

**Economics 433: Advanced International Trade**

**Prof. Andrés Rodríguez-Clare**

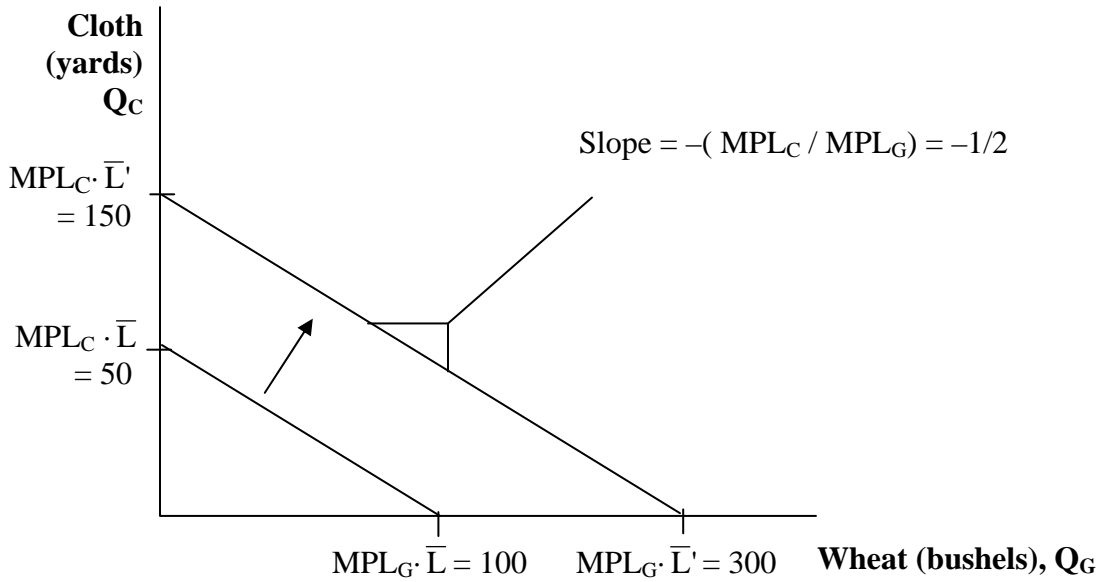
**Fall, 2007**

**ANSWERS**

Answer the following problems 1-2 using the chapter information for Home and Foreign:

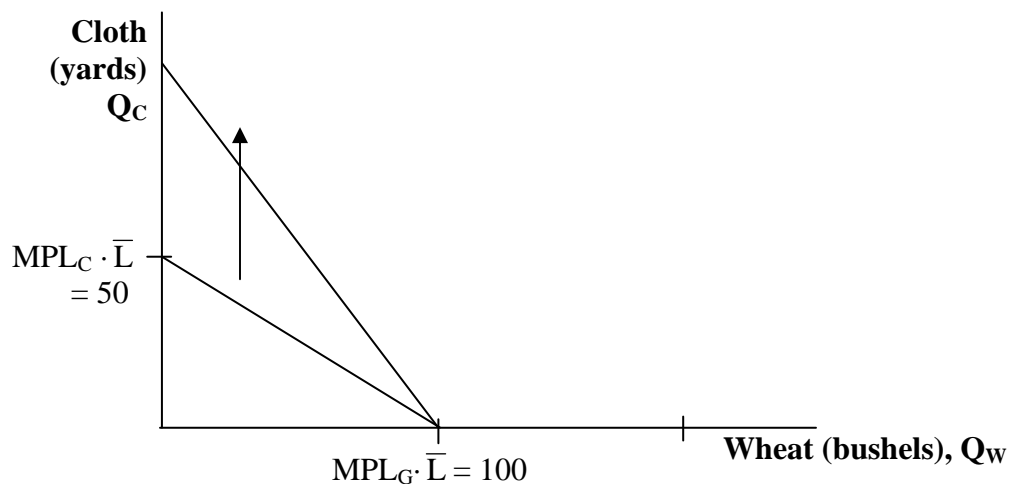
**Problem 1**

(a) Suppose that the number of workers triples in Home. What happens to the Home PPF and what happens to the no-trade relative price of wheat?



With the tripling of the number of workers in Home, it can now produce  $300 = 4 \cdot 75$  bushels of wheat if it concentrates all resources in the production of wheat or it can produce  $150 = 2 \cdot 75$  yards of cloth by devoting all resources to the production of cloth. The no-trade relative price of wheat remains the same since both  $MPL_G$  and  $MPL_C$  are unchanged.

(b) Suppose that there is technological progress in the cloth industry, so that Home can produce more cloth with the same amount of labor. What happens to the Home PPF, and what happens to the relative price of wheat?

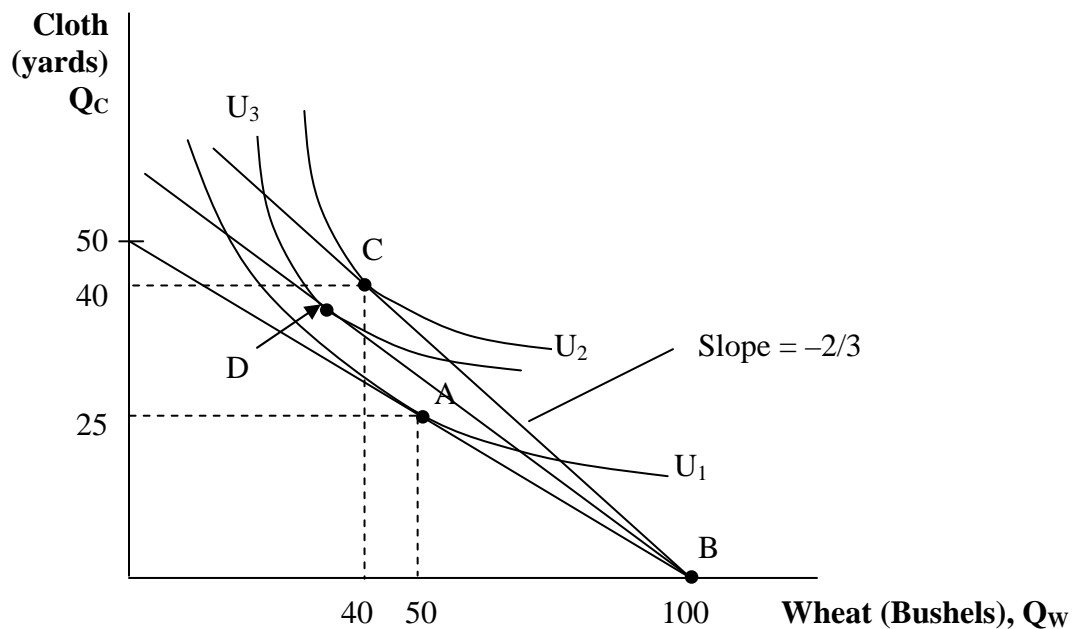


Since the technological progress is only in the cloth industry, Home's production of wheat remains the same with all Home's resources devoted to the wheat production. If instead, Home produces only cloth, it can produce more cloth using the same amount of labor. Hence, Home's PPF rotates in the direction of cloth production. Recall that the relative price of wheat is given by  $P_w / P_c = MPL_c / MPL_w$ . With the technological progress in cloth, the marginal product of labor in the cloth production increases. Thus, the relative price of wheat increases.

### Problem 2

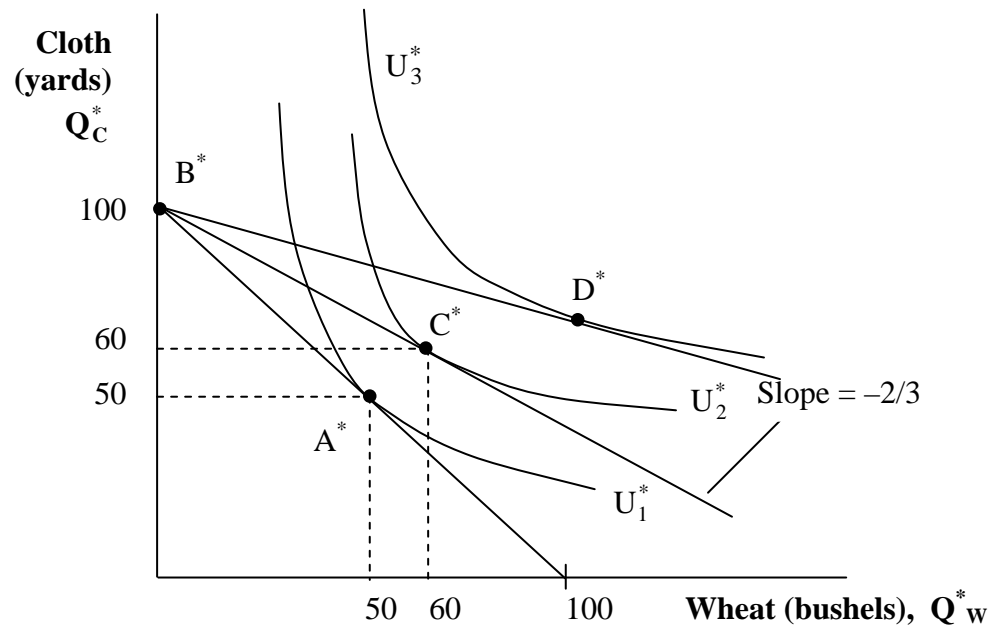
Using Figure 2.5, show that a decrease in the relative price of wheat from its international equilibrium of  $2/3$  will lower Home's utility. What is the Home's utility when the international price of wheat reaches  $1/2$ , and what happens in Home when the relative price of wheat falls *below* that level?

(a)



A decrease in the relative price of wheat from its international equilibrium of  $2/3$  makes Home utility fall. For example: at point D ( $U_3 < U_2$ ). When the international price reaches  $1/2$ , Home utility gets back to the pre-trade level, because Home would consume at point A (no-trade equilibrium point). If the international price falls below  $1/2$ , then Home will switch to exporting cloth instead of exporting wheat.

(b) Using Figure 2.6, show that a decrease in the relative price of wheat from its international equilibrium of  $2/3$  will raise Foreign's utility level.



A decrease in the relative price of wheat from its international equilibrium of  $2/3$  increases Foreign's utility to  $U_3^*$  with consumption at  $D^*$ .

### Problem 3

There are two countries: US and Mexico. There are two goods: computers and apparel. There is one factor of production: labor. The MPL for computers and apparel is as follows:

	MPL <sub>c</sub>	MPL <sub>a</sub>	Opp cost of c	Opp cost of a
US	2	3	3/2	2/3
Mexico	1/4	1	4	1/4

a) What is the opportunity cost of c and a in the two countries? Fill in the table above.

b) What country has absolute advantage in computers? What in apparel?

US has absolute advantage in both computers and apparel

c) What country has comparative advantage in computers? What in apparel?

US has comparative advantage in computers and Mexico in apparel

d) What is the autarky relative price of computers in the US and Mexico?

In US it is 3/2 and in Mexico 4

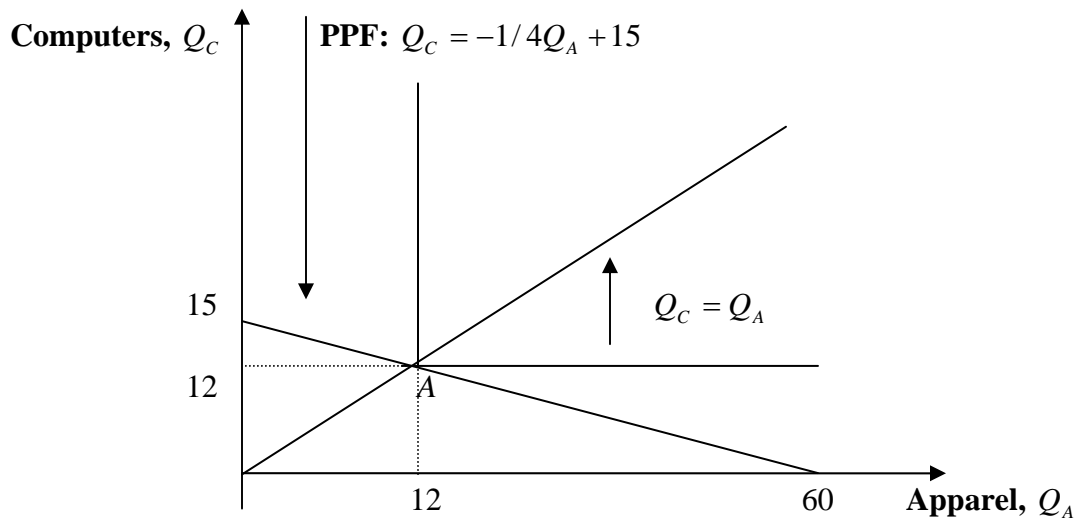
e) Imagine that the US-Mexico border is closed, so that there is no trade, but you find a little hole in the wall. What is the “roundabout” way of obtaining apparel in the US? Is this cheaper than the direct way?

You can buy apparel from Mexico and this way is much cheaper (apparel costs 1/4 of a computer in Mexico and 2/3 in US).

f) Assume that total labor units in Mexico are 60, whereas in the US there are 100. Draw the PPF for both countries with apparel on the horizontal axis. Now imagine that consumers in Mexico and the US are identical, and that they have extreme preferences: no matter what price, they always want to consume one unit of apparel per one computer. (Note: in this case the social indifference curves can be depicted as L shaped, with the corner of the L lying always on a ray given by  $Q_c = Q_a$ ). What is the equilibrium production and consumption points in autarky for both countries?

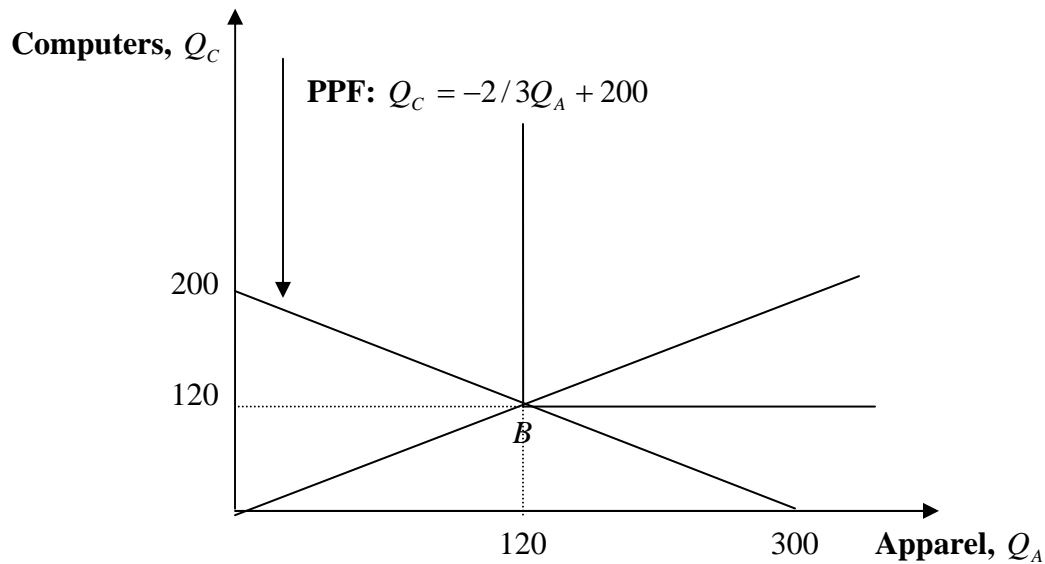
The consumption point will be on the PPF. To get the maximum utility, we need to find the point on the PPF that reaches the highest (i.e., more northeast) social indifference curve. Clearly, this is going to be the point along the PPF that just touches the corner of the L shaped indifference curves. But then this point must satisfy  $Q_c = Q_a$ . Thus, the simple algebra exercise entails finding a point on the line given by the PPF that satisfies this relationship. Graphically, this is the intersection of the PPF and a ray through the origin with slope 1. Below, we have this graphical representation and the intersection point for both Mexico and the US.

### ***Mexico:***



The equilibrium point is  $A$ . At this point:  $Q_A = -1/4 Q_A + 15$ . This implies that  $Q_A = 12$  and  $Q_C = 12$ .

## USA:



The equilibrium point is  $B$ . At this point:  $Q_C = -2/3Q_A + 200$ . This implies that  $Q_A = 120$  and  $Q_C = 120$ .

g) Now imagine that trade is established. What is the possible range for the wage in Mexico relative to the wage in the US? What would happen if the wage were to fall outside this range?

There are two ways to solve the problem

1) Possible range for the wages is  $[1/8, 1/3]$ , which reflects the ratio of productivities in each sector of economies.

If the relative wage in Mexico were lower than  $1/8$  then everything will be produced in Mexico. If relative wage in Mexico were higher than  $1/3$  then everything will be produced in US. However, this is not possible because if nothing is produced in a country the relative wage in that country will fall until the relative wage in Mexico belongs to the range specified above.

2) The possible equilibrium world relative price of apparel is  $1/4$  to  $2/3$ . It can not be strictly greater than  $2/3$  and strictly less than  $1/4$ . In this case, countries do not trade. US has comparative advantage in computers, this implies that wage in US would be equal to the world price of computers multiplied by the marginal product of labor in the computer industry:  $W_{US} = MPL_C^{US} P_C^W$ . Similarly, Mexico has comparative advantage in apparel. Thus, wage in Mexico is equal to the marginal product of labor in apparel

industry multiplied by the world price of apparel:  $W_{MEX} = MPL_A^{MEX} P_A^W$ . Hence, the relative wage is given by:  $\frac{W_{MEX}}{W_{US}} = \frac{MPL_A^{MEX} P_A^W}{MPL_C^{US} P_C^W} = \frac{1}{2} \frac{P_A^W}{P_C^W}$ . That is, the relative wage is equal to  $1/2$  multiplied by the relative world price of apparel, which belongs to  $[1/4, 2/3]$ . This implies that the possible relative wage is  $1/8$  to  $1/3$ .

h) Show that the international relative price of apparel must be  $2/3$ . At this international price, draw the CPF of both countries and determine the new equilibrium consumption and production point for both countries. Describe the pattern of specialization and trade. Draw the trade triangles. Talk about the gains from trade for both countries. What happened to the wage in Mexico in terms of apparel, and in terms of computers?

To show that the price is  $2/3$  you can use either the general equilibrium diagram as in the book or the following intuitive argument: At this price US are indifferent between producing apparel and computers and Mexico specializes in producing apparel.

Suppose that the relative price of apparel is higher than  $2/3$ . Then US produces only apparel too. This means that no computers will be produced in the world and this is not trade equilibrium because people prefer to consume 1 computer for 1 unit of apparel.

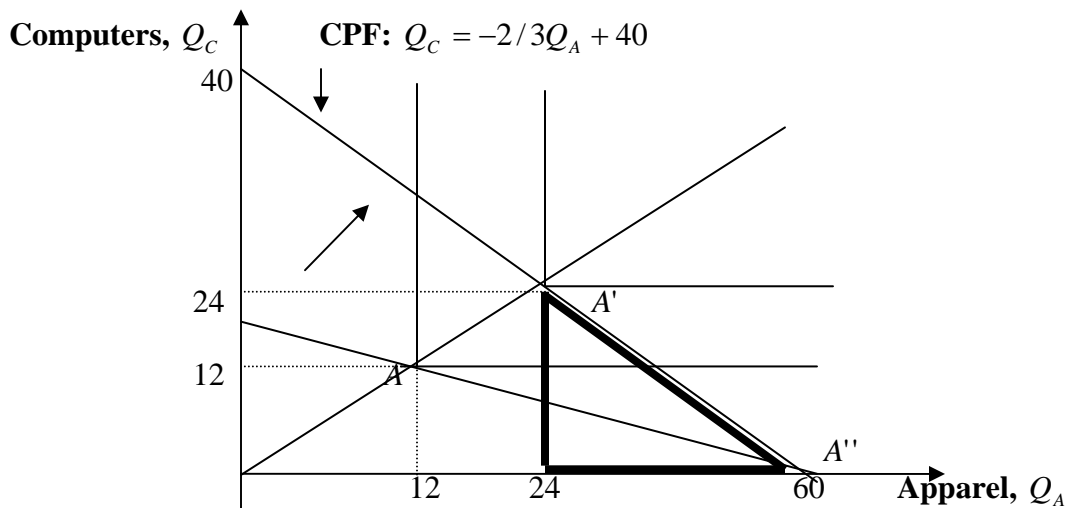
Suppose that the relative price of apparel is lower than  $2/3$ . The US produces only computers and thus 200 computers and 60 units of apparel are produced in the world. However, this is again inconsistent with preferences of the consumers. Thus, the only possible price is  $2/3$ .

To determine production, consumption and trade, note that at an international relative price of apparel of  $2/3$ , Mexico will specialize in apparel and the US is indifferent as to which point to produce along its PPF since the international relative price is the same as the opportunity cost of apparel (and autarky relative price). We then know that the production point in Mexico is 60 units of apparel and no computers. We draw Mexico's CPF going through that point with slope  $-2/3$ . Mexico's consumption point is then the intersection of the ray  $Q_c = Q_a$  and that CPF. The figure below illustrates and shows the consumption point. Now, since Mexico consumes 24 computers and doesn't produce any, imports of computers must also be 24. As to exports, we can follow two procedures to calculate Mexico's exports (and US imports) of apparel. The first procedure is to just note that since Mexico produces 60 units of apparel and consumes only 24, then it must be exporting the difference, which is 36. Alternatively, we can just note that at a relative price of apparel of  $2/3$ , then  $Q_a P_a = Q_c P_c$ , or  $Q_a = Q_c / (P_c / P_a) = 24 / (2/3) = 36$ .

The US continues to consume the same as in autarky, while its production point moves so that it exports the 24 computers Mexico wants and imports the 36 units of apparel that exchange for those computers at the international price. Note that the consumption of both computers and apparel rises in Mexico in trade equilibrium. Hence, all gains from trade go to Mexico while US gains nothing as compared to autarky case.

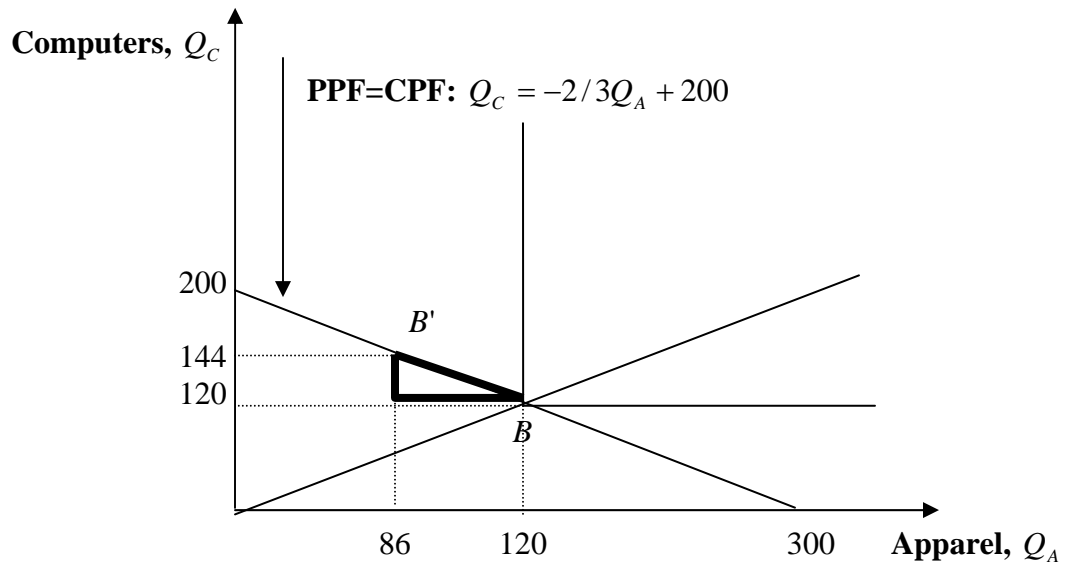
Finally, it can easily be checked that the wage in Mexico rose in terms of computers and remained unchanged in terms of apparel. To see this, note that the wage in terms of apparel is simply  $MPL_A = 1$  (since Mexico produces apparel, it must be that the wage equals the value of the MPL in apparel, but in terms of apparel this is simply  $MPL_A$ ) while the wage in terms of computers is obtained by multiplying the wage in terms of apparel by the price of apparel in terms of computers  $2/3$  (the relative price of apparel). Thus, Mexico's wage in terms of apparel doesn't change, while in terms of computers it increases from  $MPL_C = 1/4$  to  $(2/3) * MPL_A = 2/3$ .

***Mexico:***



In the trade equilibrium Mexico is completely specialized in producing apparel. Thus, the production point is  $A'$ . The consumption point is  $A$ . The coordinates can be found from the following equation:  $-2/3 Q_A + 40 = Q_A$ . This implies that  $Q_A = 24$ ,  $Q_C = 24$ . Hence, Mexico imports 24 computers and exports 36 units of apparel. The marked triangle is Mexico's trade triangle.

**USA:**



US consumption point is still  $B$ . US exports 24 units of computers and imports 36 units of apparel. The production point is  $B'$ . Again, the marked triangle is US trade triangle.