

Seminar 2

Problem 1

Consider an environmental regulator that knows the damage function of emissions, but is uncertain about the abatement costs of emitting firms. The regulator considers two policy instruments: i) direct regulation of the maximal emission ii) a uniform tax on emissions (Pigouvian tax). Analyse under what conditions direct regulation is to be preferred, and under what conditions an emission tax is to be preferred.

Problem 2

A good is produced by several firms. Emissions from each firm are not proportional to the firm's output, but are an increasing function of some of the inputs used in the production of the good.

The environmental regulator cannot observe the emission level of each firm, but can observe the sum of emissions. The regulator can also observe (at the firm level) the use of at least one of the inputs that affect emissions.

For the situation given above, describe at least one feasible type of direct regulation that can be used to influence emissions, and at least one feasible type of environmental tax. Discuss the properties of the policy instruments you have described.

Problem 3

Assume that the profit maximizing emission level of a firm, in the absence of any environmental regulation, is 10. Then the regulator introduces a command-and-control policy implying that the firm faces an emission cap of 8.

Denote the actual emissions of the firm m . The probability that the firm will be monitored is 0.5. If the firm is monitored and caught exceeding its emission cap ($m > 8$), it will have to pay a fine F as a function of m , such that

$$F(m) = 2(m-8) \quad (\text{for } m > 8. \text{ If the firm is not monitored, or if } m \leq 8, \text{ then } F=0.)$$

Assume that the firm can clean its emissions has the following abatement cost function:

$$c(a) = \frac{1}{2} a^2$$

where $a = 10 - m$.

- i) If the firm is risk neutral and is minimizing its total expected emission-related costs (abatement costs plus expected fines), will it obey or violate the new regulation?
- ii) If the penalty function is changed to

$$F(m) = 100 + 2(m-8),$$

how would that influence the firm's decision?