AAE 343 Discussion Section 3

February 8, 2019

I. **Externalities: Further Review**
- When property rights to a good/resource are not clearly defined, economic agents may generate **externalities**, resulting in inefficient market outcomes (i.e. market failure).
  - In other contexts, notion might be called "spillovers" or "neighborhood effects"
  - <u>Fine print #1</u>: Externality is an *unintended side effect* of a decision. Deliberate action that affects others is a separate class of problem (from legal/ethical/economic standpoints)
  - <u>Fine print #2:</u> If someone gains/loses from an economic decision taken by another, but the effects of the decision are transmitted fully through the market's price system, it is *not* and externality. (Google *pecuniary versus technological externality* for examples)
- Often the correction for market failure with respect to the provision of environmental goods and services focuses on **internalizing these externalities**.
  - *Internalizing*: ensuring costs and benefits of an action fall to parties who incur them.
- Externality can be either positive or negative and both result in a welfare loss.
  - Negative → typically overproduction of good
  - Positive → typically underproduction of good.

Problem 1   *Negative Externality* – By driving their cars, people often give rise to unwanted byproducts, such as air pollution, which impose indirect costs on others.
1. Draw a graph to show the difference between the social optimal quantity of pollution and the equilibrium quantity of pollution given by a competitive market.
2. Which area represents the loss of social welfare due to market failure?
3. What kind of policy could be used to reduce pollution to the socially optimal level? Show it with graph.

II. **Marginal Analysis**
- **MPD:** Marginal pollution damage curve.
- **MAC:** Marginal abatement cost curve.

Problem 2   *Shift in MAC and MPD Curves:* Aviation gasoline -- commonly used for general aviation in the US (think small prop-planes) -- contains substantial amounts of lead, which is emitted as air pollution near airports across the country. Lead is a toxic chemical, with documented health and developmental impacts. The Obama administration was preparing to issue new legislation based on leaded aviation gasoline's marginal abatement costs and marginal damages before President Trump's election in 2016. When thinking about this potential legislation…

1. How would the following shift the avgas producers MAC curve?
   a) Increase in the price of lead
   b) Decrease in the price of avgas.
   c) A lead alternative becomes cheaper.
2. How would the following shift the MPD curve?
   a) Increase in population near airports.
   b) The introduction of affordable medication that mitigates the chemical effects of lead in humans.

Problem 3   *Optimal Pollution & Command and Control* - The production processes of firms A and B generate nasty emissions. The marginal abatement cost curves for the firms are $MAC_A = 400 - E_A$ and $MAC_B = 200 - \left(\frac{1}{2}\right)E_b$.

1. What is the initial level of pollution for each firm? What is their combined level?
2. Draw an aggregate marginal abatement cost curve for these two firms.
3. Suppose the pollution from the firms causes marginal damage in society according to $MPD = \left(\frac{1}{2}\right)E_{Total}$. What is the optimal amount of pollution?

TOP HAT   Question 1: *Cost Effectiveness and the equimarginal principle:* Suppose Madison has been suffering from a nasty bout of acid rain lately. Acid rain comes from excessive SO2 in the atmosphere, which most commonly created by emissions from coal-burning power plants. Madison has 5 local power plants that emit SO_2. Based on conversations with atmospheric scientists at the UW, city government has decided to mandate an emissions reduction of 200 tons/year. **Having listened carefully to AAE343 lectures, they know that obtaining least-cost (i.e. cost-effective) pollution reduction is a necessary condition for economic efficiency.**

Using the marginal abatement cost schedule below on your handout, how many tons of emissions should each power plant abate in order to obtain least-cost pollution reduction? (answer graded)

Quantity of Emissions Reduced (tons/year)	MAC of Power Plant A ($1000s)	MAC of Power Plant B ($1000s)	MAC of Power Plant C ($1000s)	MAC of Power Plant D ($1000s)	MAC of Power Plant E ($1000s)
10	100	55	125	90	75
20	115	75	130	95	85
30	130	95	135	100	95
40	145	115	140	105	105
50	160	135	145	110	115
60	175	155	150	115	125
70	190	175	155	120	135

a) Power plant A reduces by 30T, B by 40T, C by 20T, D by 70T, and E by 60T.

b) Power plant A reduces by 20T, B by 40T, C by 10T, D by 70T, and E by 60T

c) Power plant A reduces by 20T, B by 50T, C by 20T, D by 60T, and E by 50T

d) Power plant A reduces by 30T, B by 40T, C by 20T, D by 70T, and E by 60T

III.   **The Coase Theorem**
  - Premise: Two parties have an incentive to negotiate an economically efficient and mutually advantageous solution to an externality dispute.
  - Key Point: **The welfare-maximizing outcome will be attained no matter who has the initial property right**.

- Fundamental Assumption: Transaction costs (e.g. information costs, negotiation costs, costs of writing/enforcing contracts) must be ZERO to attain socially optimally outcome.
    - Transactions costs (TCs) more likely low when there are few parties involved in the dispute.
    - When TCs are high, Coase breaks down, and market failure remains.
- How well does this theorem hold empirically in environmental context?
    - Fowlie and Perloff (2013, ReSTAT) find supporting evidence in CA SO_2 markets
    - Others find cases where Coase fails (see overview: Hahn & Stavins, 2011, JLawE)
        - Reasons: high TCs, market power, weak regulatory oversight, policy uncertainty

Problem 4   F*ishing resort and paper mill* – Consider the graph of a fishing resort and paper mill on a river in below. Assume that transactions costs are too high for Coase bargaining to take place.
1. If the fishing resort has the right to the river water quality, what is the total abatement cost to the mill owner (in other words, what does the mill owner lose by not having the right to the river's water quality)?
2. If the mill owner has the right to the river water quality, what is the total pollution damage to the fishing resort?
3. In this case where transactions costs are too high for Coase bargaining, which of the two users of the river should be assigned rights to the river if the objective is to maximize social net benefit?
4. Now suppose that transactions costs become zero. In light of your answer to part 3 – that is, given the assignment of property rights indicated in part 3 –what would be the social net gain due to Coase bargaining?
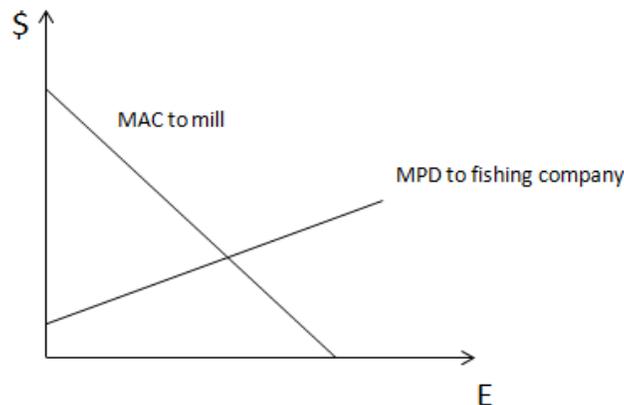
TOPHAT Question 2: The Coase Theorem is an important idea about how environmental problems can be solved without government intervention. Which of the following must be true for an efficient outcome to be achieved? (answer graded)