Econ 325 In-Class Work: Environmental Standards for Pollution Control

The most widely used form of pollution control is the imposition of *environmental standards*. Standards can be classified into two general forms: performance standards and technology standards.

**Performance standards** are simply stipulations governing the acceptable *amount* of pollution in a given area or from a given source. These standards allow for maximum amount of various pollutants in a given volume of air or water. Examples are the national standards for ambient air quality in the US stipulated in the Clean Air Act in 1970.

**Technology standards** (a.k.a. “command and control regulations”) mandate the use of specific pollution control devices or inputs in production. Technology standards may also state that certain inputs *cannot* be used.

**Abatement** is the process of reducing something, or the amount reduced.

**General economic questions we need to address about standards:**

1. How do we define the *optimal level of emissions* of a given pollutant in order to set the standard? If we cannot identify an *optimal* level, can we at least specify an *acceptable* level of the pollutant?
2. Can an *efficient solution* to the pollution externality problem be attained with standards? If so, how must standards be enforced to ensure such a solution?

**Defining the optimal level of emissions**

→ Consider a single unit of emissions about to be released into the atmosphere. What two things should you compare in order to decide if that unit should be released?

The *marginal damage function* (MDF) shows the *change* in total damages from emissions when emissions are increased by one unit. The shape of the MDF should therefore reflect how much damage is caused by the incremental unit of emissions relative to previous units.

→ With dollars on the Y (vertical) axis and units of emissions on the X axis, what is the shape of the MDF for most pollutants?

$\begin{array}{c}
\text{Emissions} \\
\end{array}$
The marginal abatement cost function (MAC) shows the change in total abatement costs when abatement is increased by one unit.

→ With dollars on the Y (vertical) axis and units of abatement on the X axis, what is the shape of the MAC for most pollutants?

$\\"Abatement\"$

→ With dollars on the Y (vertical) axis and units of emissions on the X axis, what is the shape of the MAC for most pollutants? (First consider where on the graph is abatement at its highest value)

$\\"Emissions\"$

→ Add a MDF to the above graph, and show the optimal level of emissions (call it E*).

More questions about standards:

1. If we wish to achieve E* emissions from each polluter, what fine should we impose for any emissions above E*?

2. What will happen to the optimal level of a given type of emissions if a new technology is invented which makes abatement more cost effective?

3. What will happen to the optimal level of a given type of emissions if it is discovered that the pollutant is more harmful than first estimated?
4. Of the two functions (MDF and MAC) which do you think will be harder to empirically estimate? Why? What factors might complicate the location of this function?

Because of the complications listed above, it may not be possible to define a pollution standard on economic grounds. When this is the case, standards may be defined at a level deemed “safe” for people and wildlife.

Achieving safe emissions targets with multiple polluters: an application of the equimarginal principle

Example: In the land of Smogville there are two large factories (Al’s and Betty’s) which pollute the air, with MAC functions shown below. Currently unregulated, each factory emits 20 tons of sulfur dioxide into the atmosphere per month. Suppose it is determined that at current levels of air pollution in Smogville human and environmental health are seriously threatened. Safe emissions are estimated to be one half of current emissions.

→ The current regulatory authority of Smogville mandates that each factory cut emissions in half to achieve the safe standard. Is this an efficient solution? If not, what is the efficient solution? Explain.
→ Given that a performance standard is set (be it economic or safety based), what type of monitoring is required to ensure compliance?
Technology based standards (command and control)
When monitoring is difficult, it may be desirable to mandate the use of a specific technology or set of inputs to control pollution. When particular emissions are determined to be very harmful so that the optimal amount is near zero, it is often easier to simply ban the pollutant all together rather than incur large monitoring costs.

→ What are examples of technology standards? Banned pollutants?

→ The main criticism of command and control is that it decreases the incentive to engage in research and development to find new “cleaner” technologies and inputs. Explain this criticism. Is there a parallel between this problem and the problems with uniform performance standards?

**Question to think about for next time:** Given that abatement costs will differ between firms, can you think of a more equitable way to achieve a regional performance standard such as in the Smogville example above? That is, allowing the inefficient firm to pollute more might be considered unfair, and would perhaps justify not developing clean technologies – how can we achieve the same standard and at the same time reward such innovation?