

Midterm examination

Scores add up to 50

Your name: _____ SID: _____ Your TA: _____

Answer 6 of the questions 1 to 7 (3 points each). Do not answer 7 questions. Only 6 will be read.**True/False questions 1 to 3. Give a concise but precise explanation**

1. (3) In a specific factors model, where labor is the mobile factor, trade is beneficial for the workers of the export sector.

_____False_____

FALSE The welfare effect of trade on workers in *both* sectors is ambiguous. Because labor is mobile, the wage in the export sector must be the same as in the import sector, so worker welfare cannot vary by the sector of employment. Moreover, with the opening of trade the wage falls relative to the exported good and increases relative to the imported good, so the welfare effect cannot be determined without information on the workers' consumption patterns.

2. (4) The Heckscher-Ohlin model with two factors of production, labor and capital, shows that free trade between the US and Mexico would lower US wages to the level of Mexican wages that prevails prior to the opening to trade.

_____False_____

FALSE. Although the Factor Price Equalization Theorem implies that wages will converge due to free trade, this does not mean that wages will be equalized at pre-trade Mexican levels. They will converge to an intermediate level between the US and the Mexican pre-trade levels.

[Note: Because the United States has a larger economy, the relative price of output will change less in the US than it does in Mexico with the opening of trade. As there is a one-to-one correspondence between relative output prices and relative factor prices, the movement in relative wages will mirror the movement in output prices. If output prices change less in the United States than in Mexico, then it is likely that wages will move to a level closer to that of the autarky US level.]

3. (5) Countries A and B have two factors of production, capital and labor, with which they produce two goods, X and Y. Technology is the same in the two countries. Good X is capital intensive; Country A is capital abundant. An increase in A's labor induces an increase in B's terms of trade.

_____False_____

An increase in A's labor will induce an increase in A's relative supply of the labor-intensive good, good Y (import-biased growth) and the price of good Y will decrease. Because A is an importer of good Y, A's terms of trade increase. This implies that B's terms of trade must fall.

Short-answer questions 4 to 7.

- 4.(2) Ricardian model with more than two goods. Suppose the unit labor requirements for country A and B are the following:

	Country A	Country B	ratio a_{LA} / a_{LB}
corn	2	20	1/10
avocado	6	48	1/8
tomato	5	20	1/4
apples	7	20	7/20
wheat	12	6	2

If the wage rate in A is five times that of B, which goods will country A export? which goods will country B export?

Country A will produce and exports the goods that it can produce cheaper than B, for which $a_{LA} w^A < a_{LB} w^B$, i.e., for which the relative labor requirement a_{LA} / a_{LB} is less than 1/5.

Thus, A will export corn and avocados to B while B will export tomatoes, apples and wheat to A at this relative wage rate.

5.(4) State the Rybczynski theorem.

When the endowment of one factor of production increases, there is a biased expansion of the PPF toward the good that uses the expanded factor intensively. Furthermore, at constant prices the output of the good intensive in the expanded factor increases more (in percentage terms) than the change in the expanded factor, while output of the other good falls.

6.(3-4) Consider an economy where the factors of production are labor (mobile) and capital (sector-specific in the Specific Factors model and mobile in the Heckscher-Ohlin model). Contrast the welfare effect of trade on the capital owners in the Specific Factors and the Heckscher-Ohlin models.

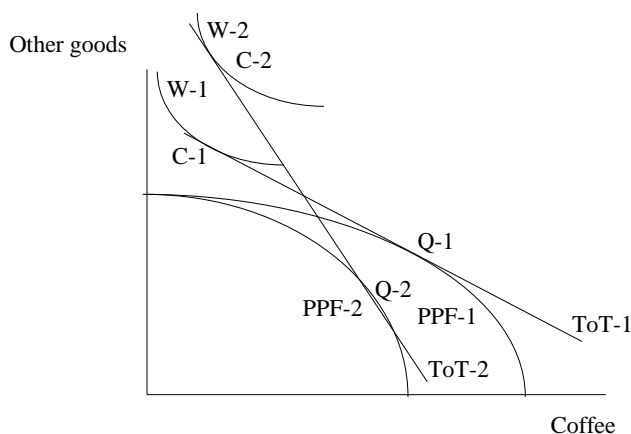
In the specific factors model, trade benefits the capital owners of the export sector of each country and hurts the capital owners of the import-competing sector. In the Heckscher-Ohlin Model, capital owners of both sectors gain if the country is capital abundant, and capital owners of the two sectors lose if the country is labor abundant. Thus, in the Specific Factors model, benefit from trade will be determined by the sector in which capital is used, in the Heckscher-Ohlin model the fate of capital depends on its relative abundance.

7. (reading) From the article “War of the Worlds: The working man’s dread” in *The Economist* of October 1994, on the role of trade in the increasing wage inequality in the US

- give two predictions of the theory that are contradicted by observations.
- the ratio of unskilled labor to skilled labor in each sector should increase
- the price of goods which are intensive in unskilled labor should decrease relative to the price of goods which are intensive in skilled labor
 - give two observations that are in accordance with the theory?
- Wage of unskilled labor should decline relative to wage of skilled labor
- There is a close relationship between import penetration and loss in manufacturing jobs (unskilled)
- There is a close relationship between import penetration and increase in skill differentials

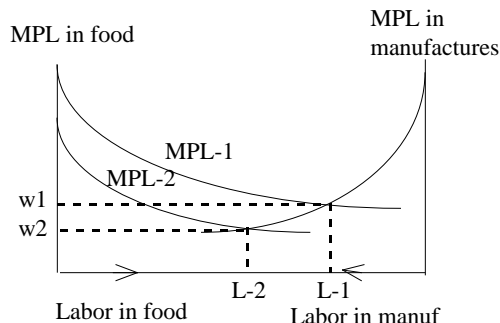
Answers the 2 following graphical questions (3 points each).

8. (5) A number of Latin American countries export coffee and import other goods. A long-term drought now reduces coffee production in the countries of the region. Assume that they remain exporters of coffee. Draw a graph showing how the long-term drought has affected the region’s PPF. Show on the graph how this might lead to an increase in the region’s welfare. What would make this gain in welfare more likely?



With the drought, the PPF shifts inward on the coffee axis, from PPF-1 to PPF-2. Decrease in the supply of coffee on the world market induces an increase in the region’s terms of trade. If the increase in the terms of trade is large enough, from ToT-1 to ToT-2, welfare may increase, as seen on the figure from W-1 to W-2. For this increase of welfare to happen, it requires a large ToT increase which is more likely to occur if the region is a large producer of coffee in the world market and if demand for coffee is inelastic.

9. (3 and pbset 2) Suppose that the United States produces only food and manufactures. Land is a specific factor input in food production and capital is a specific factor input in manufactures while labor is freely allocated across both sectors of the economy. All of a sudden, agricultural policy in the European Union induces an increase in the world food supply and reduces the international price of food. Illustrate the impact of the reduction in the price of food on the US labor demand curves for food and manufactures. What is the impact on labor allocation in the US and what is the impact on the wage rate?



Reduction in the price of food shift the value marginal productivity curve of food from MPL-1 to MPL-2. The equilibrium labor allocation shifts from L-1 to L-2 and the wage fall from w1 to w2. Labor declines in food and increases in manufactures. The US wage rate falls, although by less than the decline in the price of food.

Solve problem 10 (15 points)

10.(2) Trade and the environment in a Ricardian World

Consider a two country world (the US and a developing country) in which only two goods can be produced, good C (for CLEAN) and good D (for DIRTY). The two goods are produced using only one factor of production called “environmental resources” (E for short). A production process that uses a lot of E results in greater environmental deterioration.

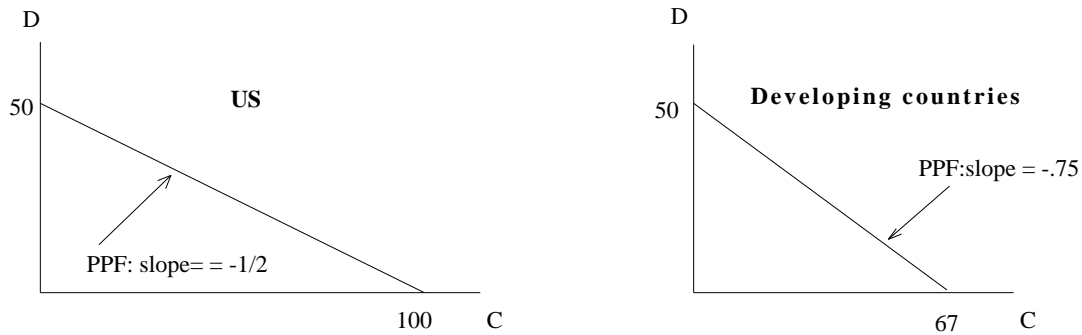
Since the US is wealthy, its citizens want environmental quality. Therefore, in the US, the “unit environmental resource requirements,” that is, the number of units of E that are required to produce one unit of a good, are small: they are equal to 1 in the production of C and 2 in the production of D. The developing country, on the other hand, spends more environmental resources producing one unit of each good. Specifically, in the developing country 3 units of E are spent producing one unit of C and 4 units of E are required to produced one unit of D.

10.1 What is the opportunity cost of producing C in terms of D in the United States and in the developing country? In which good does the U.S. and the developing country have a comparative advantage?

Production of C in the US costs 1 unit of E ($a_{EC}=1$). This unit of E could have been used to produce $1/a_{ED}=1/2 = 0.5$ units of D. The opportunity cost of C in terms of D in the US is therefore $a_{EC}/a_{ED}= 0.5$.

Production of C in the developing country costs 3 unit of E ($a^*_{EC}=3$). These three units of E could have been used to produce $3/a^*_{ED}=3/4 = 0.75$ units of D. The opportunity cost of C in terms of D in the developing country is therefore $a^*_{EC}/a^*_{ED}= 0.75$

10.2. Suppose that the U.S. is endowed with 100 units of E, and the developing country with 200 units. Draw each country’s production possibility frontier with the output of C along the X-axis, making sure that you label the intercepts. What is the slope of each PPF? What is the autarky relative price of C to D (P_C/P_D) in each country when the two goods are produced?



The U.S can put all of its 100 units of E into production of the clean good and have $100/a_{EC}=100$ units of C or it could put the 100 units into the dirty good and have $100/a_{ED}=50$ units of D. Between these extremes, the US must forego 2 unit of D for every 1 unit of C it produces, so the slope of the PPF is simply the (negative of) the opportunity cost of C in terms of D = $-1/2$.

The developing country can put all of its 200 units of E into production of the clean good and have $200/a_{EC}^*=67$ units of C or it could put the 200 units into the dirty good and have $200/a_{ED}^*=50$ units of D. Between these extremes, the developing country must forego $3/4$ units of D for every 1 unit of C it produces, so the slope of the PPF is simply the (negative of) the opportunity cost of C in terms of D = $-3/4$.

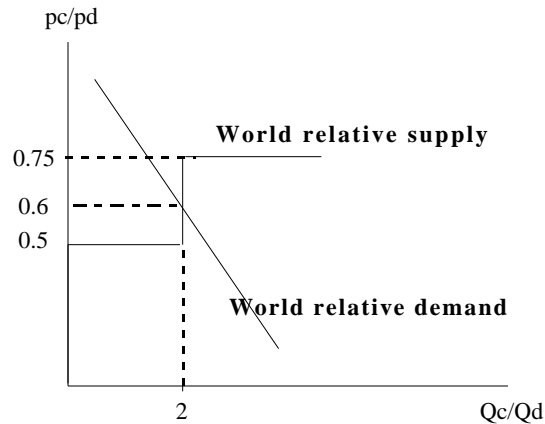
The autarky prices are equal to the nation's opportunity cost. In the US, $P_C/P_D = a_{EC}/a_{ED} = 1/2$. For the developing country, $P_C^*/P_D^* = a_{EC}^*/a_{ED}^* = 3/4$.]

[Because both goods are produced in each country under autarky, workers need to be indifferent between working in clean or dirty goods. Since workers receive all revenues from production, their wage is simply P_i/a_{Ei} for each good i. Equating the wages in the C and D sectors of the US we see that $P_C/a_{EC} = P_D/a_{ED}$ implies that $P_C/P_D = a_{EC}/a_{ED} = 1/2$. For the developing country, $P_C^*/P_D^* = a_{EC}^*/a_{ED}^* = 3/4$.]

10.3.□ Assume that the two countries can now trade with each other. Construct the world relative supply (RS) curve describing the amount of C that is produced relative to D as a function of the relative price P_C/P_D . Make sure you label your graph clearly.

From 10.2, we know that the US will be incompletely specialized so long as $P_C/P_D = 0.5$. If $P_C/P_D < 0.5$ then the wage will be higher in the dirty good so the US completely specializes in D. Similarly, the developing countries will be completely specialized in D if $P_C/P_D < 0.75$.

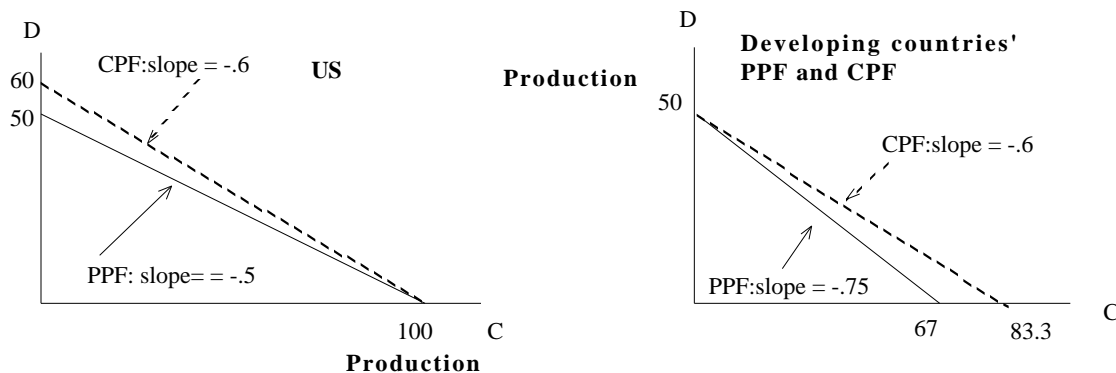
- So, for $P_C/P_D < 0.5$, the world is completely specialized in D and relative supply of C is 0.
- For $P_C/P_D = 0.5$, we could be anywhere on the US PPF, so US quantity supplied ranges from 0 to 100 units of C. The developing country specializes in D and produces 50 units. So world relative supply Q_C/Q_D ranges from $0/50 = 0$ to $100/50 = 2$
- For $0.5 < P_C/P_D < 0.75$, the US and the developing country are specialized. Supply is 100 units of C by the US and 50 units of D by the developing country. Hence relative supply is 2.
- For $P_C/P_D = 0.75$ the developing country's workers are now indifferent between working in clean vs. dirty goods so production in the developing country is somewhere on its PPF while we know that the US is completely specialized in clean goods. Thus at $P_C/P_D = 0.75$ developing country supply of C ranges from 0 to 67. Thus world relative supply Q_C/Q_D ranges from $100/50$ to $(100+67)/0 = \text{infinity}$:



10.4. Assume that relative demand (RD) for the two goods is the same in the two countries and is given by the expression $Q_C/Q_D = 4.4 - 4(P_C/P_D)$. Add this RD relationship to your previous diagram and determine the world relative equilibrium price P_C/P_D . What does each country produce? What is the pattern of trade?

At $Q_C/Q_D = 2$ the countries are specialized in different goods and this specialization pattern occurs when $0.5 < P_C/P_D < 0.75$. If the relative demand curve generates P_C/P_D in this range at $Q_C/Q_D = 2$, then we know $RS = RD$ when countries are completely specialized in different goods. $2 = 4.4 - 4(P_C/P_D)$ implies $2.4 = 4(P_C/P_D)$, $P_C/P_D = .6$, which is indeed in the price range required for complete specialization in different goods. In other words, we have confirmed that RD intersects RS in the vertical portion of RS:

10.5. Draw on your graphs from question 2 the after-trade consumption possibilities frontier for the two countries. Have consumption possibilities expanded or contracted in each of the two countries?



Consumption possibilities have indeed expanded in each country with the opening of trade.

10.6. Environmental consciousness in the world has increased the relative demand for CLEAN in the two countries. Specifically, relative demand is given now by the relationship $Q_C/Q_D = 5.5 - 4(P_C/P_D)$. What is the new world relative equilibrium price P_C/P_D ? What goods does each country produce? What is the pattern of trade?"

At $P_C/P_D = 0.75$, relative demand is $5.5 - 4(0.75) = 2.5$, which is larger than the relative supply under full specialization. The RD curve intercept the RS curve on the horizontal line at relative price equal to 0.75. Hence the US produces only C (100 units) and the developing country produces both C and D. The US imports some D from the developing country in exchange for some C.

Answer question 11 (11 points):

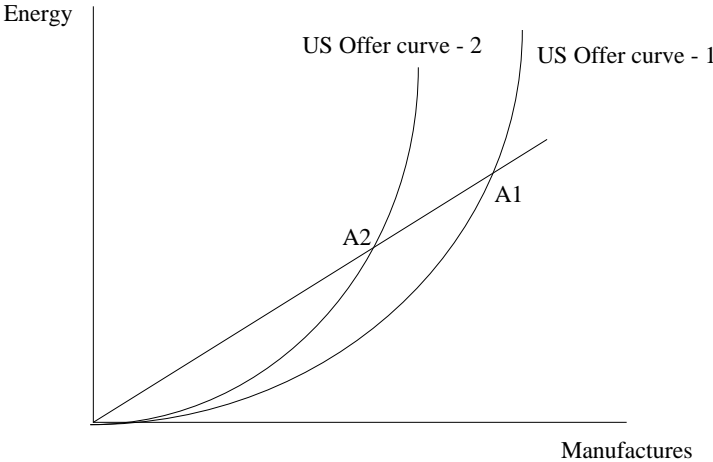
11. (5) The effect of a US policy of energy conservation on the rest of the world

A free-trade equilibrium exists in a two-region, two-product world. The United States trade with the Rest-of-the-World, exporting manufacturing and importing energy. Suppose that environmental consciousness has reduced the demand for energy in the US.

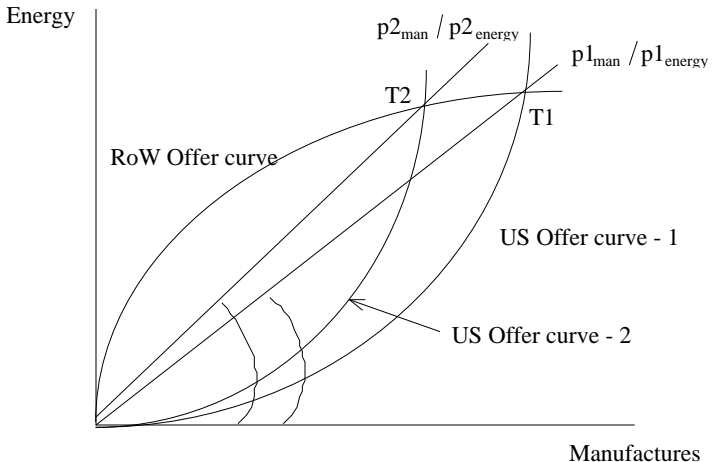
11.1. At given international price, what is the effect in the US of this change in demand on the desired levels of imports and of exports?

At any given price the relative demand of energy in the US decline. This implies a decrease in the desired level of imports, and correspondingly a decrease in the desired level of exports.

11.2. Illustrate this result on a graph showing the impact of this decline in the demand for energy on the US offer curve.



11.3. Assume that the United States is large enough to influence international prices, show on the previous graph how this reduction in the demand for in the US affects the equilibrium international price ratio and volume of trade.



The international relative price for manufacturing to energy increases. The trade equilibrium shifts along the RoW offer curve from T1 to T2, implying a contraction of trade, with less imports and less exports in both countries.

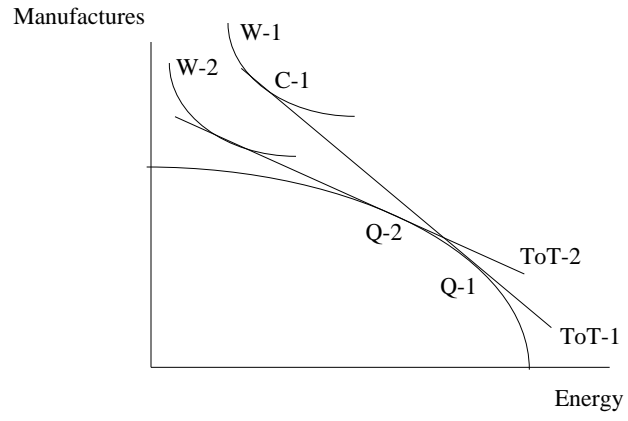
11.4. Show on a graph and explain the effect of this change in the terms of trade *in the Rest of the World* on

- quantities of manufacturing and energy produced
- Rest of the World's welfare

The production possibility frontier has not been affected. The increase in the relative price of manufacturing implies a decline in the RoW's terms of trade.

The decline in the terms of trade induce a shift in production from Q-1 to Q-2, implying less production of energy and more of manufacturing. Welfare decline from W-1 to W-2.

Rest of the World Production and Welfare



Alternate questions:

1. (3) In a specific factors model, where labor is the mobile factor, trade is beneficial for the workers of the import sector? _____false_____

FALSE The welfare effect of trade on workers in *both* sectors is ambiguous. Because labor is mobile, the wage in the import sector must be the same as in the export sector, so worker welfare cannot vary by the sector of employment. Moreover, with the opening of trade the wage increases relative to the imported good and falls relative to the exported good, so the welfare effect cannot be determined without information on the workers' consumption patterns.

2. (5) Countries A and B have two factors of production, capital and labor, with which they produce two goods, X and Y. Technology is the same in the two countries. Good X is capital intensive; Country A is capital abundant. An increase in A's capital induces an increase in B's terms of trade. _____true_____

TRUE: An increase in A's capital will induce an increase in A's relative supply of the capital-intensive good, good X (export-biased growth) and the price of good X will decrease. Because A is an exporter of good X, A's terms of trade deteriorate. This implies that B's terms of trade must increase.

3.(2) Ricardian model with more than two goods. Suppose the unit labor requirements for country A and B are the following:

	Country A	Country B	ratio a_{LA} / a_{LB}
corn	2	20	1/10
avocado	6	48	1/8
tomato	5	20	1/4
apples	7	20	7/20
wheat	12	6	2

If the wage rate in A is 3 times that of B, which goods will country A export? which goods will country B export?

Country A will produce and exports the goods that it can produce cheaper than B, for which $a_{LA} w^A < a_{LB} w^B$, i.e., for which the relative labor requirement a_{LA} / a_{LB} is less than $1/3$.

Thus, A will export corn, avocados, and tomatoes to B while B will export apples and wheat to A at this relative wage rate.

4.(4) State the Stolper-Samuelson theorem.

An increase in the relative price of the good intensive in a particular factor A will increase the price of factor A relative to both output prices and decrease the price of the other factor relative to both output prices. [Note also: the price of factor A will increase relative to the price of the other factor].

10.(2) Trade and the environment in a Ricardian World

Numbers are now:

$a_{EC} = 1$ and $a_{ED} = 2$ in the US

$a_{EC} = 4$ and $a_{ED} = 5$ in the developing countries

10.1 Opportunity cost of C in terms of D in the US = 0.5

Opportunity cost of C in terms of D in the developing countries = 0.8

US has comparative advantage in the production of C, and the developing countries in the production of D

10.2 US PPF: intercepts are 100 C and 50 D. The slope = -0.5; $P_C/P_D = 0.5$;

Developing countries PPF: intercepts are $200/4 = 50$ C and $200/5 = 40$ D; slope is $-40/50 = -0.8$; $P_C/P_D = 0.8$;

10.3 Horizontal segments are at relative prices of 0.5 and 0.8.

Vertical segments when there is full specialization is at relative supply of $Q_C/Q_D = 100/40 = 2.5$.

10.4 $2.5 = 5.5 - 5(P_C/P_D)$ gives $5(P_C/P_D) = 3$. Hence $P_C/P_D = 0.6$.

10.5 CPF have slopes equal to 0.6.

10.6 At $P_C/P_D = 0.8$, $RD = 7 - 5(0.8) = 3 > 2.5$ (RS under specialization)