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Problem Set 1a

Exercise 1

The Fireyear and Goodstone Rubber Companies are two firms located in the rubber capital of the world. These factories produce finished rubber and sell that rubber into a highly competitive world market at the fixed price of £60 per ton. The process of producing a ton of rubber also results in a ton of air pollution that affects the rubber capital of the world. This 1:1 relationship between rubber output and pollution is fixed and immutable at both lactones. Consider the following information regarding the costs (in £) of producing rubber at the two factories *(Qp* and Q_G*):*

Fireyear: Costs: 300 + $2\,Q_F^2$ Marginal costs: $4Q_F$

Goodstone: Costs: 500 + Q_G^2 Marginal costs: $2Q_G$

Total pollution emissions generated are $E_F + E_G = Q_F + Q_G$. Marginal damage from pollution is equal to £12 per ton of pollution.

a. In the absence of regulation, how much rubber would be produced by each firm? What is the profit for each firm?

b. The local government decides to impose a Pigovian tax on pollution in the community. What is the proper amount of such a tax per unit of emissions? What are the postregulation levels of rubber output and profits for each firm?

c. Suppose instead of the emission tax, the government observes the outcome in part (a) and decides to offer a subsidy to each firm for each unit of pollution abated. What is the efficient per unit amount of such a subsidy? Again calculate the levels of output and profit for each firm.

d. Compare the output and profits for the two firms in parts (a) through (c). Comment on the differences, if any, and the possibility of one or both of the firms dropping out of the market.

Exercise 2

Acid rain is a problem in Scandinavia. Electricity-generating plants burn coal and emit sulfur dioxide. That sulfur dioxide is converted to sulfates, which travel long distances and are washed out of the air as acidic rain, particularly affecting Swedish lakes. Assume that power plants in England and Denmark are the primary culprits. Also assume that in a year one tonne of sulfur emitted in England generates deposition in Sweden of 1 gram of sulfate deposition and one tonne of sulfur from Denmark generates 3 grams of deposition in Sweden. Damage from acid rain is approximately 1 pence per gram of sulfates deposited. If *q* is the reduction in annual sulfur emissions (in tonnes) from uncontrolled levels, the marginal cost of controlling sulfur emissions is *£ q* for Denmark and *£ 2q* for England [1£ = 100p].

a. Write the damage function, giving damages as a function of total sulfates deposited.

b. Write the transfer coefficients for England and Denmark.

c. First ignore the effects of pollution on Sweden and suppose we want simply to reduce emissions by 12 tonnes. How much of that reduction should come from Denmark, on I the basis of cost efficiency? *(Hint:* Think of the marginal cost of emission control just like you think of the marginal savings for emissions,)

d. Now suppose we want to reduce emissions by 12 tonnes but we want to do it in a way that takes into account effects on pollution in Sweden. Although this might not be the right amount of pollution reduction, balancing the marginal cost of controlling pollution in Sweden from the two source countries would require how much of an emission induction in Denmark?