

*Use a blue book to answer all of the following questions. Use graphs where requested, and be sure to clearly label them and briefly explain them. Neatness and organization can affect your grade! You have until 3:55 PM. Manage your time well, and don't go into more detail than necessary to answer the questions asked.*

1. (25%) Consider two countries, Home and Foreign, each producing two goods, X and Y, with constant costs. There is only one resource, labor, with constant returns to scale and perfect competition. Home has 2000 workers, and each of their workers can produce 5 units of X per year, or 4 units of Y. Foreign has 1000 workers, and each of their workers can produce 20 units of X\* per year, or 5 units of Y\*.

- In two separate diagrams, graph the PPFs for both Home and Foreign, putting X on the horizontal axis. What is the marginal rate of transformation ( $MC_X/MC_Y$ ) in each country?
- Using indifference curves, show the autarky equilibrium for each, assuming that each country prefers to spend half of its income on the consumption of each good. At autarky, what is the price ratio ( $P_X/P_Y$ ) in each country?
- Which country has the absolute advantage in which good? Which country has the comparative advantage in which good? Which country has the higher real wage rate? What is the minimum and maximum price ratios that are consistent with a free trade equilibrium?
- Assume the equilibrium terms of trade are 2/5, and Home and Foreign trade 10,000 units of X for 4000 units of Y. Show this free trade equilibrium for both Home and Foreign.
- Using an Edgeworth Distribution Box with X on the horizontal axis and Y on the vertical axis, Home's PPF on the SW origin and Foreign's PPF on the NE origin, show and explain how specialization can increase total production. Then use indifference curves to explain how the international free trade equilibrium would be Pareto-optimal.

2. (10%) Consider three countries, the United States, Canada, and Mexico. In 2008, U.S. GDP was \$14,000 (billion), Canadian GDP was \$1,300 (billion), and Mexican GDP was \$1,600 (billion). The average trading distance was 1.5 (thousand) miles from Mexico to the U.S., 1 (thousand) miles from Canada to the U.S., and 2 (thousand) miles from Canada to Mexico. Using this gravity equation:

$$T_{ij} = 0.25 * \frac{\sqrt{Y_i Y_j}}{D_{ij}^2},$$

where  $Y_i$  is the GDP of country  $i$  (in billions of comparable dollars),  $D_{ij}$  is the average distance (in thousands of miles) between country  $i$  and country  $j$ , and  $T_{ij}$  is total exports from country  $i$  to country  $j$ . Draw a 3 by 3 matrix, and fill in the total predicted trade between each country. Add up the total predicted exports for each country. What is the Exports/GDP ratio for each country? Your predictions should be more or less realistic.

3. (10%) Consider a short-run model of trade between Home and Foreign, each producing only food and clothes, in which factors are unable to move between different sectors. Using indifference curves, show Home's autarky equilibrium with food on the horizontal axis. Then show how Home could still gain from trade with Foreign, assuming Foreign had a much higher relative autarky price for food.

4. (20%) Consider a long-run model of trade between China and the USA, in which the only resources are skilled labor (SL) and unskilled labor (UL). Suppose the USA has 60 million skilled workers and 100 million unskilled workers, while China has 100 million skilled workers and 500 million unskilled workers. Each country produces only hardware (HW) and software (SW) under perfect market conditions, using both labor and capital with constant returns to scale and diminishing marginal returns. Software production is relatively more intensive in skilled labor. Assume preferences and available technologies are identical, and factors are equally productive between the two countries.

- Graph the PPFs for both countries, with HW on the horizontal axis, and show the autarky equilibria. Which country has the higher price ratio ( $P_{HW}/P_{SW}$ )?
- With  $(W_{SL}/W_{UL})$  on the vertical axis and  $(SL/UL)$  on the horizontal, graph the relative skilled labor demand curve for both HW and SW, the average labor demand for each country, and the relative skilled labor endowment for both countries. Which country has the higher skilled wage ratio ( $W_{SL}/W_{UL}$ )? Which country uses more SL-intensive technologies?
- Under perfect free trade between the two countries, what would the Heckscher-Ohlin theorem predict? Compare the free trade equilibria to the autarky equilibrium on your PPF graphs for the two countries.
- According to the Stolper-Samuelson theorem, how would free trade affect the skilled wage ratio ( $W_{SL}/W_{UL}$ ) in each country?
- How would your predictions be different if skilled labor was twice as productive in the USA as in China, and unskilled labor was three times as productive in the USA as in China? Adjusting for effective factors, what would the factor price equalization theorem predict?

5. (15%) Consider a model of trade between France and Germany in the medium run, in which labor can move between the producer-goods sector (X) and the consumer-goods sector (Y), but capital is specific to each sector, and therefore immobile. France is relatively abundant in Y-specific capital.

- Use the four-quadrant graph, with the production function for Y in the NW quadrant, the production function for X in the SE quadrant, and the labor-allocation line in the SW quadrant. Show how specific factors lead to diminishing returns for labor, and show how to derive the PPF. What happens to the marginal rate of transformation ( $MC_X/MC_Y$ ) as you allocate more labor to the X sector?
- For France, how would free trade with Germany affect the relative price ( $P_X/P_Y$ )? Using the labor allocation diagram (i.e., the one-dimensional Edgeworth Box), show how changes to  $P_X$  and  $P_Y$  would affect labor allocation, the wage rate, the profits of X-capitalists, and the profits of Y-capitalists.

6. (10%) Suppose that Y production in the Heckscher-Ohlin model is perfectly competitive, but due to economies of scale, X is not, so  $MC_X < P_X$ .

- With X on the horizontal axis, draw a PPF and show the autarky equilibrium. How is this equilibrium different from the case of  $MC_X = P_X$ ?
- For a country with a comparative advantage in X, show how imperfect competition in X affects the free trade equilibrium.

7. (10%) What are the equations for the PP and CC curves in the Krugman-Obstfeld model of monopolistic competition under economies of scale? Draw the autarky equilibria for two countries with identically-sized markets, and show what happens when they open up to international trade. What happens to prices, profits, and the number of firms in the short-run and the long-run?