HS 232

Lecture 8 23rd January 2025

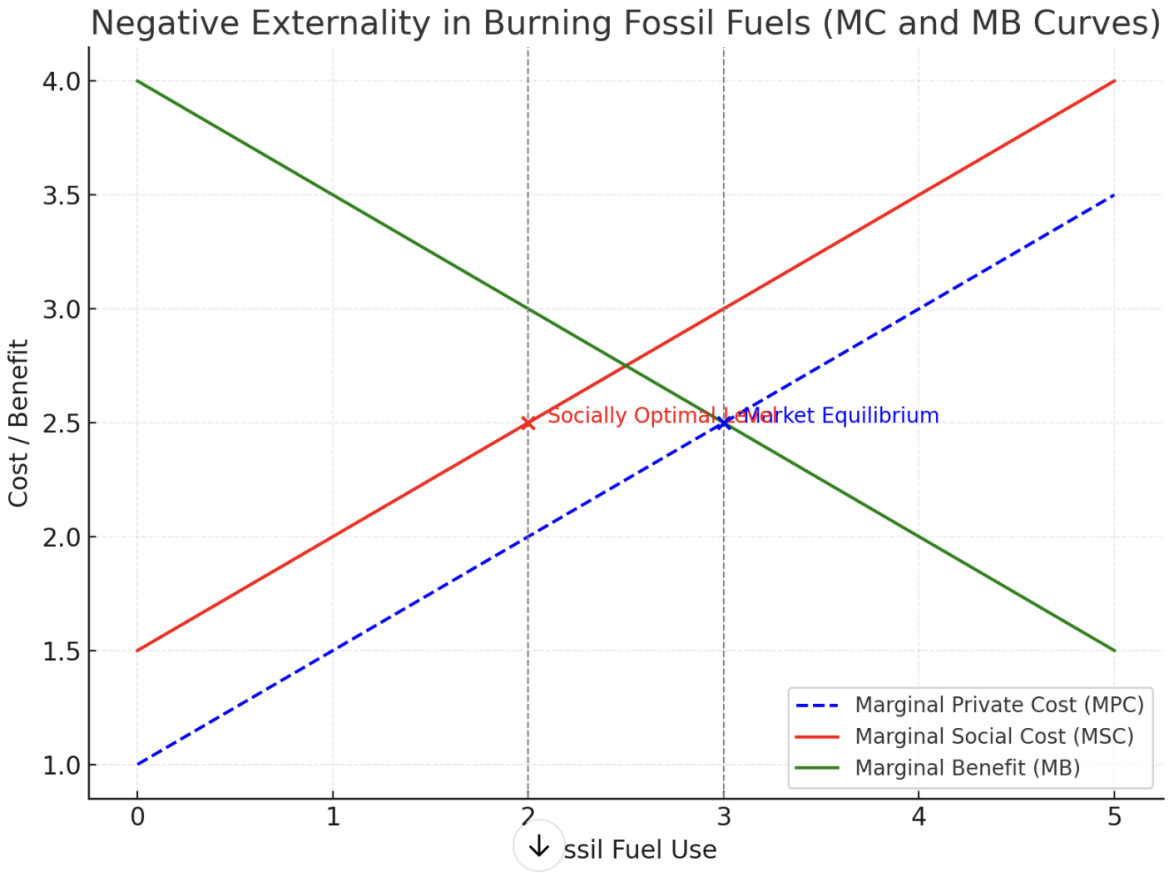
Climate change as an environmental externality

Recap

- What is climate mitigation
- Why mitigation is a positive externality and a public good
- Why it is under produced
- Mitigation and Market Failure
- Policy Interventions to Correct Market Failure – Direct and Indirect methods

Negative Externality in Burning Fossil Fuels

- Burning fossil fuels is a classic example, where the external costs include air pollution, greenhouse gas emissions, health issues, and environmental degradation.
- The gap between the market equilibrium and the socially optimal level reflects the **overproduction of fossil fuels**, which results in external costs being imposed on society.



1. **Marginal Private Cost (MPC, Blue Dashed Line):** Represents the direct costs borne by producers or consumers of fossil fuels.
2. **Marginal Social Cost (MSC, Red Solid Line):** Reflects the total costs to society, including external costs such as pollution and climate change.
3. **Marginal Benefit (MB, Green Solid Line):** Represents the declining benefits from fossil fuel use.

Key Points:

- **Market Equilibrium (Blue Point):** Occurs where MPC = MB. Here, the market produces more fossil fuels than is socially optimal because external costs are not accounted for.
- **Socially Optimal Level (Red Point):** Occurs where MSC = MB, accounting for external costs. This results in lower fossil fuel consumption.

The gap between the market equilibrium and the socially optimal level represents the **overproduction of fossil fuels**, leading to societal harm. Policy measures like carbon taxes or emission regulations aim to align private costs with social costs, reducing this gap.

Public bad

Characteristics of a Public Good:

- **Non-excludability**: No one can be excluded from enjoying the benefits of the good.
- **Non-rivalry**: One person's use of the good doesn't reduce its availability to others.

Negative externalities like pollution share the **non-excludable** and **non-rivalrous** features of public goods but represent undesirable outcomes. Therefore, they are classified as **public bads**, not public goods.

Regulations to internalize these costs
Direct methods

Carbon Tax

- A carbon tax directly imposes a fixed cost on every ton of CO_2 emitted.
- It raises the price of fossil fuels, making carbon-intensive activities more expensive.
- **How It Works:**
  - Firms and individuals are incentivized to reduce emissions by switching to cleaner energy sources, improving energy efficiency, or adopting greener technologies.
- **Example:**
  - **Sweden's Carbon Tax**:
    - Sweden implemented a carbon tax in 1991, starting at \$23/ton CO_2 and now exceeding \$130/ton.
    - The tax significantly reduced emissions while the economy grew, as businesses and consumers shifted toward renewable energy and energy-efficient practices.

How Carbon Tax Reduces Fossil Fuel Consumption:

- **Internalizes External Costs:**
  - Fossil fuel consumption generates negative externalities, such as greenhouse gas emissions. A carbon tax aligns private costs with social costs by adding a price to carbon emissions.
- **Price Signal:**
  - The tax increases the price of fossil fuels, making renewable energy and energy efficiency measures more competitive.
- **Behavioral Change:**
  - Higher prices discourage wasteful energy consumption, encouraging consumers to adopt energy-efficient practices and producers to invest in cleaner technologies.
- **Revenue Recycling:**
  - Instead of simply adding this revenue to the general budget, governments can reinvest or redistribute these funds in targeted ways to maximize their environmental and social benefits.

Revenue Recycling:Potential Uses:

- **Funding Renewable Energy Projects**: Revenue can be directed toward developing and deploying renewable energy infrastructure, such as solar, wind, or hydropower projects, helping transition to cleaner energy sources.
- **Subsidizing Green Technologies**: Support can be provided to innovative technologies like electric vehicles, energy-efficient appliances, or carbon capture systems, reducing their cost and increasing accessibility.
- **Reducing Other Taxes**: Governments can reduce taxes like income or payroll taxes to offset any economic burden on households or businesses caused by the carbon tax. This is often referred to as a "tax shift" or "double dividend" strategy.
- **Investing in Climate Adaptation**: Funds can support climate resilience measures, such as improving infrastructure to withstand extreme weather or protecting vulnerable ecosystems.
- **Supporting Low-Income Households**: Revenue can be used to provide rebates or direct payments to households disproportionately affected by increased energy costs, ensuring the carbon tax remains equitable.
- **Amplifying the Mitigation Effect**: By recycling revenue into green initiatives, governments can accelerate the reduction of emissions beyond what would occur through the price signal alone. This dual approach (pricing carbon + funding solutions) creates a more robust response to climate change.

Benefits of Revenue Recycling:

- Reduces economic impacts and public resistance to carbon pricing.
- Drives innovation in clean energy and technology.
- Ensures fairness by compensating vulnerable groups.
- Strengthens public acceptance of carbon taxes by showing tangible benefits.

Cap-and-Trade System

- A cap-and-trade system sets a limit (cap) on total emissions and allows firms to trade emission permits in a market.
- Firms that reduce emissions below their cap can sell unused permits to others.
- **How It Works:**
  - By creating a market price for carbon, firms are incentivized to cut emissions in cost-effective ways.
- **Example:**
  - **European Union Emissions Trading System (EU ETS)**:
    - The EU ETS caps emissions from power plants, industrial facilities, and airlines.
    - Firms buy or sell allowances, encouraging innovation in clean technologies.
    - The system has contributed to a steady decline in emissions across the EU.

Cap and Trade : Market based approach

- **Cap**: The government or regulatory body sets a **maximum limit (cap)** on the total amount of emissions (usually measured in tons of CO2 or equivalent gases) that can be emitted by all companies or industries within the program. This cap is usually reduced over time to encourage emission reductions.
- **Allocation of Allowances**: Companies or entities covered by the cap receive **emission allowances** (permits) that give them the right to emit a specific amount of greenhouse gases. These allowances may be distributed through:
  - **Free allocation** (based on historical emissions or other criteria)
  - **Auctions**, where companies bid for the permits.

- **Trading**: If a company emits fewer emissions than its allowance, it can **sell** or trade the excess allowances to other companies that may need more. This creates a financial incentive for businesses to reduce their emissions—those who can reduce emissions at a low cost can sell their surplus allowances, while those facing higher costs of reduction can buy additional allowances.
- **Monitoring and Enforcement**: Regular monitoring ensures companies comply with their emissions limits. If companies exceed their cap, they may face penalties, such as having to purchase additional allowances or pay fines.

Example:

- The **European Union Emissions Trading System (EU ETS)** is one of the largest and most well-known examples of a Cap-and-Trade system. Under the EU ETS, industries such as power generation, manufacturing, and aviation are subject to emissions caps. The European Commission sets an overall cap on emissions from these sectors and allocates a portion of allowances either through free distribution or auctions. Companies can trade these allowances in a market, providing financial incentives to reduce emissions. Over time, the cap is reduced to ensure that total emissions continue to fall.

Key Benefits:

- **Cost-Effectiveness**: The market-based nature of cap-and-trade allows emissions reductions to occur where they are cheapest, as companies with lower abatement costs can reduce more and sell allowances to those with higher costs.
- **Incentives for Innovation**: By putting a price on carbon, the system encourages businesses to innovate and adopt cleaner technologies to reduce their emissions.
- **Environmental Integrity**: The cap ensures that total emissions do not exceed the set limits, contributing to the overall reduction of GHG emissions.

Key Challenges:

- **Market Volatility**: The price of permits can fluctuate significantly depending on demand and supply.
- Unpredictable prices make it difficult for businesses to plan long-term investments in cleaner technologies.
- Example: In the **EU Emissions Trading System (EU ETS)**, prices dropped dramatically during its initial phases due to an oversupply of permits, reducing the incentive to reduce emissions.
- **Political and Regulatory Issues**: The setting of the cap, the allocation of allowances, and the design of the trading system are subject to political negotiation, which may lead to compromises that limit the system's effectiveness

- **Initial Allocation of Permits**:
- Deciding whether to allocate emissions permits for free or auction them is contentious.
- **Free allocation** can lead to "windfall profits" for companies that receive permits but don't need to reduce emissions significantly.
- **Auctioning permits**, while economically efficient, might increase costs for businesses and lead to political pushback.
- **Carbon Leakage**:
- Industries in countries with stringent cap-and-trade policies might relocate to regions with less stringent regulations, resulting in no global emissions reduction.
- Example: Some European industries voiced concerns that stricter caps under the EU ETS would force them to move operations to non-EU countries with lax regulations.

- **Administrative Complexity**:
- Designing, implementing, and monitoring a cap-and-trade system requires significant administrative capacity and enforcement mechanisms to ensure compliance.
- Example: Ensuring accurate emissions reporting and verification in California's Cap-and-Trade Program has been resource-intensive.
- **Equity Concerns**:
- Higher compliance costs for industries may be passed on to consumers, disproportionately affecting low-income households.
- Example: In California's program, higher fuel prices due to carbon trading raised concerns about affordability for disadvantaged communities.

- **Environmental Effectiveness**:
- Setting a cap that is too high can lead to minimal emissions reductions, while a cap that is too low can harm the economy.
- Example: During the early phases of the EU ETS, the cap was set too high, resulting in an oversupply of permits and negligible reductions in emissions.

Although programs like the EU ETS have demonstrated the potential for success, their effectiveness depends on strong oversight, robust caps, and complementary policies to address economic and social impacts.