

Preliminaries

This week, we are learning about the Heckscher-Ohlin model of trade. As many of you requested in the midterm evaluation, these problems are meant to be more similar to what you would see on an exam (indeed, they are from exam questions in previous years). For those interested in the more abstract type of questions, I have posted additional practice problems on the class website.

Questions

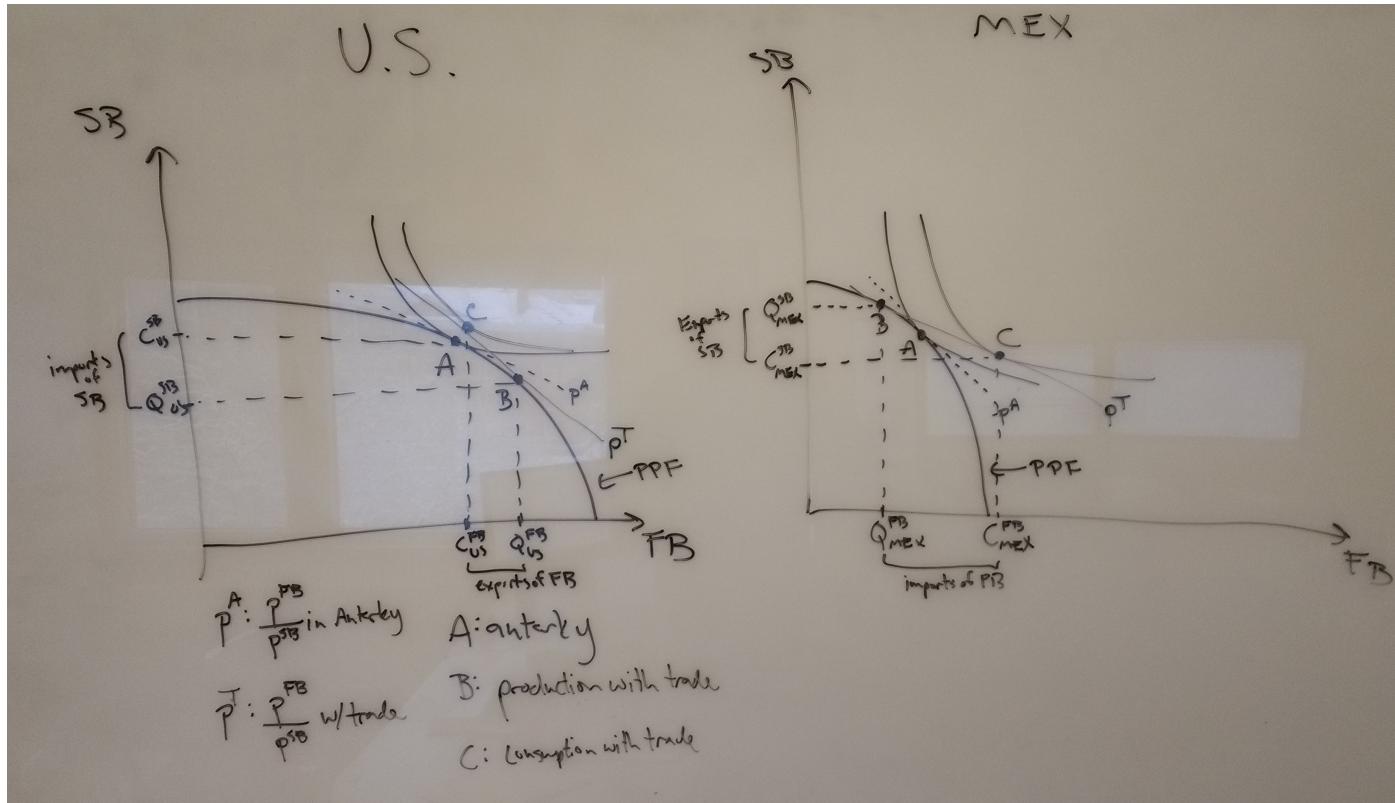
1. Consider a Heckscher-Ohlin model with two countries (the U.S. and Mexico), two goods (footballs and soccer balls), and two factors of production (high skilled labor H and low skilled labor L). Suppose that footballs are produced with production function:

$$Q_i^{FB} = (H_i^{FB})^\phi (L_i^{FB})^{1-\phi}$$

$$Q_i^{SB} = (H_i^{SB})^\sigma (L_i^{SB})^{1-\sigma}$$

for $i \in \{US, MEX\}$, where $\phi > \sigma$. Finally, suppose that $H_{US} > H_{MEX}$, $L_{US} = L_{MEX}$, and H_{US} and H_{MEX} are not “too” dissimilar.

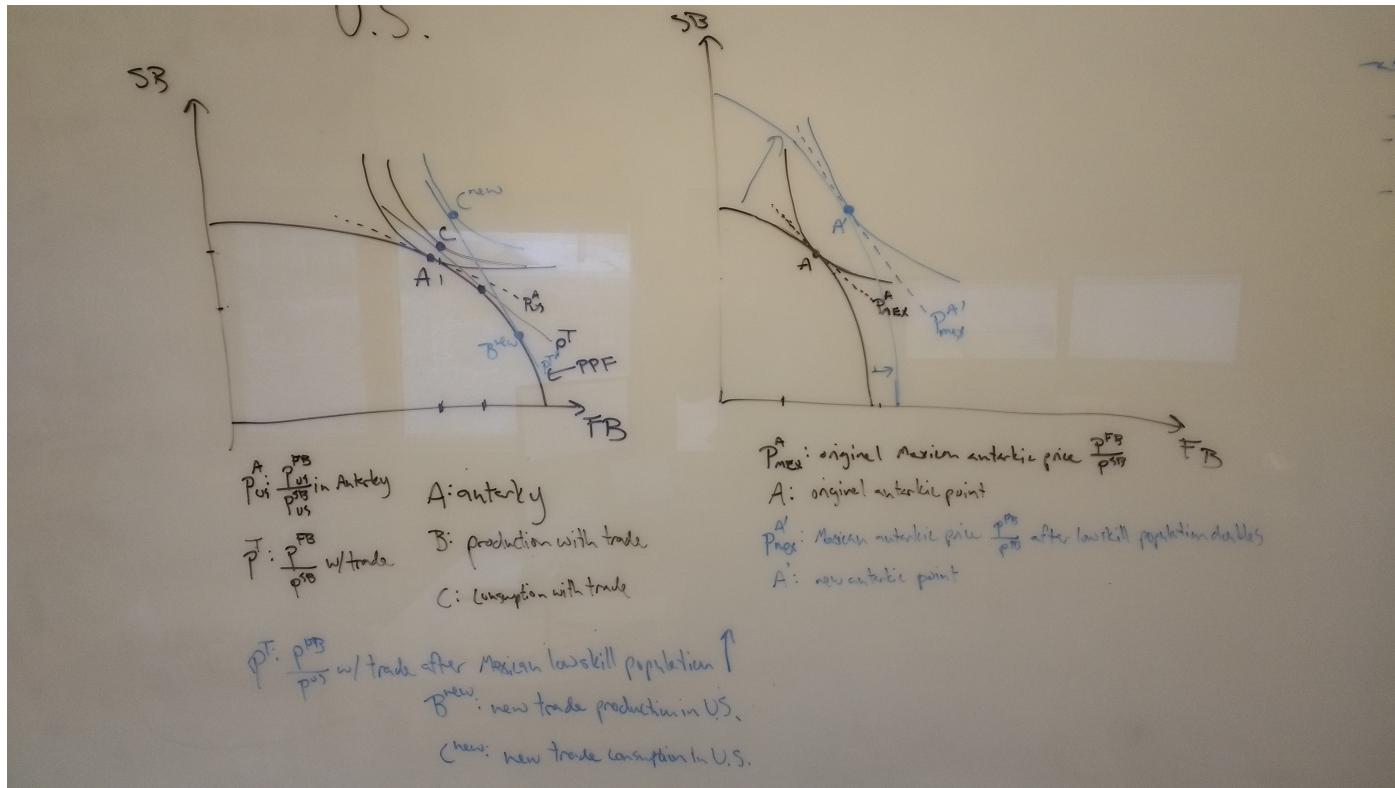
- (a) Draw the equilibrium production possibility frontier for the U.S. and Mexico. How do we see which good the U.S. imports? How do we see that equilibrium condition #2 (consumer optimization) holds?
 - *First, let us note that because $\phi > \sigma$, footballs are high skill labor intensive and soccer balls are low skill labor intensive. Furthermore, because both the U.S. and Mexico have the same amount of low skilled labor but the U.S. has a greater endowment of high skill labor, the U.S. is high skill labor abundant and Mexico is low skill labor abundant. To draw the PPF, we note that the U.S. can produce more of both goods than Mexico (because the U.S. has more high skill labor and the same amount of low skilled workers), but can disproportionately produce more of the skill intensive good (footballs). From the Heckscher-Ohlin theorem, we know that because the U.S. is skill abundant, it will export the high-skill intensive good (footballs) and import the low-skill intensive good (soccer balls), while Mexico does the reverse.*



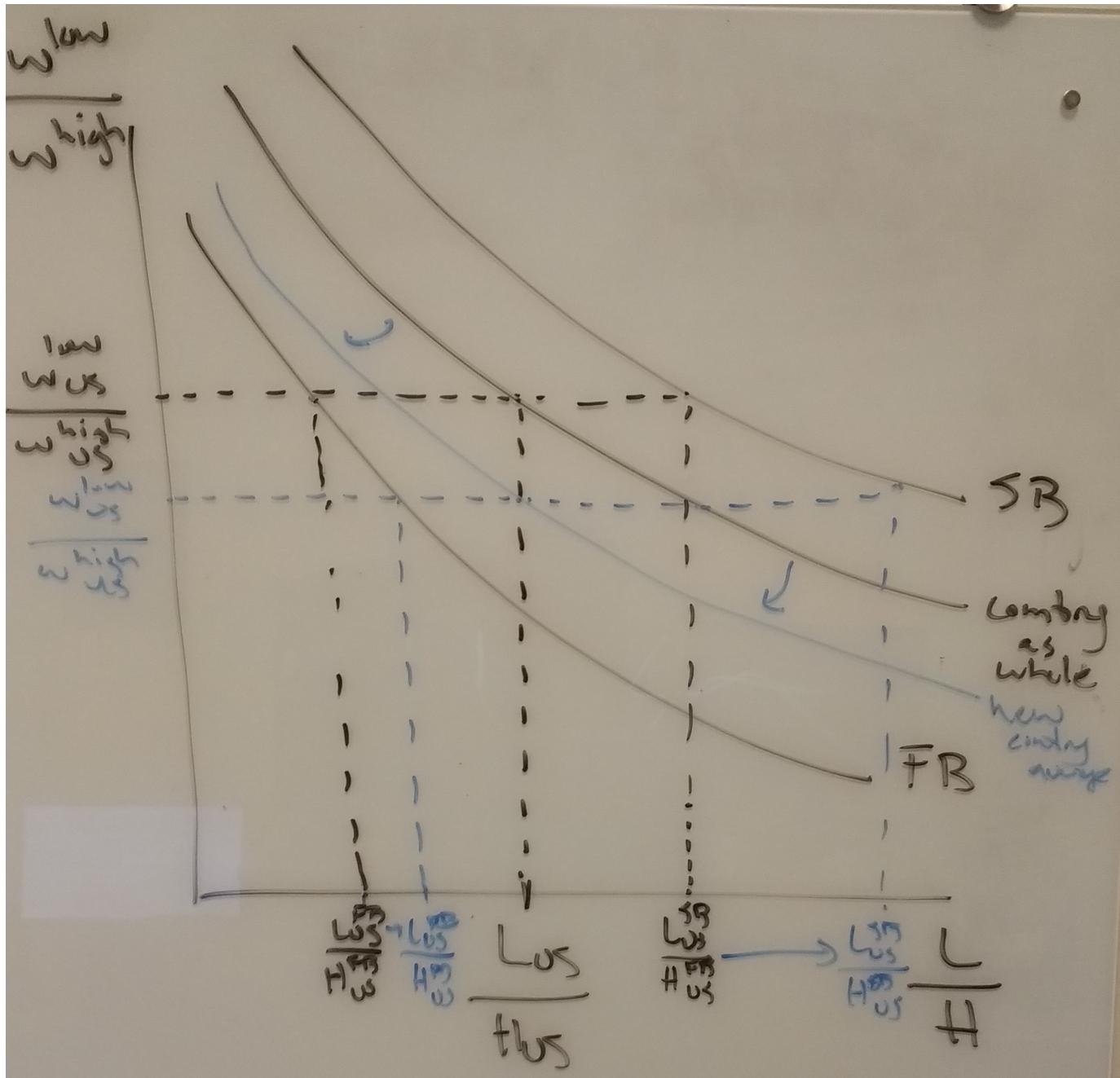
- To see on the figure which good the U.S. imports, we note the difference between where the U.S. produces (at the point on the U.S. PPF that lies tangent to the world price) and where the U.S. consumes (at the point on the U.S. CPF that lies tangent to the highest indifference curve the U.S. can achieve). As we can see, consistent with the HO theorem, the U.S. exports footballs and imports soccer balls, while Mexico exports soccer balls and imports footballs.
- We see that consumer optimization holds because the point on the CPF that the U.S. consumes is the point tangent to the highest indifference curve that the representative agent can achieve.

- (b) Suppose that the population of low skilled workers in Mexico doubles. Using words, figures, math or some combination thereof, show how this will affect the utility of high skilled workers, low skilled workers, and the overall welfare (i.e. the representative agent) in the United States.

- The first thing to note is the only way that workers in the United States will be affected by a doubling of the population in Mexico is through a change in the world price. If the population of the low skilled population in Mexico doubles, it will extend outwards the Mexican PPF, but disproportionately so in the direction of the low-skill intensive good (soccer balls). This will cause the autarkic price to become steeper, i.e. the relative price of footballs will increase in autarky in Mexico. Because the world equilibrium price is between the U.S. and Mexican autarkic prices, this change in the low-skill population in Mexico will raise the world equilibrium price of footballs in the U.S. To see how this affects the overall welfare in the United States, we increase the relative world price of footballs in the U.S. This causes the U.S. to produce even more footballs, and allows the representative agent to achieve a higher indifference curve. Hence, the U.S. is benefited from the low-skilled population increase in Mexico:



- From the Stolper-Samuelson theorem, we know an increase in the relative price of footballs will benefit the high-skill workers and hurt the low-skill workers. To see this, note that an increase in the production of footballs (which are high-skill intensive) will shift the aggregate relative demand in the U.S. toward the football sector demand. This will cause the equilibrium low skill wage to high skill wage to fall, which will in turn cause the low skill labor to high skill labor ratio in each sector to rise. As a result, the marginal product of low skill labor in both sectors will fall, while the marginal product of high skill labor in both sectors will rise:



$\frac{L}{H}$ ratio \uparrow in both sectors \Rightarrow

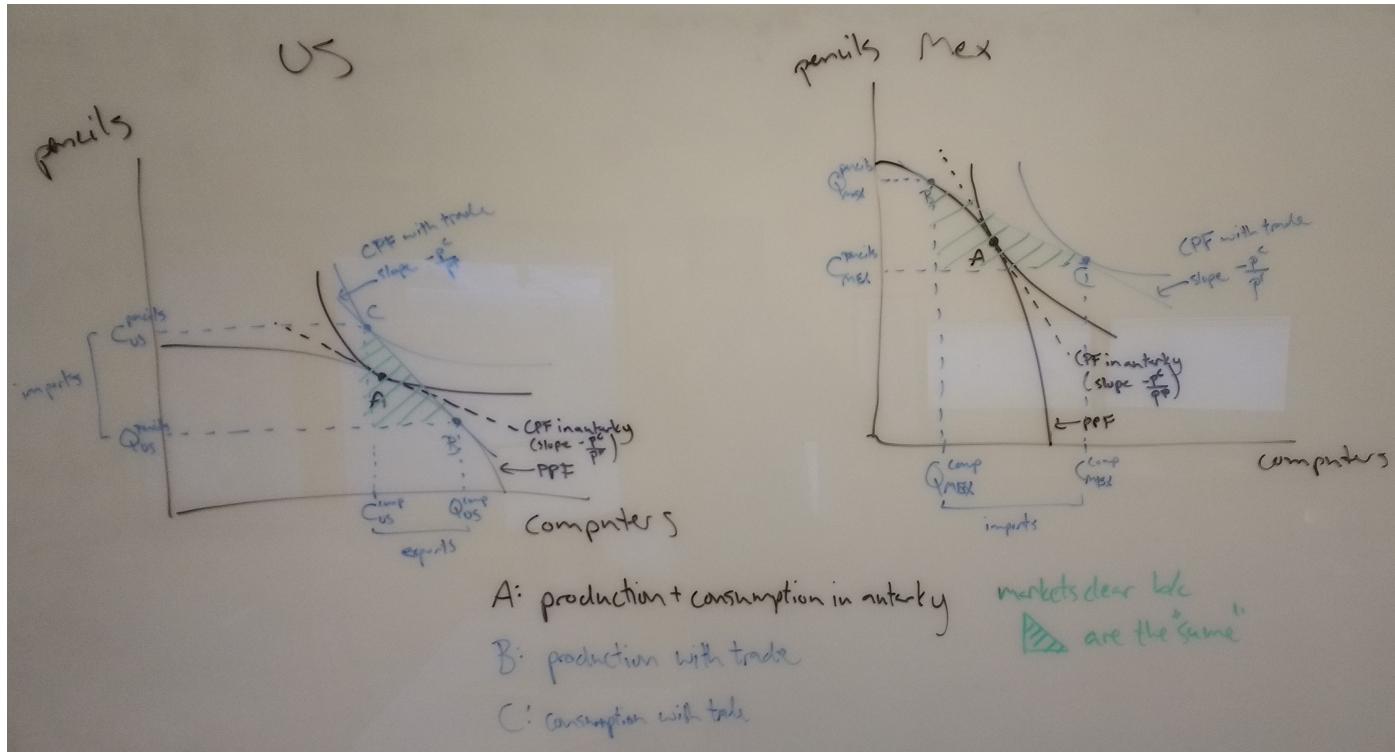
MPL ↓ in both sectors

MPA g in both sectors

- Recall that $w_{US}^{low} = p^{FB} \times MPL_{US}^{FB} = p^{SB} \times MPL_{US}^{SB}$. Since $\frac{w_{US}^{low}}{p^{FB}} = MPL_{US}^{FB}$ is the amount of footballs the

low skilled worker can consume and $\frac{w_{US}^{low}}{p^{SB}} = MPL_{US}^{SB}$ is the amount of soccer balls the low skilled worker can consume and the marginal product of low skilled labor in both sectors has fallen, the price change makes low skilled workers unambiguously worse off. Similarly, recall that $w_{US}^{high} = p^{FB} \times MPH_{US}^{FB} = p^{SB} \times MPH_{US}^{SB}$. Since $\frac{w_{US}^{high}}{p^{FB}} = MPH_{US}^{FB}$ is the amount of footballs the high skilled worker can consume and $\frac{w_{US}^{high}}{p^{SB}} = MPH_{US}^{SB}$ is the amount of soccer balls the high skilled worker can consume and the marginal product of high skilled labor in both sectors has risen, the price change makes high skilled workers unambiguously better off.

- (c) If the population of low skilled workers in Mexico had halved instead of doubled, would your answer just be the opposite of what you said in part (b)? Why or why not?
- It would not just be the reverse answer. This is because there are two possible outcomes of halving the low skill population in Mexico: first, it could just reduce the relative world price of footballs but not affect patterns of trade (in which case the answer would just be the reverse of part (b) - i.e. high skilled labor in the U.S. is hurt, low skilled labor benefits, and the U.S. as a whole is made worse off); second, it could reduce the world price of footballs so much so that the patterns of trade reverse so that Mexico begins to export the high-skill intensive good (footballs) and import the low-skill intensive good (soccer balls). In this case, high skilled labor in the U.S. is (still) hurt, low skilled labor (still) benefits, but it is ambiguous whether or not the U.S. as a whole benefits.
2. Consider a Heckscher-Ohlin model with two countries (the U.S. and Mexico), two goods (computers and pencils), and two factors of production (high skilled labor and low skilled labor). Suppose that computers are intensive in high skilled labor and the U.S. is abundant in high skilled labor. Finally, suppose that the U.S. and Mexico are not “too” dissimilar in their endowed high-skilled labor to low-skilled labor ratio.
- (a) Which country exports what? How do we know?
- The Heckscher-Ohlin theorem says that a country will export the good that is intensive in the factor the country is abundant in. Because computers are intensive in high skilled labor and the U.S. is abundant in high skilled labor, the U.S. will export computers and Mexico will export pencils.
- (b) Show using a figure (i.e. graph) how opening up to trade would affect the consumption and production of pencils and computers in the United States and in Mexico. Is the equilibrium world price of computers to pencils higher or lower than the autarkic price in the U.S.?
- The figure is as follows:



- As you can see, the autarkic relative price of computers to pencils in the U.S. is lower (flatter) than the world relative price of computers to pencils (this is why the U.S. begins to specialize more in the production of computers with trade)

(c) Indicate in the figure from part (b) that the equilibrium market clearing condition holds.

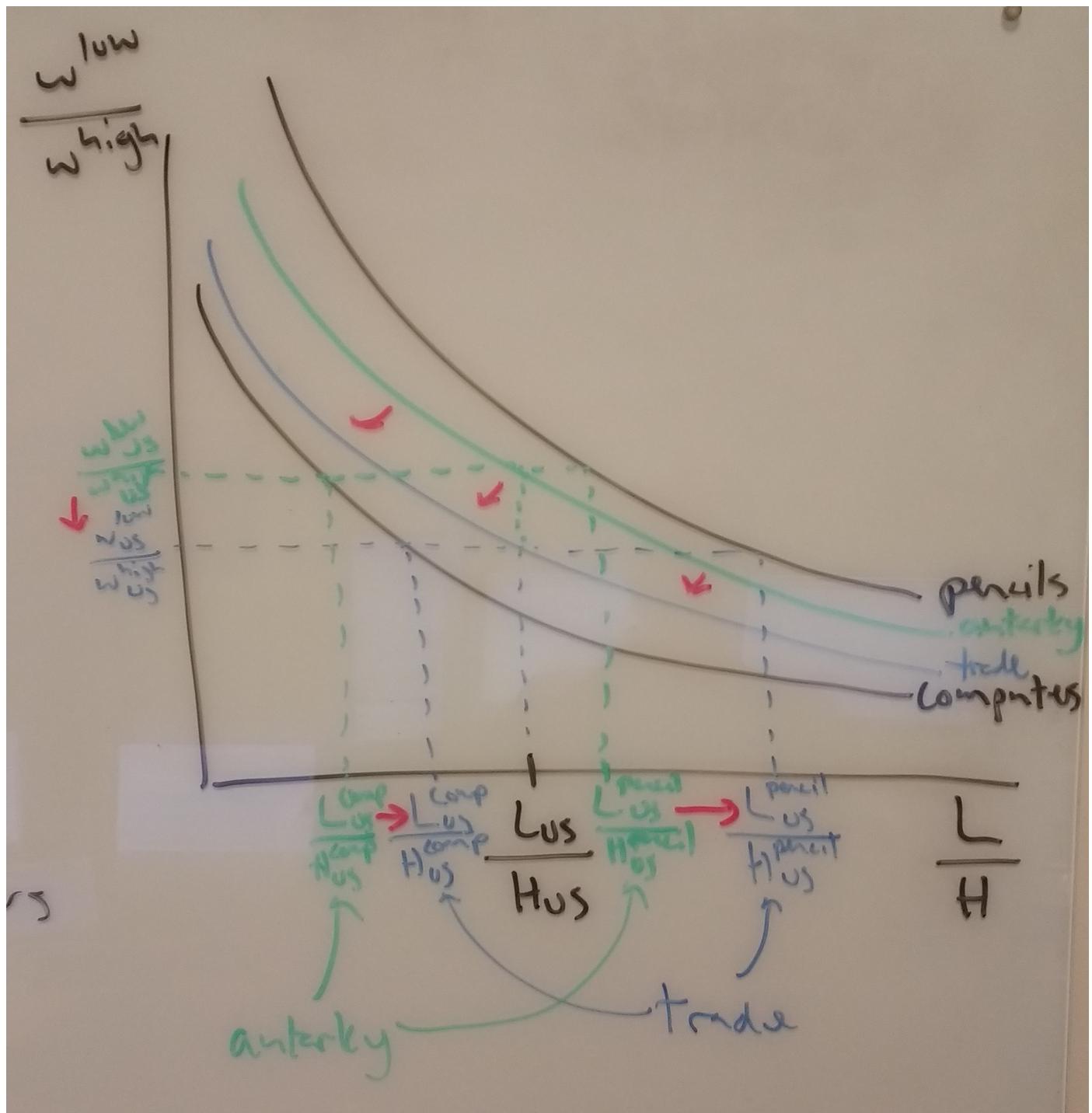
- You can see that markets clear because the quantity of computers exported in the U.S. is equal to the quantity of computers imported in Mexico; similarly, the quantity of pencils imported in the U.S. is equal to the quantity of pencils exported in Mexico. This is because the green trade "triangles" are the same (or, at least, are supposed to be the same) for the two countries.

(d) Show using a figure (i.e. graph) how the change in the relative price of computers to pencils you found in part (b) affects the relative wages of high skilled to low skilled workers in the United States. In the U.S., who is made better off by trade and who is made worse off?

- The Stolper-Samuelson theorem says that a relative increase in the price of a good will benefit the factor used intensively in the production of that good (and harm the factor not used intensively in the production of that good). To see this in a figure, we first note that opening up to trade causes the relative price of computers in the U.S. to rise. Because wages of both high skill and low skill labor are equalized across both sectors, we have:

$$\frac{p_{US}^{computers}}{p_{US}^{pencils}} = \frac{MPL_{US}^{pencils}}{MPL_{US}^{computers}} = \frac{MPH_{US}^{pencils}}{MPH_{US}^{computers}}$$

For this equation to hold, an increase in the relative price of computers requires both high-skill and low-skill labor to move from the production of pencils to the production of computers. This shifts the U.S. aggregate relative demand of low skill to high skill labor toward the computer industry relative demand, causing the relative low-skill wage to high skill wage to fall, and increasing the quantity of low skill labor relative to high skill labor employed in both sectors:



- Because there is now more low skill labor relative to high skill labor being employed in both sectors, the marginal product of low-skill labor falls in both sectors and the marginal product of high-skill labor rises in both sectors. As we have seen in the answer to 1(b), this means that low-skilled labor can consume fewer pencils and/or computers (and hence are worse off), whereas high-skilled labor can consume more of both pencils and computers (and hence are better off).

- (e) Now suppose that all workers are born low skilled and choose whether or not to pay tuition to attend college and become high skilled. If all workers are identical, how do you think the price of college in the U.S. will change when the U.S. opens to trade?

- If all workers are born identical, they must be indifferent between attending college (paying tuition and becoming high skilled) and not attending college (not paying tuition and remaining low skilled), i.e.:

$$w_{US}^{high} - \text{tuition} = w_{US}^{low} \iff \\ \text{tuition} = w_{US}^{high} - w_{US}^{low}$$

As we saw in part (d), opening up to trade made high-skilled workers better off and made low skilled workers worse off. Indeed, if we normalize the price of pencils to one, we have:

$$w_{US}^{high} = MPH_{US}^{pencils},$$

which increases and

$$w_{US}^{low} = MPL_{US}^{pencils},$$

which decreases. For workers to be indifferent between going to college and not, tuition must rise.