

ECON4910 Environmental Economics

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Problem set 2

Ex. 1. Market in Licenses

When we in class complemented the analysis of “Markets in licenses and efficient pollution control programs” by Montgomery (1972), we simplified by assuming interior solutions and that all license prices were strictly positive.

- (a) Is this a reasonable assumption? Why/why not?
- (b) How does Montgomery (1972) distinguish between “pollution licenses” and “emission licenses”?

Suppose there are $n = 10$ firms and $m = n = 10$ locations but, referring to the notation in the paper, $h_{i1} = 1$, $h_{i2} = 2$, and $h_{ij} = 0$ for every firm i , and every location $j \notin \{1, 2\}$.

- (c) Can you draw the harm matrix from Montgomery (1972) of the unit diffusion coefficients for this exercise?

Suppose, further, that $\sum_i l_{ij}^0 = 40 \forall j$ and that the firms are identical in that the loss functions are the same and given by $F_i(e_i) = 10 - e_i(20 - e_i)$.

- (d) Can you derive the first best (i.e., the socially optimal) when the number of licenses are given?
- (e) How would you derive the second best when the number of licenses are given?
- (f) If the firms take the permit prices as given, what is the firm’s optimal purchase of licenses to pollute in the various districts, as a function of the permit prices?
- (g) Can you characterize the equilibrium license prices and allocation of licenses?
- (h) How many license markets do we need for the market outcome to coincide with the efficient social outcome in this simple model?

Ex. 2. Coasian bargaining

Consider Coase's example with the cattle-raiser and the farmer (Coase, 1960). Suppose that the cattle raiser's profit of the herd is an increasing but concave function in the number of cows, $N \in \{0, 1, 2, 3, 4\}$:

$$\pi = N \left(7 - \frac{N}{2} \right).$$

The farmer experience a linear marginal loss from each cow (One extra cow gives one unit extra damage).

- (a) Is it reasonable that marginal profits is decreasing in N ? Why/why not?
- (b) Draw the two agents' marginal benefit and marginal damage curves.
- (c) Suppose the farmer owns the land (has the property rights). What allocation is predicted by the Coase theorem? Describe both the number of cows N and any transfer you may predict. What is the net social benefit in equilibrium, and is this the maximum?
- (d) Suppose the farmer has the property rights and the cattle-raiser has the opportunity to leave the cattle-business and instead earn the salary $Y > 0$ as a professor. Given Coasian bargaining, for what Y will the cattle-raiser become a professor?
- (e) Repeat your analysis of questions (c) and (d) assuming that the cattle-raiser has the right to use the land.
- (f) Assume now that the cattle-raiser is not yet in town, and thus unable to negotiate or discuss with the farmer. We still assume that the potential cattle-raiser is still deciding between being a professor and a cattle-raiser. Can you repeat your analysis when the farmer has the property rights and when the cattle raiser has the property rights.

References

- Coase, R. H. (1960). The problem of social cost. *Journal of Law and Economics*, 3(October):1–44.
- Montgomery, W. (1972). Markets in licenses and efficient pollution control programs. *Journal of Economic Theory*, 5(3):395–418.