

# ECONOMICS 181: INTERNATIONAL TRADE HOMEWORK # 4 SOLUTIONS

Ricardo Cavazos and Robert Santillano

University of California, Berkeley

Due: November 21, 2006

1. The nation of Bermuda is “small” and assumed to be unable to affect world prices. It imports strawberries at the price of 10 dollars per box. The Domestic Supply and Domestic Demand curves for boxes are:

$$S = 60 + 20P$$

$$D = 1160 - 15P$$

- (a) Assume Bermuda is Completely open to trade. What is the equilibrium price and quantity consumed? How much is produced domestically, and how much is imported?

*Sine they are open to trade, the equilibrium price will be determined by the world market. Therefore, using the Domestic Supply and Demand equations, and recognizing that Import Demand is given by  $MD = D - S = 1100 - 35P$ , we get:*

$$P^w = 10$$

$$D = 1160 - 15 \times 10 = 1010$$

$$S = 60 + 20 \times 10 = 260$$

$$MD = 1100 - 35 \times 10 = 750$$

- (b) Now consider the effect of an import quota of 400 boxes. What happens to the price of strawberries and quantity consumed?

*The effect of an import quota is to limit imports at exactly 400. Using the import demand equation expressed above, we can solve for new equilibrium prices to be:*

$$400 = 1100 - 35P \Rightarrow P^q = 20.$$

*With this higher price, we can simply go through the same calculations as before to get:*

$$D^q = 1160 - 15 \times 20 = 860$$

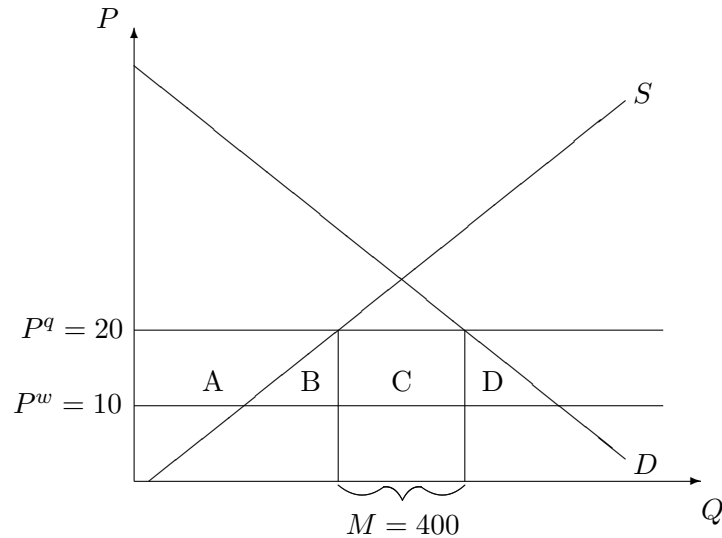
$$S^q = 60 + 20 \times 20 = 460$$

$$MD^q = 1100 - 35 \times 20 = 400$$

- (c) Who wins and who loses? Discuss consumers, domestic producers, and importers (Be sure to compute the change in their welfare).

*To answer this, it is useful to look at a diagram.*

Figure 1: EFFECT OF A STRAWBERRY QUOTA ON BERMUDA



*From the figure, the welfare affects caused by the quota are clear. First off, the restricted imports allow domestic producers to sell more strawberries at a higher price of \$20/box. Therefore, producer surplus increases by area A. Consumers have to pay a higher price, so consumer surplus falls by the areas A, B, C, and D. Lastly, importers of the good can buy strawberries at the lower world price of \$10, but sell them for \$20, so they gain the area marked by C. The overall impact is a loss of areas B and D. Calculating the areas for each, we have:*

$$\begin{aligned}
 A &= \frac{1}{2} \times (100 + 80) \times 10 = 900 \\
 B + D &= (750 - 400) \times 10 \times \frac{1}{2} = 1750 \\
 C &= 400 \times 10 = 4000
 \end{aligned}$$

*so the overall welfare loss is: -\$1,750.*

2. Assume California's supply and demand for beef is:

$$\begin{aligned} D_c &= 800 - 10P \\ S_c &= 200 + 30P \end{aligned}$$

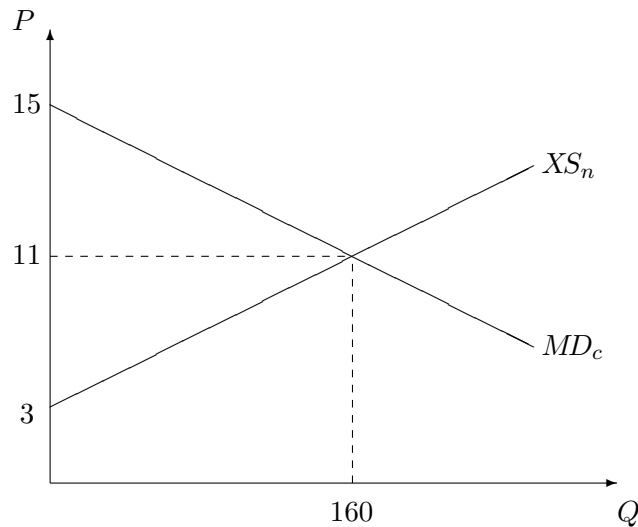
- (a) Derive and graph California's import demand schedule. If California's agricultural department outlawed purchasing out of state beef to prevent the slaughter of unhappy cows, what would the price of beef be( i.e. what is the price of beef in autarky)?

*California's import demand schedule is given by demand minus supply whenever price is below the autarky equilibrium price, or  $MD_c = D_c - S_c$ . This is given by:*

$$MD_c = 600 - 40P$$

*Outlawing the purchase of out of state beef is equivalent to the case where there is no import demand, or  $MD_c = 0$ . From the previous equation, this occurs at  $P = 15$ . The demand schedule is seen in the following diagram.*

Figure 2: TRADE MARKET FOR BEEF BETWEEN CALIFORNIA AND NEBRASKA



- (b) Now consider Nebraska, with the following demand and supply schedules for beef:

$$\begin{aligned} D_n &= 100 - 5P \\ S_n &= 40 + 15P \end{aligned}$$

*Export supply is determined by excess supply above the autarky equilibrium price in Nebraska, or  $XS_n = S_n - D_n$ . This is given by:*

$$XS_n = -60 + 20P$$

*Again, the absence of trade is equivalent to the case with no excess supply, or  $XS_n = 0$ . This occurs at  $P = 3$ . Foreign's export supply is graphed in the above figure.*

- (c) Suppose that interstate sale of beef is permitted between California and Nebraska. What is the world price? What is the volume of trade?

*If trade is permitted, equilibrium is determined where  $XS_n = MD_c$ . We therefore have,*

$$-60 + 20P = 600 - 40P \Rightarrow P = 11.$$

*With a free trade price of 11, we have  $XS_n(11) = MD_c(11) = 160$ .*

- (d) What happens if California limits beef imports from Nebraska by adding a 15 percent tax? Calculate the effect of the tariff on (1) the price of beef in each state (2) the quantity of beef supplied and demanded in each state and (3) the volume of trade. Calculate the impact on the welfare of California consumers, producers, government revenue, and total welfare.

*There are two things of importance we must notice. The first is that the tariff puts a wedge between the price seen in California and Nebraska. Californians now see the Nebraskan price plus the 15% tariff. The second is that we have to be careful to recognize which price goes into the import demand and which into the export supply. We therefore get the following system of equations:*

$$\begin{aligned} P_c &= P_n(1 + 0.15) \\ XS_n(P_n) &= MD_c(P_c) \end{aligned} \tag{1}$$

*Using these two equations we can solve for the new equilibrium. Solving for the Nebraskan price, we have:*

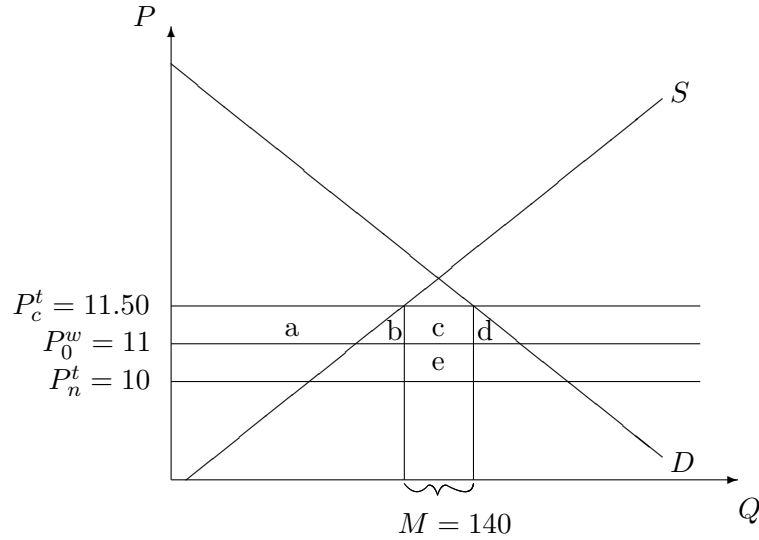
$$\begin{aligned} XS_n(P_n) &= MD_c(1.15P_n) \\ -60 + 20P_n &= 600 - 40(1.15P_n) \\ P_n = 10 &\Rightarrow P_c = 11.50 \end{aligned}$$

*Now that we know the prices seen in both states, we can solve for each states production and consumption decisions, as well as the volume of trade. We get:*

$$\begin{aligned} XS_n(10) = MD_c(11.50) &= 140 \\ D_c(11.50) = 685 & \quad S_c(11.50) = 545 \\ D_n(10) = 50 & \quad S_n(10) = 190 \end{aligned}$$

We now have all the information to calculate the welfare effects for California. Below we graph the effects in California's market for beef.

Figure 3: EFFECT OF TARIFF ON CALIFORNIA'S MARKET FOR BEEF



In the above graph, area  $a$  represents the gain to producers, areas  $a$ ,  $b$ ,  $c$ , and  $d$  represent losses to consumers, and  $c$  and  $e$  represent government revenue. Calculating the areas, we get:

$$\begin{aligned}
 a &= (11.50 - 11) \times \frac{1}{2}(545 + 530) = 268.75 \\
 b + d &= \frac{1}{2} \times (11.50 - 11) \times (160 - 140) = 10 \\
 c &= (11.50 - 11) \times 140 = 70 \\
 e &= (11 - 10) \times 140 = 140
 \end{aligned}$$

Overall welfare effects are then given by:

$$\begin{aligned}
 \text{consumers} &: -268.75 - 10 - 70 \\
 \text{producers} &: +268.75 \\
 \text{government} &: +70 + 140 \\
 \text{net } \Delta &: +130
 \end{aligned}$$

**FOR EXTRA CREDIT:** Problems 1, 2, 3, and 4 in the Textbook, Chapter 8.

1. Home's demand curve for wheat is

$$D = 100 - 20P.$$

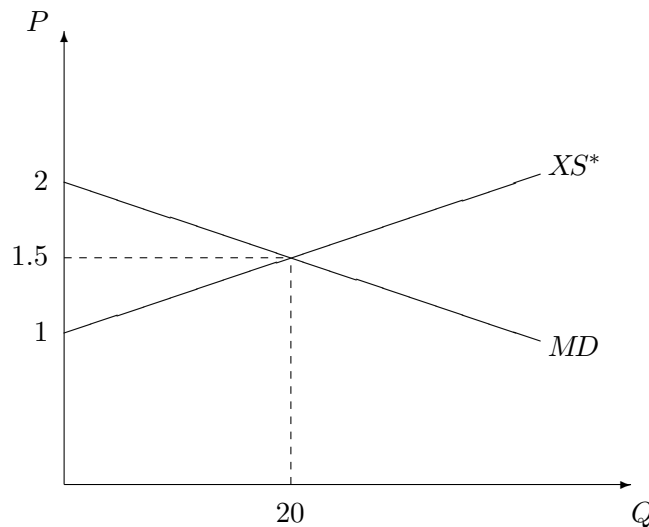
Its supply curve is

$$S = 20 + 20P.$$

Derive and graph Home's *import* demand schedule. What would the price of wheat be in the absence of trade?

*Import demand is given by the equation  $MD(P) = S(P) - D(P) = 80 - 40P$ . The absence of trade is the equivalent to import demand being zero, which happens at  $P = 2$ . The graph is seen below.*

Figure 4: TRADE MARKET FOR WHEAT



2. Now add Foreign, which has a demand curve

$$D^* = 80 - 20P,$$

and a supply curve

$$S^* = 40 + 20P.$$

(a) Derive and graph Foreign's *export* supply curve and find the price of wheat that would prevail in Foreign in the absence of trade.

*Foreign's export supply curve is given by:  $XS^*(P) = S^*(P) - D^*(P) = -40 + 40P$ . The absence of trade is equivalent to export supply being zero, which occurs at  $P^* = 1$ . The graph is included in the above figure.*

- (b) Now allow Foreign and Home to trade with each other, at zero transportation cost. Find and graph the equilibrium under free trade. What is the world price? What is the volume of trade?  
*When they are allowed to trade, there is no distortion in prices so we have a common world price of  $P^w = P = P^*$ . In order to find equilibrium, we set import demand equal to export supply giving:*

$$MD(P) = XS^*(P^*) \Rightarrow 80 - 40P^w = -40 + 40P^w \Rightarrow P^w = 1.5$$

*At this world price we have  $MD(1.5) = XS^*(1.5) = 20$ .*

3. Home imposes a specific tariff of 0.5 on wheat imports.

- (a) Determine and graph the effects of the tariff on the following: (1) the price of wheat in each country; (2) the quantity of wheat supplied and demanded in each country; (3) the volume of trade.

*The tariff causes a wedge to be placed between prices seen between the two countries, so we now have  $P = P^* + 5$ . Setting export supply equal to import demand, we get:*

$$MD(P^* + 5) = XS^*(P^*) \Rightarrow 80 - 40(P^* + 0.5) = -40 + 40P^* \Rightarrow P^* = 1.25 \Rightarrow P = 1.75.$$

*At these prices production in each country is given by the following:*

Table 1: Quantity of Wheat Supplied and Demanded in Each Country.

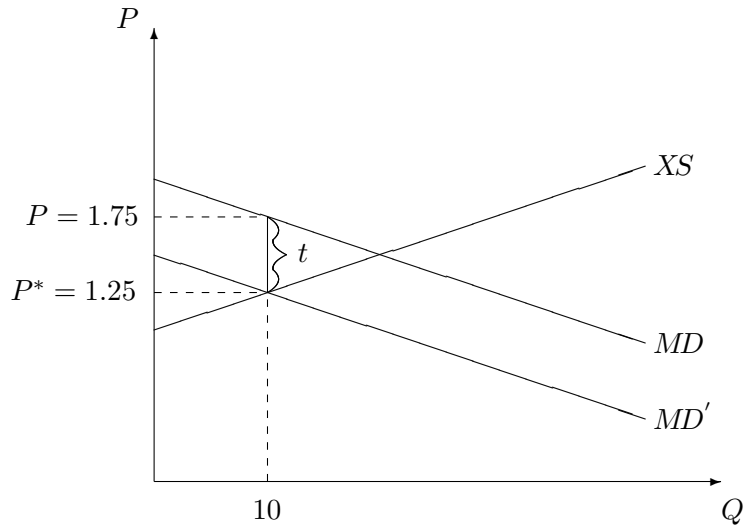
	<u>Supply</u>	<u>Demand</u>
Home ( $P = 1.75$ )	55	65
Foreign ( $P^* = 1.25$ )	65	55

*The volume of trade is given by:*

$$MD(1.75) = XS^*(1.25) = 10$$

*The effects on the trade market are given in the graph below.*

Figure 5: TRADE MARKET FOR WHEAT WITH A TARIFF

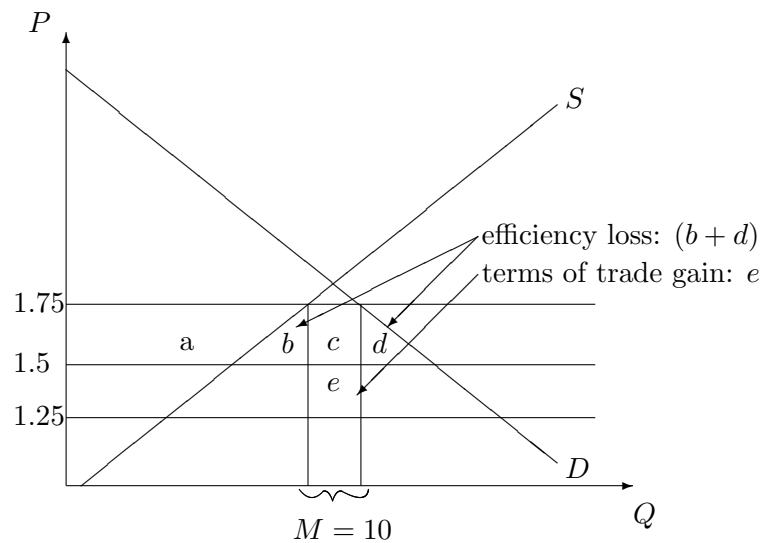


- (b) Determine the effect of the tariff on the welfare of each of the following groups: (1) Home import-competing producers; (2) Home consumers; (3) the Home government.

*Home import-competing producers are better off because they have less foreign competition, which means both price and quantity of good produced domestically increases. Home consumers are worse off because they now have to pay a higher price. The home government benefits in that they now have additional tariff revenue.*

- (c) Show graphically and calculate the terms of trade gain, the efficiency loss, and the total effect on welfare of the tariff.

Figure 6: TERMS OF TRADE GAIN AND EFFICIENCY LOSS FOR LARGE COUNTRY WITH TARIFF





From this figure we can see the areas that were referred to in the answer to part (e). Producers gain area  $a$ , consumers lose areas  $a$ ,  $b$ ,  $c$ ,  $d$ , and the government receives tax revenue  $c$  and  $e$ . We can calculate the areas with some simple geometry. Recall, before the tariff, total trade was 20 bushels of wheat, but now it is 10. Also, notice the height of both triangles  $b$  and  $d$  is 0.25. Therefore, we have:

$$\begin{aligned} b + d &= \frac{1}{2} \times (20 - 10) \times 0.25 = 1.25 \\ e &= 10 \times 0.25 = 2.5 \\ \Rightarrow e - b - d &= 1.25. \end{aligned}$$

Therefore, the overall welfare effect is positive. These numbers also tell us the efficiency loss and the terms of trade gain. Efficiency loss is defined as the loss caused by the tariff in the market, or triangles  $b + d = 1.25$ . The terms of trade gain is defined as the additional gain created by the distortion on the market, or rectangle  $e = 2.5$ .

4. Suppose that Foreign had been a much larger country, with domestic demand

$$D^* = 800 - 200P, \quad S^* = 400 + 200P.$$

(Notice that this implies that the Foreign price of wheat in the absence of trade would have been the same as in problem 2.)

Recalculate the free trade equilibrium and the effects of a 0.5 specific tariff by Home. Relate the difference in results to the discussion of the small country case in the text.

With the larger foreign country, export supply is given by:  $XS^*(P) = -400 + 400P$ . Therefore the free trade equilibrium is given by:

$$MD(P^w) = XS(P^w) \Rightarrow 80 - 40P^w = -400 + 400P^w \Rightarrow P^w \approx 1.09.$$

Now, with a tariff of 5 imposed by home, the new equilibrium is given by:

$$MD(P^* + 5) = XS(P^*) \Rightarrow 60 - 40P^* = -400 + 400P^* \Rightarrow P^* \approx 1.05 \Rightarrow P \approx 1.55.$$

We can further recalculate the net welfare effects by focusing on the terms of trade gain minus the efficiency loss, given below.

$$\begin{aligned} b + d &= \frac{1}{2} \times (1.55 - 1.09) \times (36.4 - 18) = 4.232 \\ e &= (1.09 - 1.05) \times (18) = 0.72 \\ \Rightarrow e - b - d &= -3.512. \end{aligned}$$

From the above calculations we see that there is now an overall welfare loss from imposing the tariff. This is because being a small country implies there is less effect on the world market. A small country has less influence over the world and the terms of trade gains are smaller. Even further, the home market will be most effected with higher prices, increasing the efficiency loss.