Taxes and Emission Fees

I. Pigouvian Taxation

The "Pigouvian Tax" is a tax levied on each unit of a polluter's output (= output of the final product) in an amount equal to the marginal damage that it inflicts at the efficient level of production.

⇨ The goal is to set the tax so that the polluter incorporates the social cost.

Note that Pigouvian taxation is a *second-best solution*, as we are taxing the output. It would be better to tax the pollution directly. Modern economic solutions to pollution, take this into account (see emission fees/taxes).

- It is a second-best solution because, although the level of output is correct for the technology being used, the firm doesn't have the correct incentives to use the appropriate technology (e.g. pollution control, more efficient machines, etc.) because there is no price placed on pollution.
- However, there may be times when this is the best that could be achieved. For example, the actual emissions from cars can not be measured directly, so gasoline consumption is taxed instead, since pollution is a by-product of gasoline consumption.

The Pigouvian tax works by internalizing the cost of the externality. The same thing can be done with a ***subsidy***.

- In the case of a subsidy, the opportunity cost of polluting would be to lose the subsidy.
- Types of subsidies:
    a) Abatement equipment subsidy: pays a firm for adopting a specific abatement technology.
    b) Per unit subsidy: pays a firm for each unit of pollution reduced below some predetermined level.
- Problems with subsidies:
    - Very different distributional effects compared to taxes (the polluter receives money from the government, rather than paying).
    - Firms may enter market (if they might be able to make a profit out of the subsidy), so that total pollution increases.

- The government may have to raise taxes elsewhere in order to be able to pay for subsidies.
- Ethics? Should we have to pay to avoid pollution?
- Subsidies are often politically motivated, and are inefficient.

II. Emission Fees / Taxes

= a payment (fee) for each unit of pollutant that is discharged into the environment or for each unit of environmental damage.

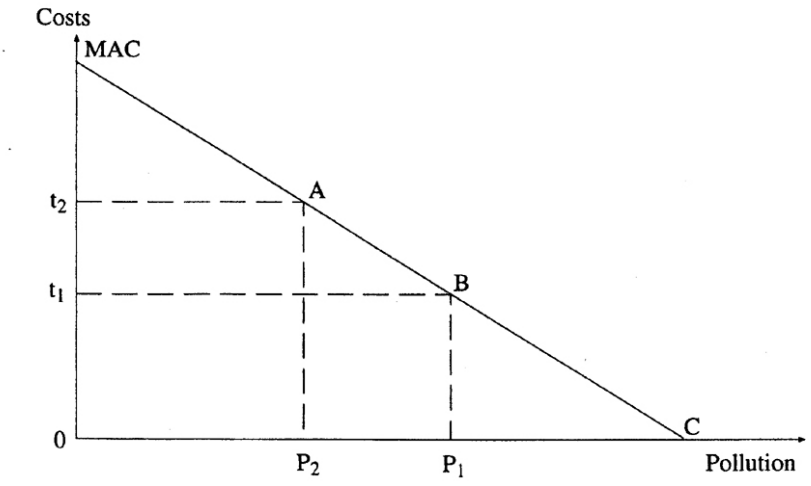
As we have learned, the problem with externalities is that they are not reflected in prices.

⇨ The government can rectify the problem by setting a price for pollution.

⇨ The goal is to set the fee so that the polluter incorporates the social cost.

Polluters will react automatically to a tax by reducing emissions to the level where the unit rate of the tax and the marginal pollution abatement cost are equal. In Figure 1, the MAC curve increases from right to left, because the more pollutant is abated, the higher the unit (marginal) cost. If a tax rate t_1 is imposed, the polluter will abate pollution from C to P_1 because beyond this level (B on MAC) it is cheaper to pay the tax than to abate emissions further.

Figure 1: Pollution tax and the level of abatement

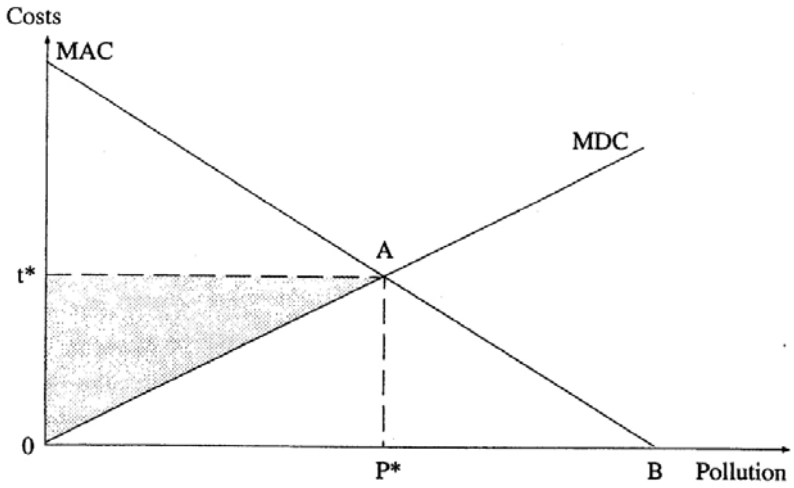


Source: Barde (2000): Environmental policy and policy instruments, p.173

Obviously, the higher the level of the tax, the higher will be the level of abatement (e.g. in Figure 1 with a tax t_2 the level of abatement is $CP_2 > CP_1$). Assuming marginal abatement will be automatically obtained with an appropriate level of tax. The consequences of pollution

taxes can be better understood when we recall the "optimal" level of pollution. This optimum level corresponds to the point where MAC equals MDC. Any departure from this level (point A in Figure 2) implies a welfare loss, because either pollution damage exceeds abatement costs (moves to the right of A on MDC) or abatement costs are higher than damage costs (move to the left of A on MAC). Non of this situations is satisfactory from an economic point of few.

Figure 2: A tax fixed at level t* would achieve the optimal level of pollution P*.



Source: Barde (2000): Environmental policy and policy instruments, p.174

In Figure 2 you can see, that with a tax t*, the payment of the polluter can be divided into three parts:

1. surface P*AB = total abatement costs (surface under MAC)
2. surface 0AP* = residual damage tax, corresponding to the residual damage 0P* (surface under MDC)
3. surface 0t*A = "residual tax" which can be interpreted as the payment of a tax for using scarce environmental resources.

Note: The surface 0AB reflects the total value of the internalized environmental costs (abatement costs plus damage costs).

⇨ We can see that the tax imposes an additional burden on the polluter who pays the abatement cost (P*AB) plus the tax (0t*AP*). If an emission standard P* were imposed, the polluter would only pay the pollution abatement costs.

⇨ If MAC is known, we would simply set the Fee/Tax equal to MAC at the optimal level of pollution.

- The firm will find it beneficial to abate up to this point, since abating is cheaper than paying the fee.
- After this point, paying the tax is cheaper than abatement, so no further abatement occurs.
- Note that since MAC = MDC at the optimal level, the firm is taking into account the value of the damage it is doing.

⇨ If MAC is unknown, the fee should be based on the expected value (the "best guess" of MAC).

- The main advantage of emissions fees is that, when there is more than one polluter, they achieve a given level of pollution control at the lowest possible cost.
  - Thus, economists say that emissions fees are an efficient environmental policy.
  - An efficient solution is found when the marginal abatement costs are equal across all firms.
    - At this point, there is no way to shift abatement responsibilities among the firms and achieve a lower total cost.
    - However, the cost to each individual firm is greater, since the firms pay both abatement costs and the fees. Thus, emissions fees are politically unpopular.

- What about *innovation* ?

  Another potential advantage of fees over CAC is that fees encourage innovation.
  - Once you have met a CAC regulation, you have little incentive to do better.
  - However, if you lower your MAC, you can abate more, and pay less in fees.

III. Implementation issues: Four major questions for designing an environmental excise tax may arise:

1. What is to be taxed (what is the tax base) ?

- May be direct (e.g. CFCs, emissions), or indirect (e.g. gasoline)

2. Who is to be taxed?

- Here we're focusing on administration, not on the ultimate incidence (recall that economic incidence is independent of legal incidence).
- Ideally, we would like to tax the users of the environment directly. However, it can be difficult to know the users (e.g., to prevent non-point pollution, we may tax fertilizer, since we can't tax each farmer for his individual contribution).
- Also, there may be many users (e.g. for CFCs, it was easier to tax production than tax each user).

3. What tax rate should be imposed?

- This may really rise some problems, thus this is where most of the economic analysis comes in.
- Knowing MD is difficult. Therefore it is hard to set the tax correctly.
  - Uncertainty could be bad if mistakes are costly. In these cases (e.g. threshold effects), regulation may be the better option.
- Although we also might not know about MAC, taxes may help us learn about the MAC of firms (as they will choose to pay the tax when tax < MAC).

4. Are their ancillary policy goals?

- Taxes are not enacted in a policy vacuum.
- Multiple goals often conflict.
- A common conflict is: revenue vs. abatement
  - Taxes are a source of revenue for governments.
  - If an environmental tax is successful, it lowers emissions, thus lowering the tax base.
  - Therefore, if revenues are important, the rate might be adjusted.
- What should be done with the revenue?
  - Some economists have argued that these taxes not only help the environment, but that they also improve economic efficiency.
  - The ***double-dividend hypothesis*****:** the idea that the revenues from environmental taxes could be used to lower other taxes, thus providing an additional gain for the economy.

- The theoretical argument for that is as follows:
  - Most taxes cause distortions in the economy. However, environmental taxes correct a distortion.
  - Since the revenues from environmental taxes can be used to lower other taxes, the economy benefits.

  However, most economists have not found evidence of such benefits.
  - The main reason is that the tax base for environmental taxes is much smaller than the tax base for more general taxes, such as income taxes. Thus, even a large environmental tax only raises enough revenue to allow a small cut in a more general tax.

- Distributional issues
  - Recall that the economic incidence is the same no matter who legally is responsible for the tax. That is because prices change after the tax.
  - Concerns about equity might make some environmental taxes politically unpopular. For example, lower income families spend more of their income on gasoline, making a gas tax a regressive.