Introdução à Economia/Introductory Economics

6. Economy, environment and climate change

(adapted from CORE, The Economy.

Based on Unit 20)

2021/2022

2nd Quarter (P2)

Context

Living standards increased significantly due to technological progress and globalization.

However, this rapid economic growth has negatively affected the environment and natural resources (e.g., overfishing, pollution).

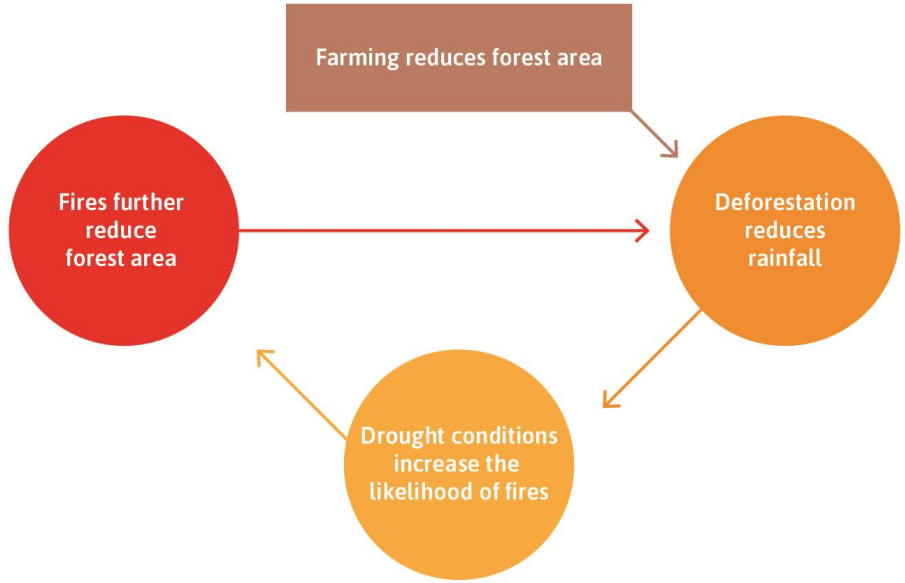
- What are the future consequences of our actions?
- How can we lessen our impact on the environment?
- What are the limitations of these approaches?

Context

The supply of **natural resources** (raw materials in the Earth's crust) is vast.

That is why world commodity prices (inflation adjusted) have not changed much over the long run – growing demand pushes prices up, but cheaper extraction technology pushes prices down.

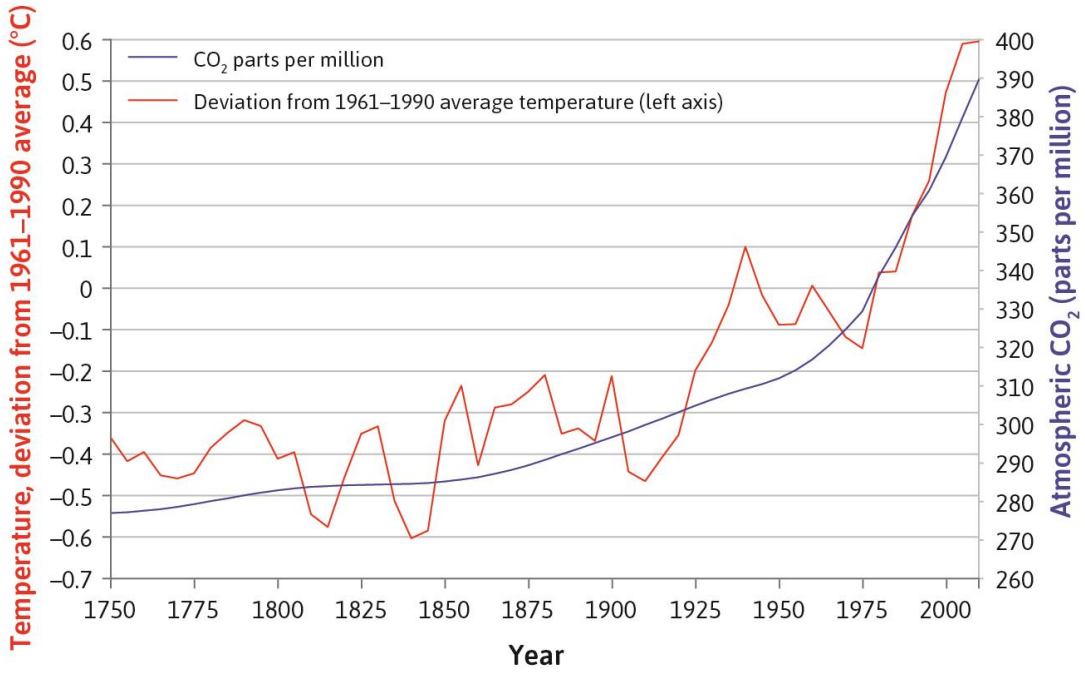
- Economic growth is a challenge to natural resource management.
- Changes (e.g., overfishing, deforestation) may become self-reinforcing due to **feedback processes**.



Climate Change

Climate change is a particularly difficult environmental problem to handle, for various reasons:

- Capping emissions is not enough (stock of CO_2 matters, not the flow)
- May be irreversible
- Requires global cooperation
- Conflicts of interest (between/within countries and generations)
- Worst-case scenario is catastrophic



Abatement cost curve

Abatement policies can address climate change. The degree of abatement chosen depends on the relative costs and benefits.

Optimal abatement choice depends on

1. Citizens' value for the environment, and
2. Costs of abatement.

Conflicts of interest

Costs of abatement are not equally shared across society.

Polluter pays principle: those responsible for external effects should pay for these damages.

However, this is not always the best policy:

- Fairness – polluters may be low-income families (e.g., burning wood).
- Effectiveness – subsidies/taxes may be less costly than tracking down the polluters.

Conflicts of interest

Benefits of abatement are also not equally shared across society.

Unlike citizens, polluters may not have to experience pollution.

Distribution of mutual gains from abatement depends on relative bargaining power of groups.

Bargaining power depends on:

- Verifiable information (ability to detect pollution)
- Consensus among citizens about environmental quality
- Lobbying by the firm
- Legal entitlement to pollute (e.g., pollution permits)
- Enforcement capacity

Types of abatement policies

How can we achieve the desired level of abatement?

Policymaker's aim: achieve the desired amount of effective abatement (e.g., units of CO_2) at minimum cost.

There are 2 types of abatement policies:

1. **Price-based policies** use taxes and subsidies to affect prices
   - Aim to internalise the external effects of individual choices
2. **Quantity-based policies** use bans, caps, and regulations

Cap and Trade

Environmental external effects arise because of missing markets.

Cap and trade creates a market for emissions:

- Government sets a limit (cap) on desired pollution and creates enough permits to meet this cap.
- Governments allocate permits (e.g., via auction) and firms buy/sell permits among themselves.
- Cap and trade is a combined (quantity- and price-based) policy.

Cap and Trade

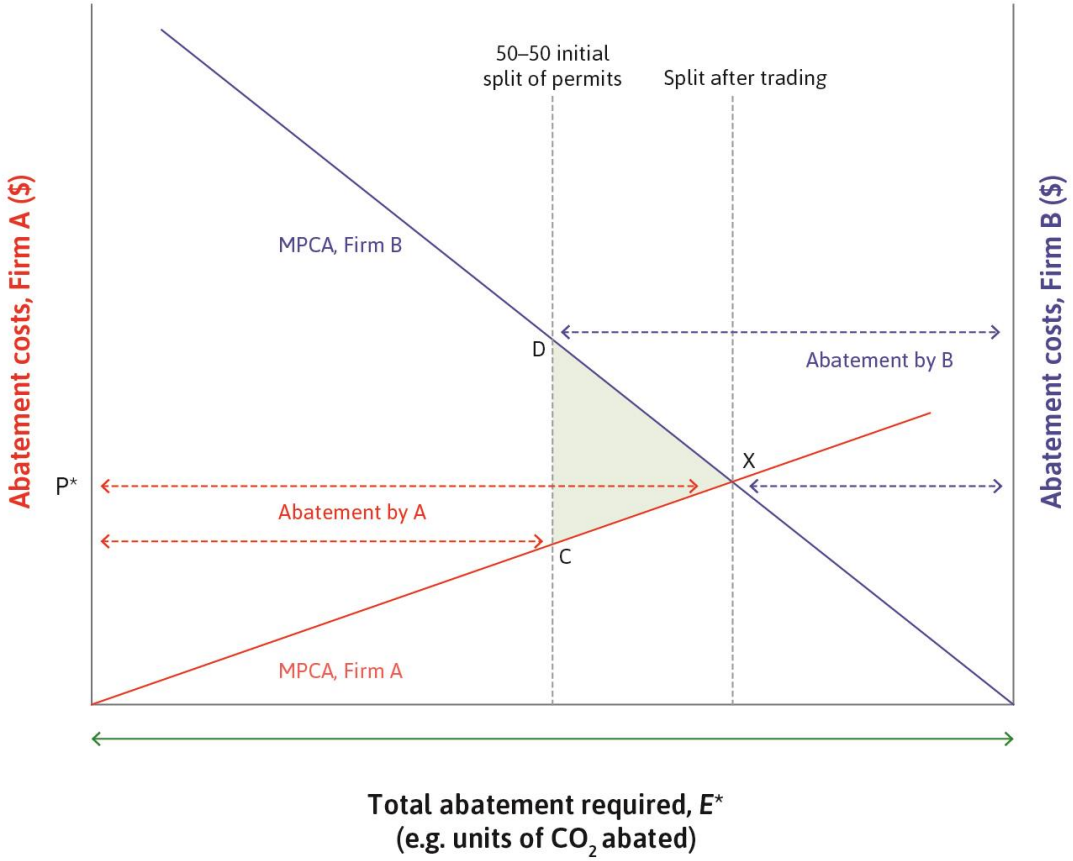
- Given that firms vary in their production technologies, how will the total amount of required abatement be divided among them?
- The objective of a scheme for trading permits is that the abatement should be done by the firms for which this is least costly, because this saves scarce resources that can be used elsewhere.

Cap and Trade: Model

Firms trade until permit price = MC of abatement (Pareto-efficient outcome, because we cannot improve the situation of one agent without deteriorating the other's).

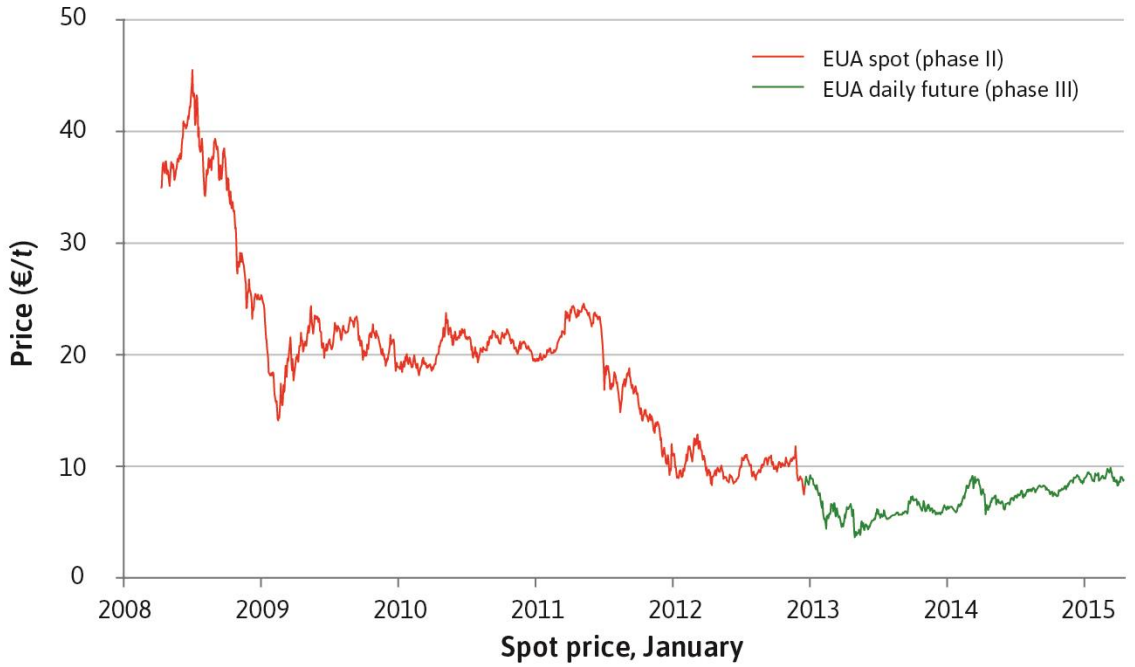
Figure: The Government emits permits compatible with the total abatement required (horizontal axis). At the initial split of permits (points C and D), firm B has a higher marginal private cost of abatement (MPCA) than Firm A, so there is room for B to pay A to abate more (and B less), since B is willing to pay more for that than A demands.

- Both firms benefit from buying/selling permits until the MPCA is equalized across firms (benefit = triangle area). The point where they equalize is the equilibrium price in the market for permits.
- In this way the objective of cap and trade (that abatement is done by the firms for which this is least costly) is attained.



Cap and Trade: Issues

- Policymakers need to set the correct total level of abatement (the cap) – not easy to determine
- Putting a price on pollution may send the wrong signal to firms (e.g., making pollution profitable)



Example: EU Emissions Trading Scheme set too large a cap. The price of polluting permits fell dramatically after the 2008 crisis, associated with this large supply and also with lower electric power demand due to the economic crisis, providing little incentive to abate (because the price of polluting was low).

- A price floor on permits can mitigate this issue

Measuring environmental costs/benefits

1. **Contingent valuation:** Use surveys to assess the value of nonmarket resources

- This is a **stated preference** approach - assumes respondent's statements indicate their true preferences

2. **Hedonic pricing:** Uses prices of market goods to infer the economic value of unpriced attributes (e.g., environmental qualities)

- This is a **revealed preference** approach – uses behaviour as an indication of preferences

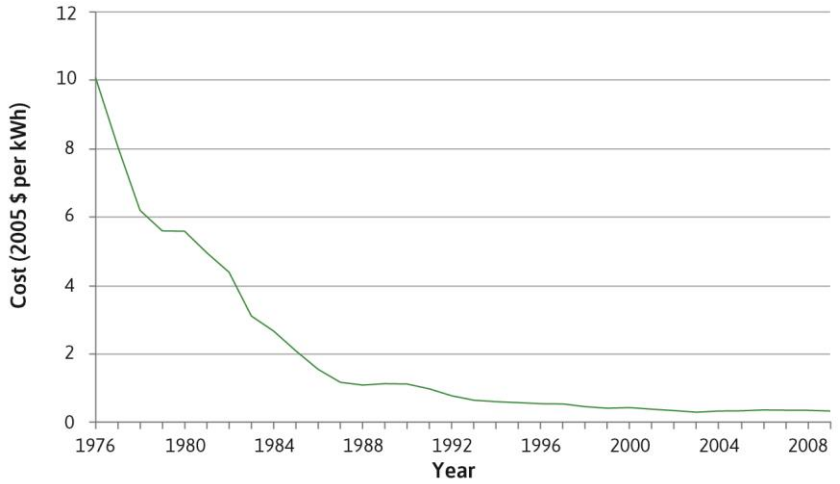
Effect of technological improvement

Technological improvements may make abatement more efficient (increase the marginal productivity of abatement expenditure) or reduce the environmental costs of consumption.

Example: Renewable energy production

Innovation rents can drive progress, leading to technological breakthroughs that deliver substitutes for non-renewable resources.

- Subsidies to firms that produce solar panels have helped fund R&D in alternative energy sources.
- Growing demand for solar panels led to a sharp decrease in their price, thanks to **learning by doing** in the production process.



Taxing firms

Taxes can create innovation rents by changing relative prices, which promotes private-sector innovation.

Example: Without a tax, the coal-intensive technology is cheaper, but a tax on coal makes solar-intensive technology cheaper.

Taxes on firms may make renewable sources of energy relatively more profitable, but also make adoption necessary to stay competitive.

Taxing consumers

Taxes can create lifestyle changes that improve well-being by changing how much consumers value goods.

Example: A tax on air travel

Taxes are not just incentives; they are also a source of information about the need to change behaviour.

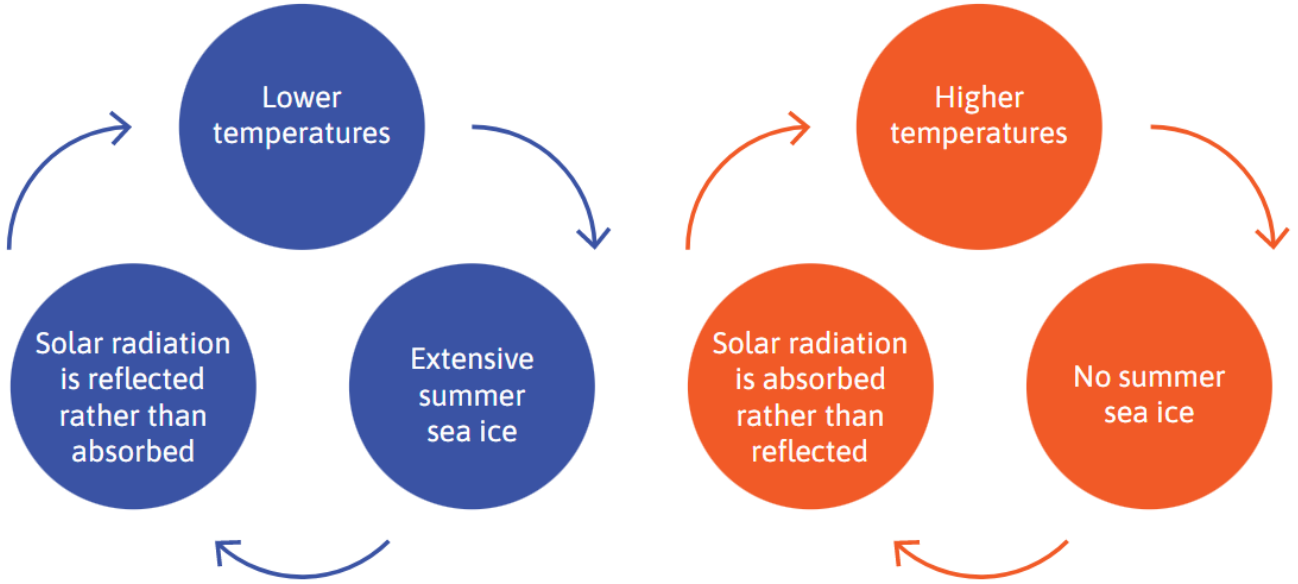
Modelling environmental dynamics

A healthy environment and degraded environment are both possible equilibria of this game.

- On one side, processes of environmental degradation are self-limiting.
- On the other side, they are self-reinforcing.

Example: Arctic sea ice

There are two stable equilibria (a lot of ice or no ice).



Extensive summer sea ice

virtuous cycle

No summer sea ice

vicious cycle

Addressing climate change: Challenges

Addressing climate change is difficult because:

1. People may value the economy more than the environment
   - Lack of adequate information and conflicts of interest
2. Future generations are unrepresented
   - **Discounting**: how much should we value the costs/benefits of our actions on future generations?

3. Requires international cooperation (Prisoner's Dilemma)

Prisoner’s Dilemma

- A prisoner’s dilemma is a game that illustrates the existence of conflict between private interests and social or group interests. In this game the equilibrium (solution) is “bad”, in the sense that each player/economic agent will pursue his/her own interests, at the expense of the community.
- It applies to many real-life situations, namely in the environmental field.

Win-win policies

However, there is not always a tradeoff between consumption and environmental quality.

Some technologies are cost-saving (e.g., fuel-efficient vehicles; insulation in houses).

Additional Reading

- https://mpra.ub.uni-muenchen.de/106340/1/MPRA_paper_106340.pdf
- https://www.ft.com/content/d666b9a8-f2a9-4a51-9c85-fb4223c556b0?accessToken=zwAAAX1l0NlUkdPWZrmo8qlKUdOchftCI8VWsAE.MEYCIQCAVtCZurThqq5yepLVS0f3e13kyLki0yhXx1Rm_PWO4wIhAKbIRHAto4Bn9srPysc8i-rZVjOsdQi8lZ49Q8DJ-vAt&segmentId=d666b9a8-f2a9-4a51-9c85-fb4223c556b0
- https://www.economist.com/leaders/2021/10/30/why-the-cop26-climate-summit-will-be-both-crucial-and-disappointing