Environmental Economics

Prof. Philippe Thalmann

EPFL ENAC LEUrE

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PUBLIC GOODS

Motivation (1)

- UNFCCC article 3 Principles: ‘The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their **common** but differentiated **responsibilities** and respective capabilities.’ *(emphasis added)*
- Ban Ki-moon, UN secretary general: ‘Climate change does not respect border, it does not respect who you are − rich and poor, small and big. Therefore, this is what we call global challenges which require global solidarity.’ (Remarks at "Momentum for Change" Initiative, Durban, 06 December 2011)

Motivation (2)

Carbon Conundrum: The Biggest Market Failure Facing Climate Change

Global warming, as described by Nicholas Stern in his landmark report, is one of the biggest market failures the world has ever seen. This article will delve into the carbon conundrum, examining the root causes of this failure, its impact on climate change, and potential solutions to address it.

Understanding the Carbon Conundrum

The carbon conundrum refers to the persistent market failure that allows the emission of greenhouse gases, primarily carbon dioxide (CO2), to go unchecked. This failure is a result of three main factors:

- Externalities: The social costs of emitting CO2, such as damage to the environment and health risks, are not reflected in the market price.
- Public goods: The atmosphere is a shared resource, and its preservation is a classic example of a public good, which markets struggle to provide efficiently.
- Lack of property rights: There is no clear ownership of the atmosphere, making it difficult to assign responsibility and manage emissions effectively.

https://economatik.com/news/1219130/carbon-conundrum-market-failure-and-climate-change

So, what is a ‘public good’?

Two properties characterise public goods:

- Exclusion, e.g. for non-payment, is impossible or very costly
- There is no rivalry between users, i.e., an additional user does not diminish the good for the other users, or adding one user causes no extra cost

Types of public goods

	Exclusion is possible	Exclusion is impossible
Use is rival	**Private goods** e.g. food, dwelling	**Common goods** e.g. fishing grounds, oil fields
Use is non-rival	**Impure public goods** e.g. radio or TV broadcasts, internet, public transportation	**Public goods** e.g. knowledge, national defence, street lighting, clean air, road network, fireworks, lighthouse

These properties are not absolute:

- When its capacity limit is attained, a non-rival good becomes rival, e.g. congested public transportation or roads
- Technical innovation can render exclusion possible, e.g. signal coding for broadcasts or road use recording
- Non-exclusion (free access) could be the owner's choice, or the result of undefined ownership (absence of property rights)

How is the global climate a public good?

- By ‘global climate’, we mean the relatively stable climatic conditions that prevailed over the last thousand years during which Humanity thrived
- One person’s or country’s enjoyment of its local climate does not alter the local climate of anyone else (non-rivalry) and no one can be excluded from enjoying their local climate which is part of the global climate (non-excludability)
- Altering the global climate alters everyone’s local climate
- The public good can also be seen as the ability of the earth-sea-atmosphere system to absorb our greenhouse gas emissions without damage; unfortunately, this capacity is limited (cf., planetary boundaries)
- Even adaptation to climate change can be construed as a form of public good, as is prevents a public bad, namely mass migration

Implications of non-excludability

- Free riding: if there is cost of providing the good but non-payers cannot be excluded from using it, how do you share this cost?
- For this reason, public goods are generally provided by the public sector (power of taxation); NB: not all goods and services provided by the public sector are public goods as defined here
- Free riding is generally exaggerated: there is a lot of voluntary donation (but not enough)
- Therefore, organisations benefiting from voluntary contributions can also provide public goods (e.g., Sierra Club or B&M Gates Foundation)
- Private organisations can provide public goods with financial support from the public sector, generally in exchange for a mission and oversight

Optimal quantity of a non-rival good

Rival good	Non rival good
Every consumer can consume a different quantity	Every user uses the same quantity (potentially)
Aggregate demand or WTP is obtained by ordering the marginal WTP of the consumers in decreasing order → horizontal addition of mWTP (demand)	Total WTP is the vertical sum of the WTP of the users
To find the optimal quantity, compare the marginal cost with the highest mWTP that is not yet satisfied	To find the optimal quantity, compare marginal cost with the sum total of all users' mWTP
Quantity is optimal when the mWTP of the last served consumers equals the marginal cost for that quantity	Quantity is optimal when the sum of mWTP of all users equals marginal cost for that quantity
Every consumer's mWTP equals the marginal cost (price): same mWTP, but different total WTP for the different quantities consumed	Every user can have a different WTP for the proposed quantity, both at the margin and in total
The price plays a central role in allocating the good, making sure that total demand = supply	No allocation role for a price, as the quantity is the same for all anyway and no user should be excluded
The consumers' WTP are revealed by their response to the price	WTP must be revealed through another mechanism than price

Covering the costs of a non-rival good

- Many non-rival goods are produced with essentially a fixed cost and little variable (i.e. user dependent) cost; e.g. a bridge or tunnel, a national park; to decide whether it should be built, compare its fixed cost with total users' WTP: but first, define optimal size, see above
- To collect this total WTP to cover the costs, one would have to charge different prices to different users
- No one should be excluded from using a non-rival good, so its price should be sufficiently low that it lies below every potential user's WTP for the use of the good; this often means that the good should be made available for free
- In periods of congestion, a positive price should be charged
- Provided that exclusion of non-payers is possible…

Other implications of non-rivalry and non-excludability

- Charles Tiebout (1956): municipalities propose bundles of public goods with a price tag in the form of a municipal tax schedule; people can choose bundles that suit them best by moving (‘voting with their feet’)
- Shared responsibility: one user degrading the good degrades it for all users
- Non-excludability can lead to overuse (congestion), transforming a non-rival good into rival
- Non-excludable access to a common resource can lead to its overuse and possible extinction (‘tragedy of the commons’)

The tragedy of the commons

- Garrett Hardin (1968). The Tragedy of the Commons. Science 162, 1243–1248
- In his much cited parable, Hardin described overgrazing of a pasture open to all: Every herdsman would try to maximize his cattle because he benefits from the full products of every additional animal while he shares the costs of overgrazing with all the other herdsmen; since every herdsman reasons in the same fashion, the tragedy unfolds, the herdsmen cause their own ruin by following implacable economic logic
- Hardin used his parable to illustrate his view of the "population problem" and his conclusion is very politically incorrect: "The only way we can preserve and nurture other and more precious freedoms is by relinquishing the freedom to breed, and that very soon." Only China really implemented this recommendation...
- With his "Tragedy of the Commons" article, Hardin challenged at least two widely held views:
  - that there exists a technical solution to every problem (in a demonstration published in one of the most eminent science journals!)
  - that the "invisible hand" of Adam Smith would always coordinate the actions of optimizing decentralized individuals to generate the greatest common good

Solutions out of the tragedy

Elinor Ostrom (1990). Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge, UK: Cambridge University Press

- Elinor Ostrom was awarded the Nobel Memorial Prize in Economics in 2009 for having demonstrated through studies in many fields that very diverse communities were or are still able to well manage a common resource by setting up and respecting formal or informal institutional arrangements
- It is not simply a question of private or state property rights, but of genuine pooling, with cooperation and shared responsibility
- She even demonstrated that these arrangements work better than private or state ownership
- Of course, this only works when the community can control the resource…

Public goods and external effects

- Fireworks are a public good because non-rival and no possible exclusion
- The author of the fireworks creates external benefits (and costs) for everyone nearby
- These external benefits should be added to her personal benefit, just as the mWTP are added up to determine the optimal supply of any non-rival good
- More generally, the provider of a public good for which she is not charging a price covering its costs creates an external benefit for the users of this good
- The policy response is to subsidize the provider of a good that benefits many users, which amounts to privatizing a public good (private fireworks with subsidy or public fireworks)
- When the use of a public good is excessive, causing congestion or depletion, every user has an external impact on the other users

What does this imply for international climate policy?

- Consider the biosphere as a reservoir for our GHG emissions (oceans, biomass)
- Until now, about ½ of the CO_2 released by Humanity was absorbed by the reservoirs and ½ remained in the atmosphere
- The rising concentration of CO_2 and other greenhouse gases (GHG) has warmed the planet by about 1.5°C
- It does not matter by who or where the GHG are released, they disseminate quickly in the atmosphere and affect the climate everywhere
- Hence, everyone must reduce their emissions
- Problem: pollution havens and race to the bottom

Example for discussion: what size for a forest?

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How to assess the WTP for forest services?

- Ecosystem and protection services: cost of alternative provision
- Landscape: property prices and rentals, room rentals in hotels
- Leisure activities in forest: survey, travel cost method