AAE 343 Discussion Section 5

February 22, 2019

Problem 1: *Environmental policy, redux (modified from an old 343 exam: worth ~25/100 points)*

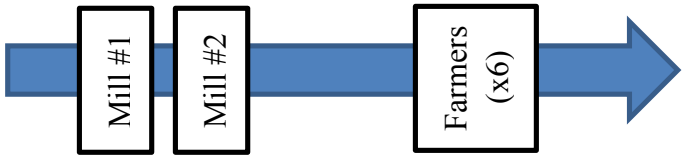
Consider a river with an upstream mill and a downstream farmer. The marginal abatement cost of emissions into the river by the mill is given by MAC = 30 – 3E. The marginal pollution damage done by these emissions to the farmer, who uses the river's water to grow crops, is MPD= 3. You can visualize this scenario for parts (a-b) as:

a. What is the efficient amount of emissions generated by the mill? *(1 point)*
b. What is the social net benefit of moving from the situation where the mill emits as much as it wants to the efficient amount of emissions? *(1 point)*

Now suppose there are two upstream mills. Their respective marginal abatement costs are given by the functions $MAC_1 = 30 – 3E$ and $MAC_2 = 30 – 6E$. The pollution from mill #1 has no measureable effect on the production or abatement costs at mill #2. You can visualize this scenario for parts (c-e) as:

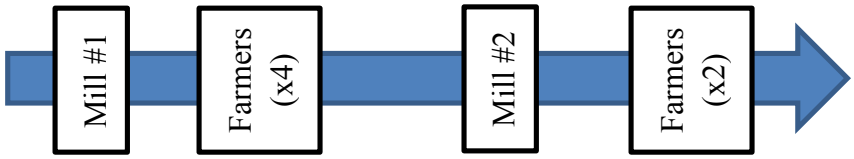
c. What level of total emissions is efficient in this new scenario? Emissions for firm 1? Firm 2? *(3 points)*
d. Suppose now that a regulator is considering the use of a Pigouvian tax to enforce pollution reduction on the river. How much should the per-unit tax be in order to achieve economic efficiency? What are the total costs of compliance for each mill? The total social cost of compliance? (*4 points)*
e. Both firms lobby the regulator against using this tax, suggesting a cap-and-trade scheme might lower their overall compliance costs and result in the same efficient outcome. The regulator is cheeky: after much negotiation, she concedes and sets an emissions cap at the efficient level E* = 13.5, but requires that the two firms go to auction to buy their permits. Assuming that the permit auction is perfectly competitive (i.e. abstracting away from any potential price collusion between the two firms) and firms know each others' cost curves, why is the regulator cheeky? *(3 points)*

Now suppose that there are 6 farmers on the river: they are all downstream of the mills, and all identical in the sense that pollution is uniformly mixed between the mills and individual marginal pollution damages to each farmer is given by MPD = 3. You can visualize this scenario for parts (f-h) as:



f. What is the aggregate <u>marginal</u> pollution damage of emissions? What is the <u>total</u> pollution damage when the mills can pollute as much as they like? *(2 point)*
g. What level of total emissions is efficient in this scenario? Emissions from mill 1? From mill 2? *(3 points)*
h. In this situation, Coasean bargaining is unlikely to generate the efficient amount of emissions. Explain why in a sentence or two. *(1 point)*

Finally, consider a case of non-uniformly mixed pollutants. Imagine the mills and farmers are spaced out on the river as follows (see visualization below for parts i-j): mill #1 is furthest upstream, followed by 4 farmers, followed by mill #2, followed by 2 farmers who are furthest downstream. The pollution from mill #1 damages all 6 farmers, while the pollution from mill #2 only damages the 2 farmers downstream of it. In other words, pollution doesn't flow upstream.



i. What level of total emissions is efficient in this scenario? Emissions from mill 1? From mill 2? *(4 points)*
j. When jointly regulating pollution from both mills, would you expect an emissions tax or cap-and-trade scheme to be effective here? Why or why not? *(3 points)*

Top Hat Question 1: In the Q1 above, using the scenario of parts (i-j), which of the farmers listed face the largest total damages from river pollution when the mills are allowed to pollute as much as they want?

a. Farmer #1 (furthest upstream)
b. Farmer #6 (furthest downstream)
c. All six farmers face the same amount of total damage
d. All six farmers face no total damage

Problem 2: *A quick taste of cost-benefit analysis*

(a) The WI DNR has $50,000 allotted for surface water improvement projects, and their appropriations committee has 4 proposed projects under consideration. Using a strict cost-benefit criterion, which of these projects should be selected?

1. Dane County project: benefits of $125k, costs of $50k.
2. Bayfield County project: benefits of 35k, costs of $7.5k.
3. Eau Claire County project: benefits of $120k, costs of $40k.
4. Door County project: benefits of $50k, costs of $35k.

(b) As an environmental economist, you are hired to conduct a cost-benefit analysis of frac-sand mining north of La Crosse, WI, to decide whether more local mining permits should be given out. How would you categorize the follow values: costs, benefits or neither?

1. Opportunity cost of the land's next most valuable use (present value of $5m)
2. Payment of $1.5m to buy more land from the local community as a "mine buffer".
3. Forgone benefits from farmers growing crops on the land under consideration ($2m)
4. Construction costs of the mine and local road infrastructure ($750k)
5. Expected revenue from additional frac-sand mining (present value of $10m)
6. Boost in property tax revenue from the mining company ($400k)
7. Creation of local jobs at the mine ($1m)