Homework Exercises 9: Public Goods and Externality

1a. No, it would not be efficient for the truck driver to stay on the highway because his gain ($12) is greater than then resident's loss ($7), and these are the only two people affected.

1b. To keep the truck on the highway instead of the shortcut road, the resident would have to pay at least $12. Since this exceeds $7, the resident would not do it.

1c. If the resident has the legal right to block the truck driver, the driver would probably pay somewhere between $7-$12 dollars to use the shortcut. This would be the efficient outcome, because the drivers gain from using the shortcut, exceeds the resident's loss.

2. The sink and the dishes are both a form of public good for those who live in the house. If there were no one else there who might clean up, each individual would benefit from cleaning up the mess. However, the possibility that the other person might do the dishes makes it seem that an optimal strategy is to simply leave dishes, and wait for the other person to do them (i.e. free-riding). Unfortunately, they have the same dominant strategy, and the dishes accumulate.

3a. Within the dorm room, the showing of a movie is a public good. None of the roommates can be excluded from viewing the movie. Because one roommate's viewing does not affect the ability of another roommate to view the movie, the good is also nonrival in consumption.

3b. The roommates should rent two movies because the value of the third film ($9) would be less than the cost ($10).

3c. The total cost would be $\$10 \times 2 = \$20$. If the cost were divided evenly among the roommates, each would pay $5. Judd values two movies at $13 so his surplus would be $8. Joel values two movies at $9 so his surplus would be $4. Gus values two movies at $5, so his surplus would be $0. Tim values two movies at $3 so his surplus is -$2. Total surplus among the three roommates would be $10.

3d. The costs could be divided up by the roommates based on the benefits they receive. Because Judd values the movies the most, he would pay the greatest share. The problem is that this gives each roommate an incentive to understate the value of the movies to him.

3e. Because they are going to pay equal shares, Judd definitely has an incentive to tell the truth about the value he places on movies to ensure that the group rents more movies. It is because he values each of the movies more than his cost per movie ($2 per person).

However, under this equal share mechanism, as each person knows the cost per movie is $2 per person, the people with lower valuation (such as Tim) might have an incentive to hide his valuation if his value is lower than $2 in an attempt to avoid making losses!

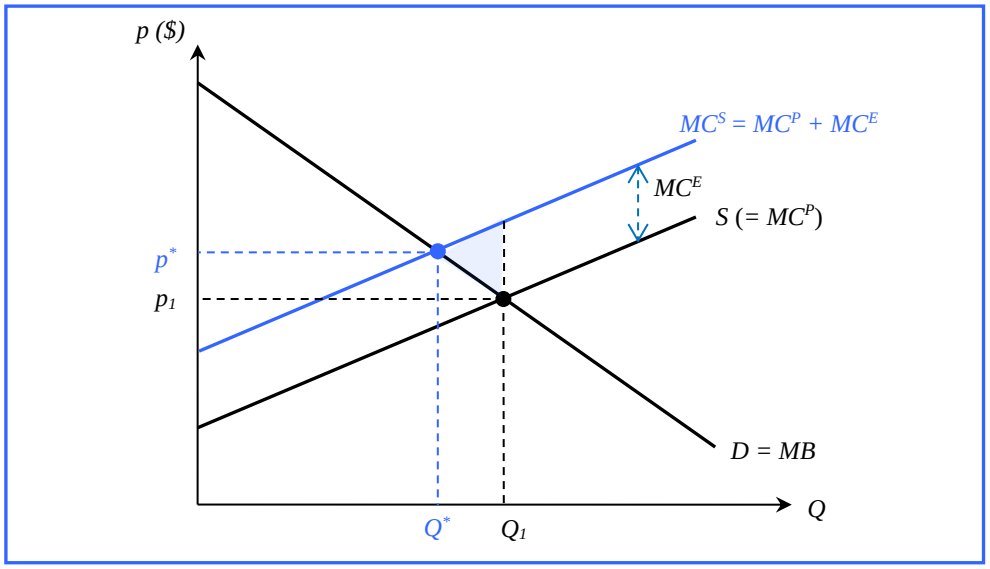
3f. The optimal provision of public goods will occur if individuals do not have an incentive to hide their valuation of a good. This implies that the cost-sharing mechanism in part d (i.e. each individual's cost relates to his valuation) would not work. However, it does NOT imply that the mechanism of equal sharing MUST result in optimal provision.

4a. A permit is worth \$25 to firm B, \$20 to firm A, and \$10 to firm C, because that is the cost of reducing pollution by one unit. Because firm B faces the highest costs of reducing pollution, it will keep its own 40 permits and buy 40 permits from the other firms, so that it can still pollute 80 units. Because firm A values them more highly than C, B can buy 40 permits from C at a lower cost. So it must be that firm C sells its 40 permits to firm B.

4b. Firm B does not reduce its pollution at all, firm A reduces its pollution by 30 units at a cost of \$20 × 30 = \$600, and firm C reduces its pollution by 50 units at a cost of \$10 × 50 = \$500. The total cost of pollution reduction is \$1,100.

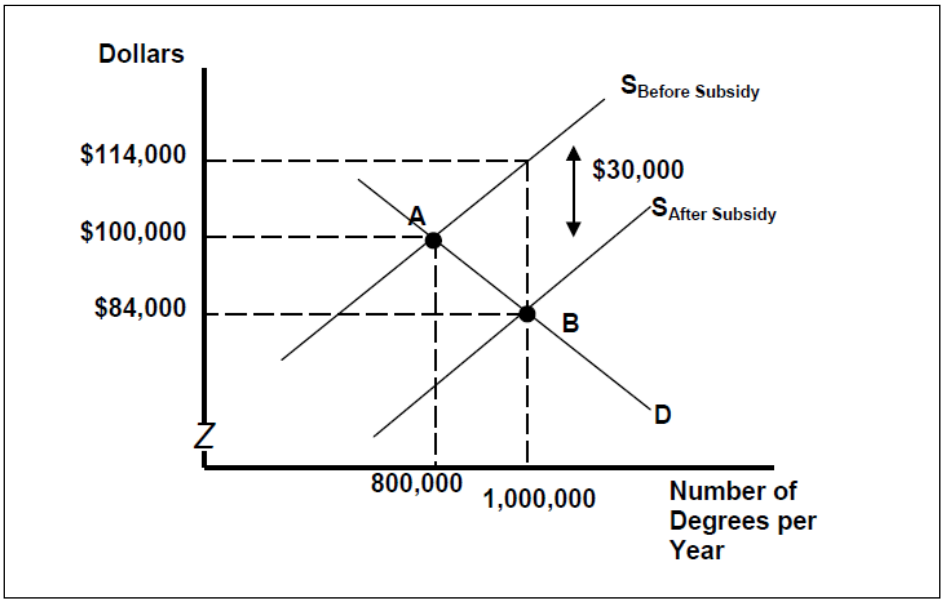
4b. If the permits could not be traded, then firm A would have to reduce its pollution by 30 units at a cost of \$20 × 30 = \$600, firm B would reduce its pollution by 40 units at a cost of \$25 × 40 = \$1,000, and firm C would reduce its pollution by 10 units at a cost of \$10 × 10 = \$100. The total cost of pollution reduction would be \$1,700, \$600 higher than in the case in which the permits could be traded.

5.



The use of coal in electricity production will increase pollution. Therefore, it generates negative externality, creating external costs to third parties. With negative externality, it is economically efficient to produce an output level at which the marginal social cost equals the market demand. The efficient output level is therefore Q^* and the social optimal price is p^*. However, since the producers only consider the private cost when they make their production decisions, the market equilibrium output is Q_1, resulting in an **overproduction** of $Q_1 - Q^*$**.** It creates a deadweight loss of the shaded area.

6. When the government pays a unit subsidy of \$30,000 to colleges. It shifts the supply curve downward by s = \$30,000. The market equilibrium changes from A to B. Therefore, the equilibrium price decreases from \$100,000 to \$84,000 and the equilibrium quantity increases from 800,000 to 1,000,000. With subsidy, the students pay less per unit. However, the colleges receive more per unit (after receiving the subsidy), i.e. \$114,000. The result is exactly the same if the \$30,000 subsidy per student had been given to students.


Dollars
$S_{Before\ Subsidy}$
$114,000
$30,000
$S_{After\ Subsidy}$
A
$100,000
$84,000
B
D
Z
800,000
1,000,000
Number of Degrees per Year