Lecture # 4 – Modeling Pollution/The Coase Theorem

I. Equimarginal Principle (continued)

- The example below illustrates how violating the equimarginal principle increases costs. (source: Lade and Rudik, NBER Working Paper 24139.)
  - Regulations in North Dakota address flaring of natural gas at oil wells
    - While oil is the main product in the Bakken shale formation, wells also produce natural gas.
    - If there is no infrastructure to capture the natural gas (e.g. pipelines), the natural gas is burned at the site (flared).
    - Natural gas pipeline infrastructure has not kept up with the expansion of oil wells, so much gas is flared.
    - In July 2014, the state passed a rule requiring each well operator capture 91% of gas produced by 2020.
  - Analysis
    - Since each firm must meet the same target, costs will be too high if marginal costs vary across firms.
    - Why might they vary?
      - Marginal abatement costs include on-site fixed costs and pipeline costs
      - Different wells produce different levels of natural gas
        - Thus, the cost per thousand cubic feet (mcf) of flaring reduced will depend both on the distance of the pipeline needed to connect to other infrastructure and the amount of natural gas produced at each well
The figures below show the impact of inefficient regulation.

- Figure A is the observed MAC, with sites sorted from lowest to highest costs.
  - Orange dots represent sites connected to pipelines.
  - Blue X’s are unconnected sites that continue to flare gas.
  - Note that orange dots continue well up the MAC.

\[(a)\) Observed Industry MAC Curve\]
Figure B is the efficient MAC.
- Here, only the lowest costs sites are connected. All orange comes first.

(b) Efficient Industry MAC Curve

- The authors' calculations show that if the efficient allocation were used, costs would fall by $96 million. This is a cost savings of 20%.
II. The Efficient Level of Pollution

- The optimal level of pollution is where the MDF and the MAC curves intersect. Here, the additional benefits from pollution control are just equal to the additional costs.
  - In these examples, the marginal benefits are the marginal damages avoided by increased abatement.
  - Note that this is not where total benefits equal total costs. If that were the case, net benefits would be zero. Rather, we maximize net benefit by equating marginal benefits and marginal costs.

- Some examples:
  1. How would the desired level of pollution control change if a new technology is discovered that improves the efficiency of scrubbers for power plants?
     - A new technology lowers the marginal abatement costs curve. Since abatement is cheaper, we should do more of it. The efficient level of pollution falls.
  2. How does the desired level of pollution change between summer and winter if the pollution leads to greater problems in the summer (e.g. ground level ozone)?
     - Here, the marginal damage function is higher in the summer than in the winter. As a result, we want less pollution (e.g. more abatement) in the summer.
III. Enforcement Costs

- For any environmental policy, we also need to consider the costs society pays to enforce and administer the policy.
  - These can be modeled as increasing the marginal abatement cost, which decreases the desired level of abatement.
- Thus, an important policy consideration is the level of enforcement.
- Enforcement can be continuous or random.
  - For example, some EPA air regulations require installation of a device to constantly measure emissions (continuous emissions monitoring systems, or CEMS).
  - Alternatively, random spot checks can take place.
- The problem is to balance out the cost of monitoring and the punishment
  - For a regulated firm:
    - MB of compliance = avoided penalty = penalty for cheating * probability of getting caught
    - MC of compliance = marginal abatement costs
  - Thus, the government can increase compliance by either raising the penalty for cheating or increasing the probability of getting caught.
    - Raising the penalty is less costly for the government, but it must be practical.
IV. The Coase Theorem

- The Coase Theorem is the notion that an efficient solution will be achieved independently of who is assigned property rights, as long as someone is assigned the rights.
  - Coase implies that once property rights are established, no government intervention is necessary.
  - Note that the distribution of income in the final outcome will vary based on who is assigned the rights.
- The Coase Theorem doesn't simply mean that assigning property rights to a polluter will cause the pollution to continue. A deal could be struck among both parties to bring about a more desirable solution.
  - However, the decision on property rights will affect the distribution of income in the final outcome.
- Coase's main points:
  1. Externalities are reciprocal in nature.
     - Not only does the pollution cause an externality, but also the presence of the victims harms the polluter.
     - If no one were harmed, there would be no problem.
  2. The economic problem is to maximize the value of production. Thus, you need to determine which activity has the higher value.
     - Since externalities are reciprocal, Coase argues that the highest value option should be preserved.
  3. Victims should not be compensated
     - Because of the reciprocal nature of externalities, compensation would lead to too many people living in harm’s way.
- Our discussion of the policy examples on the reading list suggested several limitations to the Coase Theorem. These included: (my apologies if I don't remember all of those raised in the discussion today)
  - Costs of bargaining and transactions costs
    - Negotiation won't work when large numbers of people are involved, or when the victims aren't well defined (e.g. endangered species).
    - Similarly, different groups may have different bargaining power, affecting the distribution of the final outcome.
  - Information asymmetries: Will both sides know the best options available to each side?
  - Uncertainty: Will it be difficult to establish the value of the harm?
  - Willingness to pay and willingness to accept are different.
    - Because of income effects, you may not be willing to pay as much to avoid damage as you would require in compensation to accept it.
    - May lead to differences in power among opposing parties
  - Determining property rights may be difficult
    - For example, if the harm crosses jurisdictional boundaries, or if different groups have different interests (e.g. fishermen and boaters concerned about pollution on a river for different reasons)