

Pigovian Tax

Kolstad - Chapter 7

Introduction

- Production Cost factory $C(X, Y)$, X amount of Pollution and Y goods output
- ① Input Price Constant
- ② Y will be produced where $C'(\cdot) = P_y$
- Simplify (given 1 and 2) the model to $C(X)$
- $MC(X)$ additional cost of producing one more unit of pollution
- $MS(X)$ marginal savings. $MS(X) = -MC(X)$. Assumptions:
 - ① N people surrounding the factory
 - ② Pollution causes damage
 - ③ $D_i(X) = \sum D_i(X)$ damage for person i , $D'_i(X) > 0$
 - ④ $B_i(X)$ benefits from pollution, $B_i(X) < 0$ (or WTP to eliminate pollution)

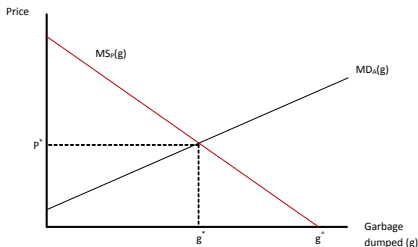


$$MC(X^*) + MD(X^*) = 0 \Leftrightarrow MS(X^*) = \sum D_i(X^*)$$

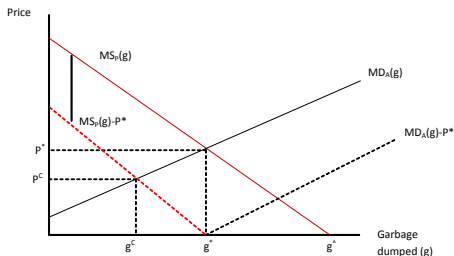
$\min_x \{C(X) + D(X)\}$

- **Definition:** *A Pigovian tax is a fee paid by the polluter per unit of pollution exactly equal to the aggregate marginal damage caused by the pollution when evaluated at the efficient level of pollution. The fee is generally paid to the government.*

- Consider the case of Anna and Pedro who are neighbors
- Pedro generates a lot of garbage and Anna does not.
- NO PR, so Pedro gets rid of his excess of garbage by tossing it over the fence into his neighbor's yard.



- Now suppose society institutes a tax of P^*
- $MS(g)$ is reduced by $P^*(MS_p - P^*)$
- Without anything happening, Pedro generates g^*
- Now suppose Anna offers to pay P^C for each bag of garbage
- Pedro generates g^C



- Assume we have two polluters:

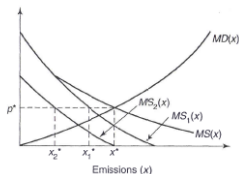


Figure 7.3 The case of two polluters. $MS_1(x)$, Marginal savings from emitting firm 1; $MS_2(x)$, marginal savings from emitting firm 2; $MS(x)$, aggregate marginal savings from emitting; $MD(x)$, marginal damage from emitting; p^* , Pigovian fee; x^* , total amount of emissions with Pigovian fee; x_1^* , emissions from firm 1 with Pigovian fee; x_2^* , emissions from firm 2 with Pigovian fee.

- Definition:** In controlling emissions from several polluters whose emissions all contribute to damage in the same way, *the equimarginal principle* requires that marginal cost of control be equated across polluters to achieve an emission reduction at the lowest possible cost.

- Is it possible to obtain the same output by subsidizing firms to reduce pollution?
- In the "real world" is there any danger in providing tax breaks and other subsidies for pollution control, rather than making polluters pay for the pollution they generate?
- Is it possible to obtain efficiency using subsidies instead of a fee?

- The tax is efficient, whereas the subsidy can result in too many firms in the industry and thus an inefficient amount of both pollution and the good associated with the pollution.