Final Exam

Directions. If you took the midterm exam, answer any three questions from Part II.
If you did not take the midterm exam, answer one question from Part I and two questions from Part II.
All students must answer a total of 3 questions

Part I. Answer one of the following questions if you did not take the midterm.

1. Answer all parts.

   a) Consider an N good, (N+1) factor model, where only one factor (L, labor) is mobile. Thus:

   \[ Q_i = F^i \left( X_i, L_i \right); \quad X_i \leq \bar{X}_i, \quad i = 1, ..., N; \quad \sum_{i=1}^{N} L_i \leq \bar{L} \]

   where \( \left\{ \bar{X}_1, ..., \bar{X}_n, \bar{L} \right\} \) represents the given stock of factors, and each production function exhibits constant returns to scale.

   i. How will an increase in the price of good 1, given all other goods prices, change the returns to each factor? Relate to the Stolper-Samuelson Theorem.

   ii. How will an increase in \( \bar{X}_1 \), given goods prices and other factor endowments, affect output and factor prices. Relate your results to the magnification theorem.

   iii. Briefly indicate whether the results above will hold in any (constant returns to scale) model with N goods and (N+1) factors.

   b) Using the basic 2 good (C, M), 2 factor (K, L) Heckscher-Ohlin model, where good M is capital intensive, show how a Hicks neutral increase in productivity in sector M will affect output levels and factor prices, given output prices.

2. Answer all parts.

   a) Consider an economy with H agents, in which factor supplies are endogenous. Using the GNP function and the expenditure functions for each agent, prove that even if lump sum transfers are not feasible, that with appropriate policy free trade can be made Pareto superior to autarky. Be sure to indicate what the required policy is, and explain where the potential gains come from if this policy is used.

   b) Using the Dornbusch-Fischer-Samuelson version of a Ricardian model with a continuum of goods, let \( a(z), \bar{a}(z) \) denote labor productivity in the US and Europe, respectively where \( z \in [0,1] \) indexes the good. Assume that \( A(z) = \left( a(z) / \bar{a}(z) \right) \) is monotonically decreasing in \( z \). Assume preferences, which are Cobb-Douglas, are identical across countries, and let \( \left\{ L, \bar{L} \right\} \) represent the labor force in each country.

   i. Show how the equilibrium relative wages, and the pattern of trade, are determined.

   ii. Show how an ad valorem (%) import tariff, at the same rate, on all goods will affect the pattern of trade, prices, real wages, and welfare in each country.
Part II. If you took the midterm, answer any three questions from Part II. If you did not take the midterm, answer two questions from Part II.

3. Consider the extension of the H-O model to the Helpman (or Krugman) variant with two industries, food (F) and manufactures (M), and two factors (K, L). Food is a homogeneous good, produced under constant returns to scale, while there are a potentially infinite number of varieties of manufactures. Each manufactured good has the same technology, which exhibits increasing returns to scale (at least under some interval); both K and L are used to produce M, and M is capital-intensive relative to F. As in class, preferences are weakly separable.

   a) Show how the equilibrium is derived for a closed economy (or an integrated world economy). In doing so, you may use the structure employed in class (production is homothetic). What determines the number of varieties of manufactures that will be produced?

   b) Next, assume there are two countries (A, B), where A is capital-abundant compared to B. Discuss how the free trade equilibrium is derived and discuss the pattern of trade between countries. Will free trade equalize factor prices? Explain.

   c) Given the aggregate stock of world capital and labor, show how a movement of capital from country B to country A would affect output levels in each country, the pattern of trade, the volume of trade in goods, and factor prices.

   d) Finally, suppose a third country, C – which previously was in autarky equilibrium – opens up trade with A and B. Assume C has identical preferences and technology as A and B, and that C’s resources (of both capital and labor) were the same as the combined resources of A and B. Discuss how the removal of C’s prohibitive trade barriers affects world equilibrium prices, factor prices, the trade pattern, and welfare. Also, discuss the resulting bilateral pattern of trade between all countries (A vs. B, A vs. C, etc.).

4. Answer all parts.

   a) In a standard two good (C, M), two factor (K, L) model, suppose a small country imports good C, the labor-intensive good. Further, suppose the country has an import tariff. In this setting, compare the shadow price of labor to the domestic market price. Can the shadow price be negative? Explain.

      i. Would your answer be different if the country had an import quota instead of a tariff? Explain.

   b) First, explain what is meant by the “optimal tariff” then, for a two good (C, M), two country (US, Japan) model derive the optimal tariff for the US, assuming it exports good M.

      i. Assume the US is banned, by trade treaties, from using border policies. Can it use domestic policy instead? Explain. If only production policy can be used, derive the optimal production policy.

5. Answer all parts.

   a) Consider a partial equilibrium model of a small steel-importing economy that has a single domestic steel producer. Under these conditions, compare the effects on domestic output, domestic price, consumer surplus and welfare of a (i)tariff and a (ii)quota which results in the same level of imports as a tariff.

      i. If the purpose of the trade restriction is to raise government revenue, which is more effective (assuming quota licenses are auctioned off).

   b) Consider an N good, M factor version of the Heckscher-Ohlin model, where N>M. Assume countries have identical preferences and technology. Assuming free trade results in factor price equalization:

      i. What can be concluded about the pattern of trade in goods? Explain.

      ii. Derive predictions related to the factor content of trade.

      iii. Starting from free trade, does a ban on trade in one good necessarily lead to inefficiency? Explain.
6. Answer all parts.

a) Dumping and countervailing duty laws permit countries to impose imports tariffs to counter situations in which foreign exporters sell products at prices that are “too low”, or when these exporters receive (export) subsidies from their domestic government. Using a partial equilibrium model in which there are US and Japanese producers, and Japan exports to the US:

i. Assuming competitive behavior, how do Japanese export subsidies affect US and Japanese welfare? Does it make sense for the US to automatically impose tariffs to offset these subsidies? Discuss.

ii. Suppose instead there is a single Japanese firm, and that it produces under constant marginal cost, $c$. Similarly, there is only one US firm, which produces under constant marginal cost $c$. Assuming Cournot competition, and that all output is sold in the US (where, for simplicity, demand is linear), show how Japanese export subsidies affect US welfare. Be as precise as possible.

b) Given a small country with trade restrictions on a number of goods, can increasing an import quota for one good ever lower welfare? Make your answer, and your analysis, as general as possible.

7. Consider a standard two sector (C, M) model with a minimum wage. Technology is given by:

$$Q_c = F^C(K_c, N_c), \quad Q_m = F^m(K_m, N_m)$$

where $F^i(\ldots)$ is a constant returns to scale technology, $\{K_i, N_i\}$ denote employment of capital and labor in sector $i$, and good $M$ is capital-intensive. Assume world prices are given by $\{P_c^w, P_m^w\}$, and $C$ is the numeraire $\{P_c^w = 1\}$. Assume, unless stated otherwise, that capital is perfectly mobile between sectors, earning the common return $R$. The wage rate in sector $C (W)$ is flexible, but in sector $M$ there is a minimum wage, $\bar{W}$, that is set above the free trade equilibrium wage (this minimum wage is fixed in terms of good $C$). Using the cost functions we have:

$$\phi_c(W, R) \geq P_c^f = 1; \quad \phi_m(\bar{W}, R) \geq P_m^f$$

where $\phi^i$ is the cost function for sector $i$, $P_i^f$ is the price faced by firms in sector $i$, and good $C$ is the numeraire. Labor, like capital, is freely mobile between sectors. Since the return on capital adjusts freely, all capital is fully used. However, due to the minimum wage in sector $M$, the wages paid in the two sectors cannot be the same. Instead, labor moves to equalize the expected wage in each sector (and there will be unemployment). Define:

$$L_i = \text{number of potential workers in sector } i; \quad N_i = \text{number of workers employed in sector } i.$$

Since wages in sector $C$ are flexible, all labor in that sector is employed. Thus, if $\{K, L\}$ denote the aggregate stocks of capital and labor, the resource constraints are:

$$K_c + K_m = K; \quad L_c + L_m = L; \quad N_c = L_c$$

Finally, labor mobility that equalizes the expected wage across sectors implies:

$$W = (1-u)\bar{W}; \quad (1-u) = \left(\frac{N_m}{L_m}\right)$$

where $u$ is the unemployment rate ($(1-u)$ is the employment rate). Finally, assume the country in question is a developing economy that imports good $M$. [Comment: This model is a variant of the Harris-Todara model. Sector $M$, manufactures, is located in urban areas, and thus the minimum wage is for urban workers. Sector $F$ is the traditional agricultural sector. Manufactures are imported]
a) What distortion is created by the minimum wage and what is the first best policy solution to eliminate this distortion? Explain.

b) How would an import tariff affect domestic output, the unemployment rate and welfare? If you had to choose between an import tariff and a production subsidy (to sector M) of the same magnitude, which policy would be better? Explain. *(In deriving the effects of an import tariff be sure to check the analytics of your result).*

c) Assuming only commercial policy is feasible, what is the appropriate policy? Set up the objective function and show how to calculate the optimal value for this policy instrument.

d) In what ways would your results, and the choice of an optimal (second best) policy, be modified if capital were not mobile across sectors? Explain.