Enhancing Cooperation – New Challenges

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P I K

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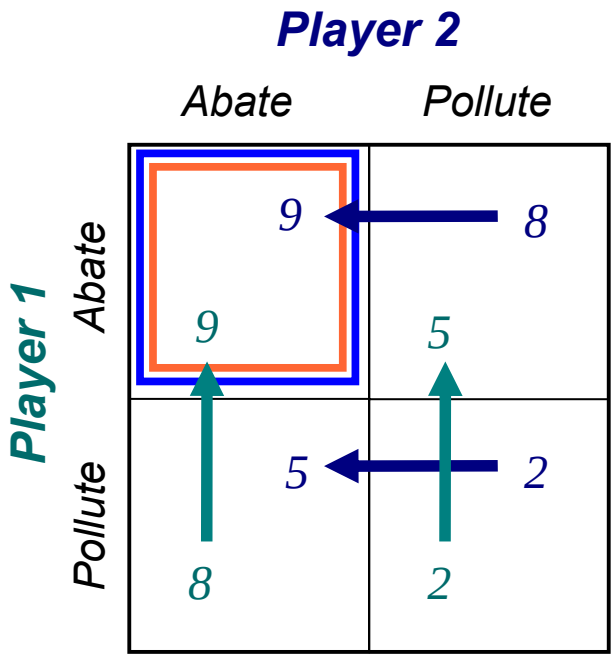
Overview

1. What is the structure of the “global warming game”?
2. Changing the rules of the game:
    a. Rewards
    b. Punishment
3. Summary and Outlook

Co-Benefits – an *Assurance Game*?



- Nash Equilibrium and Social Optimum coincide

- Attempt to create focal point on Social Optimum:
  - 'Co-Benefits of mitigation so high that unilateral abatement pays, irrespective of others' decision'

→ A mere issue of proper perception

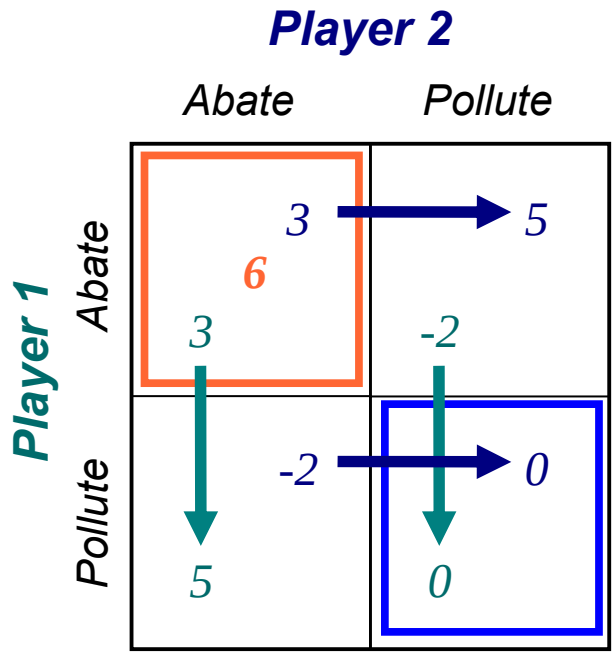
→ Co-Benefits matter, but really large enough to resolve PD automatically?

→ The Hartwell-Paper argues the climate policy should be an indirect outcome of achieving co-benefits

Public Good Provision as a *Prisoners' Dilemma*

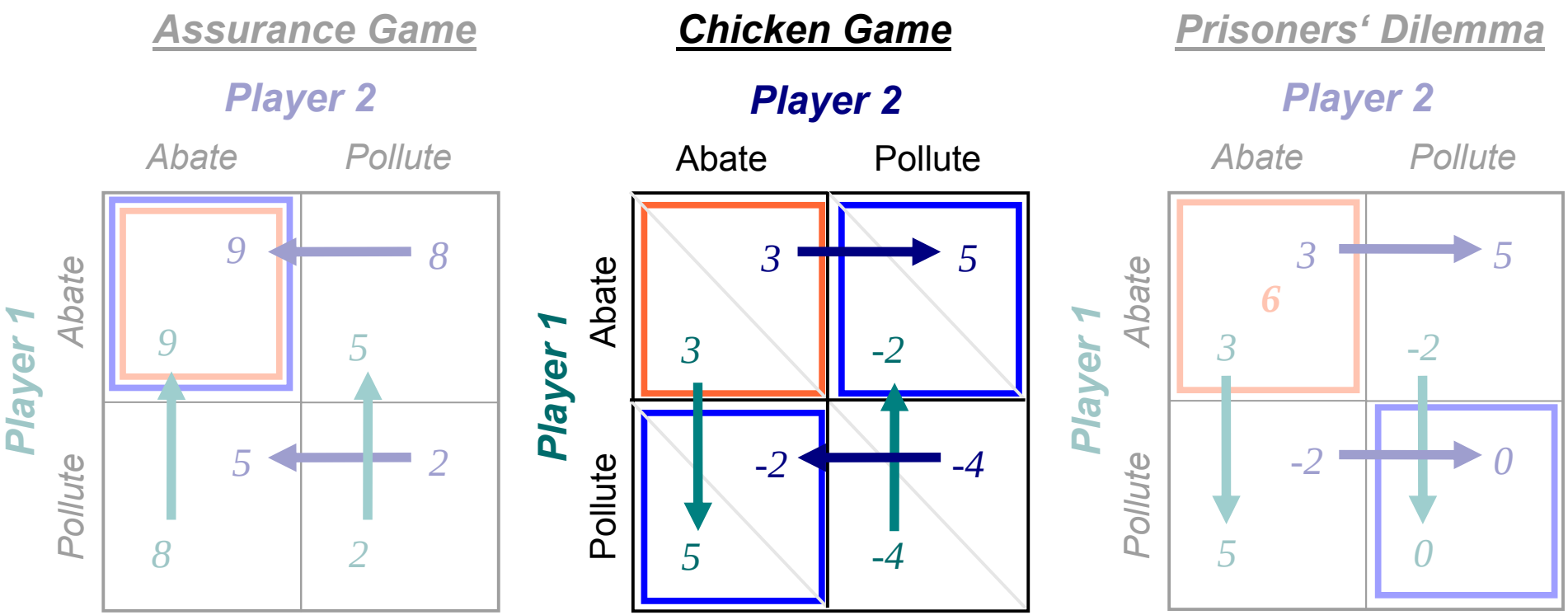
- Provision of a global Public Good:
  - (Same) benefits for every one, say e.g. *5* (*per contributing party!*)
  - (Same) costs to contribute, say e.g. *7*

- Game Structure of the ***Prisoners' Dilemma:***
  - Individual rationality for players to act selfishly
    - → Incentive to *free-ride*
    - → *Suboptimal outcome*



- If abating global warming resembles a Public Good, then climate negotiations face a Prisoners' Dilemma

Public Good Provision as a *Prisoners' Dilemma*



- *Prisoners' Dilemma (PD)* –IEA→ *Chicken Game (CG)*
  (Carraro/Siniscalco 1993, Barrett 1994)
- Chicken Game shows partially cooperative behaviour

What determines gains from international cooperation?

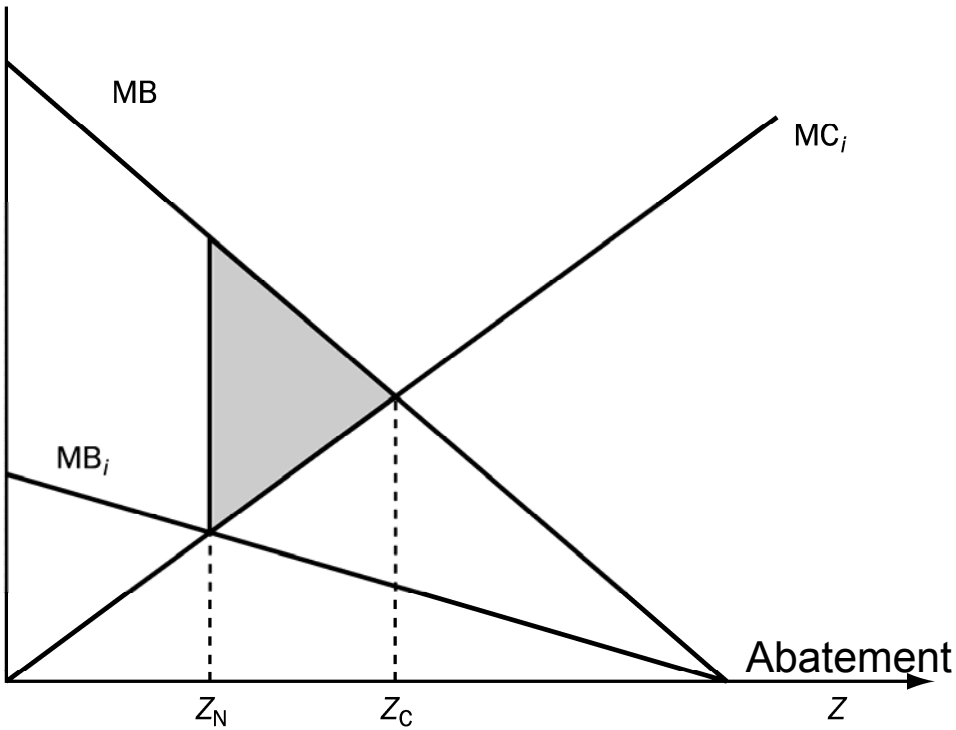


Figure 10.10 A comparison of the non-cooperative and full cooperative solutions to an environmental public good problem

Source: Perman et al. 2003

MB_i : marginal benefits for *i*

MC_i : marginal costs for *i*

MB : marginal benefits across all countries

full cooperation exceeds non-cooperative abatement

efficiency gain from full cooperation (shaded triangle)

A theory of global inaction so far?

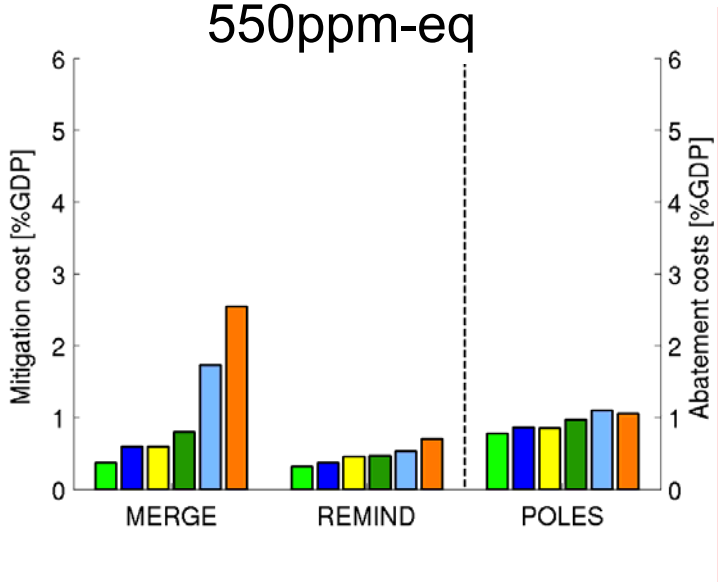
- The assurance game assumption has become popular. However, it is not justified due to the fact that it exaggerates the impact of co-benefits.

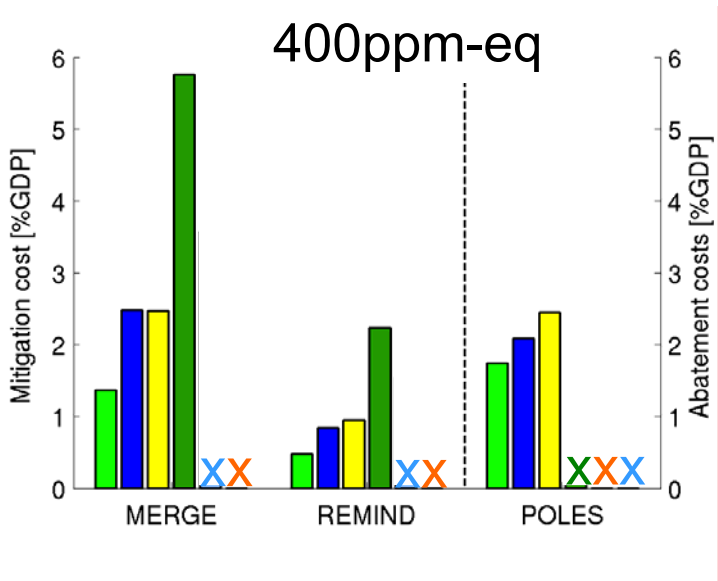
- The prisoner‘s dilemma can be transformed in a chicken game. However, the paradox of IEA is not resolved: The number of signatories to the self-enforcing IEA will be larger the smaller is the total gain to cooperation.

- Potential candidates: reciprocity, norms, issue linking, credible punishments, heterogeneity of costs and benefits across nation states, firms etc., dynamic evolution of costs and benefits.

→ *How well do we know cost, benefit of abatement and the structure of the agreement?*

More technological options reduce the costs…



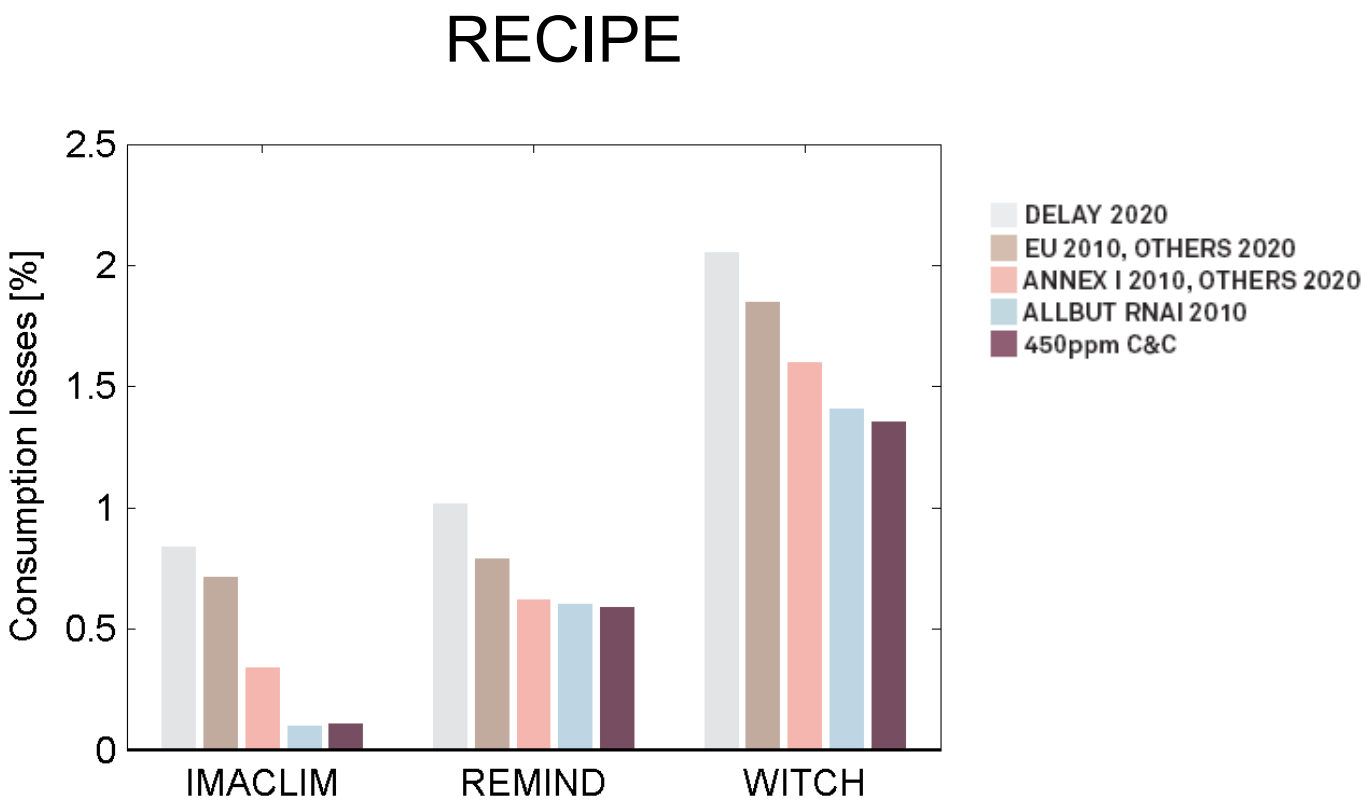


high biomass potential
with all options
no nuclear beyond baseline
low biomass potential
no CCS
no renewables beyond baseline

➔ Robust ranking of options

Knopf, Edenhofer et al. (2009)

Delayed participation increases costs…



➔ Global costs below 2.5% GDP losses for low stabilisation

➔ Costs of Delay (2030 Infeasible)

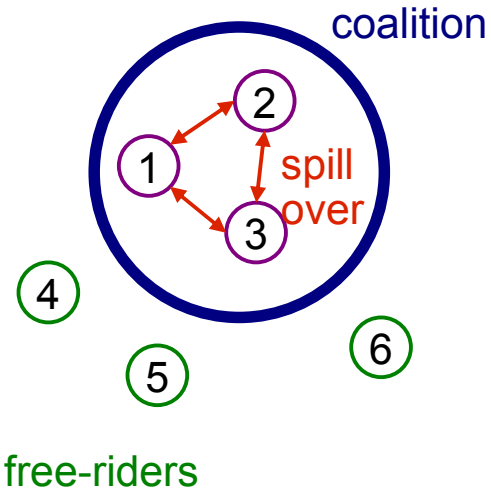
➔ Uncertainy: Refine Modeling + Need for real world experiments

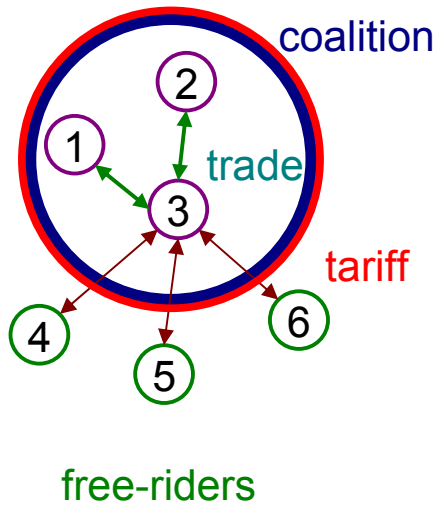
Concluding Remarks

- The impact of the risk of climate damages with potential threshold effects has to be taken into account
- The impact of technological change and delayed participation on the pay-off matrix is unclear. These aspects are not well-explored in the literature.
- The structure and the evolution of the agreement.
- A dynamic framework is needed because the impact of increasing damages and change costs due to technological change and delayed participation on the gains of cooperation are unclear!

Reward: Technology Cooperation and Punishment: Import Tariffs

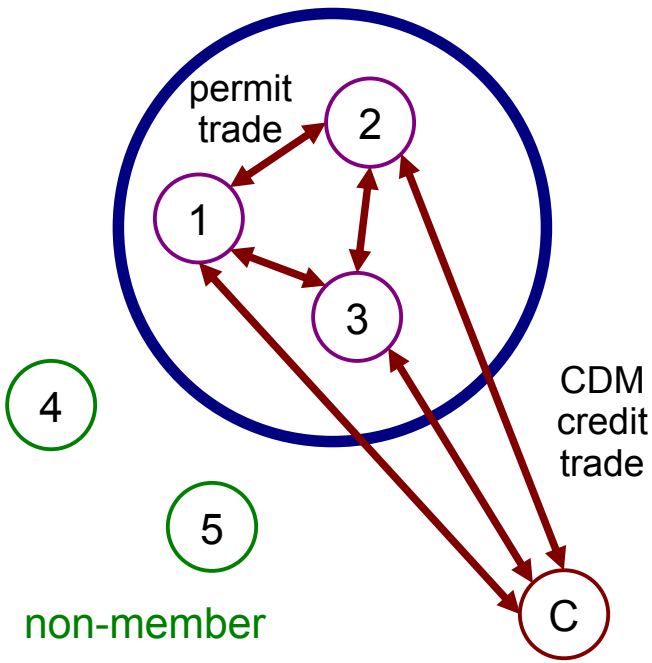
- Tuning incentives in MICA by treaty design:
  - Positive incentive: *Research Cooperation*
    - R&D spill-over within coalition
    - Participation rises with spill-over intensity
    - Improving *productivity* by R&D shown to be a stronger incentive than improving *abatement*
  - Negative incentive: *Import Tariffs*
    - Coalition levies tariffs on imports from free-riders
    - Tariffs induce up to full cooperation
    - Tariffs are individually + socially rational
- Examples, where IEA design changed the game from a dilemma to an assurance game
- For details see
  - Lessmann et al. (2009), Economic Modelling
  - Lessmann and Edenhofer (2010), Resource and Energy Economics





Reward: Emission Trading outside Coalition (I)

- Coalition Design enables permit trade with uncapped regions ("improved CDM")

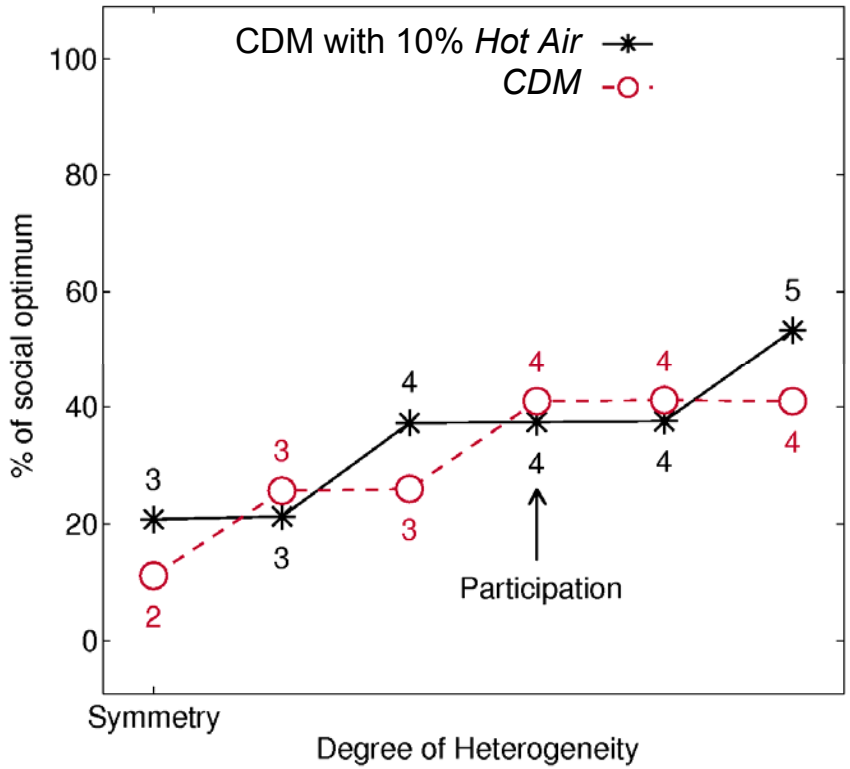


Reward: Emission Trading outside Coalition (II)

Preliminary results:

- When CDM negotiated *together* with abatement targets
  → more stringent targets result
  → stronger incentive to free-ride
  → smaller stable coalitions

- When CDM is negotiated *ex-post:*
  - Positive effect on coalition stability
  - *Increase in participation*, when volume of traded CDM rises due to heterogeneity between players
  - Hot air (here: 10 percent)
    - Raises participation
    - Sacrifices some environmental effectiveness



Source: own calc., Lessmann/Marschinski/Finus/Edenhofer

Summary and outlook

- The fundamental structure of the game: A Prisoners Dilemma or Chicken Game, despite attempts to create new focal points
- But: Social Dilemma payoff might be changed by a variety of strategies:
  - Rewards, e.g. research partnership, offsetting mechanisms, ...
  - Punishment, e.g. tariffs, border tax adjustments, ...
- Important Research Questions:
  1. How to enhance Cooperation after Copenhagen?
  2. What is the appropriate formulation and quantitative specification of the payoff matrix and structure of negotiations?
     - (Dynamic game, uncertainty on costs and benefits)
  3. The empirical design, institutional feasibility and transaction costs of rewards and punishments