Public Economics
05 Externalities

Dr. Jonathan Stäbler
Masaryk University
Faculty of Economics and Administration

Fall 2024

Outline of Lecture

Introduction

Definition externality: An action by a firm or consumer that affects other firms or consumers but is not accounted for in the price mechanism.

- **Negative externality:** A cost is imposed on a third party without compensating them.
  $\rightarrow$ Oversupply of such goods.
  Examples: air, water, or soil pollution; noise; smoking; road usage: traffic congestion
- **Positive externality:** A benefit is received by a third party without receiving a financial reward.
  $\rightarrow$ Undersupply of such goods.
  Examples: beautification of building facades; oil exploration on public land; spendings on research and development

Negative Externalities: Example SUV

The consumption of large cars such as SUVs produces three types of negative externalities:

- Environmental externalities: SUVs need more gas than compact cars (or public transports).
- Wear and tear on roads: Larger cars wear down the roads more.
- Safety externalities: The odds of having a fatal accident quadruple if the accident is with a typical SUV and not with a car of the same size.

Outline of Lecture

Market Failure due to Externalities

Example:

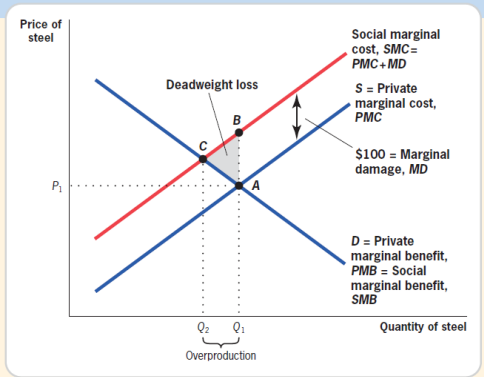
- Steel mill discharges wastewater into a river, while downstream, fisherman are catching fish.
- Wastewater is a byproduct of steel production.
- Wastewater reduces the fish population.
- Now, fishermen must fish longer to catch the same amount of fish.

Marginal Costs and External Costs

- **Private Marginal Costs (PMC)**
  = The additional cost incurred to produce one more unit of a good or service.
- **External Marginal Costs (Marginal Damage MD)**
  = The additional costs incurred by the fishermen when the steel mill produces one additional unit.
- **Marginal Social Costs**
  = Marginal Costs (MC) + Marginal Damage (DM)

Market Failure due to Negative Externalities

■ FIGURE 5-2



Market Failure Due to Negative Production Externalities in the Steel Market • A negative production externality of $100 per unit of steel produced (marginal damage, *MD*) leads to a social marginal cost that is above the private marginal cost, and a social optimum quantity (Q_2) that is lower than the competitive market equilibrium quantity (Q_1). There is overproduction of $Q_1 - Q_2$, with an associated deadweight loss of area *BCA*.

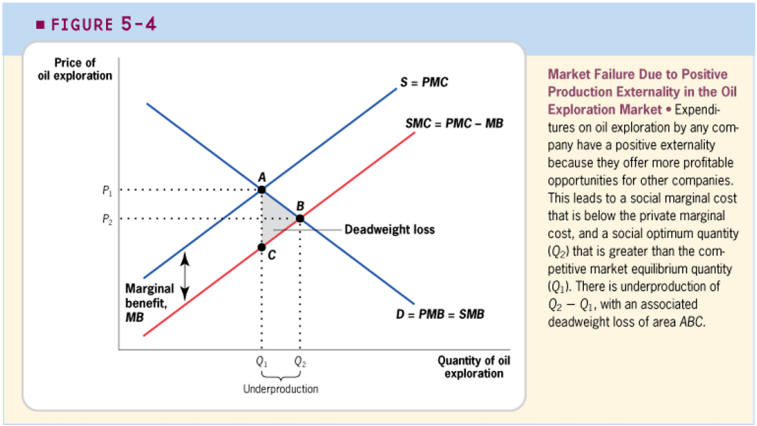
Source: Gruber (2005)

Result: The private market equilibrium (point A, Q1) leads to overproduction compared to the socially optimal level (point C, Q2).

Market Failure due to Positive Externalities

- **Not all externalities are negative.** There are positive externalities, where production benefits others without compensation to the producer.
- *Example: Oil exploration on public land.*
  $\longrightarrow$ The first company to explore increases the chances of finding oil for other companies, creating a positive externality.
- **Positive production externality:** The social marginal cost (SMC) of exploration is lower than the private marginal cost (PMC), as exploration benefits other firms.

Market Failure due to Positive Externalities



Source: Gruber (2005)

Result: The private market equilibrium (point A, Q1) leads to underproduction compared to the socially optimal level (point B, Q2) since the first explorer is not compensated for the benefits it generates.

Outline of Lecture

Remedies for the Problem of Externalities

Internalizing an externality means incorporating external costs or benefits into the decision-making of those responsible.

Possibilities:

- Taxes or fines
- Subsidies
- Regulations
- Tradable Permits

Goal: Align private actions with public welfare by making parties accountable for social costs or benefits.

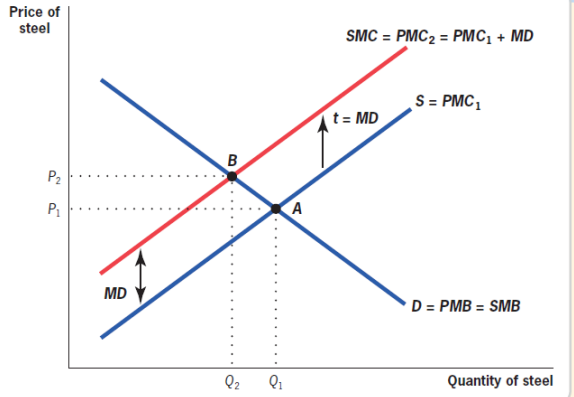
Outline of Lecture

Corrective (Pigouvian) Taxation

- **Corrective taxation** can internalize externalities when private markets fail to do so.
- *Example: Steel production.*
  - The government levies a tax equal to the marginal damage (MD) per unit of steel produced.
- **Effect of the tax:**
  - Shifts the private marginal cost (PMC) upward to align with the social marginal cost (SMC).
  - Leads to the socially optimal outcome (quantity Q2, point B) by reducing production to the efficient level.
- **Pigouvian taxation:** Named after A.C. Pigou, this approach addresses externalities by making producers account for the social costs of their actions.

Corrective (Pigouvian) Taxation

■ FIGURE 5-6



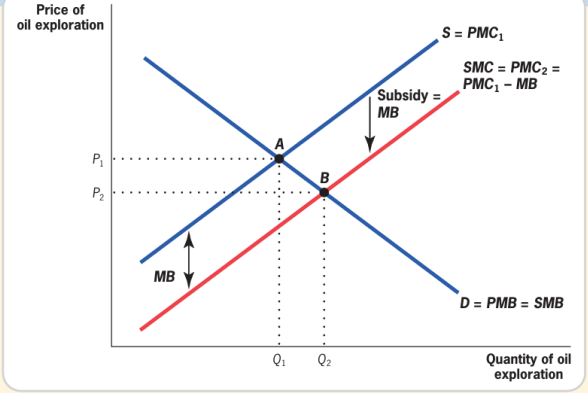
Taxation as a Solution to Negative Production Externalities in the Steel Market • A tax of \$100 per unit (equal to the marginal damage of pollution) increases the firm's private marginal cost curve from PMC_1 to PMC_2, which coincides with the *SMC* curve. The quantity produced falls from Q_1 to Q_2, the socially optimal level of production. Just as with the Coasian payment, this tax internalizes the externality and removes the inefficiency of the negative externality.

Source: Gruber (2005)

Outline of Lecture

Subsidies for Positive Externalities

■ FIGURE 5-7



Subsidies as a Solution to Positive Production Externalities in the Market for Oil Exploration • A subsidy that is equal to the marginal benefit from oil exploration reduces the oil producer's marginal cost curve from PMC_1 to PMC_2, which coincides with the SMC curve. The quantity produced rises from Q_1 to Q_2, the socially optimal level of production.

Source: Stiglitz and Rosengard (2015)

Outline of Lecture

Pollution Abatement

Pollution Abatement: Reduction or elimination of pollutants released into the environment.
Example: Technological innovations, which lead to cleaner production processes and pollution control technologies.

- Reducing pollution is costly (marginal costs of pollution abatement).
- Reducing pollution creates a social benefit as it decreases the externality (marginal benefit of pollution abatement).
- Giving a fine for every quantity of pollution introduces an incentive to reduce pollution.
- Subsidizing pollution abatement introduces a private benefit of pollution abatement.

Fines and Pollution Abatement

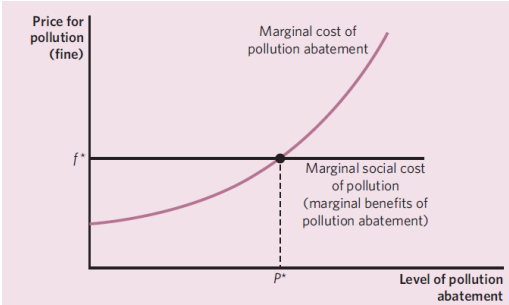


FIGURE 6.4

EFFICIENT CONTROL OF POLLUTION

The efficient level of pollution can be attained either by charging firms a fine of f^* per unit of pollution (say, measured by the number of particles added to the air) or by imposing a regulation that firms have a pollution abatement level P^*.

Source: Stiglitz and Rosengard (2015)

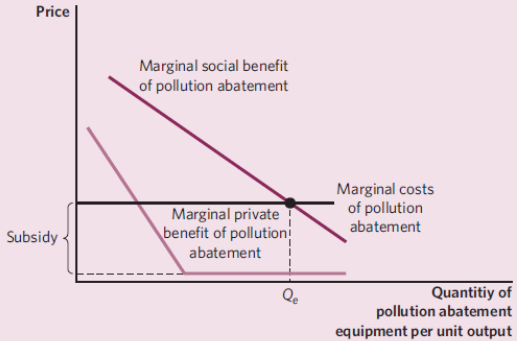
- Set a fine f^* equal to the marginal social cost of pollution (marginal benefits of pollution abatement) to achieve a pollution abatement level of P^*.
- Efficient level can be achieved (similar to Pigouvian taxation).

Pollution Abatement Subsidies

FIGURE 6.5

POLLUTION ABATEMENT SUBSIDIES

By subsidizing the purchase of pollution abatement equipment (by the difference between marginal social benefit of pollution abatement and marginal private benefit), an efficient level of expenditure on pollution abatement can be attained.



Source: Stiglitz and Rosengard (2015)

Alternatively, subsidize pollution abatement such that the marginal private benefit of pollution abatement equals the the marginal social benefit of pollution abatement to achieve Q_e.

Subsidizing Pollution Abatement

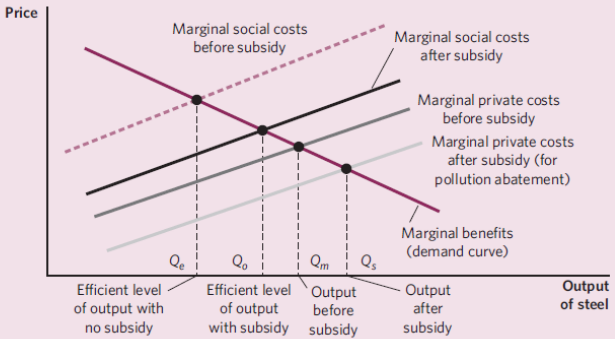


FIGURE 6.6

MARKET EQUILIBRIUM WITH POLLUTION ABATEMENT SUBSIDIES

Even after the pollution abatement subsidy, the equilibrium level of output of steel is still inefficient; the firm fails to take into account the extra costs of public subsidies for pollution abatement associated with increased output of steel as well as the marginal social cost of any remaining pollution.

Source: Stiglitz and Rosengard (2015)

- Subsidy decreases social costs, as $Q_m - Q_e > Q_S - Q_0$.
- Subsidies reduce pollution but still lead to overproduction ($Q_S - Q_0$), as firms don't account for full social costs (which include the subsidy itself).

Pollution Abatement Conclusion

- Firms have little incentive to reduce pollution without penalties or subsidies, leading to underinvestment in pollution abatement.
- Fines and subsidies for pollution abatement can reduce pollution by lowering the total marginal social cost of production.
- However, subsidies do not address the full social cost of production, leading to overproduction ($Q_s > Q_0$).
- Firms prefer subsidies over fines as they increase profits, but fines are more efficient, as they force firms to internalize the true social costs of their actions.
- A well-designed subsidy scheme may reduce distortions but remains less efficient than fines.

Outline of Lecture

Regulations

Traditional Regulation: Governments have relied on direct regulation to reduce externalities.
Examples:

- Emission standards/ caps for automobiles (and other products).
- Regulations on toxic chemical disposal.
- Smoking bans on flights.
- Restrictions on fishing and hunting to manage common resources.

\+ Advocates argue regulations provide certainty in pollution limits.
− Critics highlight inefficiencies:

- Regulations may not account for varying marginal costs of abatement.
- No incentive to reduce pollution below set standards.

Outline of Lecture

Coase Theorem

Coase Theorem (Part I): When there are **well-defined property rights** and costless bargaining, then **voluntary negotiations** between the party creating the externality and the party affected by the externality **will lead to efficiency.**

Coase Theorem (Part II): The efficient quantity for a good producing an externality does not depend on which party is assigned the property rights, as long as someone is assigned those rights.

[[Watch Video]]

Example Coase Theorem

Example: Individual X has a car worth \$3000 to her, individual Y values the car with \$4000.

- Socially efficient if individual Y owns the car.
- We don't need the law to allocate the car to Y.

Case 1: Y owns the car.

- No reason for X to buy the car. $\longrightarrow$ Efficient allocation.

Case 2: Y owns the car.

- Clear incentive for Y to buy it, Y ends up with the car. $\longrightarrow$ Efficient allocation.

Regardless of who owns the car first (who gets allocated the property rights), we get to the efficient outcome due to voluntary negotiations.

$\longrightarrow$ The key: lack of transaction costs.

Example Coase Theorem

Example: Individual X has a car worth \$3000 to her, individual Y values the car with \$4000.

Coase theorem is about efficiency, not distributional justice (inequality):

- If Y starts with the car, she doesn't have to pay for it.
- If X starts with the car, Y has to pay \$3000 to X to buy the car
- It matters for individual payoffs, who starts with the car.
- It does not matter for efficiency (sum of individual payoffs), as Y will always end up with the car.

Example Coase Theorem

Example: You want to have a party in the house next door to mine.

- If it's efficient for you to have the party...
  - Your benefit from having the party is higher than my benefit from a good night's sleep.
  - If you start out with the right to have the party, no problem.
  - If I start out with the right to quiet, you can pay me for the right to have the party.
- If it's efficient for you not to have the party...
  - Good night sleep is worth more to me than for you to have the party.
  - If I start with the right to silence, no problem.
  - If you start with the right to party, I can pay you to not have it.

$\longrightarrow$ Independent of what is efficient, we **achieve efficiency** through voluntary negotiations.

$\longrightarrow$ **Regardless** of who started with the right.

Conditions for the Coase Theorem

- Property rights have to be **well-defined**.
  $\longrightarrow$ We need to be clear on who has what rights, so we know the starting point for negotiations.
- Property rights need to be **tradable**.
  $\longrightarrow$ We need to be allowed to sell/transfer/reallocate rights if we want to.
- **No transaction costs.**
  $\longrightarrow$ It can't be difficult or costly for us to buy/sell the right.

The Coase Theorem

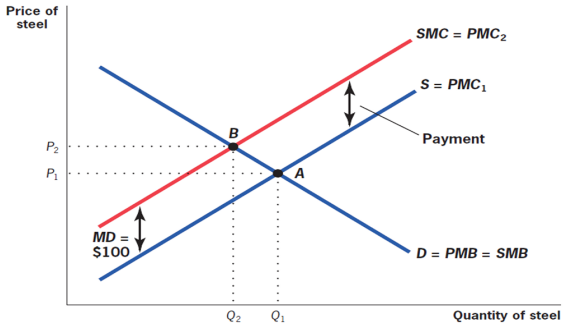
Coase Theorem (Part I): When there are **well-defined property rights** and costless bargaining, then **voluntary negotiations** between the party creating the externality and the party affected by the externality **will lead to efficiency.**

Coase Theorem (Part II): The efficient quantity for a good producing an externality does not depend on which party is assigned the property rights, as long as someone is assigned those rights.

$\longrightarrow$ Initial allocation of rights does not matter to reach efficiency.

$\longrightarrow$ Initial allocation of rights matters for distribution (inequality).

Coasian Payments



Coasian payments equal the damage of each produced quantity of the externality.

- If price is above MD, individuals would want to sell an extra unit of the externality, so price must fall.
- MD is the equilibrium efficient price in the newly created externality market.

Problems with Coasian Solution

In practice, the Coase theorem is unlikely to solve many of the types of externalities that cause market failures:

1. **The assignment problem:** In cases where externalities affect many agents (e.g., global warming), assigning property rights is difficult.
2. **The holdout problem:** Shared ownership of property rights gives each owner power over all the others (because joint owners have to all agree to the Coasian solution).
3. **Transaction Costs and Negotiating Problems:** it is hard to negotiate when there are large numbers of individuals on one or both sides of the negotiation.

Outline of Lecture

Application of Coase Theorem: Tradable Permits to Reduce Externalities

Examples: EU Emissions Trading System, water pollution trading programs in the US, etc. [[Watch video]]

- Tradable permits operate under a cap-and-trade system.
- A cap limits total emissions; permits are allocated or sold to firms.
- Firms can trade permits, allowing flexibility in emissions reductions.
- Firms who can reduce pollution most efficiently, reduce their emissions and sell permits
- Firms, for which it is expensive to reduce pollution buy permits.
- In equilibrium, firms reduce pollution where marginal cost equals permit price.

Challenges of Tradable Permits

- **Initial Assignment Issues**:
  - Assigning permits based on past pollution raises equity concerns.
  - Alternatives: base on production levels or auction permits.
  - Governments may issue too many permits, reducing pollution effectiveness.
- **Geographical Considerations**:
  - Pollution location matters; effects vary by area.
  - Tradable permits may not address regional pollution disparities effectively.

Conclusion

When externalities exist, market outcomes are often not efficient.

- **Coase theorem:** Private bargaining can solve externalities, but when many parties are involved and there are transactions costs, negotiations may fail.
- **The role of government:** When private solutions fail, the public sector can intervene through:
  - **Pigouvian taxes:** Imposing taxes that align private costs with social costs.
  - **Subsidies and fines** for pollution abatement.
  - **Regulation:** Setting rules to limit harmful externalities.
  - **Pollution permits:** Creating a market for externality rights.

Conclusion: Market forces, when properly redirected, remain powerful tools to address market failures. Government intervention should complement, not replace, the market.

Readings for Next Week

6 Public Expenditures

Main Reading: Stiglitz and Rosengard (2015)

- Chapter 8: Public Production of Goods and Services (p.199-213)
- Chapter 12: Research and Technology (p.345 - 354)
- Chapter 13: Health Care (p. 357-371)
- Chapter 14: Education (p.394-407)

Thank you and see you next week!

Jonathan.Stabler@econ.muni.cz

References I

Gruber, J. (2005). *Public Finance and Public Policy*, Worth Publishers.

Stiglitz, J. E. and Rosengard, J. K. (2015). Economics of the public sector (4th edition).