ECONOMICS 181: INTERNATIONAL TRADE
MIDTERM SOLUTIONS

Please answer all parts. Please show your work as much as possible.

1 Short Answer (40 points)

Please give a full answer. If you need to indicate whether the answer is true or false, please explain your answer. You must give an explanation to get full credit for the answer.

1. One shortcoming of the Heckscher-Ohlin framework is that it predicts that wages everywhere in the world are equal, yet the empirical evidence suggests that wages in fact vary with country productivity levels. True or False?

   TRUE. One of the results of the H-O framework is the Factor Price Equalization theorem, which states that the returns to factors will equalize with trade around the world. One of the necessary assumptions for this is that technology is identical across countries. However, empirically, neither wages nor productivity levels are equalized around the world. We can therefore point to this evidence as a shortcoming of the H-O framework.

2. Theories of foreign direct investment predict which of the following should attract foreign investment to a host country?

   (a) High tariffs

   (b) Large markets

   (c) Firm-specific assets (internalization)

   (d) Low factor prices

   (e) All of the Above

   Answer: e. High tariffs block companies from selling goods to a country. By producing goods in these countries directly, they sidestep these tariffs. Producing goods in a large market increases access to sell goods in the large market. Firm-specific assets in another country ease the production process. Finally, low factor prices lower the cost of production.

3. Home and Foreign can produce cheese, wine, and tools with the following unit labor requirements:

	Home	Foreign
Cheese	12	2
Wine	4	4
Tools	9	3

   In world trade equilibrium, wages at home are half of foreign, with $w = \frac{1}{2}w^*$. What good(s) will Home produce? What good(s) will Foreign produce?

The production of goods will depend on which country has the lower unit factor costs. For good i, we have to compare $a_i \times w$ with $a_i^* \times w^*$. Rearranging this expression, home is more efficient at the production of good i if $w/w^* < a_i^*/a_i$. Therefore, looking at the ratio of unit labor requirements for each good, we get: $a_c^*/a_c = 1/6$, $a_w^*/a_w = 1$, and $a_t^*/a_t = 1/3$. Since $w/w^* = 1/2$ home will produce wine and foreign will produce cheese and tools.

4. True or False? (please explain your answer using a diagram) In the standard trade model, an improvement in the terms of trade for a country will lead the country to export less and import more, placing the country on a lower indifference curve.

   <u>FALSE</u>. Although an improvement in the terms of trade may lead a country to export less and import more, the country will necessarily be on a higher indifference curve.
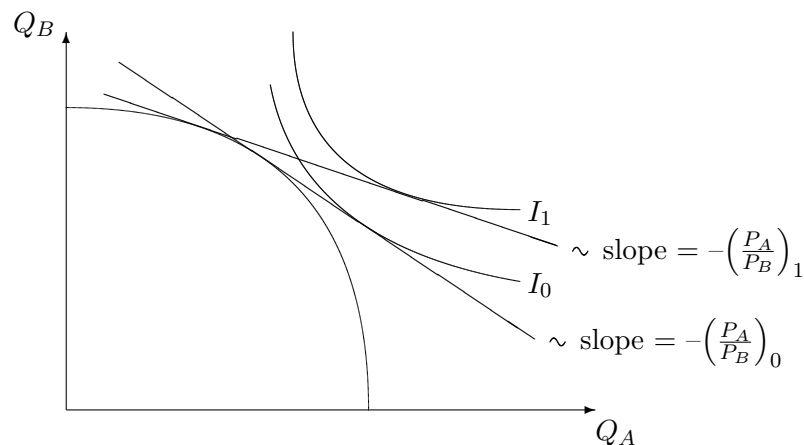
In the above diagram, the country is an exporter of good B and an importer of good A. Terms of trade is therefore given by $\frac{P_B}{P_A}$, and an increase in the terms of trade implies a flatter price line. The country is unambiguously better off, but we can always create preferences such that the indifference curves could lead to an increase or decrease in the amount of exports and imports.

5. Define unit labor costs. Use the definition to show how both rich and poor countries can remain competitive on world markets despite very different factor prices.

   A Unit Labor Cost (ULC) is the cost of paying a worker to produce one unit of a finished good. For good i this is given by: $a_i \times w$ where a_i is the unit labor requirement and w is the prevailing wage. Rich and poor countries can remain competitive in two ways. Either they can have low wages, or they can be very productive. Rich countries tend to have high wages, but also very high productivity levels (remember, a high productivity level implies a low unit labor requirement). Poor countries are not as productive (i.e. high unit labor requirements), but remain competitive with low wages.

6. True or False? The Rybczynski Theorem states that if the US has a comparative advantage in producing capital-intensive goods, then an increase in the endowment of capital of 10 percent in the US will lead to a more than 10 percentage point increase in the production of capital-intensive goods.

   <u>TRUE</u>. Assuming that prices stay fixed, the Rybczynski theorem states that an increase in the endowment of one factor without an increase the endowment of the other factor, will lead to a more than proportional increase in the production of the good that uses that factor intensively.

7. Discuss the predictions of the gravity model. What does this model say about the pattern of bilateral trade? Is the evidence consistent with the model?

   The gravity model is based on the following equation:

   $$T_{ij} = \frac{A Y_i Y_j}{D_{ij}},$$

   where T_{ij} is volume of trade between countries i and j, Y is the GDP of the two countries and D is the distance between the two countries. It predicts two things: 1 - As either country's GDP grows, so will the volume of trade between the two countries, 2 - as the distance between the countries grows, the volume of trade will fall. The evidence is highly consistent with the model.

8. Discuss two explanations for increasing inequality which focus on the demand for labor. Show how these could account for increasing inequality. Briefly mention the evidence for or against these two explanations.

   In order to increase inequality between skilled and unskilled workers, we need to increase the wage of skilled workers and decrease the wage of unskilled workers. Skill-Biased Technical Change would lead to an increase in the demand for skilled workers, and should raise their wage. Evidence of this could be prerequisite education levels needed to get certain jobs. A demand explanation for lowering wages of unskilled workers is outsourcing of low-skilled jobs. Evidence of this is the increased imports of goods from developing countries with large stocks of unskilled workers.

9. True or false? According to the Heckscher-Ohlin framework, if the US is skill-abundant and scarce in unskilled-labor, then the US will produce more skill-intensive goods. If telecommunications is a skill-intensive good, then the Heckscher-Ohlin framework implies that opening up to trade will increase the return to skilled workers relative to unskilled workers, as well as increase the ratio of skilled to unskilled workers within the telecommunications sector.

   <u>FALSE</u>. In the H-O framework, if the US is relatively skill-abundant, then opening up to trade should lead to an increase in the price of skill-intensive goods. This would in turn lead to an increase in the returns to skilled workers, since they are used intensively in the production of skill-intensive goods. Therefore, it is true that H-O predicts an increase in the return to skilled workers relative to unskilled workers, however, this relative increase would induce producers to employ a smaller ratio of skilled to unskilled workers in the telecommunications sector.

10. In the past, many economists have argued that opening up to trade should reduce world poverty because the poorest countries have a comparative advantage in exporting labor-intensive goods. Has the incidence of poverty declined? Give two reasons why the Heckscher-Ohlin framework may not apply in trying to estimate the impact of opening up to trade and poverty.

    The incidence of poverty has declined but not the absolute number of poor. The H-O framework may not be appropriate to estimate the impact of opening up to trade and poverty for the following reasons:

    1. Workers cannot easily relocate to expanding sectors

    2. Countries protect sectors that use unskilled workers

    3. Exporters/foreign firms use skilled labor even in unskilled-labor rich countries

    4. Getting goods produced by the poor (or using their labor) to global markets requires many complementary policies (infrastructure, human capital development, etc.)

2   The Ricardian Model of Trade (20 points)

The production possibility frontiers for Home (no asterisk) and Foreign (asterisk) are depicted in the graph below. both countries' labor forces are equally large, $L = L^*$.
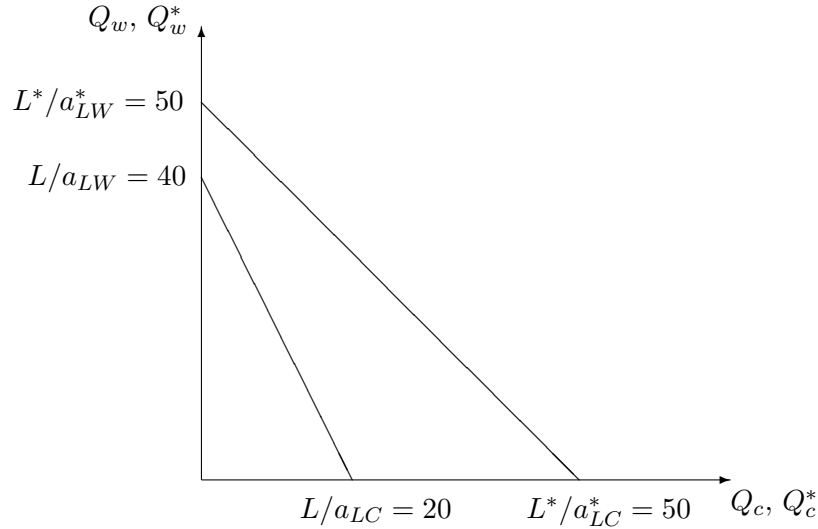
II.A (10 points) Calculate the opportunity cost of cheese in terms of wine for Home and Foreign. Which country has an absolute advantage in cheese production? Which country has a comparative advantage in cheese production?

The opportunity cost of cheese in terms of wine is given by a_c/a_w. We therefore have the following:

$$\frac{a_c}{a_w} = 2$$
$$\frac{a_c^*}{a_w^*} = 1$$

First, we know that the amount of labor is the same in both countries, therefore, since $L/a_{LC} < L^*/a_{LC}^*$ we know that $a_{LC} > a_{LC}^*$. This implies foreign has an absolute advantage in the production of cheese. Also, from the opportunity costs of the two countries, we can see that foreign has a comparative advantage at the production of cheese.

II.B (5 points) Home and Foreign are trading. Each country completely specializes in one good. What is the possible range of the relative equilibrium price of cheese P_c/P_w.

The range of prices must be in-between or equal to the relative autarkic prices, which are given by the opportunity costs. We therefore have

$$\frac{P_c}{P_w} \in [1, 2]$$

II.C (5 points) Choose one possible relative equilibrium price P_c/P_w. Is trade beneficial to both countries? You may explain briefly in words or illustrate your answer graphically.

If the relative price is at either end point (i.e. 1 or 2) then only one country will gain from trade (although no country will lose). We therefore choose relative prices to be in between the two endpoints: $P_c/P_w = 3/2$. With this world price for cheese we know that both countries positively gain from trade. Home benefits because they can buy cheese for less than it costs them to produce it. Foreign benefits because they can sell cheese for more than it costs them to produce it. Graphically, we can see the gains from trade by recognizing the separation between the PPF and the budget constraint. For example, for foreign we would have the following:

Figure 1: FOREIGN GAINS FROM TRADE
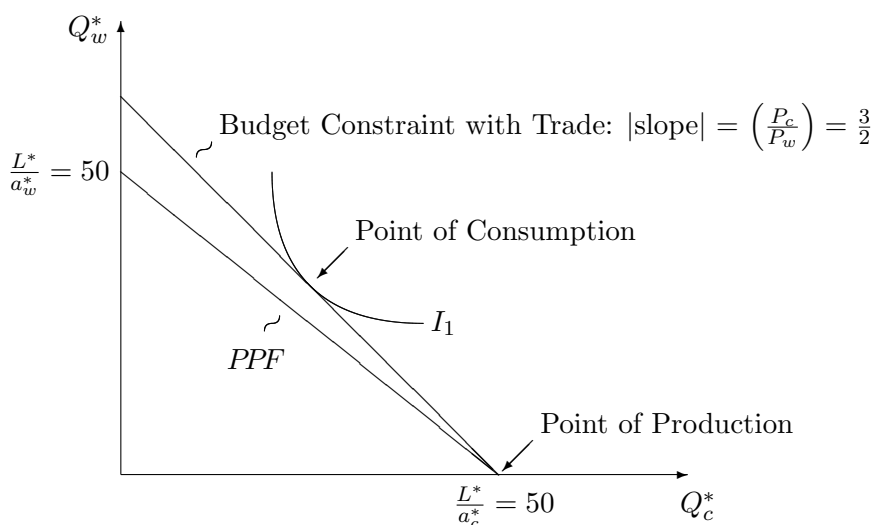
3 The Specific Factor Model (20 points)

According to an article that appeared in the New York Times several weeks ago, there has been an increase in suicides among Indian cotton farmers. The article attributes this increase at least in part to the 18 billion dollar a year spent on subsidies to cotton that the United States gives its own cotton farmers.

You are a consultant for the World Trade Organization, which has asked you to determine how Indian cotton farmers would be affected by removing the subsidies on US cotton. Assume the following:

- There are two goods produced in India and the USA, cotton and high technology services (software, back-office processing etc).

- Technology is the same in both countries.

- There are 3 factors: unskilled labor which is specific to cotton, skilled labor which is specific to high technology services, and capital, which is the mobile factor.

- Assume that the removal of US cotton subsidies increases the world price of cotton P_c but has no impact on the price of high technology services, P_t.

- Assume that the ratio of the endowment of unskilled to skilled labor in India is higher than in the United States, although there are equal numbers of skilled workers in both countries.
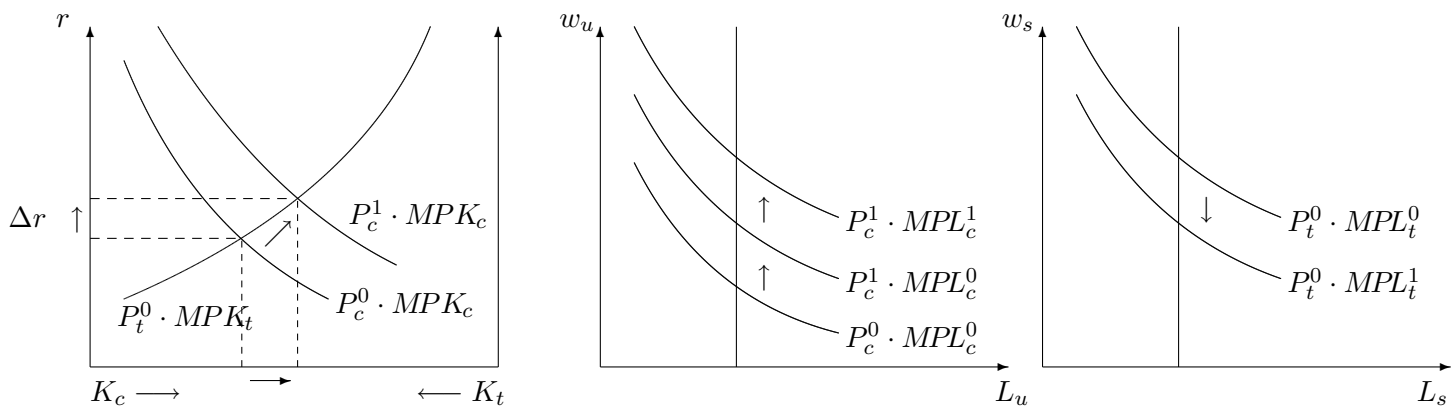
Answer the following questions:

III.A (5 points) What impact does the removal of US cotton subsidies have on nominal wages and the nominal return to capital in India?

To answer this question, we can use the assumptions and look to see what happens in the market for factors. The graphical results are listed below:

Figure 2: FACTOR MARKETS

In the above figures we use c to denote cotton and t to denote high technology goods. The increase in the price of cotton causes the value of marginal product of capital to shift upward in the cotton sector. This induces capital to leave the high tech sector and enter the cotton sector. The move in capital then causes the value of marginal product of unskilled labor to increase in the cotton industry and decrease in the high technology industry. Therefore, the nominal return to capital increases, the nominal return to unskilled labor increases, and the nominal return to skilled labor decreases.

III.B (5 points) What impact does the removal of US cotton subsidies have on real wages and the real return to capital in India?

With the nominal changes identified in the previous problem, we now need to look at returns by taking into account prices. The effects are listed in the following table. Let an up arrow "↑" imply an increase, a downarrow "↓" represent a decrease, a dash "−" represent no change and two up or down arrows represent a relatively large change.

Table 1: CHANGES IN REAL FACTOR RETURNS

Real Return w.r.t Good	Overall Change w.r.t Good	Change in Income w/trade
$\frac{r\uparrow}{P_c\uparrow\uparrow}$	↓	Ambiguous
$\frac{r\uparrow}{P_t-}$	↑	Ambiguous
$\frac{w_u\uparrow\uparrow}{P_c\uparrow}$	↑	Increase
$\frac{w_u\uparrow}{P_t-}$	↑	Increase
$\frac{w_s\downarrow}{P_c\uparrow}$	↓	Decrease
$\frac{w_s\downarrow}{P_t-}$	↓	Decrease

We can see that unskilled labor benefits, skilled labor loses, and the effect on capitalists is ambiguous.

III.C (5 points) What will happen to inequality in India as a result of the US removal of its cotton subsidies?

If our concern is inequality between skilled and unskilled labor, and the returns to skilled labor are initially higher, then wage inequality will decrease. This is because skilled wages decrease and unskilled wages increase.

III.D (5 points) If you are told that capitalists consume high technology services, but refuse to wear cotton shirts, how does this change your answer to (B)?

From the above table, we see that the real returns to capital decrease with respect to cotton and increase with respect to high technology services. Therefore, if capitalists only consume high technology services, they will be better off.

4   The Hecksher-Ohlin Model (20 points)

Suppose there is only one technique that can be used in clothing production. To produce a unit of clothing requires four labor-hours and one unit of capital; in food production each unit requires a single labor-hour and one unit of capital. At an initial equilibrium suppose the wage rate and capital rental are each valued at two dollars. If both goods are produced, what must be their prices? Now keep the price of food constant and raise the price of clothing to 15 dollars. Trace through the effects on the distribution of income. Rank the relative changes in the wage rate, the price of clothing, the price of food (unchanged), and the rent on capital. Relate your results to the Stopler-Samuelson theorem.

First, we must find the prices of the two goods. From the zero profit condition, we know that the cost of producing each good must equal its price, in other words, the price must equal the unit factor costs. We therefore have:

$$P_c = a_{Lc}w + a_{Kc}r = 4 \cdot 2 + 1 \cdot 2 = 10$$
$$P_f = a_{Lf}w + a_{Kf}r = 1 \cdot 2 + 1 \cdot 2 = 4$$

Now we want to allow the price of clothing to raise to 15 dollars, but to keep the price of food at 4 dollars. This means the returns to labor and capital must change such that the unit factor cost of cloth increases, but the unit factor cost of food doesn't. Assuming fixed factor requirements, we must solve the following system of equations:

$$4w + 1r = 15$$
$$1w + 1r = 4$$

Solving for w and r we get $w = 11/3$ and $r = 1/3$. To rank the relative changes, we can look at proportional changes. w went up by $5/6$, r fell by $-5/6$, the price of clothing increased by $1/2$, and the price of food remained constant. Ranking the changes, we have:

$$\%\Delta r < 0 = \%\Delta P_f < \%\Delta P_c < \%\Delta w$$

The Stopler-Samuelson theorem states that trade leads to an increase in the return to the factor that a country is relatively abundantly supplied and a decrease in the return to the scarce factor. In order for the price of clothing to go up, it must have been the case that clothing was relatively cheaper before trade. Given two countries have identical technologies, this is possible only if the country is relatively well endowed in the factor that cotton production uses intensively. Looking at the unit factor requirements, it is clear that cotton uses labor intensively because $a_{Lc}/a_{Kc} = 4 > 1 = a_{Lf}/a_{Kf}$. Therefore, this country must have been relatively well endowed with labor, and the Stopler-Samuelson predicts an increase in the returns to labor and a decrease in the return to capital, which is indeed the case.