

## Midterm Exam 1

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

1. Assume the domestic supply and demand curves for sugar in Haiti are given by:

$$S = 7P^f; \quad D = 100 - 3P^c$$

where  $P^c$  is the price domestic consumers pay for sugar, and  $P^f$  is the price domestic firms (producers) receive for their sugar output.

- (a) Assuming Haiti does not trade with the rest of the world, find the equilibrium (autarky) price and the quantity transacted. (Since there are no domestic taxes or subsidies, then  $P^f = P^c = P^d$ , where  $P^d$  represents the domestic price). **(7 points)**
- (b) Assume that a change in economic policy allows free trade in sugar between Haiti and the rest of the world. Further, assume the world price is 25 ( $P^w = 25$ ), and that the imports (or exports) of Haiti have no impact on this price. (Further, continue to assume there are no taxes or subsidies to producers or consumers in Haiti).
- i. How does trade affect price, production and consumption in Haiti? Find the country's trade volume (exports or imports) under free trade. **(5 points)**
  - ii. Show graphically, and **calculate**, the changes in consumer and producer surplus due to the movement to free trade. **(7 points)**
- (c) Suppose the government of Haiti, in addition to allowing free trade, also subsidizes domestic sugar production; let the amount of the subsidy be **10** (the price domestic producers receive is:  $P^f = P^w + 10$ , since each unit produced is sold at the world price and since the government pays producers **an additional 10** for each unit produced. Consumers pay the world price for sugar).
- i. Starting from free trade, show graphically and **numerically** how this production subsidy affects Haitian sugar production, sugar consumption and imports or exports. **(4 points)**
  - ii. Assuming this production subsidy increases Haitian sugar production, **calculate** the *cost due to the increased sugar production* and compare it to the revenue generated by *exporting* this sugar. Overall, does this production subsidy raise or lower Haitian welfare? [**If** you find in (ci) that the production subsidy *lowers* sugar production, then compare the cost savings from this lower production to the lost revenue from the lower exports]. A numerical answer is required. **(7 points)**
  - iii. **Food for thought:** Given production subsidies, is it possible the movement from autarky to free trade could hurt the country? Just give a very brief answer – the focus is on *why*. **(3 points)**

2. Consider a Ricardian model, where each country's **labor productivities** are given in the following Table:

|               | Output per unit (hour) labor input |             |      |          |           |
|---------------|------------------------------------|-------------|------|----------|-----------|
|               | Clothing                           | DVD Players | Food | Aircraft | Computers |
| United States | 6                                  | 3           | 16   | 2        | 4         |
| Japan         | 12                                 | 6           | 4    | 1        | 4         |

- Find the autarky relative price of each good (**in terms of food**) in each country. Also, find the wage in each country. In which country is the real wage higher? Explain. **(6 points)**
- Suppose initially a limited trade agreement is signed between Japan and the United States that **permits trade only** in food and computers (under the agreement, trade in the other goods is banned). What will the pattern of trade be and what is the range of post-trade relative prices (of computers to food) that can prevail? How does this trade affect the real wage (in terms of each good) in each country? Be as specific as possible. **(6 points)**
- Suppose a new trade agreement allows free trade in **all** five goods. Will each country *necessarily* continue to export the good that they exported under restricted trade (in part b)? Which good will Japan definitely export? Which good will the US definitely export? How does trade in all goods affect the real wage in each country? Explain carefully. **(6 points)**
- Let  $W$  denote the wage in the US, and  $W^*$  the wage in Japan. Sketch the relative labor demands as a function of the relative wage ( $W/W^*$ ), and explain this sketch (**in particular, show how the country in which each good is produced is determined by this relative wage**). Given the relative labor supplies (US and Japanese labor supply), show how the equilibrium pattern of trade and relative wages ( $W/W^*$ ) are determined. **(8 points)**
- Finally, assume that, due to low birth rates, the Japanese labor supply decreases relative to the US labor supply. Discuss how this change in relative labor supplies will affect: (i) the pattern of trade (which goods Japan exports and imports), (ii) relative prices of goods (in terms of food), and (iii) the real wage in each country. [For simplicity, assume that Japan originally exported 3 goods and the US exported 2 goods.] **(7 points)**

3. Consider the specific-factor model with two goods (food,  $F$ , and computers,  $C$ ). Let *land* ( $T$ ) be the specific factor in the food sector, and let *capital* ( $K$ ) be the specific factor in the *computer* sector, while labor is used in both sectors and is mobile between the two sectors. In terms of equations:

$$Q_c = C(K, L_c); \quad Q_f = F(T, L_f); \quad L_c + L_f \leq L$$

Assume each production function exhibits *constant returns to scale*, which means if you double both inputs used to produce a good, you double output of that good.

- Briefly explain how the production possibility frontier (*ppf*) can be derived, then sketch the *ppf* and explain its curvature (how the slope change as you move along the *ppf*). Show how you can derive the supply curves from the *ppf*. **(6 points)**
  - Sketch the supply curve for food as a function of its relative price. What does the area under the supply curve, between any two output levels, measure? Be precise, and relate your answer to the *ppf*. **(4 points)**

Question 3, continued

- b) Suppose there are two countries (the US, Europe) that are alike in all respects (same technology, same tastes, etc.) **except** that the US has more land than Europe (the two countries have the same amounts of capital and labor). Compare autarky output prices and factor prices between the two countries. Be as specific as possible. **(7 points)**
- c) If trade is allowed between Europe and the US, what will the pattern of trade be (what good will each region export)? In each country, who gains and who loses from trade? Compare post-trade factor prices in the two countries. **(7 points)**
- d) Finally, suppose there is an increase in productivity in the food sector in Europe (the production function there changes from  $Q_f = F(T, L_f)$  to  $Q_f = (1.2) \cdot F(T, L_f)$ , representing a 20% increase in productivity). *Given output prices*, show how this productivity increase will affect output of each good and factor prices in Europe. Be as precise as possible. **(6 points)**
- i. Since Europe trades with the US, how do you think this productivity increase in Europe will affect US welfare? Explain. **(3 points)**

4. Consider the basic Heckscher-Ohlin model with two goods (food ( $F$ ) and manufactures ( $M$ )) and two factors (inputs) of production (capital ( $K$ ) and labor ( $L$ )). Each good is produced, using both inputs, under constant returns to scale; in the production of each good, capital can be substituted for labor (the input coefficients are NOT fixed). Assume good  $M$  is the capital-intensive good. Further, assume there are two countries (the US and Mexico) that have identical technology and tastes, but that the US is endowed with more capital per worker than is Mexico.

- a) Explain how the production possibility frontier is derived. Does full employment of resources (capital and labor) guarantee production is on the production possibility frontier? If not, what additional condition is needed? Explain your answer. **(5 points)**
- i. Assume that, at the current input allocation: in sector  $M$  the MPL (marginal product of labor) is 3 and the MPK (marginal product of capital) is 6; while, in sector  $F$  the MPL is 6 and the MPK is 3. How should you reallocate resources between the two sectors to increase output of **both** goods? Be specific. **(4 points)**
- b) **Given output prices**, show how an increase in the amount of labor will alter the output levels (shift supply curves) and the factor prices in each country. **(6 points)**
- c) Use the result from part (b) to compare **autarky output prices and factor prices (the wage rate and the return on capital)** between the US and Mexico. Since the US and Mexico are assumed to have the same technology, does this imply that *equilibrium* labor productivity will be the same in the two countries (in this *autarky* equilibrium)? Explain. **(6 points)**
- d) Suppose trade is allowed between the two countries. What will the pattern of trade be, and how will this trade affect output and factor prices in each country? Who gains and who loses from trade in each country? Does trade reduce, or eliminate, the gap in factor prices between countries? Explain. **(6 points)**

Question 4, continued

- e) Discuss how you could modify this model to reflect the reality that the US is more efficient (in the production of both goods) than Mexico. Assuming the US is twice as efficient as Mexico in producing both goods, do you think: (i) trade would still be mutually beneficial?; (ii) trade would equalize factor prices between the two countries?; and (iii) the pattern of trade would be affected by the efficiency differences between the two countries? Justify your answer (points will be based on your reasoning). **(6 points)**

**5. Evaluate the following statements. Justify your answers (points are awarded based on the reasoning). Be sure to answer all parts.**

- a) If production in individual countries is efficient (*i.e.*, on the country's production possibility frontier) before trade, can free trade between countries lead to an increase in world output of both goods, assuming technology is internationally identical? What condition must be satisfied to achieve efficient world production (meaning it is **not** possible to increase world output of one good without decreasing world output of some other good)? **(7 points)**
- i. Assume two countries (US, UK), two goods (C, M). Assume in autarky the relative prices are  $(P_c/P_m)^{US} = 4 > (P_c/P_m)^{UK} = 2$ . Given that these relative prices reflect the marginal rate of transformation (the opportunity cost of production) in each country, can production be altered in each country to increase world output of both goods? If so, **how?** **(4 points)**
- b) Assume there are two goods (cloth, food) and two countries (US, Japan). Starting from autarky equilibrium in each country (*i.e.*, no trade), is it always true that overall both countries will gain from trade? Use a general model to illustrate your answer. **(6 points)**
- i. Will economic growth (for example, due to increased productivity) in Japan always benefit both Japan and the US? Relate your answer to how the growth affects Japanese production of each good. **(5 points)**
- c) "When, prior to trade, there is a large difference between wages in two countries (such as the US and China), then trade between these countries is likely to lead to unemployment in the high wage country. Hence, trade is most likely to be beneficial when it is between similar countries." State whether you agree or disagree, and justify your answer. **(6 points)**
- d) "Since free trade equalizes factor prices between countries, full implementation of the free trade agreement between the US and Mexico (tariffs are being eliminated in steps) will reduce, and ultimately eliminate, the flow of illegal immigrants who come from Mexico to the US seeking higher wages." True or false? **Justify your answer.** **(5 points)**