Technology Transfer as Commitment Device

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Motivation

- The Kyoto Protocol, the Copenhagen and Cancun negotiations have proven ineffective

- Tightening the Kyoto targets while keeping the Kyoto architecture unchanged accentuates the free-rider problem

- Technology transfers, as stipulated by Article 4 of the Kyoto Protocol, are viewed an alternative way for reducing global carbon emissions

Motivation

- Increasing energy efficiency through technological change can lead to a rebound effect

- Unconditional technology transfers do not necessarily encourage to contribute to climate mitigation

- Can we propose a mechanism, which is based on technology transfers, and which motivates parties to credibly commit to greenhouse gas abatement?

Starting Point

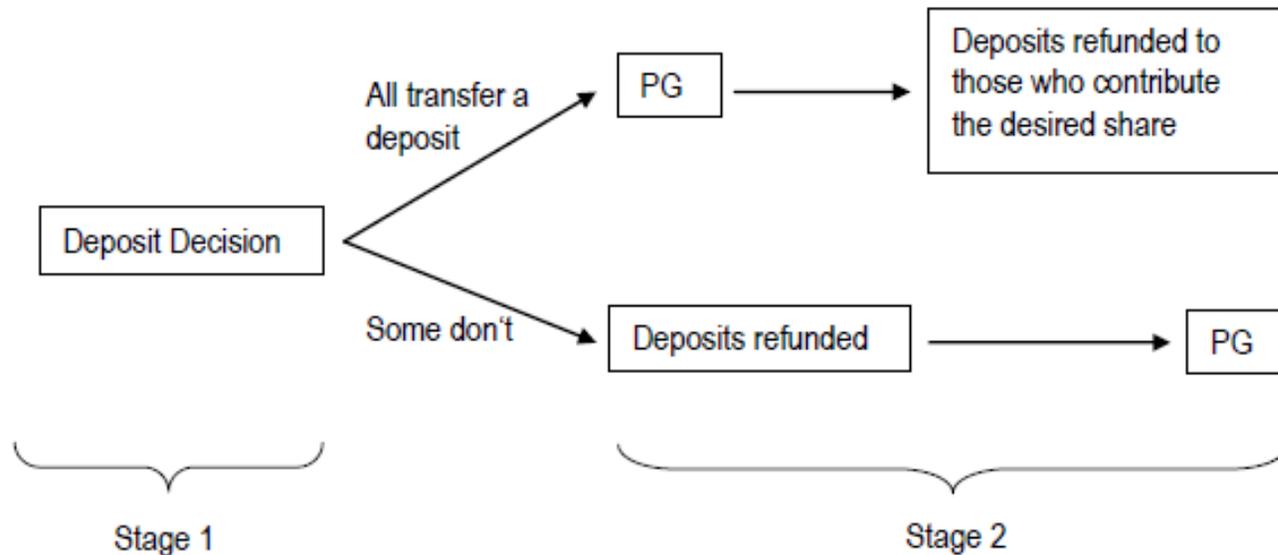Recent idea in mechanism design literature (Gersbach/Winkler 2007, Gerber/Wichardt 2009)

Figure 1: two stage mechanism for establishing optimal contribution

Budget Constraint

- The deposits must correspond to potential benefits of deviation, because in case of deviation, the loss of the deposit must cancel out the net-benefits of deviating

- Each agent must have the financial resources for covering his potential benefits of deviation

- Potential benefits of mitigation will be high in developing countries. This implies large deposits, which might exceed their financial resources

Key Features

- Two regions: NORTH, south (constraint)

- Net-benefits depend on flow of emissions E, e and technologies B, β, Δ, δ

$$\pi(e, E, \beta, \delta) = b(e, \beta) - d(e + E, \delta);$$

$$\Pi(e, E, B, \Delta) = B(E, B) - D(e + E, \Delta)$$

- Being constrained means

$$m_{max} < b(e, \beta) - d(e + E^*, \delta) - \{b(e^*, \beta) - d(e^* + E^*, \delta)\}$$

A First Modification

NORTH front-loads the payments for the constrained south

Stage 1

- Deposit south

$$m_{max} < \pi(e, E^*, \beta, \delta) - \pi(e^*, E^*, \delta, \beta)$$

- Deposit NORTH

$$\overline{M} \geq \{\Pi(e^*, E, B, \Delta) - \Pi(e^*, E^*, B, \Delta)\} +$$

$$\{\pi(e, E, \beta, \delta) - \pi(e^*, E^*, \beta, \delta)\} - m_{max}$$

A First Modification

Stage 2 (in case of cooperation)

- Refunding to the South

$$m = \pi(e, E^*, \beta, \delta) - \pi(e^*, E^*, \delta, \beta) > m_{max}$$

- Refunding to the North

$$M = \{\Pi(e^*, E, B, \Delta) - \Pi(e^*, E^*, B, \Delta)\} \leq \overline{M}$$

- This creates a participation problem.
  NORTH is doing better by not paying any deposit

The Role of Technology Transfers

- NORTH owns more efficient energy and abatement technologies, i.e., higher technology stocks

- There is no unintended technology spillover

- Costless technology transfers from NORTH to south are feasible

- Technology is a non-rival input into production and abatement
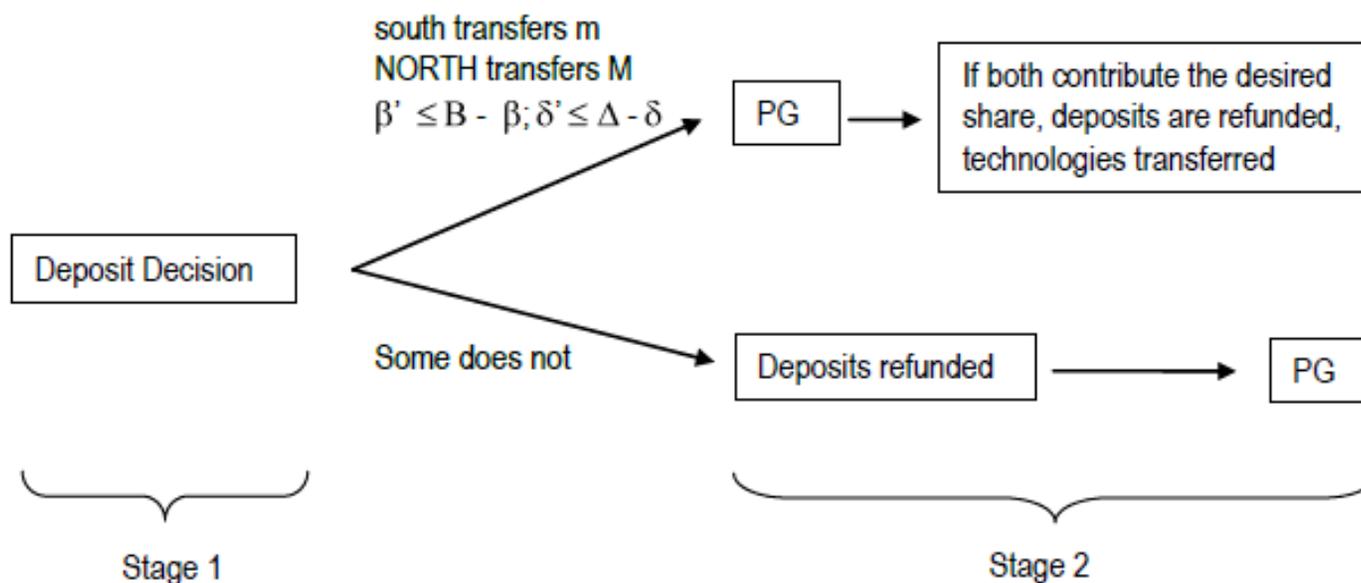
The Role of Technology Transfers

Figure 2: two stage mechanism with technology transfer

The Role of Technology Transfers

- Cooperation is a sub-game perfect equilibrium, if

$$M = B(E, B) - D(e* + E, \Delta) - \{B(E*, B) - D(e* + E*, \Delta)\}$$

$$m_{max} \geq b(e, \beta) - d(e + E*, \delta) - \{b(e*, \beta + \beta') - d(e* + E*, \delta + \delta')\}$$

- Technology transfers are sufficient such that the south's budget constraint no longer is binding

- This is equivalent to a "conditional CDM"