Homework 3
Environmental Economics: ECO 345
Due: Wednesday, November 16, 2011

Question 1

The EPA has discovered high levels of BOD in a river. Both the turkey farm and the hog farm deny responsibility, and the EPA has no way to determine which firm is causing BOD levels to rise. Propose a regulatory scheme that induces the efficient emissions.

Question 2

Suppose marginal damages and costs are as in the picture below. Would you recommend a Pigouvian tax, tradeable permits, a hybrid safety valve, or a hybrid price floor? Explain.

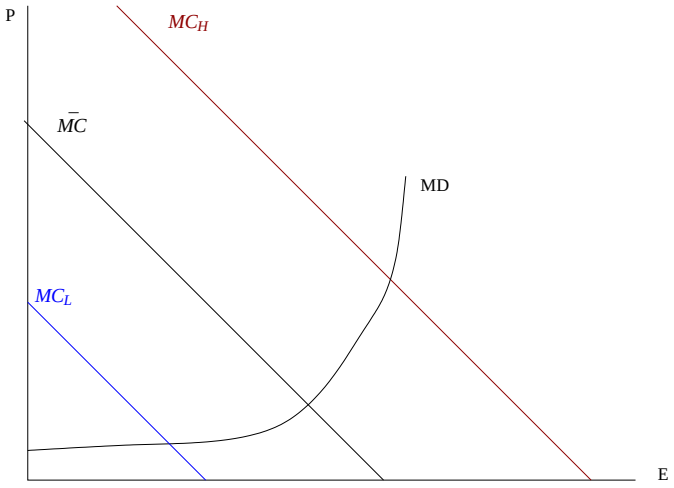

Figure 1: Convex Damages.

Question 3

Suppose firms say complying with CAFE standards is expensive (environmentalists claim complying is cheap). In response, the government modifies the CAFE standard so that if firms are below the MPG standard they pay a fine t per unit of MPG below the standard, as is currently the case, but if they increase MPG above the standard they receive a subsidy s per MPG above the standard.

a. Suppose in period one, the government observes all firms above the standard and receiving subsidies. How should the government adjust the standard in the future?

b. Suppose in period one, the government observes all firms paying fines. How should the government adjust the standard?

c. Suppose firms lied and their actual marginal costs are low. Is it necessarily optimal for firms to accept the subsidies given (a) and (b)? Explain.

Question 4

Consider the problem from the second quiz, with slightly different numbers for fun. Pollution in Bangkok, e has marginal damages and costs of:

$$MD = 4e \tag{1}$$

$$MC_L = 12 - 2e, \tag{2}$$

$$\bar{MC} = 24 - 4e, \tag{3}$$

$$MC_H = 40 - 6e. \tag{4}$$

That is the regulator is uncertain about the firms marginal costs, but guesses that there is a 50% chance of either MC_L or MC_H, with an avenge of $\bar{MC}$.

The first set of questions just asks you to repeat the second quiz:

a. Graph the marginal damages and all marginal cost curves.

b. Calculate the Pigouvian tax, and the emissions, marginal costs, and marginal damages which result if marginal costs are low, and the emissions, marginal costs, and damages which result if marginal costs are high.

c. Calculate average welfare loss with the tax. Show the welfare losses for high and low marginal costs on the graph.

d. Calculate the emissions with tradeable permits, the marginal damages, the marginal costs if marginal costs are low, and the marginal costs if marginal costs are high.

e. Calculate the average welfare loss with tradeable permits. Show the welfare losses for high and low marginal costs on the graph.

f. Which regulation system gives the lowest welfare loss? Does the best regulation system depend on whether marginal costs turn out to be high or low?

Now let us some hybrid policies.

g. Construct a hybrid policy of a safety valve. How many permits are initially issued, what is the safety valve price, and how many extra permits do the firms buy from the government? Show on a new graph the welfare loss with the safety valve. Compute the average welfare loss.

h. Consider a hybrid policy with a price floor equal to 8. Show on a new graph the welfare loss of the hybrid policy. Compute the average welfare loss.

i. Compute a tax/subsidy policy that has no welfare loss (compute the tax, the subsidy, over what range of emissions the firm receives the tax and subsidy, and show the welfare loss is zero).

j. Rank all 5 policies, taxes, permits, and the 3 hybrids, according to welfare loss.

Question 5

You are a manufacturer of rubber chickens. Unfortunately, chemicals from your manufacturing process are causing water pollution. Marginal damages and your marginal cost of reducing pollution are:

$$MD = 8 \tag{5}$$

$$MC = 10 - e \tag{6}$$

The regulation currently in place is an emissions standard equal to the efficient emissions. The EPA conducts a random audit to ensure you comply with the standard. Audits occur 40% of the time and the fine for being out of compliance is \$10, *regardless of your emissions.*

a. Compute the efficient emissions and the your cost of compliance with the emissions standard.

b. Suppose you do not comply with the standard. Given you are not going to comply with the standard, how much should you emit? Calculate the cost of not complying, including compliance costs (if any) and the average fine.

c. What is the efficient fine *per unit of emissions*?

d. Based on (a)-(c), explain why the standard/audit system is inefficient.