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Econ 200
Fall 2001 Schwab

Problem Set 3 Solutions to Problems 4, 5, and 6

4. We showed that a country could benefit from trade if the world price is below the equilibrium price. The purpose of this question is to show that a country would gain from trade if the world price is above the equilibrium price. You should present and discuss one diagram as part of your answer to the question.

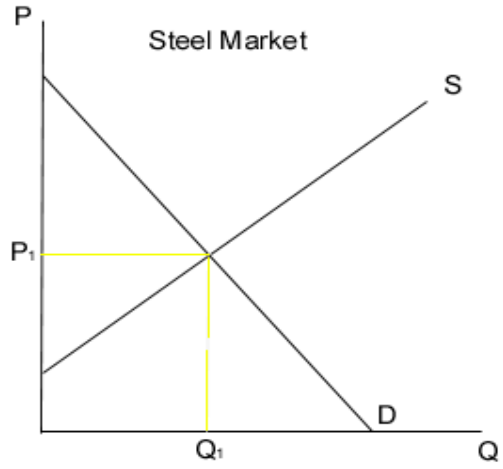
a. The steel industry in some country is perfectly competitive. Suppose initially that trade is not possible. Draw a supply and demand diagram that shows the equilibrium Quantity Q1 and the equilibrium price P1 of steel in this country.

b. Now suppose trade is possible and that the world price of steel Pw is above P1. Show the new level of steel consumption, the new level of steel production, and steel exports in this country.

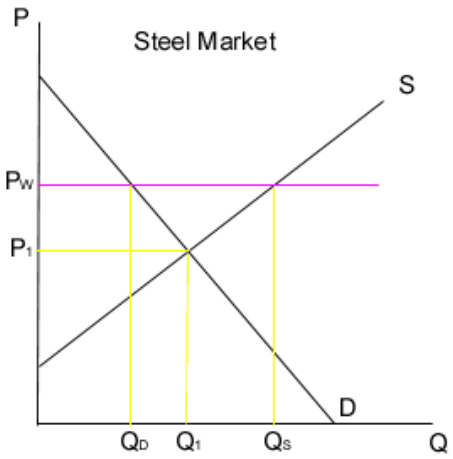
c. In your diagram, identify consumer surplus and producer surplus when trade was not possible.

d. In your diagram, identify consumer surplus and producer surplus now that trade is possible.

e. Did consumer surplus in the steel market in this country rise or fall as a result of trade? Did producer surplus in the steel market in this country rise or fall as a result of trade? Did total surplus in the steel market in this country rise or fall as a result of trade? Interpret these results carefully.

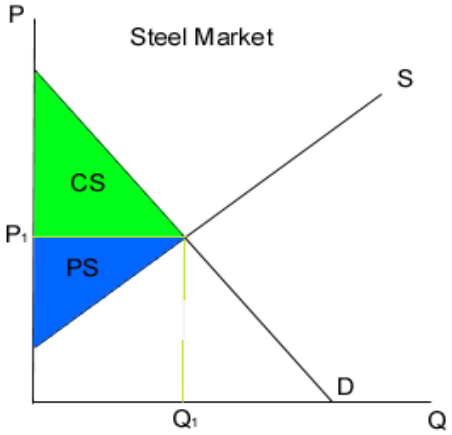


Part a is the same thing we've always been doing. Very basic.

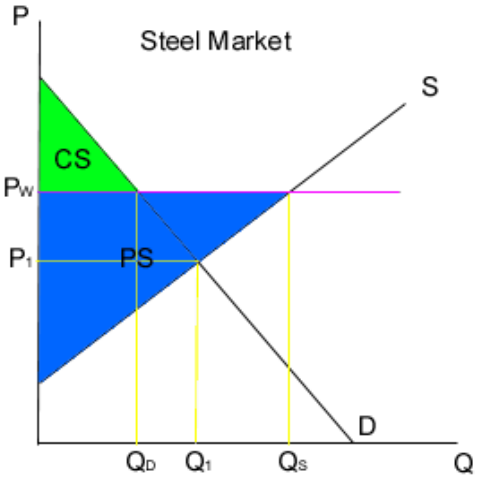


For part b, we have a higher P_W, a new level of domestic consumption Q_D below the old Q_1, and a new level of domestic production Q_S above the old Q_1.

Since production exceeds consumption, the rest of it is exported. Steel exports in this country are Q_S - Q_D. The domestic firms satisfy all the domestic consumption and then ship the extra elsewhere.



For part c, we use the no trade situation from part a. At P_1 and Q_1, we have the green consumer surplus and blue producer surplus. This is the exact same diagram that is at the end of my thing on surplus.

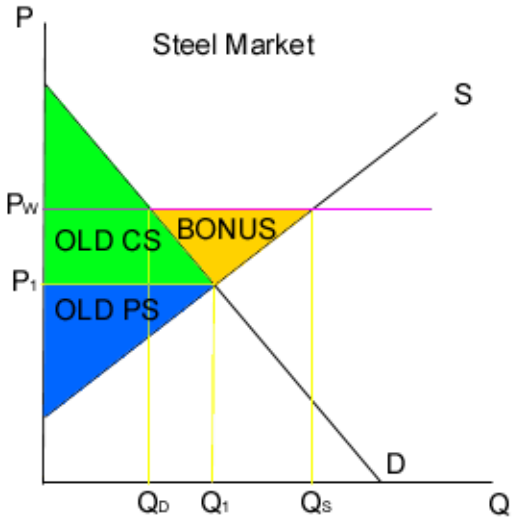


For part d, we use the open trade situation from part b. At the new world price P_W, we have lower quantity consumed but higher quantity produced. The new surpluses are shown in the new diagram at left.

Why are the triangles cut off at different places? This is because the quantity consumed no longer has to be the same as the quantity produced. Now, we have another outlet for steel that's produced: we can ship it overseas as an export.

Did consumer surplus rise? No, it fell. We know that for sure because quantity consumed by demanders dropped, so they lost the surplus from the units they no longer consume. Also, they pay a higher world price now, so each of the units they continue to produce after trade opens up gives them less of a bonus than before.

Did producer surplus rise? Yes, because now producers get the double bonus of not only selling more units (and each unit gives them some bonus), but the bonus per unit sold is higher because they are now receiving a higher price than before.



Now we want to know if total surplus rose. CS fell and PS rose, so it isn't clear what happened to TS = CS + PS if we don't actually look at the diagram.

When we compare the no trade and open trade states of the world though, we see that when open trade was allowed, we not only got all the surplus we used to get... but we also get that orange bonus part. Total surplus in this steel market went up when we opened up trade.

5. In lecture, we focused on harmful externalities that arise in the production of goods. Some externalities, however, are beneficial. Consider, for example, the birds and the bees. Suppose you raise bees that produce honey and I grow apples. Your bees will pollinate my apple trees, and consequently the social cost of honey is less than the private cost of honey.

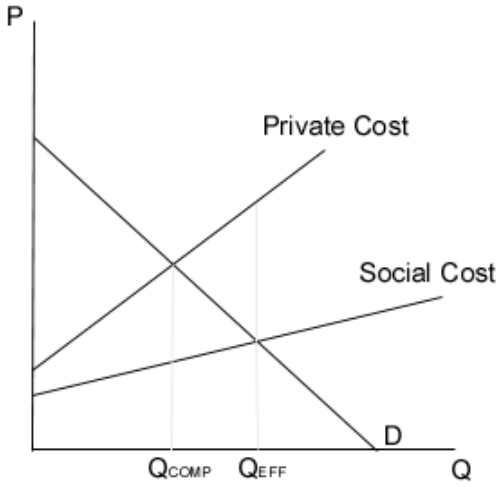
a. In a diagram, show the efficient level of honey production and the quantity of honey produced in a competitive honey market. Which is greater?

b. In a diagram, show the deadweight loss from this externality.

c. Show the government could lead honey producers to produce the efficient level of honey by subsidizing the production of honey.

The first thing we need to realize is that the private cost of production is higher than the social cost of production. This is because the honey bees lower the cost of making apples. The beekeeper will not take into account the benefit he confers on the apple orchard owner. But from society's point of view, the cost of making apples and honey is jointly lower when the honey bees are used to make honey due to the helpful effect on apple production.

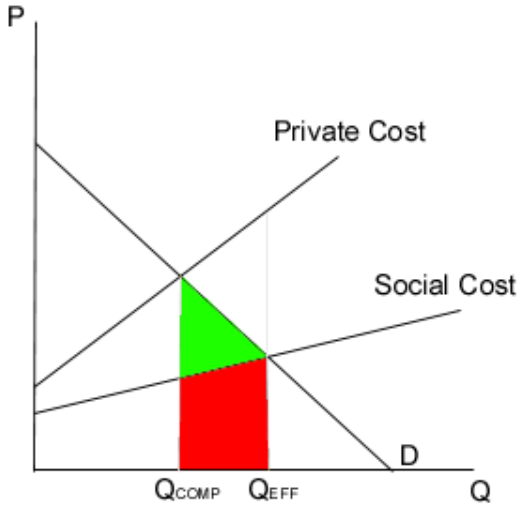
Thus, the social cost curve is lower than the private cost curve. We can make a diagram like the one that Dr. Schwab used in class:



Here, the competitive market will result in Q_{COMP} being traded. However, the socially efficient quantity is really at Q_{EFF}.

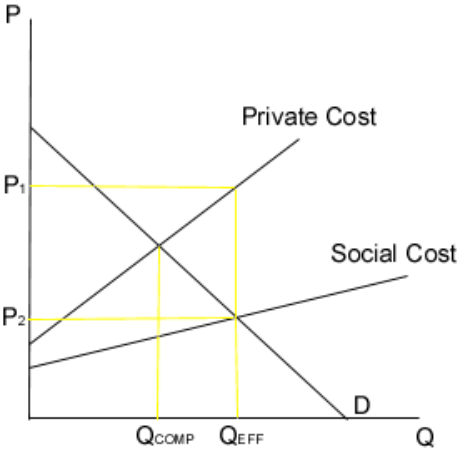
Obviously, $Q_{EFF} > Q_{COMP}$.

Remember, when cost is high, firms don't make and sell as many units as when cost is low. The firms only consider their own private costs (which in this case are high), not social costs (which in this case are low). Because of the externality, there is underproduction.



For part b, we want to know what the deadweight loss caused by the externality is in this market. The problem caused by the externality is that there is underproduction - those units between Q_{COMP} and Q_{EFF} are not produced and traded even though they are worth more to society than it costs to make them.

When we look at the situation from society's point of view, it would cost the red area to make those additional Q_{COMP} - Q_{EFF} units. The benefit to society would be everything under the demand curve *for those units*: the red plus the green areas. What is the surplus in this case? We pay the red to get the red back and also get the green back as bonus. The green is a pure gain and represents a rise in total surplus.

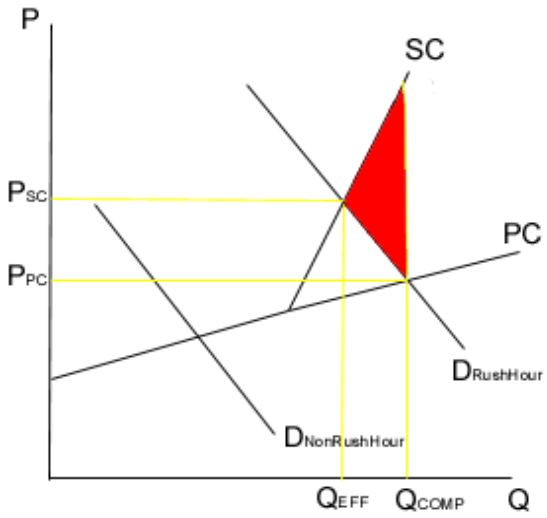


How could a subsidy fix the problem in this market and get us to the efficient quantity traded? Suppose we offered the beekeeper a subsidy equal to P_1 - P_2. This gap is exactly equal to the difference between private and social cost at the socially efficient quantity.

Our subsidy has exactly brought the beekeeper's costs in line with the true social costs. With the subsidy, we've given the beekeeper the incentive to do exactly what we want him to do: pick the socially efficient quantity.

6. a. Metro charges higher fares at rush hour. Why might these higher fares be required for efficiency? b. We do not have congestion tolls on roads in Washington. Is it possible that efficiency might require *lower* rush hour fares on Metro?

Metro is a partially rival good during rush hour because there is a negative externality when an additional person rides during rush hour. During rush hour, Metro is very crowded (Try riding Red Line anywhere between Judiciary Square and Dupont Circle at 8 in the morning). When another person gets on the train, it gets more uncomfortable for everyone on the train - in some sense, adding one more rider makes the trip less enjoyable for everyone on the train.



When a person pays the fare during rush hour, he doesn't take into account the fact that he's making everyone else's ride worse. If we don't charge consumers for both the cost to service him plus the cost they impose on other riders, too many people will want to ride. We can cut back to the lower efficient quantity by charging a higher price (remember Law of Demand? If price rises, people buy less).

Too many people end up riding metro during rush hour, and society ends up with the red area as deadweight loss.

Part b is asking about considering a totally separate market and asks us to look at road usage alongside metro usage. The toll-free congested roads are exactly what Dr. Schwab talked about in lecture on slide 8. We can see that Metro is acting like this congested road case, and that we really have two markets that both exhibit a negative congestion externality.

Suppose we raise Metro fares. People still need to get to work or school. If they aren't riding Metro, they may instead drive to work. But if roads are congested and adding more cars will cause big losses to society, do we really want to push people out of Metro and into cars? If the social losses from more people on Metro is smaller than more cars on the road, we would prefer to have more people ride Metro. Incurring a small loss and getting big savings is going to be better than incurring a big loss and getting small savings.

In order to induce more people to ride Metro, we could charge lower fares (by Law of Demand, the lower price results in people buying more). In the case of big road losses and small Metro losses, it turns out that lower Metro fares could actually be efficient.