

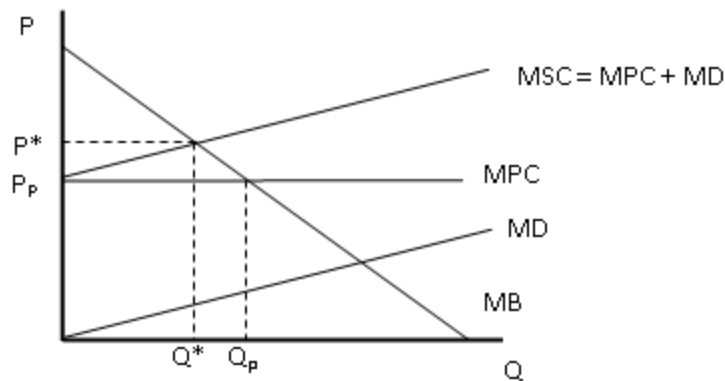
# Lecture # 20 – Externalities

## I. What are Externalities?

- An externality occurs when a person's well-being or a firm's production capability is directly affected by the actions of other consumers or firms rather indirectly through changes in price.
  - Can be both positive (e.g. research) or negative (e.g. pollution).
- Externalities occur when the costs (or benefits) to society do not equal private costs (or benefits).
- Marginal Social Cost – the sum of the marginal private cost plus the cost borne by others.

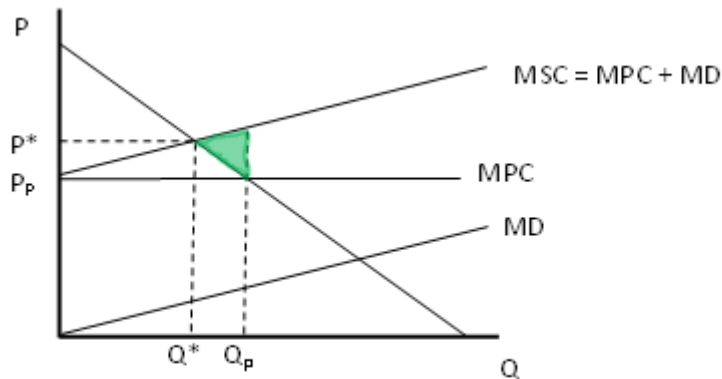
## II. Externalities and Efficiency

- Externalities are inefficient because the costs paid by the individual actor are not equal to the costs imposed on society. (Or, in the case of positive externalities, private and social benefits differ).
- Individuals equate MPC to demand (which tells us marginal benefit). Since  $MSC > MPC$  (for a negative externality), overprovision results.

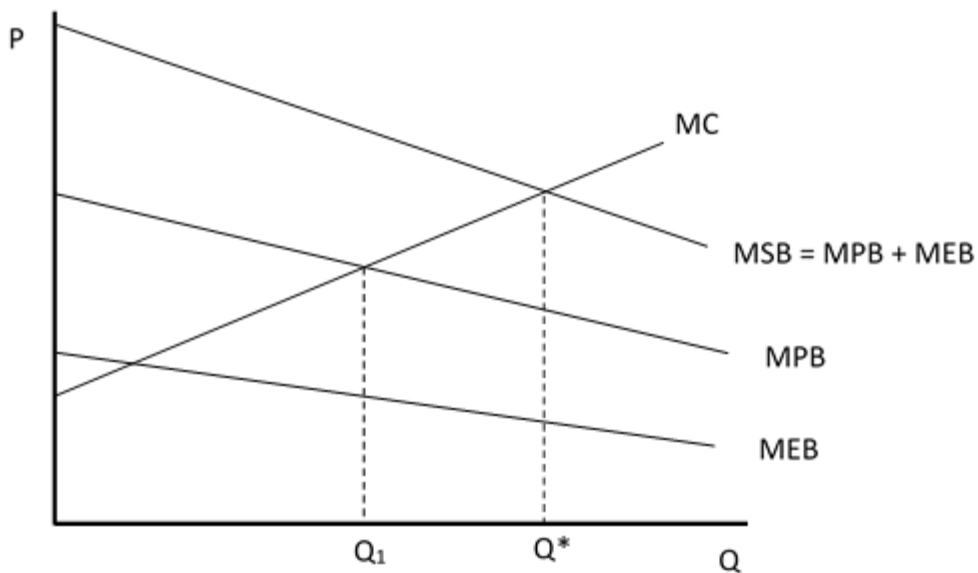


- Intuitively, firms are ignoring the costs that they impose on others, since they are not required to pay them.

- The shaded area in the figure below represents the inefficiency from overproduction.
  - In this area, the social costs of production are higher than the benefits received by consumers. However, because the external costs are ignored, these items are sold anyway.



- Note that externalities can also be positive
  - This occurs when the benefits received by society as a whole are greater than the benefits received by the individual.
  - Research and development is an example of an activity that generates positive externalities.



### III. Regulating Externalities

#### A. Taxes

- *Goal:* to set prices so that the actor includes social costs in her decision.
  - Often referred to as Pigouvian Tax for the economist who first expressed this idea
  - A Pigouvian Tax is a tax equal to the marginal damage inflicted by an activity
- Economists prefer taxes over regulation because they achieve pollution reduction at the lowest possible cost.
  - This is because they encourage the cheapest reduction possibilities to be done first.
- Two types of taxes
  - A tax on output: a tax levied on each unit of output in an amount equal to the marginal damage that it inflicts at the efficient level of production.
  - Emissions fees -- a tax per unit of pollutant emitted
    - Emissions fees are more direct, and thus more desirable.
    - However, sometimes measuring emissions may be difficult (e.g. emissions from cars). In that case, a tax on output is a possible fallback.

- Example

Demand:

$$P = 20 - Q$$

$$MPC = 6$$

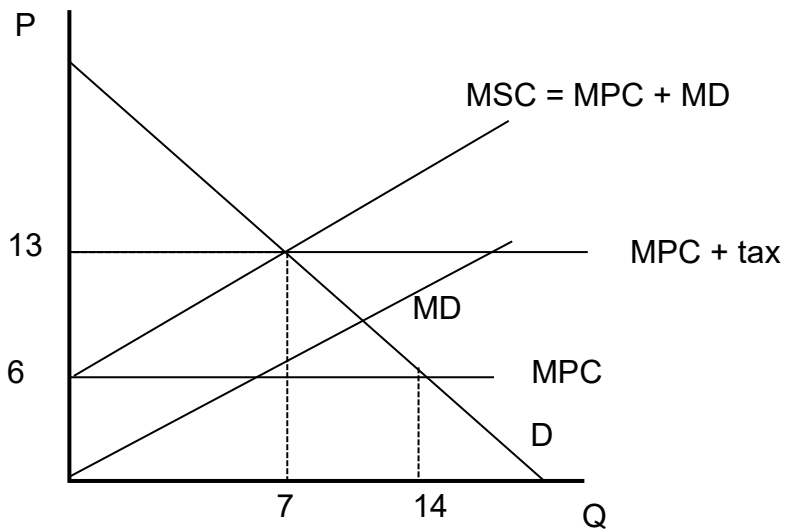
$$MD = Q$$

In free market, equate  $MPC = D$ :

$$6 = 20 - Q$$

$$\mathbf{Q = 14}$$

$$\mathbf{P = 6}$$



Now, add pollution:

$$MSC = MD + MPC = 6 + Q$$

Efficient solution: equate  $MSC$  and  $D$

$$6 + Q = 20 - Q$$

$$2Q = 14$$

$$Q = 14/2$$

$$\mathbf{Q = 7}$$

To get the price, plug the quantity of 7 into demand:

$$P = 20 - 7 = \mathbf{\$13}.$$

We can achieve the efficient solution with a Pigouvian tax:

$$MD @ Q = \$7$$

A \$7 tax shifts the  $MPC$  curve up to  $MPC + tax$ :

The private solution is now:  $MPC + tax = D$

$$6 + 7 = 13 = 20 - Q$$

$$Q = 7$$

Note that this is the efficient solution – the tax internalizes the externality!

## **B. Regulation**

- The government simply limits output to the optimal level, which is where  $MB = MSC$ .
- The advantage of regulation is that it is simple.
- However, as the example below shows, it is inefficient when there is more than one firm.

## **C. Tradable permits**

- The government determines the desired level of pollution and gives firms permits to pollute equal to that amount.
- Then, firms can buy and sell the permits among one another.
- Creating a market leads to a more efficient allocation of responsibility for reducing pollution, as I'll show below.

#### D. Efficient Environmental Policy

- Market-based policies (taxes, emission fees, or permits) are more efficient than command and control regulation. That is, firms can reduce the same total amount of pollution for lower costs.
- A given level of pollution control is attained in an efficient manner when the total costs of abatement are as low as possible.
  - ***This occurs when the marginal costs of abatement are equal across firms.***
- Intuition:
  - Regulation forces each firm to do the same thing. Market-based policies encourage firms that can more easily control pollution to pull more weight.
  - The end result is that the tax or permit price equals the marginal abatement cost of the last unit of pollution prevented.
  - We can see this from the following example:

| Firm A    |                         | Firm B    |                         |
|-----------|-------------------------|-----------|-------------------------|
| Abatement | Marginal Abatement Cost | Abatement | Marginal Abatement Cost |
| 1         | 2                       | 1         | 1                       |
| 2         | 4                       | 2         | 2                       |
| 3         | 6                       | 3         | 3                       |
| 4         | 8                       | 4         | 4                       |
| 5         | 10                      | 5         | 5                       |
| 6         | 12                      | 6         | 6                       |
| 7         | 14                      | 7         | 7                       |
| 8         | 16                      | 8         | 8                       |

- Suppose we require each firm to reduce 3 tons of emissions.
  - This will cost firm A \$12 (= \$2 + \$4 + \$6). It will cost firm B \$6 (= \$1 + \$2 + \$3). Total costs are \$18.
  - Consider instead allowing firm A to pollute 1 ton more, and firm B one ton less.
    - Firm A saves \$6 by not cleaning up the third ton.
    - Firm B spends \$4 more by also cleaning up the fourth ton.
      - Therefore, we have a net gain of \$2.
    - Indeed, total costs for A are now \$6, and total costs for B are \$10, giving us a total cost of \$16.

- What policies will give us this efficient outcome?
  - Tradable permits
    - In this case, firm A can buy a permit from firm B. Firm B must get at least \$4 to cover its additional cleanup costs. However, firm A is willing to buy permits if they cost less than \$6, since that is the cost it saves by not having to clean up the third unit. Thus, an agreement can be reached.
  - Emission fees
    - Each firm will compare its marginal abatement costs to the emissions fee.
    - Consider a fee of \$4.01.
      - It is cheaper for A to clean up its first two tons of pollution. However, it will choose to pay the fee, rather than clean up the remaining 6 tons of pollution.
      - Similarly, firm B will choose to clean up 4 tons, and will pay the emissions fee for the remaining four tons.