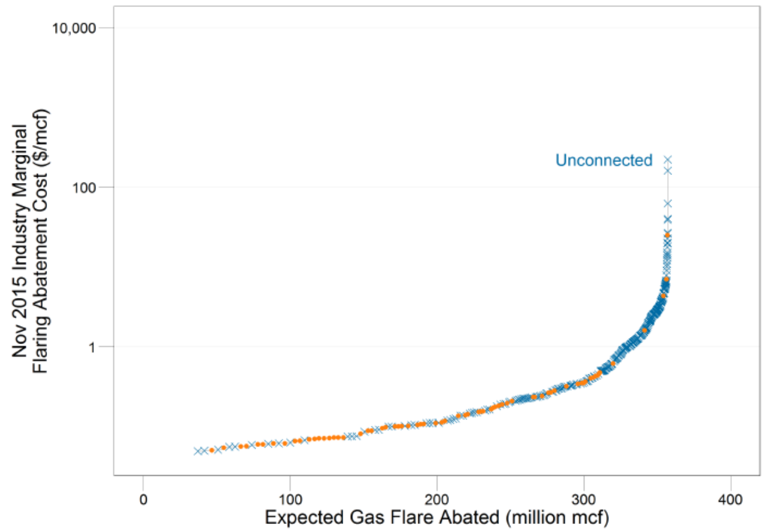
Lecture # 4 – Modeling Pollution/The Coase Theorem

I. Equimarginal Principle (continued)

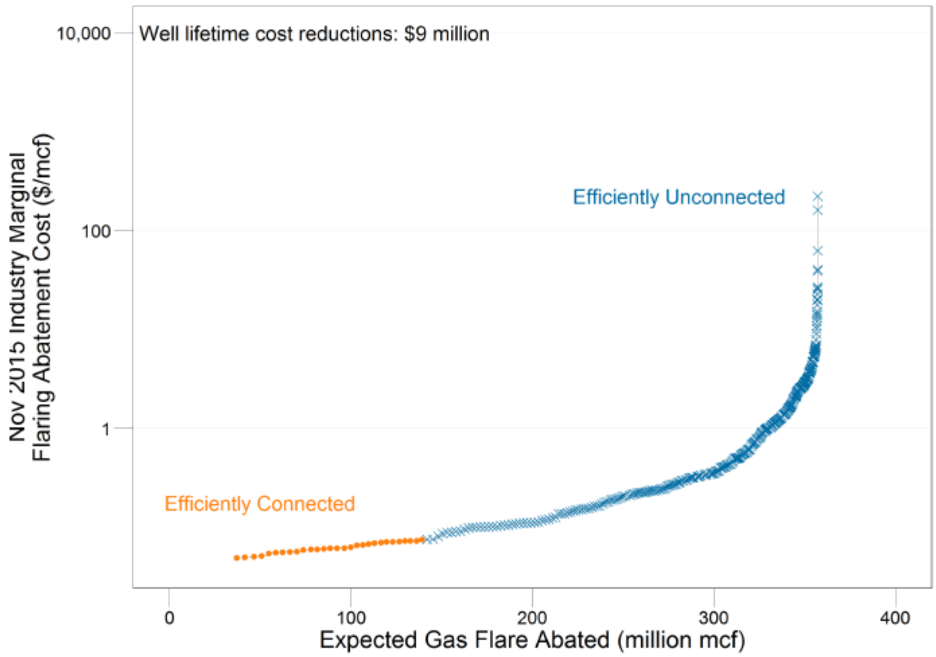
- The example below illustrates how violating the equimarginal principle increases costs. (source: Lade and Rudik, *Journal of Environmental Economics*, 2020)
    - Regulations in North Dakota address flaring of natural gas at oil wells
        - While oil is the main product in the Bakken shale formation, 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.

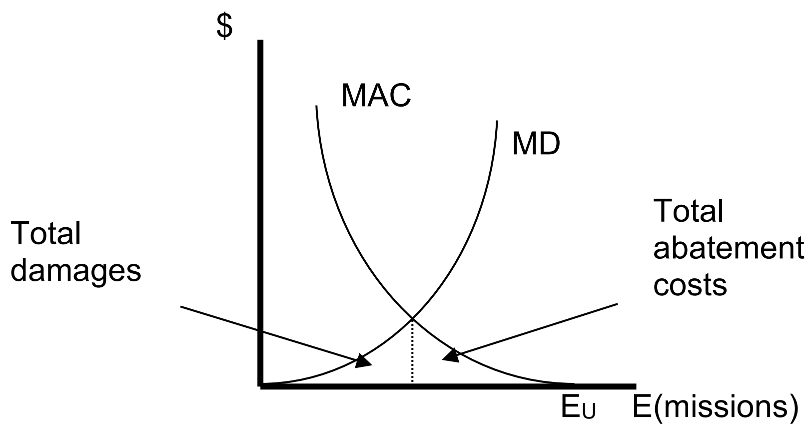


(b) Efficient Industry MAC Curve

- 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

- 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 <u>Coase Theorem</u> 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

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    - 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.