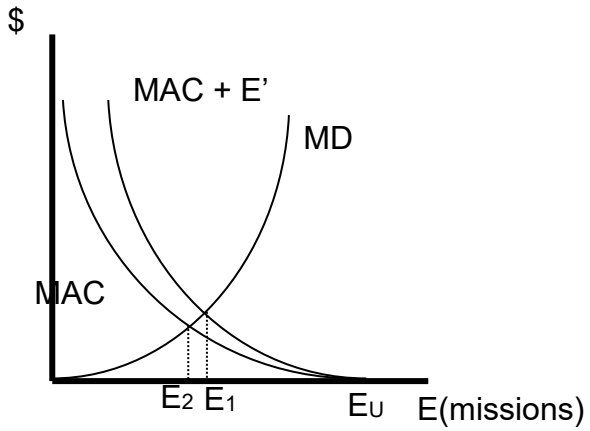
Lecture # 4 – Modeling Pollution/The Coase Theorem

I. 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.
    - Below E' represents enforcement costs. By shifting MAC up, the efficient level of emissions increases from E_2 to E_1.



- 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.

II. The Coase Theorem

- In this lecture, we look at the Coase theorem, which raises the question of whether any government intervention is necessary.
    - The text refers to this as an example of a decentralized policy, in which individuals are left to work out pollution problems on their own.
- Intellectual history
    - Pigou's solution to the externality problem (taxes) was the generally-accepted solution for many years.
    - Coase's article (1960) raised a second possibility – that private markets can sufficiently solve the externality problem.
- 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.*
- Example
    - In Oregon, voters passed Measure 37 in 2004
    - Required compensation to property owners whose value is reduced by environmental or land-use regulations
    - This shifts property rights to the property owners
        - Led to claims from landowners wanting compensation to not develop their property
    - Repealed in 2007 by Measure 49, which limited the scope of the law

- Example: consider a factory and a group of fishermen
  - Pollution from the factory reduces the fishermen's profit
  - Two options to address the pollution:
    - Factory installs a filter (costs $200)
    - Fishermen build a water treatment plant (costs $300)

Install Filter	Build Treatment Plant	Factory Profits	Fishermen Profits	Total Profits
-	-	$500	$100	$600
+	-	$300	$500	$800
-	+	$500	$200	$700

  - Best solution is to install a filter
  - If property rights go to the fishermen, that will happen
  - What if property rights go to the factory?
    - The fishermen could build the plant (profit up $100)
    - Or, they could pay for the filter
      - Their net profit will be $300 (= $500 - $200)
  - The efficient outcome happens either way.

- Coase's main points:
    - 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.
        - The California wildfires provide an example of how externalities are reciprocal in nature.
            - Under California law, PG&E has been held liable for its role in wildfires in 2018.
                - As a result, they have filed for bankruptcy, and are now turning off power in windy conditions to help prevent further blackouts.
            - Most damages from wildfires occur at the wildland-urban interface (WUI), which the US Forest Service defines as where humans and their development meet or intermix with wildland fuel.
            - Since 1990, more than 60 percent of new homes in California were built in the WUI, even though the WUI in California includes less than 10 percent of California's total land area.
            - As a regulated utility, PG&E is required to provide service to new customers in these areas, despite the greater risk of wildfires.
    - 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.
    - Victims should not be compensated
        - Because of the reciprocal nature of externalities, compensation would lead to too many people living in harm's way.
- Policy implications of Coase
    - The Coase theorem suggests a limited role for government in environmental policy.
    - Coase argues that the key problem is an absence of property rights.
        - Once property rights are established and enforced, private parties can reach mutually beneficial agreements.

- We will conclude this section with a discussion of potential limitations of the Coase Theorem. Potential limitations include:
    - 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.
    - Uncertainty: Will it be difficult to establish the value of the harm? Do we know who causes the harm? Can it be addressed at all?
    - Who represents people being harmed by pollution?
        - What about ecosystem services? What if large numbers of people are affected?
    - Different parties may have more or less bargaining power.
        - Related to this, note that 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
        - Note that Coase focuses on efficiency, but says nothing about equity.

- Wildfires in California provide an application of the Coase Theorem and liability law.
    - This example relates to Coase's point that externalities are reciprocal in nature. The problem is increasing because more people are moving to the WUI.
    - Note that federal and local governments bear many of the costs of firefighting.
        - Building homes in the WUI increases both the risk of wildfires (because power lines are needed in more areas prone to fires) and the damage from fires when they occur
        - But homeowners alone are not responsible for the higher risk due to climate change
        - In addition to firefighting costs, the liability costs borne by PG&E may be passed on to consumers through higher electricity rates.
    - What can people in the WUI do to reduce risk?
        - Maintenance of land
        - Solar and energy storage as backup power for when electricity is off
            - One study says consumers in high-risk counties could meet 95% of their electricity needs for $1500 using solar PV and battery storage
                - ***Note how this relates to the last lecture on MAC.***
                - Residents in this area may have a low-cost option to help prevent fires.
    - What can PG&E do?
        - Bury power lines underground
        - Vegetation management
    - Who should bear the costs of wildfire damages?
        - Note that higher costs to PG&E may be passed on to ratepayers.
        - But if this wasn't possible, who would opt to provide power in these high-risk locations?

III. Liability Law

(Note that we may not get to this in Monday's class, but I'm putting these notes here to keep everything on this topic together).

- An example of how the Coase Theorem applies to environmental policy is liability law.
    - If a firm will be held liable for the damages from its pollution, it has incentive to avoid pollution when the marginal abatement cost is less than the marginal damage.
        - By avoiding damage, the firm lowers its liability.
        - Note that the government does not need to know the marginal costs of the firm in order to achieve the desired level of pollution.
- Liability laws hold parties responsible for the negative consequences of their behavior.
    - As a result, liability laws internalize the externality.
- In theory, this can lead to an efficient solution.
    - Because we are dealing with uncertainty, we want to model the level of precaution taken, which affects the probability of an undesirable outcome.
    - Firms weigh the benefits of precaution (reduced marginal damages, which they must pay if held liable) versus the marginal cost of greater protection.
        - Note that these are social benefits, since the firms are held liable for all damages.
        - Thus, liability leads to the efficient level of precaution.
- Types of liability
    - Strict liability – the person doing damage is responsible, whether or not proper precautions are taken.
        - The liability faced by Pacific Gas and Electric in California is an example.
    - Negligence – the injurer is held responsible only if that person has taken less than the desirable level of precaution.
        - Requires the courts to determine what an appropriate level of caution is.
    - Joint and several liability – when the source of damages could be several parties, any one party can be sued for all the damages.
        - The theory behind this is that the party sued will have incentive to go after the other parties.

        - Joint and several liability is used in Superfund
            - Part of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA)
            - EPA is to identify, evaluate, and remediate hazardous waste sites in the U.S.
            - Key features:
                1. A financial fund derived from a tax on chemical and petroleum feedstocks to be used for investigations and cleanups.
                2. A National Contingency Plan (NCP) for selecting sites for cleanup, including creation of a National Priorities List (NPL).
                3. Authority for the EPA to clean up sites itself or to identify responsible parties to clean up the sites.
                4. A liability provision to collect damages from responsible parties. Superfund uses joint and several liability.
                    - Leads to large legal costs
- Advantages of liability
    - It is very decentralized and requires less information.
        - To regulate, information must be known before regulation put in place.
        - For liability, don't need information until after damages are done.
        - Note that this helps deal with monitoring problems that can occur with toxins.
- Disadvantages of liability
    - If the hazard is common, it makes more sense to regulate than to have each case go to court.
    - Suits might not always be brought against violators.
    - Uncertainty about the legal process:
        - If penalties will push firms into bankruptcy, they will not have to pay, and thus will not take proper precautions.
        - Alternatively, if a firm is risk averse, they may take too much precaution, because they may fear an unfavorable court ruling.
        - The burden of proof may be difficult in court.
            - Need to know both who causes the harm and what the damages are.
    - Transaction costs may be high