



Environmental Policy and Legislation

4201-431

ENVIRONMENTAL POLICY

Thomas Fellmann

Lecture Topic 3

Lecture notes and further information:
<http://www.uni-hohenheim.de/apo>



OUTLINE TOPIC 3



- **Environment as a 'Good'**
 - The Concept of Resource Scarcity
 - The Role of Markets and Their Signals
 - Market Failures (esp. Public Goods and Externalities)
 - Modelling Pollution
 - Optimal Level of Pollution
 - The Coase Theorem

THE CONCEPT of RESOURCE SCARCITY



SCARCITY

= the gap between human wants and available resources.

- Goods have value because they are scarce.
If goods were not scarce, they would be free – like air.
But: Even with air, people are probably willing to pay more to live in cleaner environments.
 - The more scarce resources are, relative to their demand, the greater their value.
- ⇒ It can be argued that scarcity is the origin of all resource policy issues. Scarcity of resources creates the conflict and pressure for changes in public policy regarding resource use.

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THE CONCEPT of RESOURCE SCARCITY



General implications to maximize the set of goods and services in a world of scarcity:

- **Choice:** we need to make choices and set priorities.
- **Opportunity Costs:** highest valued alternative that must be sacrificed to attain something or satisfy a want.
- **Efficiency:** In the presence of scarcity, no individual or society can afford to be wasteful or inefficient.
- **Social Institutions:** In the presence of scarcity the allocation and distribution of resources always causes conflicts.
To resolve these conflicts, some kind of institutional mechanism(s) need to be established. ⇒ in most countries the *market system* is used to rationing scarce resources

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EFFICIENT MARKET ALLOCATION

Recall: A perfectly complete and efficient market meets the following conditions:

- **Market players have the freedom of choice, based on self-interest and rational behaviour**
- **Perfect information**
- **Competition**
- **Mobility of resources**
- **Property rights**

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EFFICIENT MARKET ALLOCATION

PROPERTY RIGHTS

= an individual's power to use, benefit from, and exclude others from using particular resources.

- A *right* is a legally enforceable expectation. It involves an 'assurance' that an activity will be protected by the legal system.
- Property rights can be **private**, **common**, **public** or **absent** (open access).

⇒ But: no right is absolute.

"In a world of scarcity, it is impossible to implement freedom for everyone. One's person freedoms and opportunities are a cost to another. Rights defining opportunities can be understood by looking at the reciprocal relationships of people with incompatible preferences"

(Schmid, A. (1988): The idea of property: A way to think about soil and water uses)

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EFFICIENT MARKET ALLOCATION

PROPERTY RIGHTS

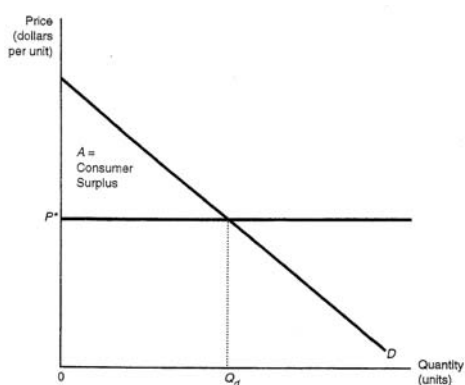
- Well defined property rights must be:
 - a) Comprehensive
 - b) Exclusive
 - c) Transferable
 - d) Enforceable
- PR are crucial to successful market systems.
- PR give a powerful incentive for the owner to use the resource efficiently, because a decline in the value of that resource = a personal loss.
- Exchange of PR facilitates efficiency.

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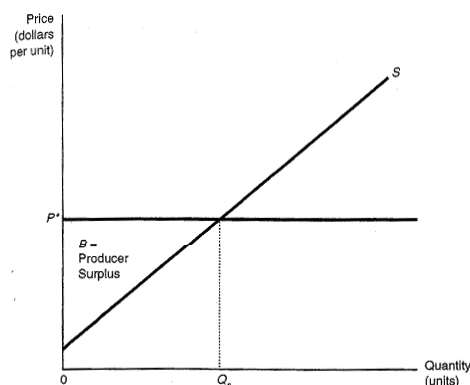


EFFICIENT MARKET ALLOCATION

The Consumer's Choice



The Producer's Choice

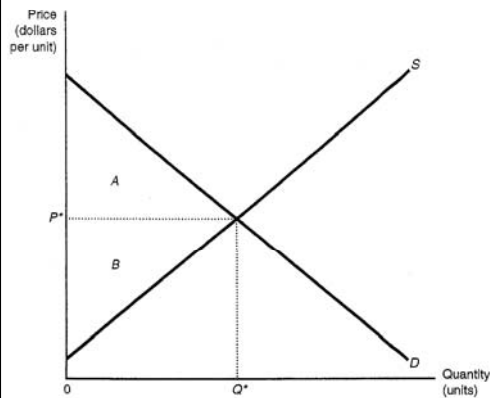


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EFFICIENT MARKET ALLOCATION



Market Equilibrium



- Consumers maximize their surplus
Demand = Marginal Benefit (MB)
- Producers maximize their surplus
Supply = Marginal Cost (MC)
- In equilibrium, $P = MB = MC$
- No further beneficial transactions are possible.
- Normally, a free market brings us to this point.

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EFFICIENT MARKET ALLOCATION



⇒ BUT:

- There are times when private marginal benefits or costs are not equal to social marginal benefits or costs.
- When this occurs, the market is unable to allocate resources efficiently.

⇒ We call this *market failure*.

⇒ There are various types of market failure:

non allocation of property rights, imperfect competition, imperfect information, public goods, externalities, and also inappropriate government intervention (= government failure).

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MARKET FAILURE



IMPERFECT INFORMATION:

- = when different parties have different levels of information.
- The market depends on perfect information, so that everyone knows all of the options available to them. If this is not possible, people may not make optimal choices.
- If no one realizes an activity is bad, imperfect information is not the problem.
- How is this relevant to environmental economics?
 - People may have imperfect information about things such as health risks or the dangers of pollution.
- What can be done?

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MARKET FAILURE



PUBLIC GOODS

Have two key features:

1. *non-rivalry*

- ⇒ The same unit of a public good can be consumed by many individuals: one person enjoying the good does not keep others from enjoying it.

2. *non-excludability*

- ⇒ Once a good is provided to some individuals it is not possible (or at least very costly) to exclude others from benefiting from it.
- ⇒ Leads to free-rider problem

Examples: street lightning, lighthouses, national defence, the natural (or urban) environment

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MARKET FAILURE



PUBLIC GOODS (contd.)

- Because the goods are non-rival, efficiency requires that the sum of each individual's marginal benefit is equal to marginal cost.
- Underprovision: results when public goods are provided by a free market.
- How is this relevant to environmental economics?
 - climate, clean air, parks
- What can be done?

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MARKET FAILURE



GOVERNMENT FAILURE:

- = wrong or inappropriate government intervention moves the market away from an optimal outcome.
- Different from market failures.
- Removal of one cause of market failure does not necessarily result in a more efficient allocation of resources.
- How is this relevant to environmental economics?
 - In some cases, chosen policy instruments may simply fail to achieve desired outcomes
 - Governments often subsidize resource extraction (e.g. forests, mining)
 - Leads to overexploitation of these resources.
- Reasons of political economy must also be considered.

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MARKET FAILURE



EXTERNALITIES:

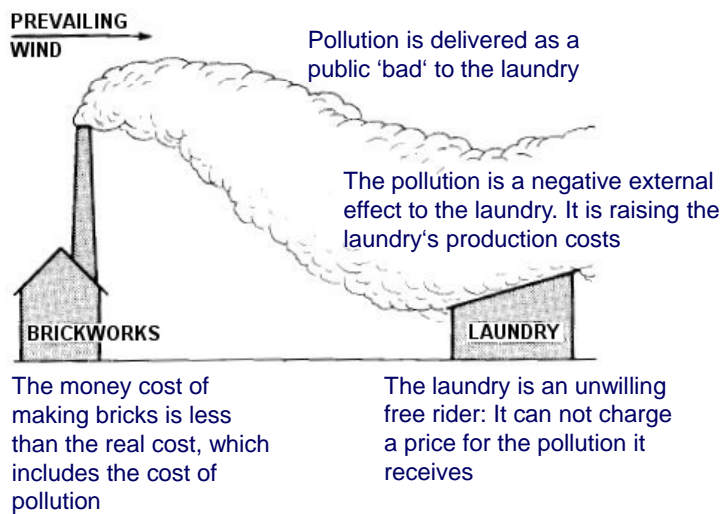
- = activity of one entity that affects the welfare of another and is not reflected in market prices.
- Positive or negative external effects.
- To find the efficient level of activity, we need to know the *marginal social cost (MSC)*.
- $MSC = \text{marginal private costs (MPC)} + \text{marginal external costs (MEC)}$
(MEC represents the damage done by the externality) ↗
- Without policy, the free market will not lead to an efficient solution, as prices will reflect private costs, but not the additional external costs.

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MARKET FAILURE

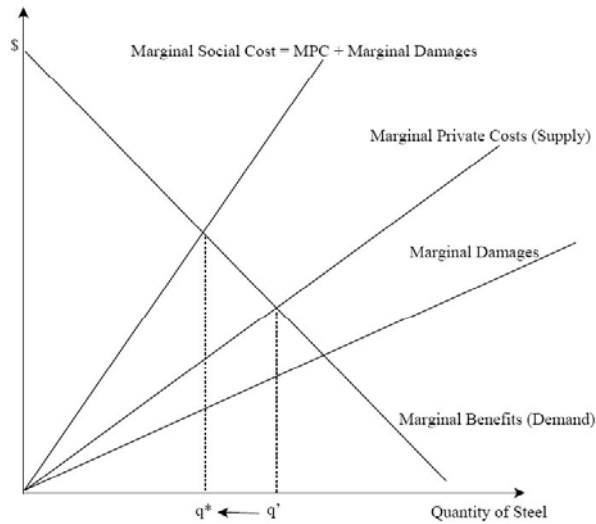


Example Negative Externality:



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Effect of Negative Externality on Efficient Level of Production



- Individuals equate MPC and MB.
- Since $MSC > MPC$, overprovision results.

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MARKET FAILURE



Different Types of Cost and Benefits associated with Externalities:

- Generated in one production process and received in another production process.
- Generated in a production process and received in consumption.
- Generated in consumption and received in a production process.
- Generated in consumption and received in consumption.

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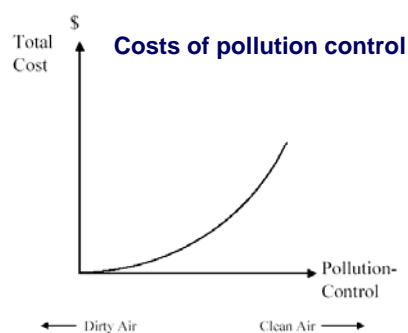
MODELLING POLLUTION

- One of the major problems in environmental policies is to determine the optimal level of environmental resource use.
 - This implies: We need to develop policies that lead to an optimal level of pollution.
- ⇒ Recall that the optimal level of pollution is not zero.

Example: Costs of Acid-Rain Control

Emission Reduction (million tons)	Total Cost (\$ billion)	Average Cost (\$/ton)	Marginal Cost (\$/ton)
8	\$2.2	\$270	\$270
10	\$3.6	\$360	\$720
12	\$9.3	\$720	\$2,775

Fuel-Switching, Scrubbing, Conservation, Clean-Coal Technology

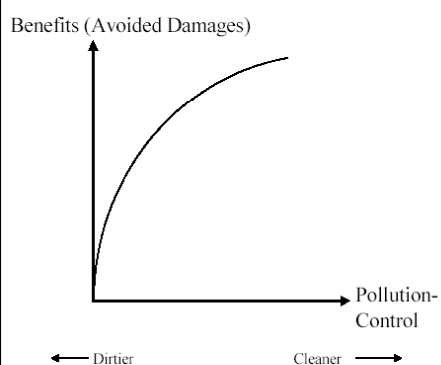


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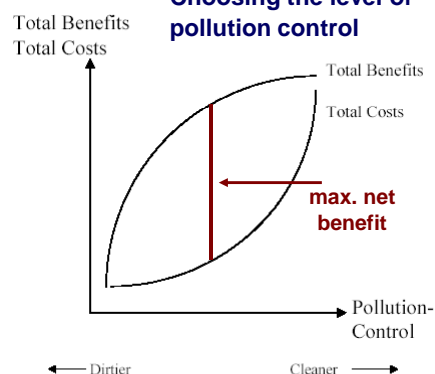


MODELLING POLLUTION

Benefits of pollution control



Choosing the level of pollution control



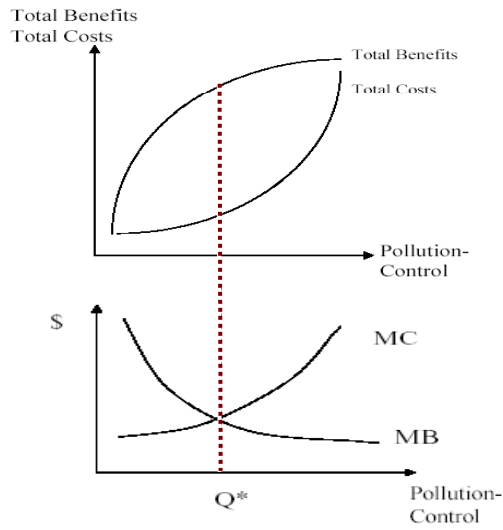
- ⇒ 'Optimal level of pollution' is not where total benefits equal total costs. If that were the case, net benefits would be zero.
- ⇒ We maximize *net* benefit by equating marginal benefits and marginal costs.

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MODELLING POLLUTION



THE ECONOMICALLY EFFICIENT LEVEL OF POLLUTION



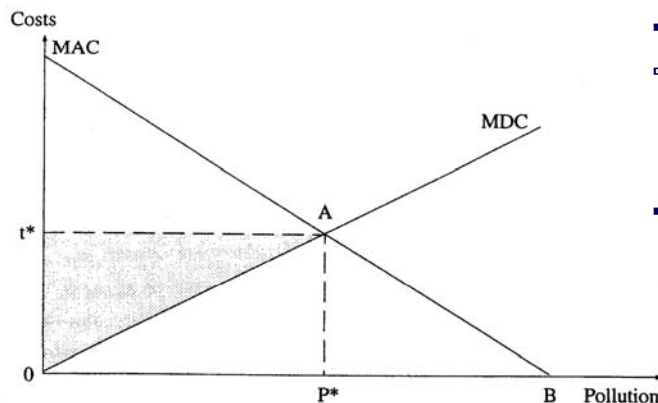
- $MC = MB = \max. \text{ net } B$
- ⇒ additional benefits from pollution control are just equal to the additional costs.
- marginal benefits are the marginal damages *avoided* by increased abatement.

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MODELLING POLLUTION



THE ECONOMICALLY EFFICIENT LEVEL OF POLLUTION



- In A: $MDC = MAC$
- ⇒ additional benefits from pollution control are just equal to the additional costs.
- marginal benefits are the marginal damages *avoided* by increased abatement.

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The Economically Efficient Level of Pollution



⇒ ... we maximize *net* benefit by equating marginal benefits and marginal costs.

Some examples:

- How would the desired level of pollution control change if a new technology is discovered that improves the efficiency of scrubbers for power plants?
- Suppose that the value of a product increases due to shortages elsewhere. What happens to the efficient level of pollution control in this case?
- Suppose population increases, so more people are exposed to damages. How does the optimal level of pollution change?

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ENFORCEMENT COSTS



- For any environmental policy, we also need to consider the costs society pays to enforce and administer the policy.
- ⇒ Can be modelled as increasing the MAC, which decreases the desired level of abatement.
- ⇒ Level of enforcement is an important policy consideration.
- Enforcement can be continuous or random.
 - continuous emissions monitoring systems
 - random spot checks
 - 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 = MAC

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EVALUATING ENVIRONMENTAL POLICY



- Analysis of marginal damages and marginal abatement costs assumes that efficiency is the criterion for evaluating environmental policy.
- Problem: overwhelming information burden
- ⇒ and: Efficiency is just one of several criterions.
- Cost-Effectiveness as an alternative
- Institutional (political and administrative) feasibility
- Distributional equity
- Sustainability/long-run considerations
- Ethics/moral considerations

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THE COASE THEOREM



The Coase Theorem (attributed to Ronald Coase,*1910), relates to the economic efficiency of a government's allocation of property rights.

- In essence, the theorem states that in the absence of transaction costs, all government allocations of property rights are equally efficient, because interested parties will bargain privately to correct any externality.
- It 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 (further) government intervention is necessary.

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THE COASE THEOREM

- Coase Theorem doesn't simply mean that assigning property rights to a polluter will cause the pollution to continue.

BUT: The decision on property rights will affect the distribution of income in the final outcome.

Main points of the Coase Theorem:

1. Externalities are reciprocal in nature.
2. The economic problem is to maximize the value of production. Thus, you need to determine which activity has the higher value.
3. Victims should not be compensated.

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THE COASE THEOREM

Complications with Coase's argument:

1. Need to be able to clearly establish who causes the harm.
2. Willingness to pay and willingness to accept are different.
3. The definition of property rights might affect the number of participants.
4. Costs of bargaining and transactions costs.
5. There is no guarantee that bargainers will reach an agreement.

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