

Part I: Short Answer Questions: To answer these questions you must identify (i.e. define) the listed concept and give its significance *to this course*. Fully correct answers do only this (Do not try to prove or derive anything or discuss the concept in detail). The answers to these questions can be given in four sentences or less. You will lose points for writing material unrelated to the answer so *think before writing*. **Credit: Answer 6 (six) of the following for 5 points each (30 total points).**

1. *Rybczynski Theorem*: This theorem states that—for an HOS economy with constant commodity prices and non-specialization, an increase in the endowment of one of the factors of production will result in an increase in the output of the good which uses that factor intensively, and a decrease in the output of the other good. Furthermore, both changes in commodity output will be proportionally greater, in an absolute value sense, than the initial increase in the endowment. This theorem provides a simple characterization of the effect of growth or migration on the production of the economy.

2. *Cone of Diversification*: For given relative commodity prices (and thus relative factor prices), the expansion paths for industries in production at those prices define a cone. Endowments in the interior of the cone permit full employment of factors of production and diversified production (i.e. production of positive quantities of both goods). All of the standard results of the HOS model assume that both countries endowments are in the same cone, or that comparative static shocks leave a given country's endowment in the same cone (or at least in the cone defined by the same two goods).

3. *Monopolistic Competition*: Monopolistic competition refers to a market structure characterized by differentiated products with decreasing average costs. Where consumers, either individual or in aggregate, have a preference for variety, welfare will depend on a tradeoff between price and variety. This model has been applied to trade to explain the presence of intra-industry trade and to argue that trade, in the presence of such a sector, is likely to be welfare-increasing.

4. *Dutch Disease*: The Dutch disease is a situation in which a positive shock in one tradable sector can lead to the elimination of a previously competitive productive sector. The reference is to the development of a large natural gas sector by the Netherlands which increased demand for factors, and thus their wages, such that previous exportables ceased to be competitive. This was used by some as an explanation of deindustrialization in the Netherlands and the UK.

5. *Marginal Rate of Technical Substitution*: The MRTS is the ratio of marginal physical products of factors in the production of a given good. In equilibrium, entrepreneurs will select a technology such that this is set equal to the equilibrium factor-price ratio.

6. *Leontief Paradox*: The HOS theory predicts that a capital-abundant country will export goods embodying a greater proportion of capital to labor than its import goods (this is the Heckscher-Ohlin theorem). However, using a 1947 input-output table, Leontief developed estimates of the capital and labor embodied in exports and import-substitutes for the US. Leontief found that the

production of a characteristic bundle of US exports used \$13,991 of K per man year, while production of a characteristic bundle of import-substitutes used \$18,184 of K per man year. Given the reasonable presumption that the US was globally capital-abundant, this would seem to falsify the HOS model.

7. *Factor Abundance*: This is a property of countries. Factor-abundance refers to the factor-endowment of one country relative to another (or to itself in a comparative static exercise). Many of the relationships in HO theory turn on the interaction between factor abundance and factor intensity and, in particular, on the assumption that one country is always *K*-abundant relative to the other, while one industry is always *L*-intensive relative to the other industry.

8. *Grubel-Lloyd Index*: The G-L index measures intra-industry trade as a share of total trade. Specifically, for sector *j*, this index is:

$$G_j := \frac{IIT_j}{TT_j} = \frac{X_j + M_j - |X_j - M_j|}{X_j + M_j} \equiv 1 - \frac{|X_j - M_j|}{X_j + M_j}.$$

This index varies between 0 (no IIT) and 1 (all trade is IIT). Studies using indexes such as this one find that IIT is a large share of total trade. A fact that appears inconsistent with standard trade models.

9. *Heckscher-Ohlin Theorem*: The HO theorem asserts that, under the assumptions of the HOS theory, a country will have a comparative advantage in the commodity whose production uses its abundant factor intensively. From the law of comparative advantage, this is the basis of a prediction about trade pattern—i.e. a country will export the commodity that uses its abundant factor intensively. Thus, we can, at least in principle, evaluate the HOS theory without information about autarky prices.

10. *Reciprocal Dumping*: In an international oligopoly (i.e. a world characterized by national monopolists that can sell into each others markets), with transportation costs, segmented national markets, and homogeneous goods, each national monopolist will sell into the other market to take advantage of prices above marginal cost. Because of the transportation costs, each will sell at FOB prices below that in their national markets. Thus, they are engaged in reciprocal dumping. Reciprocal dumping provides an alternative account of intra-industry trade.

Essay Information and Advice. Think carefully before answering. Write clearly and carefully. To answer questions correctly you must prove any assertion you make. If you use a result developed in the class or in the text you must prove that result. The proof need not be graphical, but it must be analytically clear. If you do use a graphical analysis you must clearly explain all the relevant parts of the graphical apparatus. In the questions I will use the term "neoclassical preferences" to denote preferences yielding utility functions that are: positive for positive amounts of both goods (and zero if consumption of either good is zero); increasing in both goods at a diminishing rate; and homothetic.

1. You are flying to Australia for Spring break when your airplane experiences engine trouble and crashes in the Pacific. You assume everyone else has gone down with the plane and, although you have been fortunate enough to inflate your life vest, you have pretty much given up hope of surviving. About the only good thing about this situation is that you are pretty sure you saw your least favorite class mate (the one who always gets better grades than you, and won't let you forget it) eaten by sharks. However, as fate would have it, after floating around for a couple of days you are picked up by a big canoe and taken to a very pleasant island.

It turns out that the island is in the middle of a huge political debate. For years the island has existed in isolation from the rest of the world, eating coconuts and wearing hula skirts. According to the best local practice one person can collect 10 coconuts in an hour or weave 5 hula skirts. It turns out that the big canoe in which you were carried to the island was recently washed up on the beach and when the locals were out cruising they found another island where the locals are able to collect 20 coconuts an hour and make 15 hula skirts. The people on the other island have expressed a willingness to trade. However, when the canoe was coming back from this trip they found your classmate (sadly, not eaten by sharks) floating in the ocean and he had explained to them that they had better not do it because the other country was clearly better at producing both goods. Since he had fallen out of the sky, some of the local people were predisposed to listen to him.

Since you have had Economics 433 you suggest that your classmate is wrong. The local people decide that whoever convinces them will be made Monarch while the other will be thrown to the sharks. This is your golden opportunity. How do you explain that the islanders with whom you are living can gain from trade. Note: the islanders are quite sophisticated, to be convincing you must lay out the assumptions of your argument and present your logic completely. (20 points)

Answer: A fully correct answer to this question must do two things. One, explain clearly the general notion of opportunity cost as applied to the general problem of international trade, and second, a specific application of this concept to the data in the question. For the latter, you want to show how, even though the Foreign island is absolutely better at producing both goods, the country cannot lose from trade. I would do this in three steps:

1) Show that the opportunity cost of, say, hula skirts (i.e. the coconut cost of a hula skirt) is greater on the Home island than on the Foreign island. The data given in the problem are:

	a_{LH}	a_{LC}
Home	1/5	1/10
Foreign	1/15	1/20

and, since the autarky opportunity cost is given by a_{LH}/a_{LC} :

$$\frac{a_{LH}}{a_{LC}} = \frac{1/5}{1/10} = \frac{10}{5} = 2;$$

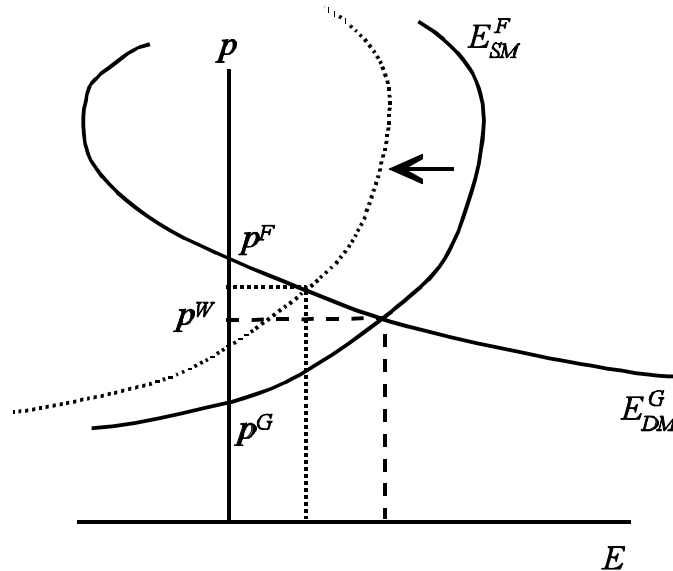
$$\frac{a_{LH}^*}{a_{LC}^*} = \frac{1/15}{1/20} = \frac{20}{15} = 4/3.$$

2) Show that this situation implies gains from trade if the Home country can trade at Foreign autarky prices. To make this argument, recall that autarky prices must be equal to opportunity cost. Thus, if the Home country can trade coconuts for hula skirts at $4/3$, 4 coconuts will acquire 3 hula skirts, where without trade 4 coconuts acquire only 2 hula skirts.

3) Finally, note that, while it will probably not be the case that trade will occur at the Foreign island's autarky relative price, as long as the terms-of-trade settle somewhere between the autarky relative prices, gains from trade will be had by both. At worst, one of the trading partners will be indifferent.

2. Suppose that West Germany and France are large, free-trading HOS economies. Specifically, suppose that Germany is K -abundant relative to France, and that in the trading equilibrium both countries produce motor-vehicles and apparel from capital and labor according to production functions which are characterized by constant returns to scale, with positive but smoothly diminishing returns to each factor if the other is held constant. Assume that motor-vehicle production is K -intensive relative to apparel production.

a. Illustrate the international equilibrium between these two economies. (10 points)



The above economy is a Heckscher-Ohlin-Samuelson economy. Thus, the Heckscher-Ohlin theorem is true of this economy and asserts that the K -abundant country (Germany) will have a comparative advantage in the production of the K -intensive commodity (motor-vehicles). That is, the autarky relative price of motor-vehicles, $p := P_M/P_A$, will be lower in Germany than in France. It is also a property of any HOS economy that the PPF is strictly concave. Thus, we can construct an illustration of the international equilibrium in the market for motor vehicles using the German excess supply function E_{SM}^G and the French excess demand function E_{DM}^F . The intersection of E_{SM}^G with the price axis, identifying the autarky price in Germany, must be below the intersection of E_{DM}^F , reflecting comparative advantage. Furthermore, E_{SM}^G will be smoothly upward sloping and E_{DM}^F will be smoothly downward sloping. As above.

b. Now suppose that West Germany is unified with East Germany (assume that East Germany had no prior trade relations with either West Germany or France). In addition, suppose that East Germany is substantially more L -abundant than West Germany. Illustrate the new international equilibrium. What happens to relative price of apparel in the two-country world made up of Germany and France? Explain your answer. (15 points)

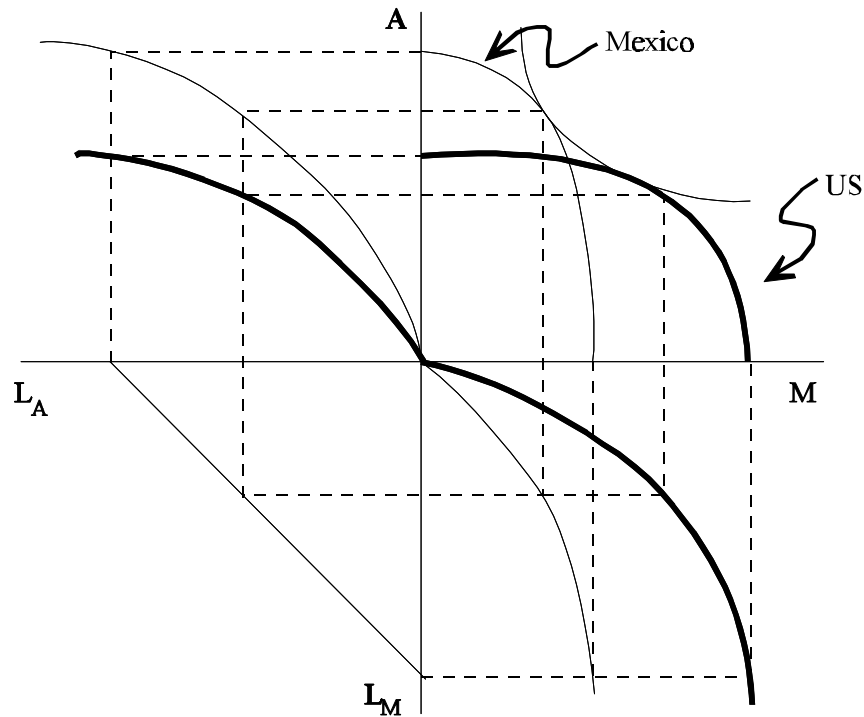
Unification between East and West Germany can be seen as an endowment change which, by the assumption of the question, is characterized by $\hat{L} > \hat{K}$. Thus, by the Rybczynski theorem, we must have, for any given price: $\hat{y}_A > \hat{L} > \hat{K} > \hat{y}_M$. This means that Germany's excess supply curve for motor vehicles will shift to the left, as shown above. The result will be an increase in the world relative price of manufactures, or a decrease in the world relative price of apparel. This is an improvement in the terms-of-trade of Germany, and a deterioration in the terms-of-trade of France.

c. What happens to the income distribution in France as a result of the change? Explain your answer. (15 points)

The change in relative prices implies that $\hat{P}_M > \hat{P}_A$. However, because this is an HOS economy, we know that it satisfies the assumptions of the Stolper-Samuelson theorem. Thus we have: $\hat{r} > \hat{P}_M > \hat{P}_A > \hat{w}$. Thus, capital-owning households in France (and in Germany) will experience an increase in real income, while labor-owning households will experience a decrease in real income.

3. Suppose that the US and Mexico liberalize trade. Suppose we call the only goods produced in those economies agriculture and manufacturing, where agriculture is produced from land and labor and manufacturing is produced from capital and labor. Suppose that Mexico is endowed with a greater supply of land relative to capital than the US, while the supplies of labor are identical. Production functions in both industries are characterized by constant returns to scale and positive but diminishing returns to each of the factors. Tastes are identical and homothetic between the two countries.

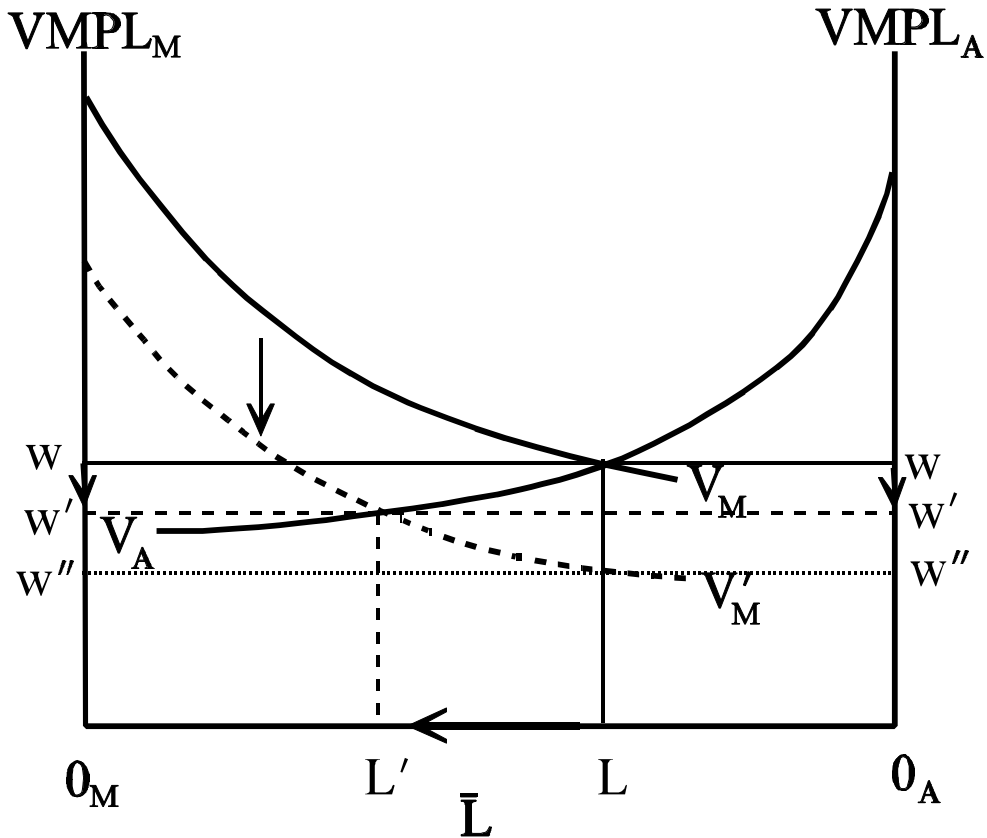
a. If the US and Mexico begin in autarky, in which commodity will the US have a comparative advantage? Explain your answer. (10 points)



Because we have assumed that the US and Mexico have the same labor endowment, we can illustrate their production condition on the same 4-quadrant diagram. Mexico's higher relative endowment of land, and thus the US' higher relative endowment of capital allows us to construct the above diagram. It should be clear that, for any given output mix, the slope of the Mexican PPF will be greater than the slope of the US PPF. Since both countries have identical homothetic preferences, this must imply that the autarky relative price of manufactures will be greater in Mexico than in the US. Thus, the US will have a comparative advantage in manufactures.

b. If we suppose that labor is costlessly mobile between industries, what will be the effect of opening trade between the US and Mexico on the short-run income distribution in Mexico? Illustrate and explain your answer. (15 points)

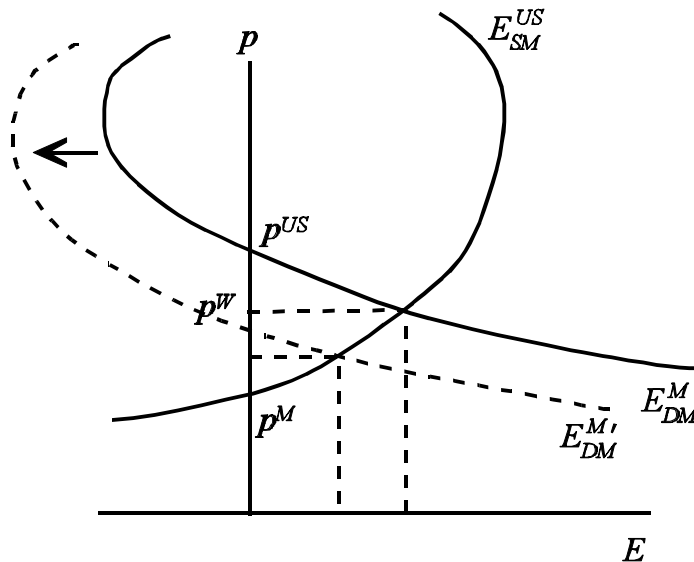
From the previous question, we know that the US will have a comparative advantage in the production of manufactures. Thus, opening international trade must result in a fall in the relative price of manufactures to the Mexican market. Suppose we take agriculture as the *numeraire*, so this price change is represented as: $\hat{P}_A = 0 > \hat{P}_M$. We can use the labor market diagram to derive the income distribution effects of the liberalization.



The fall in the relative price of manufactures shifts down the value marginal product curve for manufactures. Thus, the nominal wage of labor falls. However, the nominal wage falls proportionally less than the fall in the price of manufactures. We can see this by noting that, if L (the allocation of labor between sectors) is unchanged, K_M and L_M will be unchanged, so both must change in the same proportion as the price change. That would imply a wage of w'' . But because labor in manufacturing responded to this drop in wage by moving into agriculture, the wage only fell to w' . Thus, we have the neoclassical ambiguity: $\hat{P}_A > \hat{w} > \hat{P}_M$. At this point we can use either the weighted-average property of relative price changes, or the fact that, with endowments of specific-factors unchanged, change in the size of the triangular areas below the V_j curves but above the wage is associated with direction in return to the specific factor to conclude that: $\hat{r}_A > \hat{P}_A > \hat{w} > \hat{P}_M > \hat{r}_M$.

c. Now suppose that, as a result of liberalization-induced capital accumulation the Mexican endowment of capital increases. If both countries are large, what will happen to the relative price and the volume of international trade between these countries? Illustrate and explain your answer. (15 points)

In terms of the 4-quadrant diagram, an increase in Mexico's endowment of capital, will cause the Mexican total product of labor curve to rotate outward, causing the Mexican PPF to rotate outward on the fixed A-specialization point. This implies that, for any given relative price of manufactures, Mexico will now produce more manufactures than it did in the initial equilibrium, and less Agriculture (because labor will be drawn from Agriculture to support the increased capital in manufactures). Thus, if we consider the international market for manufactures, in which Mexico is a net importer, we have a diagram like the following:



The increase in the endowment of capital causes Mexico's excess demand for manufactures to shift to the left, resulting in a fall in the relative price of manufactures (an improvement in Mexico's terms-of-trade) and a fall in the quantity traded.

	ID	Essay1	Essay2	Essay3	Total	%Max	Dif
Mean	19	15	22	19	55	74	0
Std. Dev.	4	2	9	14	14	18	16
Max	27	18	33	37	75	100	25
Min	11	10	5	0	34	45	-29

Recall that %Max gives the score as a percentage of the maximum score (in this case 75). Dif. gives the difference between the total score on this exam and the total on the previous exam. The mean is the same as the previous exam and the mean difference is zero.