

ECON/EEP 181: INTERNATIONAL TRADE ASSIGNMENT # 1 SOLUTIONS

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1. We are given the following labor input requirements:

	Cloth	Wheat
UK	4 hours	12 hours
USA	6 hours	4 hours

- (a) What is the relative price of cloth in terms of wheat in the UK? In the USA?

In autarky, relative prices are equal to the opportunity cost of production. This is because, if a positive amount of both goods are demanded, in equilibrium, the cost of purchasing a good must equal the cost to produce the good. Letting the USA be home and UK be foreign, we have:

$$\frac{P_c}{P_w} = \frac{a_c}{a_w} = \frac{3 \text{ wheat}}{2 \text{ cloth}} \qquad \frac{P_c^*}{P_w^*} = \frac{a_c^*}{a_w^*} = \frac{1 \text{ wheat}}{3 \text{ cloth}}$$

Notice, we wrote in the units for the relative price and opportunity cost.

- (b) Where will the free trade price settle post trade? Who will export which good?

If positive amounts of both goods are demanded in each country, then the post trade price must either be equal to, or rest in between the two autarkic relative prices. This gives:

$$\left(\frac{P_c}{P_w}\right)^w \in \left[\frac{1}{3}, \frac{3}{2}\right]$$

A country will export whichever good for which they have a comparative advantage. From the above calculations, since the UK has a lower opportunity cost for cloth in terms of wheat, they will export cloth and the US will export wheat.

- (c) If the post-trade relative price of cloth in terms of wheat is equal to $1/3$, show what happens to consumption of cloth and wheat in the US and UK pre- and post-trade. Use this information to calculate the wage in the USA relative to the UK post-trade.

We answer this question by asking: "How much can we consume with one unit of labor pre- and post-trade?" Before trade, a country can only consume what it can produce itself, so it depends on technology (i.e. ULRs). With trade, however, a country will produce the good for which it has a comparative advantage and can then either consume it, or trade it at world prices for the other good. We therefore, get the following:

Table 1: Consumption with 1 Unit of Labor

	<u>Before Trade</u>		After Trade with $\left(\frac{P_c}{P_w}\right)^w = \frac{1}{3} \frac{\text{wheat}}{\text{cloth}}$	
	Cloth	Wheat	Cloth	Wheat
UK	1/4	1/12	1/4	1/12
USA	1/6	1/4	3/4	1/4

In the table above, boxes are used to denote the goods for which a country has a comparative advantage in the “Before Trade” columns. We know those amounts are produced post trade in each of the countries after trade, and then we convert them into the other good using the relative price of $1/3$. This is easily done when we notice the units on the relative price of cloth in terms of wheat. For example, if the US produces $1/4$ units of wheat, we perform the following calculation to determine how much cloth they can consume:

$$\frac{1}{4} \text{wheat} \times \frac{3 \text{ cloth}}{1 \text{ wheat}} = \frac{3}{4} \text{cloth}$$

Now, looking at the “After Trade” column, it is easy to verify that the USA is wealthier because they can consume more of either good with one unit of labor when compared to the UK. To know by how much, we just have to ask the question: “What do I have to multiply the UK consumption by in order to get the equivalent amount in the US?” We find this by the following calculation:

$$\begin{aligned} \frac{1}{12} \cdot x &= \frac{1}{4} \Rightarrow \\ x &= 3 \end{aligned}$$

Therefore, we can see that the US is 3 times wealthier than the UK, which implies $\frac{w}{w^*} = 3$.

- (d) Show that unit labor costs post-trade are consistent with the pattern of trade.

Post-trade, a country should be producing the good for which they have the lower unit labor cost (ULC). Recall, the ULC for good i is given by $a_i \cdot w$. From the previous problem we know that $\frac{w}{w^*} = 3$. Therefore, if we let $w^* = 1$, then $w = 3$. We can then calculate the ULCs for each good in each country.

Table 2: Unit Labor Costs After Trade

	<u>Cloth</u>	<u>Wheat</u>	\Rightarrow	<u>Cloth</u>	<u>Wheat</u>
UK	$4 \cdot 1$	$12 \cdot 1$	\Rightarrow	4	12
USA	$6 \cdot 3$	$4 \cdot 3$	\Rightarrow	18	12

Indeed, the table confirms the pattern of trade identified in the previous parts of the problem. The UK exports cloth because their ULC is lower. Either the USA or the UK can produce wheat, because the ULCs are the same. This is a special case - the post-trade price is exactly equal to the UK’s autarky price, so the UK does not gain from trade, and can be incompletely specialized.

2. Home and Foreign invent different technologies to produce tools. The table of unit labor requirements is:

	Home	Foreign
Tools	3	6
Wine	2	3
Cheese	5	3

- (a) Comparative advantage: In which good does Home have the strongest comparative advantage? In which good does Home have the least comparative advantage?

Recall, in the multiple good context, a country has a comparative advantage when they have a lower ULC, which is given by $a_i \times w$ for good i . Therefore, for any good i , we want to make the following comparison:

$$a_i \cdot w \quad \circ \quad a_i^* \cdot w^* \quad \Rightarrow$$

$$\frac{w}{w^*} \quad \circ \quad \frac{a_i^*}{a_i}$$

The open circles are supposed to represent potential inequalities that we have yet to fill in. However, notice what we are comparing: the relative wage of Home to Foreign, to the relative ULR of Foreign to Home. The higher these relative ULRs, the more of an advantage Home has at producing that good. We can therefore list the goods for which Home has the greatest to least comparative advantage as:

Table 3: Greatest to Least Comparative Advantage for Home.

	a_i^*/a_i
Tools	2
Wine	3/2
Cheese	3/5

- (b) Trade and wages: if the relative wage rate $w/w^* = 1$, in what goods will home specialize? (Hint: you can ignore the relative size of the labor force in giving your answer)

Home will specialize in any good for which it has a comparative advantage at the prevailing relative wage. Since $3/5 < w/w^ = 1 < 3/2$, Home has a comparative advantage at both tools and wine. Further, notice that at these wages, the unit labor costs are not the same in the production of any good, which implies both countries are specialized. Home will produce tools and wine, while Foreign will produce cheese.*

(c) Gains from trade: Do both countries benefit from trade: Present an educated verbal argument. *In the two goods case, we know that a country gains from trade when relative world prices are different from autarky prices. This is because they are able to take advantage of relative trade-offs in the market to reach a higher level of utility. Further, changes in prices cause complete specialization. In the multi-goods case, we should think of specialization as a consequence of these same changes in price (this is seen explicitly in the price calculations given in the following problem). Once we reach equilibrium, as long as both countries are completely specialized, and we are not resting at a “kink” in the relative supply curve, both countries will receive gains from trade.*

(d) Transport costs: If transport costs add 50 percent to the price of a good that is shipped from one country to another, how will goods be traded? Will all goods be traded? (Hint: Calculate the total cost of each foreign good to a home consumer and compare it to the cost of the same good when produced at home; then calculate the total cost of a home good to a foreign consumer and compare it to the cost of the same good when produced abroad).

First, recall the assumption of perfect competition implies that the price of goods are determined by their cost of production. Since cheese is produced in Foreign, and both tools and wine are produced in Home, we can use the normalized wages of $w = w^ = 1$, to get trade prices as,*

$$\begin{aligned} P_{\text{tools}} &= a_{\text{tools}} \times w = 3 \times 1 = 3\$/\text{tool} \\ P_{\text{wine}} &= a_{\text{wine}} \times w = 2 \times 1 = 2\$/\text{wine} \\ P_{\text{cheese}} &= a_{\text{cheese}}^* \times w^* = 3 \times 1 = 3\$/\text{cheese} \end{aligned}$$

Now, consider Home. They can produce their own cheese at a price of, $a_{\text{cheese}} \times w = 5 \times 1 = 5\$/\text{cheese}$, or they can buy it from Foreign and pay an additional 50% transportation cost, which is given by $3\$/\text{cheese} \times 1.5 = 4.5\$/\text{cheese}$. Since it is still cheaper to buy from Foreign, Home would still prefer to trade.

Foreign, on the other hand, can produce wine at $3\$/\text{wine}$, or they can buy it from Home for $2 \times 1.5 = 3\$/\text{wine}$, so they are indifferent. However, they can produce tools for $6\$/\text{tool}$, or they can buy one for $3 \times 1.5 = 4.5\$/\text{tool}$, so they would prefer to trade. Therefore, even with transportation costs, both countries would prefer to trade, although they may not trade wine.

3. Home (no asterisk) and Foreign (asterisk) produce cheese and wine with the following unit labor requirements: Home and Foreign have total labor forces of $L = 128$ and $L^* = 200$ workers.

	Home	Foreign
Cheese	$alc = 8$	$alc^* = 10$
Wine	$alw = 4$	$alw^* = 10$

Before we begin this problem, we should already organize the information we are given into a single table. This will help us identify all necessary information with relative ease.

Table 4: ORGANIZING INFORMATION

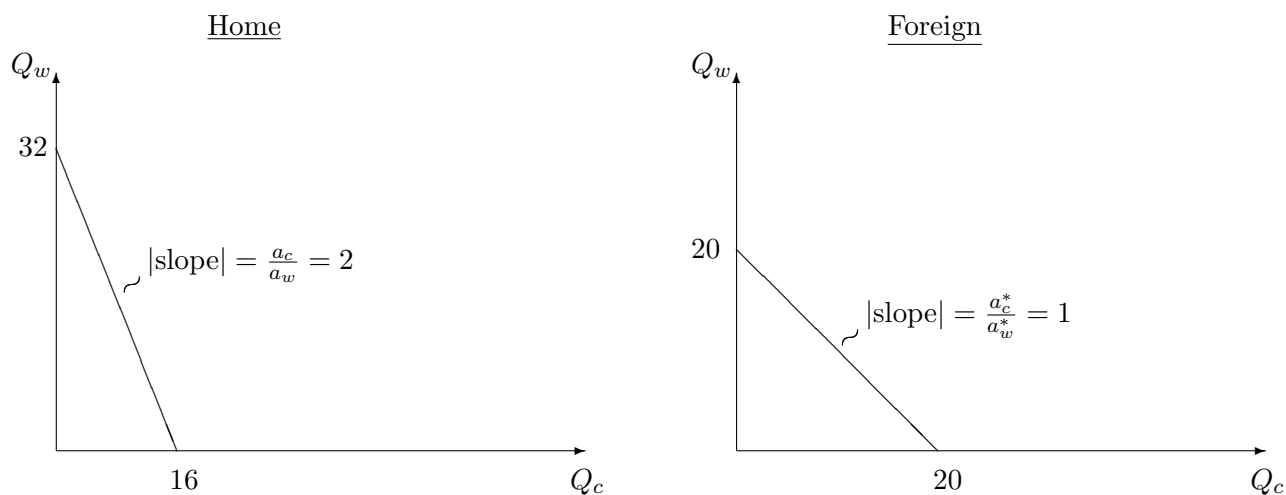
	Unit Labor Requirements		Labor Force	Total Feasible Production		$\frac{a_c}{a_w}$	$\frac{a_w}{a_c}$	
	Cheese	Wine		Cheese	Wine			
Home	8	4	128	16	or	32	2	$\frac{1}{2}$
Foreign	10	10	200	20	or	20	1	1

Notice, we have underlined the good for which each country has a comparative advantage.

- (a) Graph each country's production possibility frontier and calculate the opportunity cost of cheese in terms of wine. Which country has an absolute advantage in cheese production, which in wine production? Which country has a comparative advantage in cheese production, which in wine production?

From the above table, since home has lower unit labor requirements for both goods, it has an absolute advantage at the production of both goods. However, when comparing the opportunity cost of cheese in terms of wine, we see that foreign has a comparative advantage at cheese, and home has a comparative advantage in wine. Each countries' production possibility frontier is given below. Note the slope is given by the opportunity cost of cheese in terms of wine.

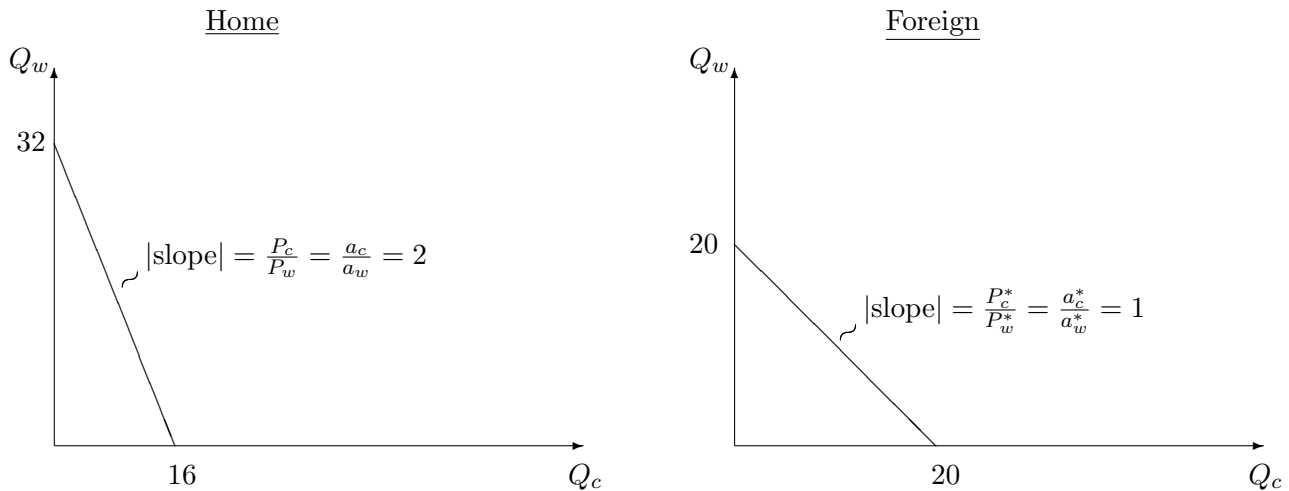
Figure 1: Production Possibility Frontiers for Home and Foreign



- (b) Using the graph from your preceding answer, draw each country's consumption possibilities in the absence of trade. Calculate the relative prices of cheese in terms of wine in autarky.

We should first recognize that, in the absence of trade, a country's consumption possibilities are the same as its production possibilities. Therefore, the consumption possibilities are given directly by the PPF. Further, if we assume there is a positive demand for both goods in autarky, the relative prices will be given by the opportunity cost. The autarkic consumption possibilities and prices are given below.

Figure 2: Consumption Possibilities for Home and Foreign



- (c) Both countries open up to free trade. Graph the relative world supply of cheese to wine and its response to the relative world price of cheese P_c/P_w base on the unit labor requirements. Provide specific values on the axes.

We can again refer to the initial table we created in order to draw the relative supply curve. Knowing that foreign has a comparative advantage at cheese production, and that the vertical component is at complete specialization, we can use the table to list all specific values. The graph is given below.

Figure 3: RELATIVE WORLD SUPPLY

