses from this tariff? **(7 points)**
- If Mexican imports affect world prices (and hence prices in the U.S.), how does the Mexican import tariff affect U.S. factor prices and U.S. per capita income? Be specific. **(4 points)**
- (e) Suppose U.S. productivity in both sectors **doubles**, so U.S. technology becomes:  
**US:**  $Q_c = 2(T_c)^{1/3} (L_c)^{2/3}; Q_f = 2(T_f)^{2/3} (L_f)^{1/3}$   
 Assuming Mexican technology is unchanged, will this change in technology affect the **pattern of trade** between the two countries? Is free trade a perfect substitute for factor movements (i.e., will free trade equalize factor prices)? Explain. **(8 points)**

2. Answer all parts to this question.

**(Labor movements).** Consider a simplified model with two countries (U.S., Mexico) that use two inputs (land, labor) to produce a **single** identical good. Since there is just one good (and we ignore time), there is no role for trade in goods. Let  $\{T^{us}, L^{us}\}$  and  $\{T^{mex}, L^{mex}\}$  denote the amounts of land and people in the U.S. and Mexico, respectively (with no migration, the number of people equals the number of workers). Assume the countries have the same amount of land  $\{T^{us} = T^{mex}\}$ , but Mexico has more workers  $\{L^{mex} > L^{us}\}$ . Assume the **US has a more productive technology**, and output in each country is:

$$Q^{us} = 60(T^{us})^{1/2} (L^{us})^{1/2}; \quad Q^{mex} = 30(T^{mex})^{1/2} (L^{mex})^{1/2}$$

(you only **need** to use these functions in part *d*, but you should assume that inputs are complements, which means as more of one input is used, the marginal productivity of the *other* input increases.)

a) Assuming no labor mobility between countries, compare the wage rates, return on land and per capita income  $\{(Q^{us}/L^{us}); (Q^{mex}/L^{mex})\}$  in the two countries (a verbal answer suffices. Pay attention both to the differences in technology and to the differences in endowments). **(10 points)**

b) Assume a guest worker program allows workers to move between the countries. Let  $I$  represent the number of Mexicans who work in the US, so the US work force is  $(L^{us} + I)$  and the Mexican work force is  $(L^{mex} - I)$ . Assume people choose where to work based solely on where net wages are higher. If workers are free to move between countries, then: **(1)**What determines how many workers move between the countries? **(2)**How does this labor movement affect wages, the return on land, and per capita income in each country? and **(3)**How does this labor movement affect world output? {Again, you do **not** need numerical answers here} **(12 points)**

c) Suppose **Mexico** imposes an annual tax (of  $F$ ) on Mexican workers who work in the U.S. These Mexican guest workers in the U.S. receive the same (annual) wage  $W^{us}$  as U.S. workers, so their after tax income is  $(W^{us} - F)$ . In choosing where to work, guest workers compare the Mexican (annual) wage  $(W^{mex})$  to **net income** earned working in the U.S.  $(W^{us} - F)$ . **National income** for each country is:

**U.S.** national income is: U.S. output less wages paid to guest workers.

**Mexican** national income is: Mexican output plus net wages earned by Mexican workers in U.S. plus taxes paid to Mexico by these workers.

In equations:  $Y^{us} = Q^{us} - W^{us}I$ ;  $Y^{mex} = Q^{mex} + (W^{us} - F)I + FI = Q^{mex} + W^{us}I$

i. Explain carefully how increases in the tax ( $F$ ) affect each of the following: **(1)**the number of guest workers ( $I$ ) in the U.S.; **(2)**wages in each country; **(3)**the return on land in each country; **(4)world output**; and **(5)national income** in each country. (a verbal answer suffices) **(10 points)**

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{question 2 continued}

- ii. Can the fee increase per capita Mexican income? How does it affect U.S. per capita income? Be specific. (a verbal answer suffices here) **(6 points)**
- d) Use the production functions given at the beginning of this question, and assume  $T^{us} = T^{mex} = 100$ ,  $L^{mex} = 125$ ,  $L^{us} = 100$ . Assuming guest workers can move freely between the US and Mexico ( $F=0$ ), find the equilibrium number of guest workers in the US. **(12 points)**

3. Consider the market for rice in a small country (e.g., Ecuador). The domestic supply and demand curves are given by:

$$S = 200P^f; \quad D = 600 - 100P^c$$

where  $P^f$  is the price rice producers in Ecuador receive for their output and  $P^c$  is the price rice consumers in Ecuador pay for rice (if there are no production subsidies or taxes, and no consumption subsidies or taxes then  $P^f = P^c$ ). Prices are in \$/ton

- a) Assuming no domestic taxes or subsidies, find the autarky price in Ecuador. **(6 points)**
- b) Historically, the world price of rice was  $P^w = 3$ . Due to world shortages (due to the use of food products to make ethanol), world rice prices have recently jumped to  $P^w = 5$ . Find Ecuador's rice exports under free trade (at  $P^w = 5$ ), and calculate the changes in consumer surplus, producer surplus and overall welfare due to the movement from autarky to free trade (at  $P^w = 5$ ) **(10 points)**
- i. Briefly discuss how the surge in world rice prices affected Ecuador's population (just a short verbal discussion is required here). **(6 points)**
- c) Ecuador, to protect its consumers from this surge in world prices, is considering several options. One option is to impose an export tariff of  $t = 2$  on rice (so rice exporters would receive the world price less the export tariff, i.e.,  $(5 - 2) = 3$ ). **Compared to free trade** (at  $P^w = 5$ ), calculate the gains and losses to each group and the overall change in welfare from this policy. **(8 points)**
- d) Suppose the export tariff were eliminated, but in its place the government imposed an export quota of 300 (this represents the maximum amount of rice exports the government would allow). Compare the effects of this export quota to the export tariff. **(6 points)**
- i. Given the export quota of 300, what effect would an export tariff of  $t = 1$  have on prices, consumption, production and welfare in Ecuador? Be specific. **(6 points)**
- e) Since the government's goal is to help consumers, not to tax or restrict exports, is there a domestic policy that would have the same effect on Ecuadoran consumers as the export tariff of 2? If so, find what it is and compare the welfare loss with this policy to the welfare loss from the tariff. If the goal really is to help domestic consumers, which is the better policy? **(8 points)**