Economic Instruments and Carbon Markets

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Content

• Different environmental markets, different issues
• Different policy choices and criteria for selection
• Externalities
• Economic policies for renewable energy and climate change
• Carbon markets
Different markets for environmental protection

• Carbon markets
• Fisheries
• Habitat banking
• Hunting black rhinos, walruses etc.

• Different practical, ethical implications
A variety of policy instruments

• Command and control (*emission standards, liability rules, trade restrictions, criminal sanctions, ...*)
• Fiscal incentives (+/-) (*pollution taxes, tradable pollution permits, subsidies, ...*)
• Voluntary agreements (*negotiated agreements, environmental reporting, EMS, product labelling,...*)
• Information based strategies (*education, public information, awards, recognition, social sanctions, ...*)
• Public Infrastructure
Instruments, energy and climate

- CO2 tax
- EU-ETS, CDM, JI etc.
- Energy labelling (mandatory and voluntary)
- Eco-labeling
- Information reg. standby, savings, behaviour
- Mandatory energy efficiency requirements for buildings, cars, TVs, fridges/freezers etc.
- Subsidies for heat pumps, fridges/freezers etc.
- Public procurement, use of LCC
- PFE: industry energy plans and investments
- Licensing and supervision
- Planning/infrastructure
- Etc.

How do they rate in terms of effectiveness, cost-efficiency, acceptability and distributional effects?
Criteria for design & selection of instruments, & evaluation

- **Effectiveness** (goal-oriented, enforceable)
- **Efficiency** (efficiency, cost-efficiency, cost-effectiveness)
- **Wider economic effects** (e.g. distributional effects)
- **Fit into political, institutional and legal structures**
- **Political acceptance** and other considerations (justice, politics, trade, individual rights, democracy, etc.)
- **Monitoring**
- **Transparency**
- **Soft effects** (e.g. attitude changes, awareness, information exchange)
- **Innovation potential?**
What is an Externality?

When a person/firm does something that affects the interests of another person/firm/society without affecting prices = market failure.

NEGATIVE
• Over-grazing
• Pollution
• Traffic/telephone/internet congestion
• Climate Change

POSITIVE
• Bees make honey to benefit beekeepers but also provide pollination services
• Education of individuals

A *positional externality* occurs when the action alters the relevant context of an existing positional good. Example: suits worn to a job interview, educational degrees.
Why is this a problem?

An externality implies:

Social Cost $\neq$ Individual Cost

Social Benefit $\neq$ Individual Benefit

The incentives for the individual are not what society wants them to do.

As a result:

- too much of socially costly goods are produced
- too little of socially beneficial goods are produced.

= RESOURCES ARE NOT USED EFFICIENTLY
An Example: One Polluting Supplier of Coffee

Demand for Cups of Coffee

= Marginal Social Value for Coffee
Private Equilibrium determined by private costs and demand

Quantity of Coffee

Price

Marginal Private Cost

Marginal Social Value
Suppose the social costs of coffee production were higher than the private costs (a negative externality)
Consequences

• Too much coffee is produced.
• The price so coffee is too low and does not reflect its true costs of production.
• The market economy does not give the right price signals
• Resources are not used in an efficient way
A 2004 Chinese report examined the environmental and social impacts of coal from exploration, extraction, transportation to comprehensively calculate the external costs of coal. They found the total external costs of coal reached RMB 1745 billion in 2007, equal to 7.1 per cent of China’s GDP for the same year.

A 2007 study lead by Harvard University also examined the full life cycle of coal. The authors found about US $345 billion a year in externalities not borne by mining companies or utilities, including health problems in mining communities and pollution around power plants.


http://solar.gwu.edu/index_files/Resources_files/epstein_full%20cost%20of%20coal.pdf
Pricing Externalities

• Pigou was one of the first economists to study externalities
• He points out the social benefits of forcing companies to pay for the costs of their pollution
• He is credited with developing a tax system for internalizing costs external to the market – called a “Pigouvian Tax”

Pigouvian Tax = A tax equal to the value of the external cost

Pigouvian Subsidy = Payment equal to the value of the external benefit

Underlying concept: if market prices correspond to true prices, society is better off
Co-benefits of climate policy – lessons learned from a study in Shanxi, China

Kristin Aunan, Jinghua Fang, Haakon Vennemo, Kenneth Oye, Hans M. Seip
Who should pay the price?

Polluter Pays Principle
(Recommendation adopted by OECD in 1974)

"The polluter should bear the expenses of carrying out the measures ... to ensure that the environment is in an acceptable state ... the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption"
Other Market based and Economic Instruments

- Pigou’s idea was further developed by Coase, who showed that allocating property rights and allowing trade can yield efficient results.
- In 1968 Dales proposed the idea of a typical “cap and trade” scheme: the government issues a total number of permits which give firms the right to emit pollution to a certain level – the “cap”

-> Further development of:
- Tradeable Emission Permits,
- Tax-neutral Charges & Fees
- Green Tax Reform
Market Based and Economic Instruments

Aldy & Stavins reading explores different types and designs of MBIs for carbon, including:

• Carbon taxes (e.g. Swedish carbon tax)
• Cap and trade systems (Kyoto trading, EU ETS)
• Emission reduction and credit systems (CDM & JI)
• Clean energy performance standards with credits (Green Certificates)
• Eliminating fossil fuel subsidies (big discussion item at COPs and RIO +20)
Cap and Trade versus Tax

• Government and market both play a role.

• Two main variables to consider:
  o PRICE
  o QUANTITY

• Cap and trade: Quantity certain (cap) at desired level, price determined by market (uncertainty)

• Carbon tax: Price certain (tax) at calculated level and quantity determined by market (uncertainty)

• Hybrid: cap and trade with some prices set (either floor or ceiling (safety valve), or both (price collar)
Carbon Taxes

• Often with exemptions or different levels
  o Carbon leakage issue relevant to any environmental pricing

• Often not politically feasible
  o Some countries have a hard time with “taxes” in general (e.g. USA)
  o Some taxes end up including many exemptions and a low price but still can’t get passed into legislation (e.g. NZ first proposed tax)
  o Carbon taxes have been the political death of some politicians (e.g. in Australia)
More complicated: the government

- The regulator has to find out the estimated cost of abatement from firms, only has estimates of benefits.

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More complicated: the firms

- Firms have an idea of their costs, but will they disclose transparently to the regulator? Why or why not?

From: http://economics.kenyon.edu/corrigan/pollutiongame/
Cap and Trade: the SO$_2$ in the US: the success story

**Traditional Approach: 30% Mandatory Reduction**

- **Plant A**
  - Before: 600 tons
  - After: 420 tons
  - Reduced: 180 tons

- **Plant B**
  - Before: 400 tons
  - After: 280 tons
  - Reduced: 120 tons

**Total Emissions Reduced:** 300 tons
**Cost to Reduce:** $12,000

**Flexible Cap-and-Trade Approach**

- **Plant A**
  - Before: 600 tons
  - After: 500 tons
  - Reduced: 100 tons

- **Plant B**
  - Before: 400 tons
  - After: 200 tons
  - Reduced: 200 tons

**Permits Payment**

**Total Emissions Reduced:** 300 tons
**Cost to Reduce:** $9,000
To promote Renewable Energy

- **Green certificates**
  Tradable certificates in renewable "green" energy

- **Feed-in Tariffs**
  A legal obligation on utilities to purchase electricity from renewable sources. The government regulates the tariff rate.

- **Subsidies**
  Encourages adoption of renewable energy by subsidizing the cost to pay for the benefit of avoided pollution. Such a subsidy of a positive externality can be considered a "negative Pigouvian tax”

- **Production/Investment Tax credits**
  Encourages adoption of renewable energy by giving tax credits to eligible renewable energy projects

Thanks to Lars Hansson for the following slides with Swedish examples
Sweden has a quota model, which requires utilities to supply fixed levels of renewable power or buy tradable credits to make up the difference.
The Swedish Electricity Certificate System

The system was introduced in May 2003 with the purpose to increase renewable electricity production in Sweden by **17 TWh to year 2016** relative to production in 2002
Renewable generation in the electricity certificate system (excluding peat), 2003-2010, in TWh
The Swedish Electricity Certificate System

In 2010 the Swedish Parliament decided to increase the production of electricity from renewable sources from 17 TWh to 25 TWh in 2020 relative to production in 2002.
Electricity Price (Nord Pool)
The Electricity Certificate Price

(2003-2011)
The production costs for electricity in Sweden without MBI

(EMISSION TAXES, GREEN ELECTRICITY CERTIFICATES, ETC.)

Production cost with coal: 44

Production cost with wind: 68
The production costs for electricity in Sweden with MBI

Green Taxes

Production cost with coal

MBI stimulation

Production cost with wind
Production costs for electricity

- Wind: 53
- Coal: 55
- Wind: 43
- Coal: 63
- Wind: 83
- Coal: 59
- Wind: 68
- Coal: 44

Without MBI
Costs for District Heating in Sweden (1999)
- NOx charge
- Congestion charge
- Vehicle registration charge
  - Old passenger cars pay a fee related to the weight of the vehicle.
  - New passenger cars (registered after 1 October 2006) pay a basic fee plus 15 SEK per gram CO$_2$ for emissions exceeding 100 gram/vkm
Global GHG abatement cost curve beyond business as usual – 2015

Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO₂e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

Source: Global GHG Abatement Cost Curve v2.0
Brief history of International Climate Change Policy

World Climate Conference Adopts climate change as major issue

IPCC releases its First Assessment

UNFCCC after 15 months of negotiation

Toronto Conference on the Changing Atmosphere/ IPCC established

First negotiation session of the United Nations Framework Convention on Climate Change (UNFCCC)

UNFCCC came into force

The Kyoto Protocol is adopted at COP3

Why not just ban greenhouse gases?

In a modern economy, nearly all aspects of economic activity affect greenhouse gas—in particular, carbon dioxide (CO2)—emissions, and hence the global climate. – Aldy & Stavins
KYOTO PROTOCOL
“Flexible mechanisms”

JI - Joint Implementation
> Emission reduction projects implemented jointly between Annex I countries (developed countries and transition economies).

   ➢ ERUs (Emission Reduction Units) can be used by the project investor to meet its own commitments, or sold on the open market.

CDM - Clean Development Mechanism
> Allows public or private entities to invest in greenhouse gas (GHG) mitigating activities in developing countries.

   ➢ CERs (Certified Emission Reductions) can be used by the project investor to meet its own commitments, or sold on the open market.

ETS - Emissions Trading System
> Can be used as supplementary to actions to meet reduction commitments.

   ➢ One AAU (Assigned Amount Units) represents the tradable right to emit one t CO2eq.
KYOTO PROTOCOL
“Flexible mechanisms”

Key features:

• Offer industrialized (Annex-B) countries an opportunity to accomplish cost-effective reductions of GHG but should be supplemental to domestic action (Art 17)

• Additional provisions for Annex-B countries.

• Promote sustainable development through technology transfer and investment

• Encourage private sector and developing countries to contribute to climate change mitigation
KYOTO PROTOCOL
“Flexible mechanisms”

Eligibility requirements:

• Must have ratified the Kyoto Protocol

• Must have calculated their assigned amount, in terms of tonnes of CO2-equivalent emissions

• Must have in place a national system for estimating emissions and removals of GHG within their territory

• Must have in place a national registry to record and track the creation and movement of ERUs, CERs, AAUs and RMUs and must annually report such information to the UNFCCC secretariat

• Must annually report information on emissions and removals to the UNFCCC secretariat
Clean Development Mechanism

Distribution of CERs issued by Host Party
Total number of CERs issued: 1,400,387,921

Year of date of issuance
Data as of 31 Oct 2013
Source: UNFCCC

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CDM and JI Criticism

• Moral hazard. Developing country governments have an incentive not to impose emission regulations to attract CDM instead.

• “Hot Air” projects that do not represent additionality.
  o E.g. no new projects for burning off of the refrigerant gas HFC-23 are accepted because the windfall credits it generated had created an incentive to set up chemical factories for the sole purpose of burning HFC-23 (one ton of it fetched 12,000 CO2 credits)
  o Some Eastern European countries have soft Kyoto targets and can “launder” their excess AAUs by converting them to ERUs and selling them

• Project participants have an incentive to design their projects so that they just, at the margin, fail to be economically sensible without the support of carbon finance.

• Transaction costs can be high
Points of Contention

- Economic impacts
- Role of carbon sinks
- Limit on amount of emissions to be traded
- “Supplemental” issue
- Non-participation countries in binding commitments (USA, Canada, New Zealand...)
- Developing countries face no legal targets (e.g. China & India)
- Carbon leakage
Cost Effective Global Emission Reductions

1. Harmonized domestic taxes or a uniform international tax.
2. System of international tradable permits (e.g. Kyoto Protocol’s Annex B emission targets and the Article 17 trading mechanism).
3. Decentralized system of internationally linked domestic cap and trade programs.

-- Aldy & Stavins, 2012
The World’s Carbon Markets

A CASE STUDY GUIDE TO EMISSIONS TRADING

ASIA UPDATE: Ahead of Carbon Forum Asia, IETA and EDF have provided updated case studies for the Asia-Pacific region. The updated case studies are available by clicking the map above or using the links to the right of the page.

Even as the outcome of the international climate discussions remains unclear, policymakers in a growing number of countries are adopting and implementing market-based measures to limit carbon pollution. Programs already in effect include the European Union Emissions Trading System (EU ETS), the Australian Emissions Trading System (carbon pricing and offsets market in 2012, full emissions trading in 2015), the New Zealand Emissions Trading System (NZ ETS), the Regional Greenhouse Gas Initiative (RGGI) in the Northeastern United States, the California Emissions Trading System (CA ETS, which conducted its first auction in November 2012 for the 2013 first year of coverage), and the Tokyo Emissions Trading System (Tokyo ETS). Others stand on the verge of commencing operations, including Québec (2013) and the Republic of Korea (2015). Sub-national jurisdictions that have considered, or are now examining, emissions trading legislation or regulations as part of a national carbon trading pilot program include Chinese provinces (Hubei and Guangdong) and cities (Beijing, Tianjin, Shanghai, Chongqing, and...
Allocation

• In terms of environmental effectiveness it does not matter, HOWEVER, it matters for fairness and distribution.

• Three ways of allocating units
  o Free allocation based on past emissions
  o Output-based allocation based on an allocation proportional to the current output level. – also called intensity based. (e.g. it provides x allowances per tonne of steel produced, y quotas by MWh, etc).
  o Auctioning

• It makes a difference if sectors are sheltered from international competition (e.g. power generation) or are trade exposed sectors (i.e. if they can’t pass on prices to consumers)
  o In the sheltered sectors, auctioning is definitely preferred. If they are given free allocation they may still pass on cost (as an opportunity cost) resulting in higher electricity prices. The result is also higher corporate profits from the free allocation of allowances = “windfall profits”
  o In the exposed sectors, free allocation is worth considering to reduce threats of carbon leakage, though auctioning is still preferred.
Allocation and carbon leakage

• If producers cannot pass on the price of carbon, it is probably because they cannot raise prices and remain competitive in a market where there is no charge (or less of one) for carbon.

• They are considered “trade exposed” and there may be a risk of carbon leakage.

• Carbon leakage: occurs when there is an increase in carbon dioxide emissions in one country as a result of an emissions reduction by a second country with a strict climate policy (i.e. a polluting firm moves from one country to another)

• Free allocation is often argued as necessary to prevent this.
Allocation and windfall profits

Why do producers who can pass on the price do so even if they receive free allocation?

Consider the decision that must be made by a producer who did not receive enough free permits to cover all of the pollution he or she would have otherwise emitted. The y must either:

1. buy a permit from another polluter in the market
2. undertake costly abatement activity (e.g. increasing conversion efficiency at an electricity plant),
3. cut production output.

• Option 1 or 2: if they are going to sell the units they produced without losing money, they will have to raise the price of the output. Because prices are set at the margin (i.e., the price of the last unit sold in a market is the price that all units sold receive), the price of all output from all producers will increase by the same amount.

• Option 3: Like any other reduction in supply, this will cause prices to rise. Again, because all units will sell for the same price, this price increase will also accrue to units sold with the benefit of free allocations.

In all three cases, producers who receive free permits will price their output exactly as if they had received no free permits.
Banking and borrowing

• The possibility of carrying over emissions allowances from one compliance period to the following period is known as banking

• Examples?
  o Banking was not possible in the first compliance period of the EU ETS but is now possible in subsequent compliance periods.
  o Most ETS have the banking option

• Banking is worthwhile if increased prices for emissions allowances are expected or to hedge against future price changes.

• Borrowing from future commitment periods is generally not allowed in ETS
EU Trading Scheme

- Decision for trading scheme largely influenced by international negotiation crisis and Kyoto market
- Failure of carbon tax first
- Policy entrepreneurs and networks
- Compromise short term for long term (feasibility /flexibility / lower cost / environmental effectiveness)
- Start long term investment signals
- Start a trend

Braun, 2009; Ellerman, Convery, de Perthius, 2010
EU ETS

• Positive

• EU ETS continues to increase stringency and transfer more responsibility to EU Commission rather than individual member states.

• Phase III: A single, EU-wide cap on emissions applies in place of the previous system of 27 national caps.

• Auctioning, not free allocation, is now the default method and will rise progressively each year.

• For those allowances still given away for free, harmonised allocation rules based on ambitious EU-wide benchmarks of emissions performance will apply.

• Wider coverage with more sectors and gases included.
Problem: Loose cap

• How do you tell?

• Why is it loose?
  o Something else results in emissions reductions (e.g. recently it is the recession. It can also be other emission reduction policies.
  o Energy and industrial companies have lobbied against a more ambitious cap. (e.g. in the EU industry lobbied against the 30% reduction target. The Commission would have liked to set a more ambitious target.
  o Industry cut more emissions than anyone ever expected and people started saving energy (harder to find a good example of this).
EU ETS outlook

- EU Commission is looking for ways of addressing. In the short-term, it has proposed ‘back loading’ = delaying auction through amendment of directive

- The six options identified by the Commission are:
  - Increasing the EU’s greenhouse gas emissions reduction target for 2020 from 20% to 30% below 1990 levels
  - Retiring a certain number of phase three allowances permanently;
  - Revising the 1.74% annual reduction in the number of allowances to make it steeper
  - Bringing more sectors into the EU ETS
  - Limiting access to international credits
  - Introducing discretionary price management mechanisms such as a price management reserve.