

**Economics 433: Advanced International Trade
Fall, 2006**

Practice Problems, Set 2

Suggested Answers

1. The following are (*very* approximate) data on the national income and population of the United States and the world as a whole (including the United States) in 2001:

	Population (millions)	Income (billions of US\$)
United States	300	8,000
Entire World	6000	32,000

Assume for simplicity that in all countries, the available labor force equals exactly $1/3$ of the population and that the U.S. trade is balanced. Further, assume that factor prices equalize across countries.

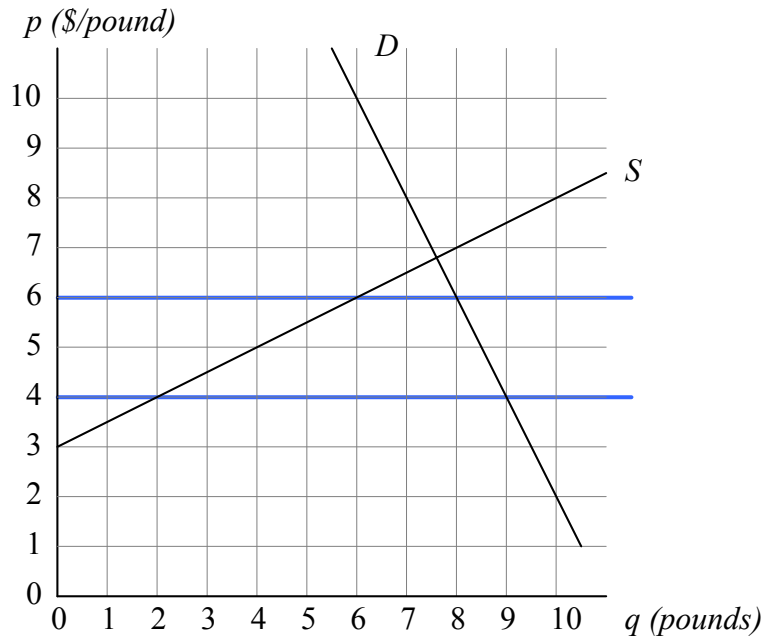
- a) Applying the factor content theorem, what should the net labor content of U.S. trade be?

The US share in income = $8,000/32,000 = 1/4$, the U.S. labor force is $L_{US} = (1/3)300 = 100$, and the world labor force is $L^* = (1/3)6000 = 2000$. Thus, using the formula from lecture 13, $T_{L(us)} = L_{us} - s_{us}L^* = 1/3 * 300 - 1/4 * 1/3 * 6,000 = 100 - 500 = - 400$ (millions)

- b) Using your answer to part (a), does the factor content theorem predict that the United States will be a net exporter or a net importer of capital services? (You may assume that labor and capital are the only two factors of production.)

According factor content theorem, the country is a net exporter of the abundant factor and importer of the scarce factor. From a), we may conclude that labor is a scarce factor. That means that means that capital must be an abundant factor. As a result, US are expected to be a net exporter of capital services. Put differently, if the U.S. generates $1/4$ of the world's income, and holds *less* than $1/4$ of the world's labor force, it must hold *more* than $1/4$ of the other factor—capital.

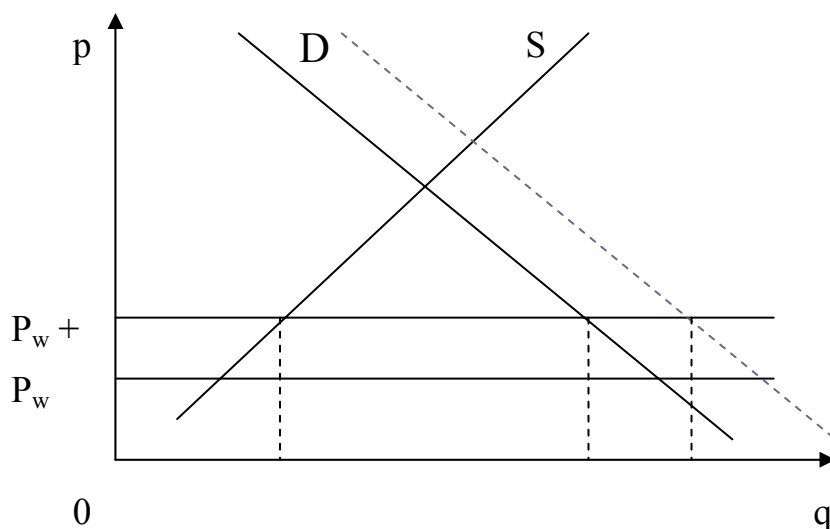
2. The graph below shows domestic supply and demand for sugar in a small country. Suppose that the world price of sugar is \$4 per pound. Show the effects on this market of a 50% *ad valorem* tariff on sugar by drawing the equilibria with and without the tariff, then using the grid lines in the figure to calculate the following effects of the tariff:



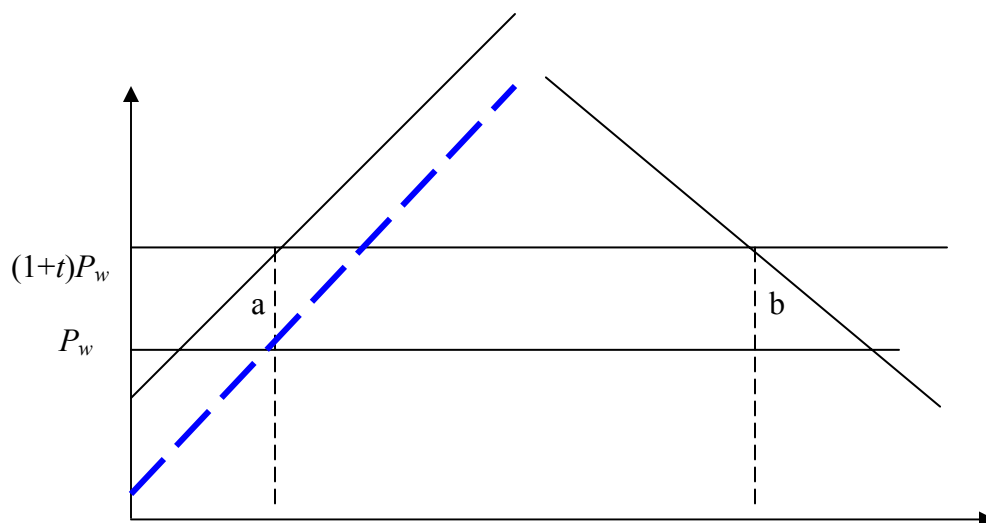
Quantity supplied rises from 2 to 6 pounds
 Quantity demanded falls from 9 to 8 pounds
 Quantity imported falls from 7 to 2 pounds
 Suppliers gain \$ 8
 Consumers lose \$ 17
 Government gains \$ 4
 Country as a whole loses \$ 5

3. Suppose that a country is initially in equilibrium with a certain non-prohibitive tariff. (“Non-prohibitive” means that, despite the tariff, some imports still come into the country.) Using the partial equilibrium model of a small importing country, and assuming that the tariff rate does not change, what will be the effects on prices (up, down, **unchanged**) _____, quantities (**up**, down, unchanged) _____, and imports (**up**, down, unchanged) _____ of a shift to the right in the domestic demand curve?

The price does not change. The quantity demanded increases, the quantity supplied is unchanged, and imports increase (refer to the diagram below).



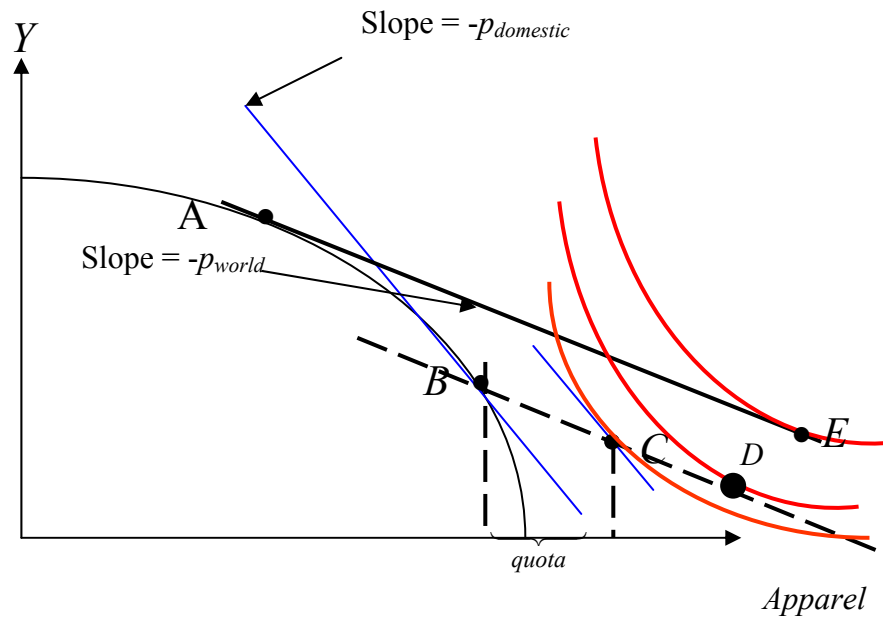
4. Suppose that the reason the United States re-imposed apparel quotas in 2005 was to increase employment in the apparel industry to a certain level. Using a general equilibrium diagram of a small-open economy (i.e., a diagram with a production possibility frontier), explain why this policy is not the economically optimal way for the United States to accomplish this objective? What policy or policies might have achieved it at lower cost to the American economy? Do you think these policies would have been politically acceptable?



A production subsidy would have been better than a tariff because it would not have induced a deadweight loss for consumers. On the picture, the supply curve inclusive of the subsidy would have been the thick dotted line, and consumers would have faced world prices, P_w . The deadweight loss would have been a rather than $a+b$.

A subsidy is less politically acceptable because, instead of raising government income (as a tariff would), it raises government expenditures.

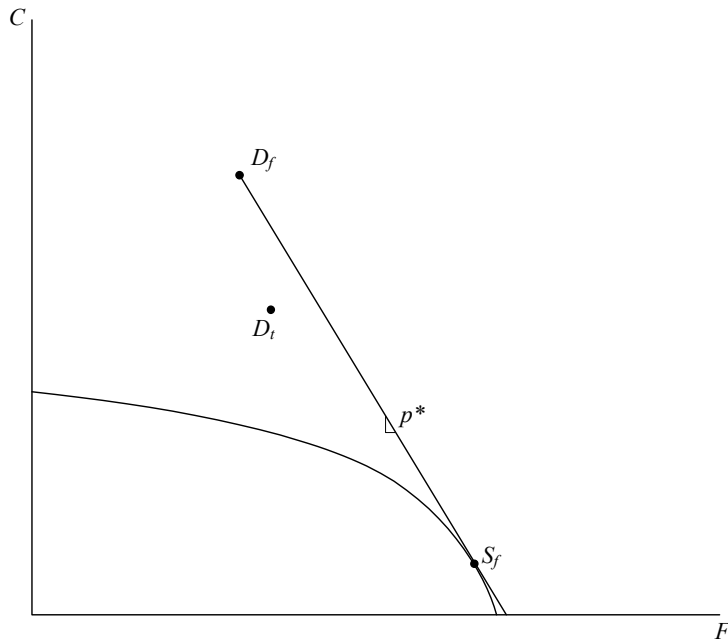
You can also use a general equilibrium diagram to answer this question.:



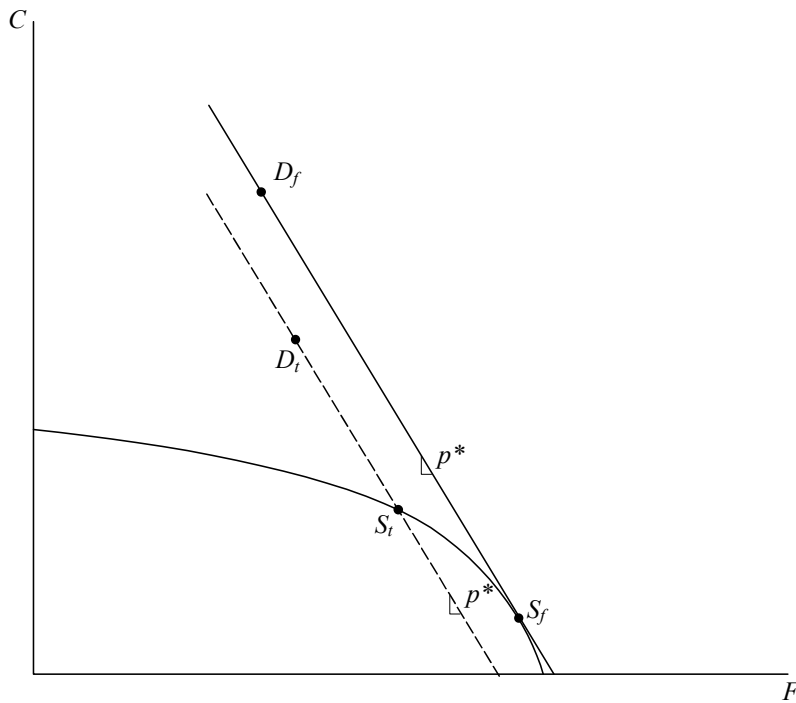
The diagram above comes from lecture 18 (slide 7). If the government imposes a quota the economy will consume at point C. However, if the government subsidizes the production of apparel, the economy will consume at point D on the diagram after the subsidy. Since the production point remains unchanged (it is always B) when government switches from a quota to a subsidy, the employment objective is achieved under both policies. However, a subsidy policy is less costly for the economy because the consumption point D lies on a higher indifference curve than consumption point C. (A tax on the production of Y could also be used to achieve that objective more efficiently than a quota.)

5. The diagram below shows the PPF of a small economy that produces food (F) and clothing (C), together with the free trade consumption point (D_f) and a tariff-distorted consumption point (D_t). Perhaps surprisingly, this is sufficient information for you to derive the free-trade relative price of food, P_F^W / P_C^W , and the domestic relative price of food under the tariff, P_F / P_C . Indicate these relative prices as slopes of lines on your graph. Also identify the points on your graph that indicate the quantities of food and clothing produced both with (point A) and without (point B) the tariff. Now assume homothetic preferences, and make a good guess at what the indifference curves look like through D_f and D_t . Finally, explain how you could use your graph to estimate the ad valorem size of the tariff.

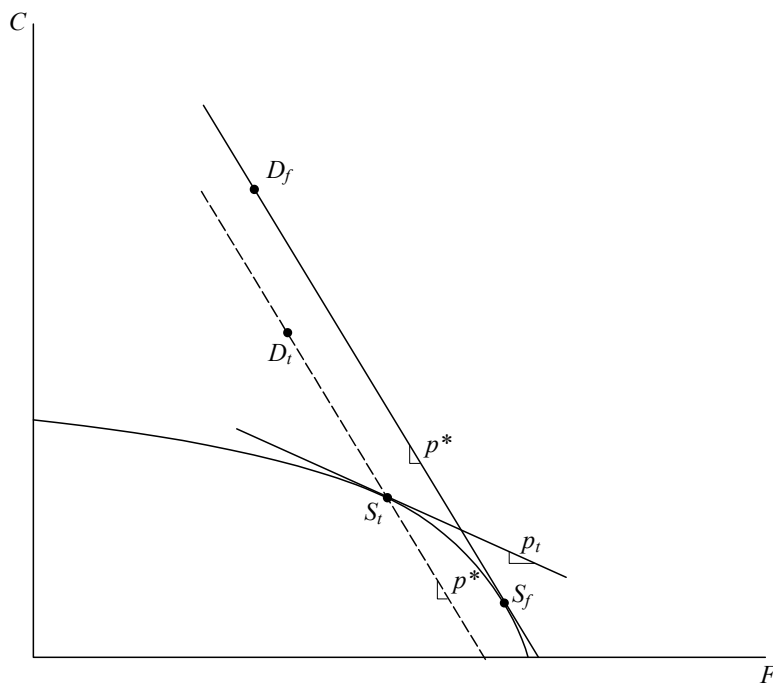
I will show this in steps. First, construct the straight line through point D_f that is also tangent to the PPF. The slope of this line is the negative of the world price ratio, $-P_x^W / P_y^W = -p^*$, and the point where it is tangent to the PPF is the production point with free trade, S_f .



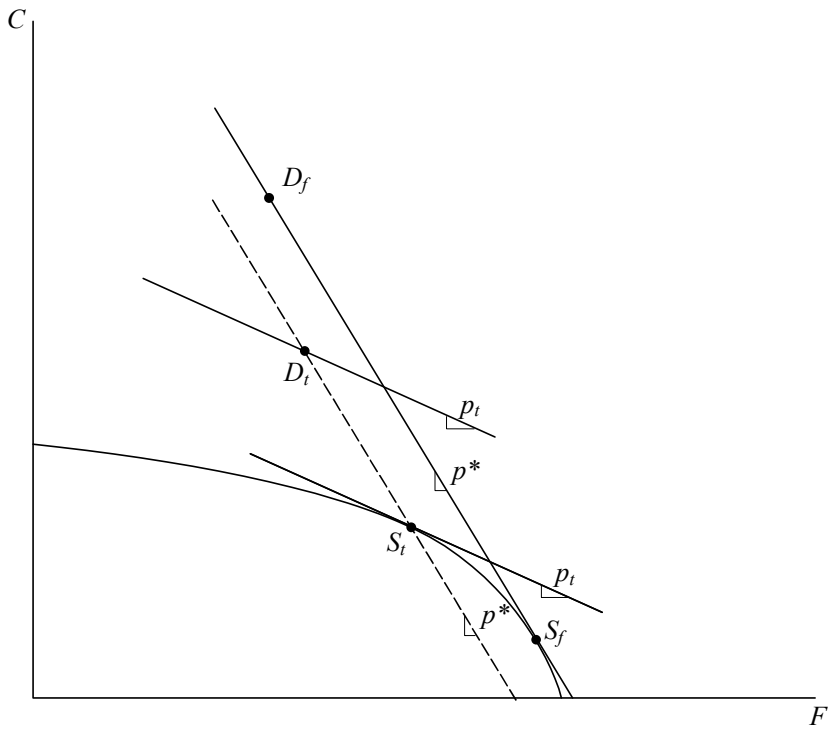
Next, draw a second line parallel to the one you just found, passing through point D_t . Its intersection with the PPF is the production point under the tariff, S_t :



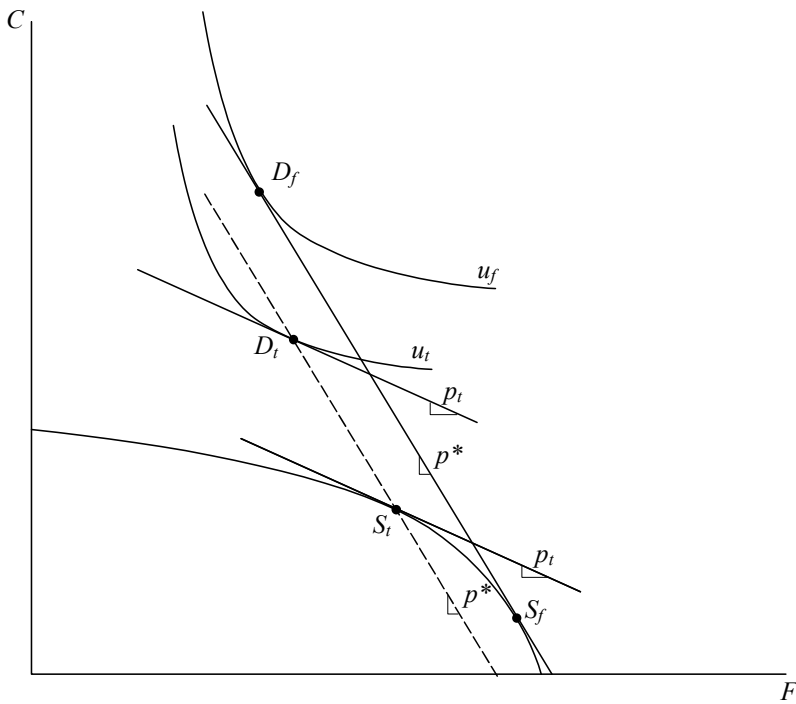
Production at S_t requires that domestic prices equal the slope of the PPF at that point, so draw another straight line tangent to the PPF as S_t . Its slope is the negative of the domestic price ratio under the tariff, $-P_x^W / [(1+t)P_y^W] = -p_t$.



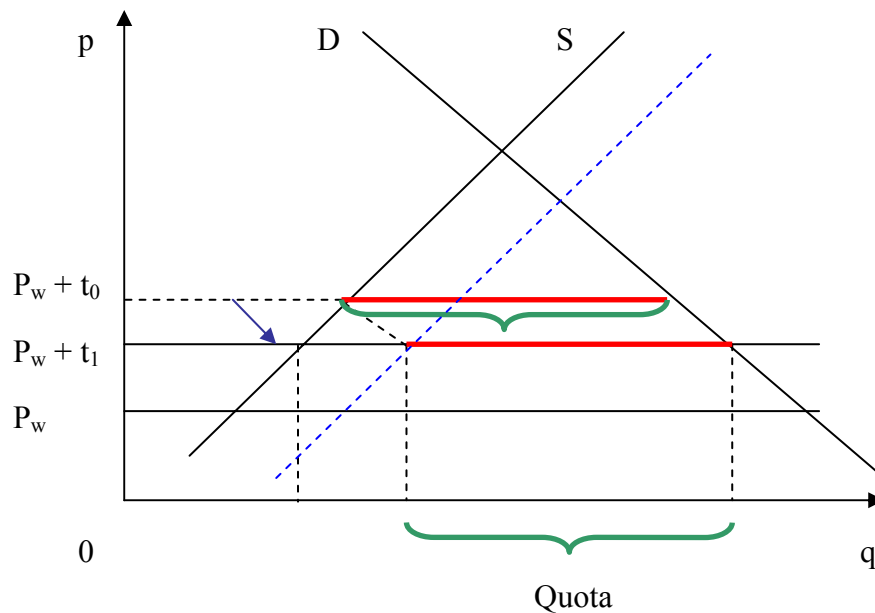
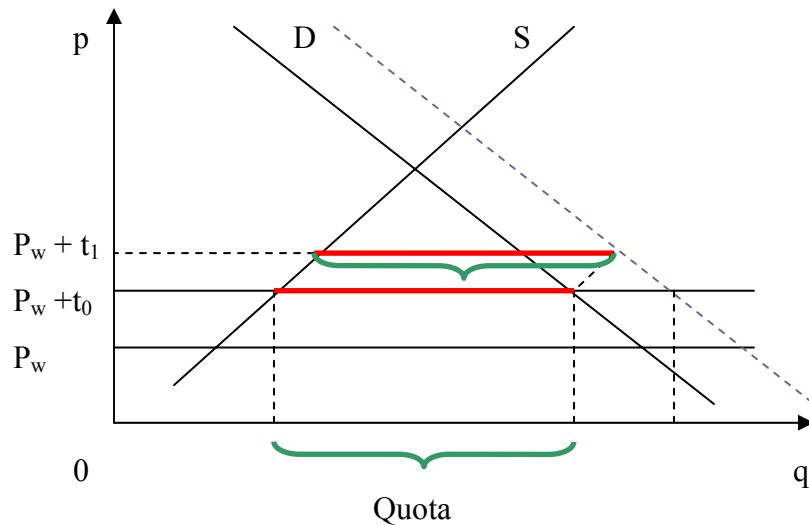
The budget line of consumers also must have slope equal to p_t , and so it is a straight line parallel to the one just drawn but passing through the consumption point D_t :



Finally, two indifference curves can be drawn into the figure, one tangent to the p_f line at D_f , and the other tangent to the p_t line at D_t .

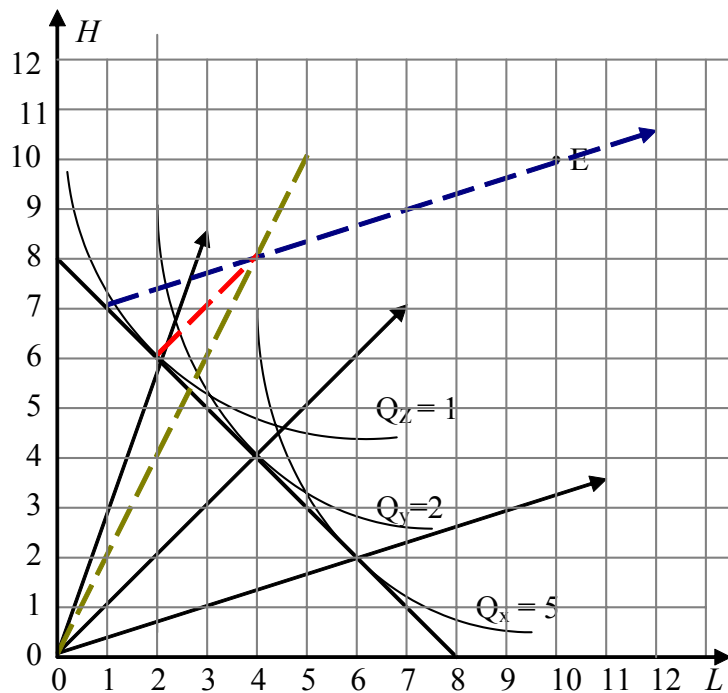


6. The “tariff equivalent” of an import quota is the tariff that would have led to the same quantity of imports as the quota. Use a partial equilibrium diagram (i.e., a diagram with supply and demand curves) to show how the tariff equivalent of a particular quota changes in response to an increase in (rightward shift of) the importing country’s demand for the good. Now draw a new diagram to show how it changes in response to an increase in the importing country’s supply of the good. Is it possible for either of these changes to cause the tariff equivalent of the quota to become negative?



A negative tariff equivalent is impossible here. If the autarky price becomes smaller than the world price then the country starts to export the good rather than import it and the quota becomes irrelevant.

7. In Technoland, there are two types of factors—human capital (H) and unskilled labor (L). There are also two basic sectors: industry and services. Services, denoted by X , are non-traded and very unskilled-labor intensive. Industry encompasses involve two types of activities, both of which are more human-capital intensive than services: product development and operations management (Z), which is very human capital-intensive; and component manufacturing/assembly (Y), which is somewhat human-capital intensive. Isoquants for services and the two industrial activities are presented in the graph below. (Note the quantities associated with the isoquants.) Arrows represent factor intensities of production for each activity, given the \$1 isocost line that is depicted.



- a) When there is no cheap way to do manufacturing and assembly abroad, all three stages of production are done within the country, and the prevailing factor prices are given by the \$1 isocost line graphed above. What is the price for a unit of human capital in this “un-fragmented” equilibrium? $w_h = 1/8$ What is the price for a unit of unskilled labor? $w_u = 1/8$.
- b) In the un-fragmented equilibrium, what are the implicit prices associated with each type of activity? $P_x = 1/5, P_y = 1/2, P_z = 1$. (Recall that implicit prices reflect the costs of producing *one* unit of output.)
- c) If each unit of product development and management leads to 1 unit of manufacturing and assembly (that is, Y and Z are always produced in a one-to-one ratio), and the endowment point is E (that is, $H = 10, L = 10$), how much of each good is produced in the un-fragmented equilibrium described above? $Q_x = 5, Q_y = 1, Q_z = 1$.

Idea: Since $Q_x = Q_y$, it must be that for every 6 units of H and 2 units of L used in Z production, there must be 2 units of H and 2 units of L used in Y production. This condition is satisfied, of course, if one unit of each good is produced (refer to the line segment connecting the origin to (2,6), which reflect factor usage in Z; the line segment from (2,6) to (4,8), which reflects factor usage in Y; and the line segment from (4,8) to (10,10), which reflects factor usage in X production.) In fact, this is the *only* way the condition $Q_x = Q_y$ can be satisfied. If any more Z were to be produced, there would have to be less Y production; similarly, if any more Y were produced there would have to be less Z production. (Imagine shifting the red segment up or down, holding its slope constant but adjusting its length so that it continues to connect the Z ray and the dashed blue X ray.)

There is another way to see the solution to this problem. Since Y and Z are produced in fixed proportion we could treat them together as one good (say Y+Z). Given the price ratio we could calculate the factor intensity of production for that combined good. It is represented by the brown dashed line. Now we have only two goods Y+Z and X. Given the factor intensities, the equilibrium quantities produced will be determined by the intersection of the brown and blue lines. We see that in the equilibrium this economy devotes 8 units of human capital and 4 units of unskilled labor to the production of the combined good and the rest is devoted to production of X. Given the amount of resources devoted to the production of each good, we could calculate the amounts above.

- d) Now suppose that, because of improved education and infrastructure in developing countries, it becomes possible to manufacture and assemble goods abroad at some price below the P_y that you calculated in part b. This is true even after accounting for transport costs, so firms shift their manufacturing operations to low-wage countries. Presuming for the moment that the prices of for x -type activities and z -type activities don't change, what happens to the volume of X activity and Z activity in Technoland? Q_x goes (up, down) **Goes Up**, Q_z goes (up, down) **Goes Up**.

Idea: Since the prices of Z and X are fixed, production of Y is moved completely to the developing world. So the resources now are allocated between only two goods Z and X. Moreover, the factor intensities of producing X and Z do not change. Thus the new equilibrium is given by the intersection of the factor intensity line for Z and the blue line. Clearly at that equilibrium more resources are devoted to the production of both X and Z. Hence, the answer follows.

- e) Assume that management and product development are globally traded services—that is, managers, scientists and engineers from any country can develop products and business plans for goods that are produced in *any* country. So if Technoland is small, any change in the amount of z activities that it supplies is unlikely to affect the world price for z . But services are not traded, so their price is not pinned down by global supply and demand conditions. Given these facts and your answer to part (d) above, how is the price of x likely to adjust to the

offshore shifting of manufacturing and assembly? P_x (*goes up, goes down, doesn't change*) **Goes down.** How are skilled and unskilled wages likely to adjust? w_h (*goes up, goes down, doesn't change*) **Goes Up** w_u (*goes up, goes down, doesn't change*) **Goes Down.**

Idea: Since the amount of good X produced increased and it is non-traded good, the price for X should fall. The fall in price would cause the unit revenue isoquant for X to shift outward (not pictured). The associated isocost line would have a lower intersection on the vertical axis and a higher intersection on the horizontal axis, reflect the increase in skill wages and the reduction in unskilled wages.