

Answers to Exam in Environmental Law and Economics, Oslo University.

Wednesday November 20, 2013.

### Question 1

Consider the case of a firm that emits noise which keeps a neighbor awake at night. Society aims for a regulation that is Kaldor-Hicks optimal.

**Question 1.1.** Explain what is meant by Kaldor-Hicks optimality.

Answer: Kaldor-Hicks efficiency is equivalent to value maximization. A state is K-H efficient if there does not exist another state which is better in the sense that those who are better off in that other state can compensate those who are worse off so as to make the latter equally well off in the two states, and still be better off themselves.

**Question 1.2.** Explain why, if transaction costs are zero, it makes no difference to the Kaldor-Hicks optimality of the outcome whether the firm is freely entitled to emit noise or whether the neighbor is granted the right to enjoin the firm in case it emits noise.

Answer: If transaction costs are zero and the parties can bargain at zero cost, the Coase theorem stipulates that the parties will attain a Kaldor-Hicks optimal outcome. Rational parties will bargain to the value maximizing outcome, otherwise they will leave 'money on the table'.

We now assume that transaction costs are not zero but prohibitive (very large), e.g. because the firm and the neighbor are not on speaking terms. We assume that we can measure the prospective harm to the neighbor by estimating how much the value of the house will decline if the firm is allowed to emit a given level of noise. Let us assume that the level of harm for the neighbor and the cost for the firm of reaching a given level of abatement are given by the following table:

	25 dB noise	35 db noise	45 db noise
Cost to the firm of abatement	50000 \$	20000 \$	5000 \$
Harm to the neighbor	35000 \$	55000 \$	100000 \$

We assume first that the numbers in the table are known by all, i.e. by the firm, by the neighbor and by the regulator.

Society can choose to regulate the firm's conduct in one of two ways. Either society can grant the firm the right to emit a given level of noise and then sanction deviations from this level harshly (i.e. use a property rule) or it can require the firm to compensate the neighbor for the harm created (i.e. use a liability rule).

**Question 1.3.** Explain why this choice of how to regulate does not matter under the assumptions made so far. Explain what the outcome will be.

Answer: If society regulates through a liability rule, and liability is strict, the firm will internalize all costs to the neighbor and will hence choose the level of noise that maximizes total value. If society regulates through standards (the property rule), it will set the standard at 35 dB noise, which is the value maximizing level of noise, and the outcome will again be Kaldor-Hicks -optimal (or -efficient). If society regulates through a negligence rule, it will set the standard of negligence at 35 dB, in which case the firm will comply with the standard of negligence and the optimal outcome will be attained.

Assume now that the regulator knows neither the cost to the neighbor nor the harm to the neighbor but that he regulator can become informed at a cost. It costs 5000 \$ for the regulator to become informed of the firm's costs (the numbers in the first row of the table), and 5000 \$ to become informed of the neighbors harm (the numbers in the second row of the table).

If the regulator opts for the liability rule, it can choose between the negligence rule and strict liability. When harm must be measured ex post, this measurement costs also 5000 \$. Assume that the regulator chooses the instrument of regulation before choosing how much information to acquire ex ante.

**Question 1.4.** If the regulator chooses the negligence rule, what should ideally be the standard of due care if there were no costs to the regulator of being informed?

Answer: As indicated above, the standard should be 35 dB as this is the value maximizing level of noise. In the law and economics theory, the standard of due care should be set at the value maximizing level.

**Question 1.5.** Explain in what sense the negligence rule is a hybrid between a property rule and a liability rule.

Answer: The negligence rule allows the firm to 'pollute' freely up to a threshold level of due care. For the interval up to the threshold level, the rule resembles a property rule that entitles the firm to pollute. (The neighbor is not entitled to stop the firm from producing; such action might involve intervention by the police rather than only payment of liability). For levels of pollution higher than the threshold level (35 dB), the right or entitlement resides with the neighbor, but this right does not, under the negligence rule itself, involve the right to enjoin the firm but only the right to compensation for harm suffered.

**Question 1.6.** Which rule is better to use, if any: the negligence rule or the strict liability rule, from a total cost perspective when information is costly for the regulator to obtain?

Answer: when information is costly to acquire, the strict liability rule does not involve other costs than that of measurement of harm. That is, it involves a cost of 5000 \$. The negligence rule, involves setting an optimal level of negligence. This requires knowledge of both rows, which means a total cost of 10.000 \$. However, it does not involve a measurement of harm ex post as the firm will not act with negligence.

**Question 1.7.** Which instrument is better to use: the property rule or the better of the

negligence rule and the strict liability rule when information is costly to acquire for the regulator?

Answer: we should compare the strict liability rule, which is the better liability rule, with the property rule. The property rule can grant the right to either the firm or the neighbor. To know who should hold the right under a property rule regime, the regulator must know both parties costs, but will not have to measure actual harm (at the law will be adhered to when the sanction is severe). Still, the cost of knowing both parties costs is, as under the negligence rule, higher than the cost of only measuring the harm ex post. Thus, liability remains preferable.

Let us now relax the assumption that the regulator cannot know the harm to the neighbor. Assume that, based on experience, it can form a good opinion of the neighbor's harm schedule.

**Question 1.8.** Discuss under which conditions it might then be advisable for the regulator to use the property rule, allowing for a threshold of noise without compensation.

Answer: If harm is well-known from a given level of exposure to noise, the information requirement of the negligence rule (applied to nuisance law) is reduced to knowing the costs of the firm. In principle, these costs must still be known, at a cost of 5000 \$. The actual measurement of harm, however, does not have to be measured under the property rule, as just mentioned (in the answer to Question 1.7). Then, the property rule (or in fact the negligence rule) may be advantageous because it does not involve the cost of conflict resolution every time a harm occurs. Measurement of harm is of course only one part of conflict resolution costs. It can be noted that it may even be that it is optimal to set a threshold level without knowing the cost schedule of the firm if it is known that the harm from noise rises sharply when some level of noise is surpassed. It is enough if the students observes that the property rule, - the setting of a standard the breach of which is harshly sanctioned- will avoid conflict resolution costs that will tend to be high under a regime of strict liability.

## **Question 2**

It sometimes happens that a city expands into an area in which a polluting firm resides.

**Question 2.1.** Discuss how rights and compensation might efficiently be assigned in this situation.

Answer: In an American case (Spurr industries versus Dell E. Webb Development Company), this was resolved by granting the right to the firm but protected only through a liability rule. What this meant was that the 'victims' could pay the firm for the cost of relocating. In this way, the Kaldor-Hicks optimal outcome could be reached, assuming that the harm to the firm could be measured correctly. It can

be mentioned here that this solution tends to create good incentives for the location decision; the households must bear the cost of their location decision when the firm was there first (at least when the firm could not predict that the city would expand; it is fine if the student mentions the issue concerning the ex ante incentives of the location decision).

### **Question 3**

In the regulation of climate change, society can rely on a tradable permit system or on the use of a CO<sub>2</sub> tax. If society chooses the tradable permit system, it can choose to either hand out permits for free or auction them off.

**Question 3.1.** Explain why it does not matter for the level of emission whether permits are handed out for free or auctioned off.

Answer: In the equilibrium the price of a permit will equal the marginal cost of abatement at the total level of pollution required. This marginal cost will be the same across firms as they will trade until equality has been attained. But this uniquely determines each firm's pollution or abatement level, and so whether permits are grandfathered or auctioned cannot play a role for each firm's emission level. Only income distribution is affected. (This ignores the role of bankruptcy, i.e. the role of the number of firms in the industry which may be affected by the policy).

**Question 3.2.** Discuss what information the authorities need to be able to set the correct tax or the correct amount of permits.

Answer: Both the correct tax and the correct amount of permits requires information about costs of abatement and harm of pollution at alternative levels of pollution. The correct tax must be set at that level where marginal cost of abatement equals marginal harm of pollution (this requires information about both marginal cost and marginal harm). Likewise, the total number of permits must be set at that level of pollution where the marginal cost of abatement equals the marginal harm; the same information is obviously required to reach this level.

Assume that the marginal harm from the emission of CO<sub>2</sub> is roughly constant within the levels of emission that are realistic to expect.

**Question 3.3.** Which instrument should then be considered superior, tradable permits or the CO<sub>2</sub>-tax?

Answer: if marginal harm is known, the tax can be set equal to this marginal harm, and the firm can then choose to pollute according to their marginal abatement costs. The regulator will not have to know the marginal costs of abatement at different levels of pollution under a tax-system, whereas this is required under a tradable permit system.

