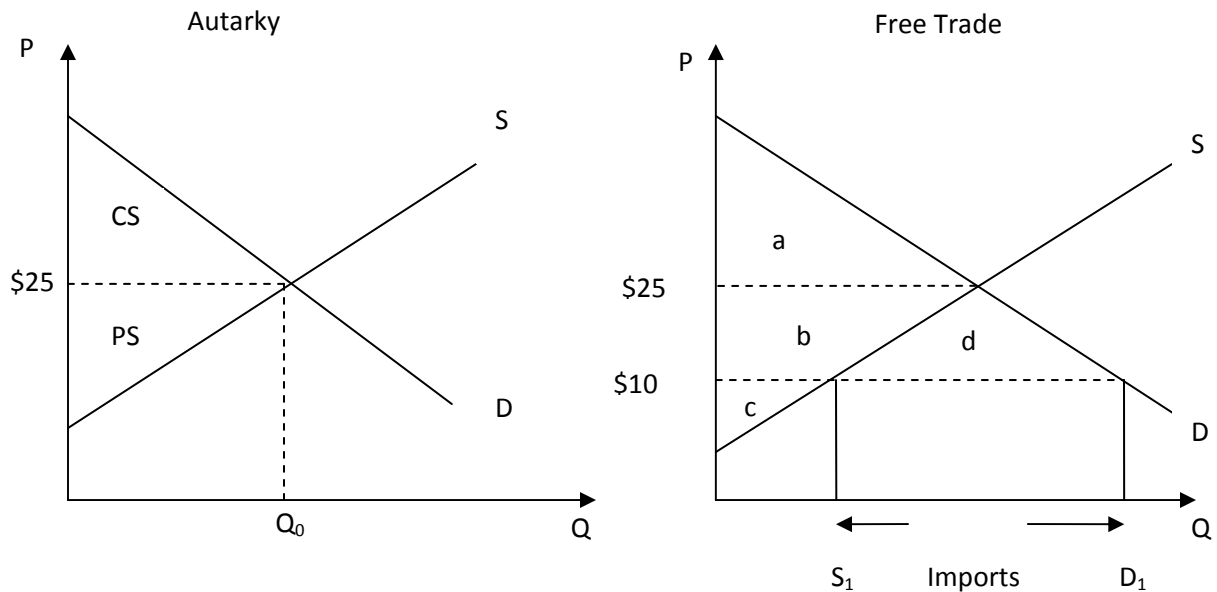


For Q1-8, assume the markets for wheat and oil are perfectly competitive.

1. In autarky, Costa Rica can produce wheat for \$25 a bushel. The world price of wheat is \$10 and Costa Rica represents a very small share of world demand for wheat

a. Draw a diagram showing Costa Rica's supply and demand for wheat. Label domestic quantities supplied and demanded under autarky and under free trade and the quantity of wheat imported. Show changes in producer and consumer surplus as a result of the move to freer trade.



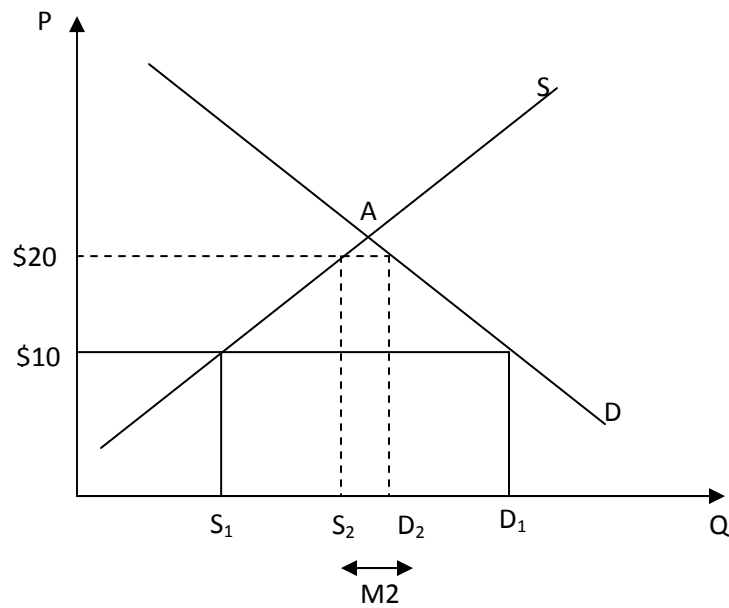
The left panel in the figure above shows the Costa Rica's supply and demand for wheat under autarky. The right panel represents Costa Rica's demand and supply under free trade. Under free trade quantity demanded increases to D_1 and the difference between quantity supplied and demanded under free trade represents the quantity of wheat imported. Consumer surplus increases by the area (b+d), and producer surplus falls by the area b.

b. If wheat production intensively uses land, what should free trade do to the price of land in Costa Rica?

Under free trade home supply will decrease from Q_0 , the producers of wheat will demand less land, as a result price of land will decrease. Alternatively, you can think of this in terms of a specific factors model, where land is the specific factor used to produce wheat. The fall in wheat prices will reduce the returns to the specific factor.

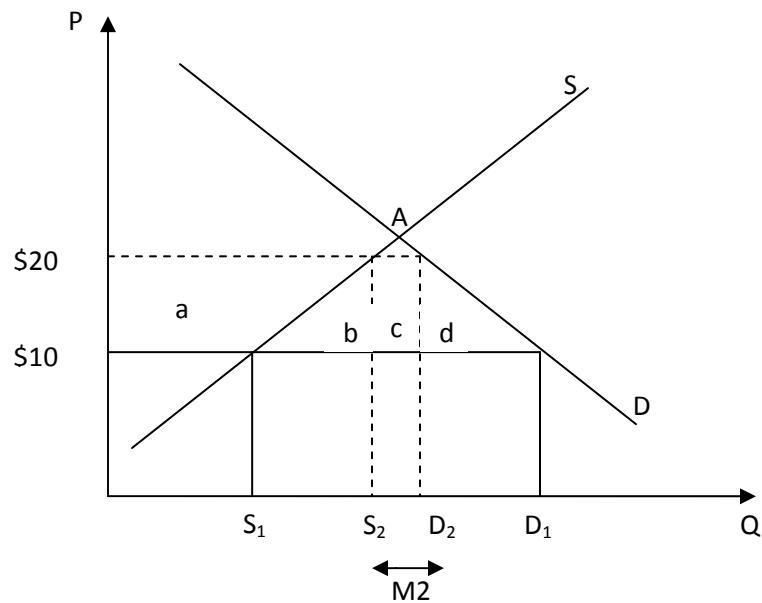
2. Costa Rica imposes a wheat tariff equal to \$10 a bushel.

a. Show in a diagram how the tariff changes the price of imported wheat in CR, the quantities demanded, supplied, and imported.



The tariff increases the price of wheat in Costa Rica. As a result the home quantity supplied of wheat will increase from S_1 to S_2 and the quantity demanded falls from D_1 to D_2 . Home import falls from $(D_1 - S_1)$ to $(D_2 - S_2 = M_2)$.

b. Show what happens to welfare (and its components). Does the tariff raise or lower welfare compared to free trade?



Consumer surplus falls by the area (a+b+c+d) and producer surplus rises by the area a. Government revenue increases by the area c. The net loss in welfare as a result of tariff is given by the area (b+d).

c. Is there anyone in CR who is better off with the tariff than under free trade?

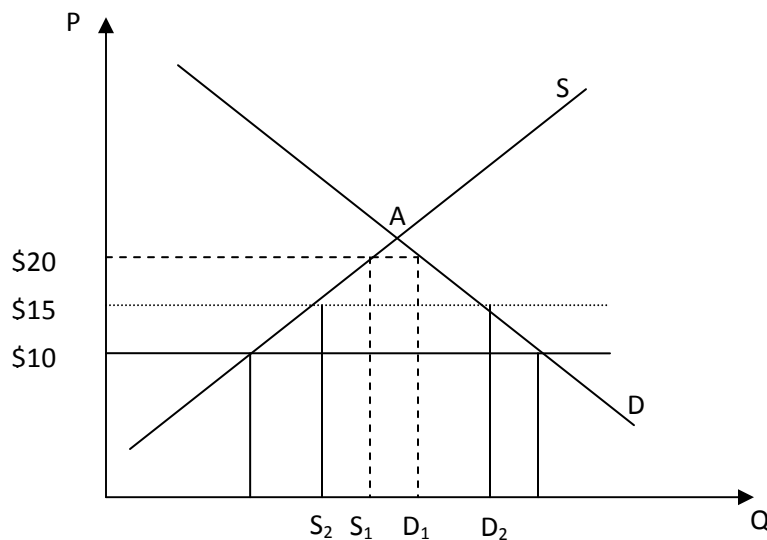
Producers of wheat in Costa Rica are better off with the tariff than under free trade as they receive a higher price per bushel of wheat. With the tariff, the returns to land increase and land owners are also better off. Workers in the wheat industry would gain from the tariff if their skills were not transferable to other industries.

d. What happens to welfare and incomes for wheat exporters?

CR is a small country and the imposed tariff leaves the world price of wheat at \$10. Thus, the welfare of wheat exporters does not change. Revenues of exporters reduce as CR imports of wheat decrease. However, this change is negligible given CR "small" size.

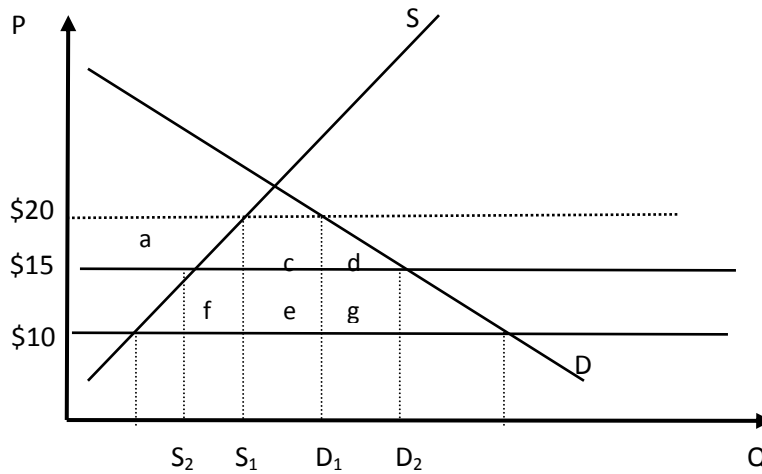
3. CR lowers its wheat tariff from \$10 to \$5.

a. What is the new price of wheat that clears the market? Does this change in tariffs affect the world price of wheat?



In the diagram above, we draw the world price of wheat (\$10) as a flat line. The new price that clears the wheat market in Costa Rica is \$15. The quantity supplied falls from S_1 to S_2 and the quantity demanded increases from D_1 to D_2 . CR has a small share of the world demand for wheat it means that changes in the quantity of wheat sold on the CR market does not affect world prices.

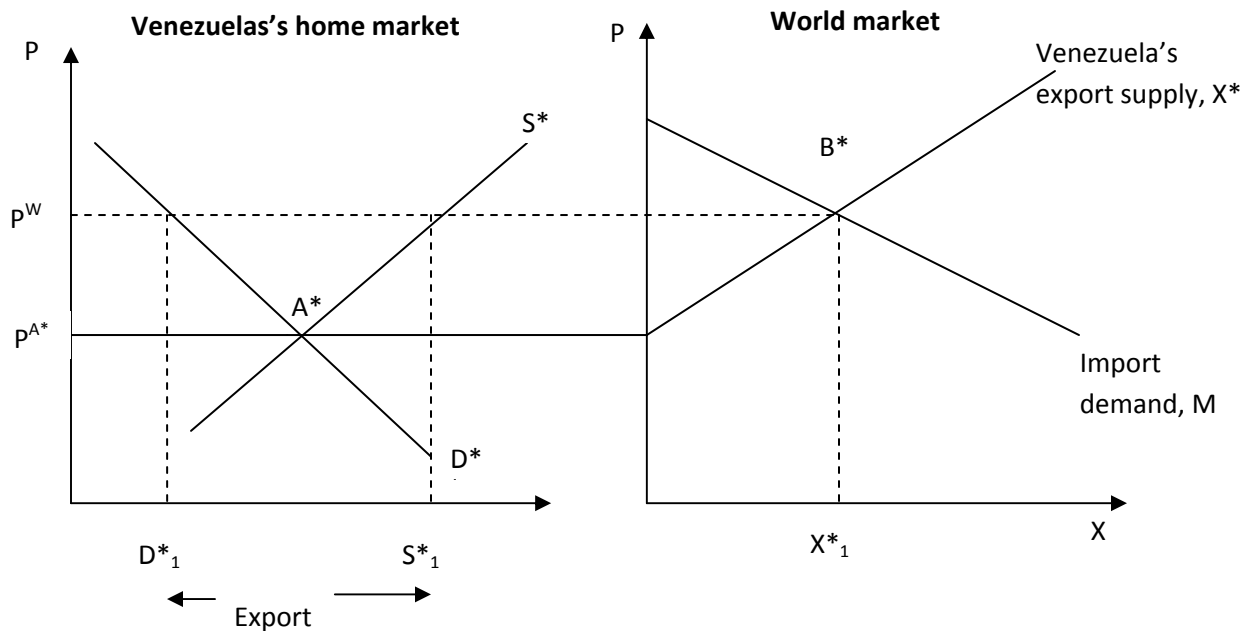
b. Does tariff revenue change? On what does that depend?



Government revenue = amount of the tariff x quantity imported. As a result of the change in tariff Δ Government revenue = $-c+f+g$. This could be positive, negative or zero, depending on how elastic demand and supply are.

For Q4-8, assume that Venezuela has a strong comparative advantage in oil production and the US has a strong comparative dis-advantage. The US represents a large share of world demand for oil.

4. Draw a diagram showing the domestic oil market in Venezuela, and Venezuela's export supply curve for oil.

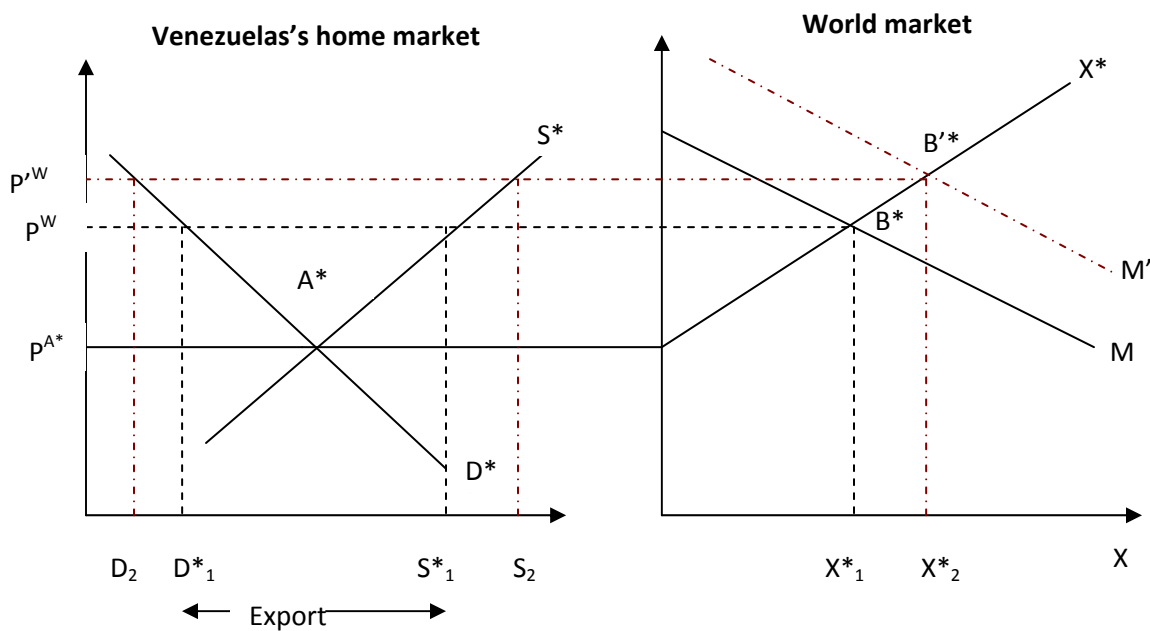


Since Venezuela has a strong comparative advantage in oil production the domestic price of oil in Venezuela is below the world price. This is shown in the left panel of the diagram above. P^W represents the world price and P^{A*} is the domestic price of oil in Venezuela. Venezuela exports X^*_1 (i.e., $S^*_1 - D^*_1$) at price P^W .

a. How does the quantity of oil exported depend on world prices?

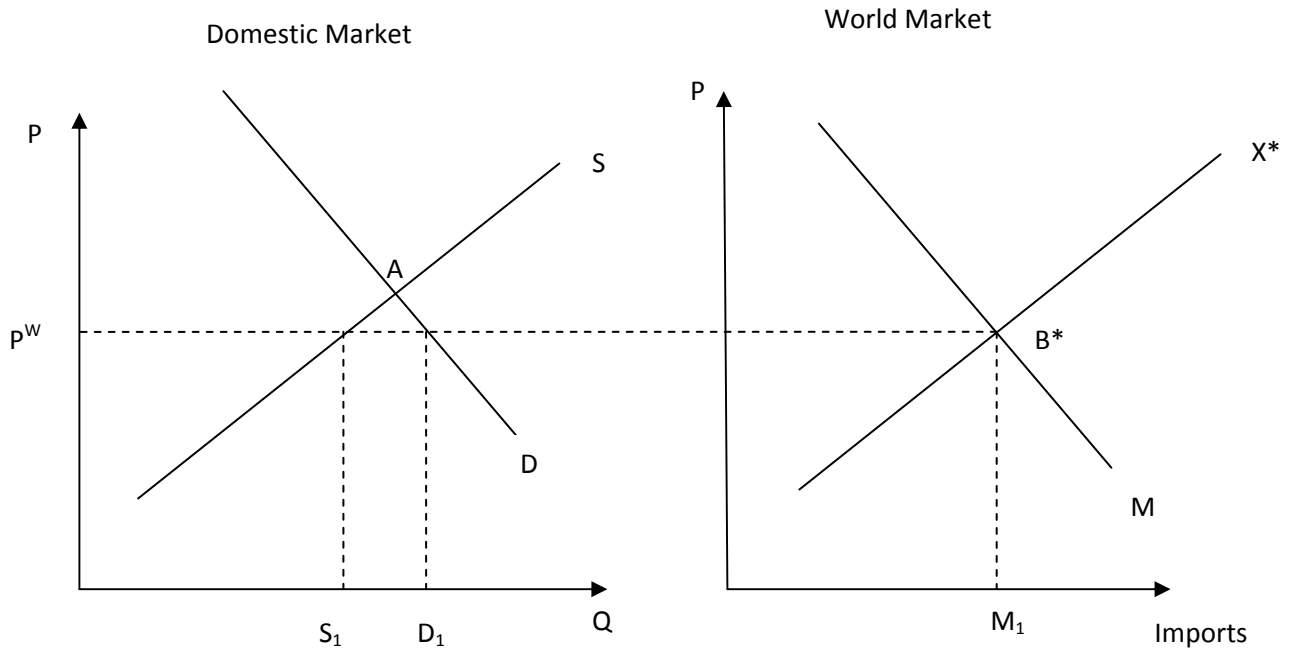
The quantity of oil exported increases with the world price for oil.

b. If world demand for oil rises, what will happen to the world price of oil, the quantity of oil supplied and demanded in Venezuela, and the quantity of oil exported.



If the world demand for oil rises the world price of oil rises to P'^W from P^W (B'^* becomes the new equilibrium), quantity of oil supplied increases from S_1 to S_2 and demand falls from D_1 to D_2 . Quantity of oil export increases from X^*_1 (i.e., $S^*_1 - D^*_1$) to X^*_2 (i.e., $S_2 - D_2$).

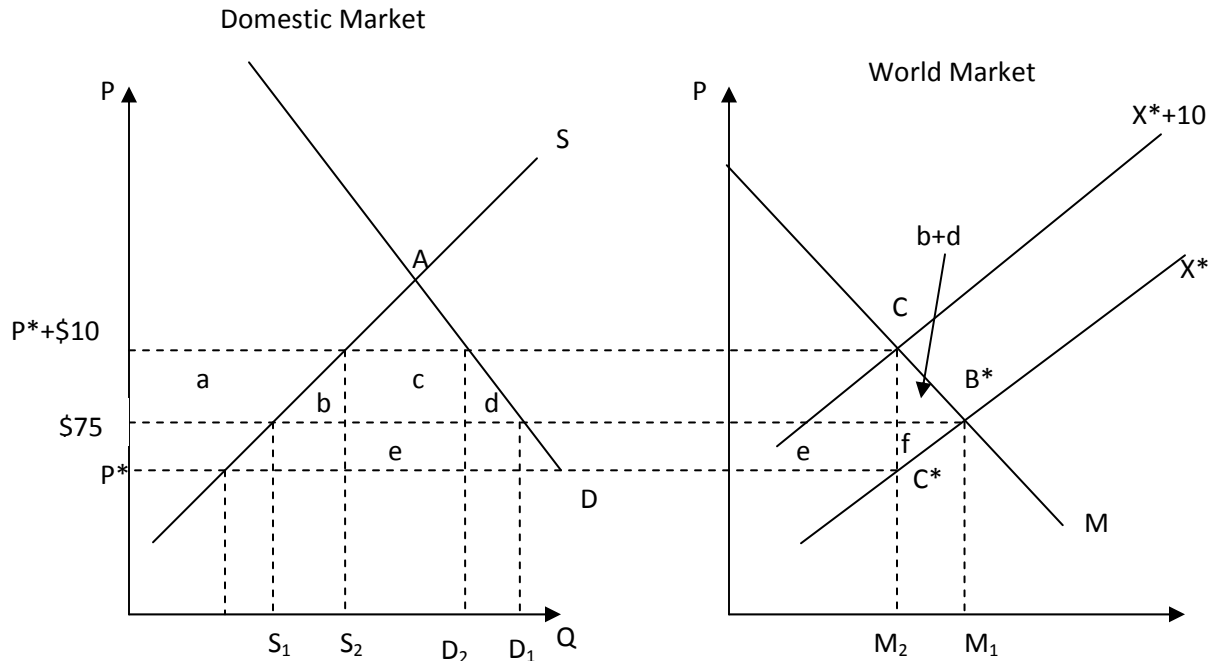
5. Currently the US imports oil with no tariffs attached. Draw two diagrams, the first showing the US domestic market for oil and the second showing US import demand for oil.



The left panel in the figure above shows the US domestic market for oil. The right panel represents the US import demand curve, M and the Rest of the world (ROW) export supply, X*. Before the tariff is imposed the equilibrium in the World Market for oil occurs at B* and the world price of oil is P^w.

6. Suppose that at the current world equilibrium, the world price of oil is \$75 a barrel. The US raises a \$10 a barrel (non-prohibitive) tariff on oil imports.

a. Show what happens to US import demand for oil.



When the US imposes the tariff the ROW export supply shifts up by the amount of the US tariff. As a result the US domestic price of oil rises to $P^* + \$10 > \75 , thus decreasing the US demand for imports of oil M_1 to M_2 .

b. What happens to the world price of oil? What is the most / least that oil prices could change?

Given that the US represents a very large share of the world demand for oil, the decrease in its import demand induces a decrease in the world price of oil. Most/least: the most that oil prices could change is that they would drop by the full amount of the US tariff (if export supply were vertical); the least they could change is 0, i.e. the small country case.

c. Is the new price of oil in the US market greater than, equal to, or less than \$85?

The new price of oil in the US market is less than \$85 ($P^* + \10 and $P^* < \$75$). This is because the price receive by the foreign producers of oil, has fallen as compared with the initial world price of \$75. Foreign producers are absorbing a part of tariff, by lowering their price from \$75 to P^* .

7. In the US, what happens to domestic oil consumption and domestic oil production?

a. Describe the changes in quantities.

The quantity of oil consumption falls and domestic production rises.

b. Make a guess about how the changes in quantity supplied and demanded would come about. That is, how specifically would consumers and producers change their behavior to generate the quantity changes?

Consumers would reduce the quantity demanded by driving less, buying more fuel efficient cars, maybe turning down the thermostat in their homes.

Producers will increase production. This might involve bringing high marginal cost oil fields into production (offshore drilling, drilling in the arctic); or exploiting difficult to extract sources of oil like oil shale and oil sands. Some firms will also find it profitable to develop alternative energy sources (solar, wind) to substitute for oil.

c. Would US oil production become more or less efficient at the margin? Would Venezuelan oil production become more or less efficient?

The introduction of the tariff protects US producers by foreign competition. The rise in the domestic price of oil allows producers that previously could not produce as their costs were too high to enter the oil market. As a consequence US oil production becomes less efficient at the margin.

Venezuela's production of oil become more efficient because the price received by the producers of oil in Venezuela decreases as a consequence of the tariff. Only low cost producers can survive in the Venezuelan oil market.

8. Now examine welfare in the US and in Venezuela.

a. Who in the US would benefit from this policy? Who would be hurt?

US consumers are worse off due to the raise in the price of oil. US producers are well off as now they receive a higher price on oil sold. The government enjoys tariff revenues in the amount of tariff (t) times the new amount of imports ($D_2 - S_2$).

In terms of areas in the figure above, the changes in US welfare can be summarized as follows:

Consumer loss: (a+b+c+d)

Producer gain: a

Gov't Revenue: c+e

Net Change in US welfare: e- (b+d)

If $e > (b+d)$, US will be better off due to the the tariff otherwise worse off.

Notice: By imposing a tariff on oil the US is able to decrease the world price of oil. The change in the world price of oil times the new amount of imports represents the US terms-of-trade gain (area e in the figure above).

b. Is Venezuela affected by the US tariff? If so, who would benefit, who would be hurt?

Venezuela will loose from the tariff. The loss is measured by the area (e+f). (e+f) is the loss of Venezuela's oil producer surplus.

c. Is it possible that US welfare could be improved by raising this tariff?

In order to answer this question we can use the concept of optimal tariff. For the US an increase in oil tariff will affect the magnitude of both the terms- of-trade-gain (e) and the deadweight loss (b+d). If you look at figure 8-8 in the text you can see that depending on whether the new tariff is higher or lower than the optimal tariff the US welfare decreases or rises respectively. In particular, the optimal tariff equals the inverse of the ROW's export supply elasticity. For the US to experience an increase in welfare as the tariff is increased it should be the case that the Row's export supply is not too elastic.

d. Would your answer to 8.c. be the same regardless of the size of the US tariff?

No. If the tariff is too large, then the welfare will fall below the free-trade level of welfare.

For Q9-10, assume that there are N monopolistically competitive producers of racing bicycles. They face fixed production expenses of \$1 million, and marginal product costs of \$100. The demand curve facing a firm is given by

$$Q = S\left(\frac{1}{N} - .01(P - P_{avg})\right)$$

where P_{avg} = average price of bikes in the market, and $S=100$ million is industry sales.

9. What determines the number of firms on the market and the price they can charge?

Firms will enter a market if there are positive profits and exit if there are negative profits. The number of firms is in an equilibrium when profits are zero.

$$\pi = PQ - cQ - F = 0$$

$$PQ = cQ + F$$

$$P = c + F / Q = AC$$

So firms will enter until price equals average cost.

Profit maximizing prices: set marginal revenue = marginal costs. For simplicity, let $b=0.01$.

$$\begin{aligned} MR &= P + (dP/dQ) * Q \\ &= P - Q/Sb \end{aligned}$$

$$P = c + Q/Sb$$

So we have two equations with prices on the left hand side. Set them equal to one another

$$c + F/Q = c + Q/Sb$$

Then you can plug in values for variables c, F, S, b and solve for Q.

If firms are symmetric and charge the same prices, then you can solve these equations by having each firm make $Q = S/N$ sales.

Plugging that in you arrive at

$$AC = c + F/Q = c + NF/S$$

$$P = c + Q/Sb = c + 1/bN$$

Note that AC is increasing in number of firms (for fixed quantity of industry sales a rise in N means each firm sells less, so that there are fewer units of sales to spread fixed costs over).

Prices are decreasing in the number of firms because an increase in prices results in firms losing sales more quickly when there are more competitors.

Combining those equations you get

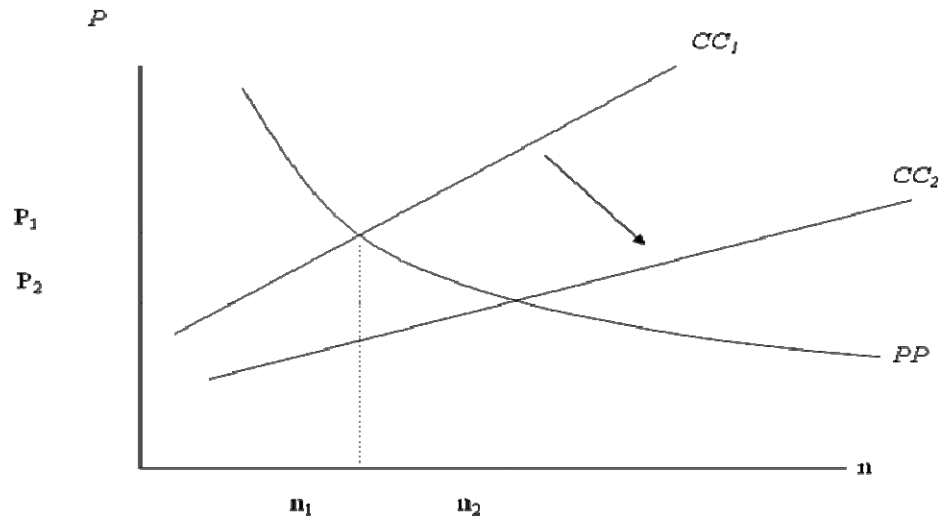
$$c + NF/S = c + 1/bN$$

$$N^2 = S/Fb = 100m/1m * .01 = 10,000$$

$$N = 100$$

a. How would a rise in industry sales (S) affect N and P? Explain.

In the equations above, AC is decreasing in S. That means that more firms can enter, driving down prices.



10. If firms are symmetric (face the same demand and costs), solve for N , Q , and P .

$$c + F/Q = c + Q/Sb$$

$$Q^2 = FSb$$

$$= (1m) * (100m) * .01 = (1m)^2$$

$$Q = 1m$$

$$c + NF/S = c + 1/bN$$

$$N^2 = S/Fb = 100m/1m * .01 = 10,000$$

$$N = 100$$

$$P = c + 1/bn$$

$$= 100 + 1/.01 * 100$$

$$= 100 + 1/1 = 101$$

Note that with 100 firms, each firm is marking up its bikes by only 1 dollar. TO cover 1 million dollars in fixed costs with only a \$1 dollar markup they have to sell 1 million bikes.