Climate policies:
Distributional effects and transfers

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1. Motivation

Justice is the first virtue of social institutions, as truth is of systems of thought. A theory however elegant and economical must be rejected or revised if it is untrue; likewise laws and institutions no matter how efficient and well-arranged must be reformed or abolished if they are unjust.

John Rawls, 1971

1. Motivation (cont.)

- Example from Hausman and McPherson (2006): *Economic Analysis, Moral Philosophy and Public Policy*,

- As the chief economist at the World Bank in 1991, Lawrence Summers argued for *encouraging more migration of dirty industries to LDCs*:

  – The valuation of negative impacts from pollution (e.g., health) is lower in LDCs than in DCs

  – An increase in pollution gives a lower damage the lower the pollution level is (increasing marginal damage costs)

  – The demand for clean environment is lower in LDCs than in DCs. Good environment has a high income elasticity. If people die early, they may not be concerned about negative health effects late in life

2. Why does equity matter in climate policy?

- It is hard to reach a climate agreement that is significant
    - Public good nature of the environment (Hardin, 1968)
    - Free riding (Barrett, 1994)
    - Equity issues

    → Even if everybody agreed on the natural science background, feedbacks to the economy, future emissions scenarios and the costs of abating (no uncertainties), it is still hard to agree on a climate treaty.

2. Why does equity matter in climate policy?

- Two reasons why equity matters in climate policy:

  – Optimal emissions reductions depend on ethical considerations (e.g., social discount rate concavity of utility function)

    → optimal emissions/mitigation paths in IAMs vary

  – Treaties that are considered unfair may be hard to implement

    - Examples from ultimatum games - Gampfer (2014):

      – Participants have to agree on how to share mitigation costs in ultimatum games. If rejection: Both players lose part of their endowment due to "climate catastrophe".

      – «Unfair offers» are rejected – ability to pay and historical emissions strongly determine agreed cost distributions

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2. Why does equity matter in climate policy? (cont.)

- Climate change may have influenced global income distribution already (Diffenbaugh and Burke, 2019):

  - Combine counterfactual historical temperature trajectories with empirical evidence of the relationship between historical temperature fluctuations and economic growth

  - "global warming has very likely exacerbated global economic inequality"

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3. Equity concepts: Taking time into account

- Consider equity as *distributive justice*: The distributions of goods and burdens

- Intragenerational equity: How should we distribute the burden within a generation (present or future)?
  - Who would suffer from inaction (climate change)
  - Who would suffer from action (mitigation)

- Intergenerational equity: How should we distribute the burdens across generations?

3. Equity concepts: Taking time into account (cont.)

- The distribution problems are often assumed autonomous, but choices that affect the intergenerational distribution also have impacts on the intragenerational distribution and vice versa:

  – A high discount rate reduces action and increases damage. The poor regions will suffer more than the rich in the future: *higher intragenerational inequality*

  – Lowering global income inequality may induce higher economic growth in LDCs. This may again give higher GHG emissions

- There seems to be a *trade-off* between intra- and intergenerational equity in climate policies.

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4. What is the best equity principle?

- Equity principles may serve as focal points which reduce negotiation costs (Schelling, 1960).

- But do countries individuals share equity principles?

- While *Pareto optimality* is an accepted efficiency principle, there is no consensus on a "best" equity principle.

- Equity principles may be used strategically and depend on your situation.

- For the time being: Focus on *intragenerational justice*

5. Do countries or regions support different equity principles?

- Lange, Vogt and Ziegler (2007) study equity principles for allocating the burden of mitigation:

    - **The egalitarian rule:** Equal per capita emissions

    - **The sovereignty rule:** Equal percentage emissions reductions

    - **The polluter-pays principle:** Equal ratio between abatement costs and emissions

    - **The ability-to-pay rule:** Equal ratio between abatement costs and GDP

    - **The poor losers rule:** Exemption of obligations for poor countries

    - **The stand alone rule:** No excessive emissions entitlements (no hot air).

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5. Do countries or regions support different equity principles? (cont.)

- Some results from a global survey of people involved in climate policy:

  - Equity issues are considered highly important in international climate negotiations

  - Equity issues are seen as more important by individuals from poor countries

  - Individuals from rich countries are less in favor of polluter-pays and the ability-to-pay principle

  - The poor losers rule are more strongly supported by individuals from poor countries

  - In the long run: Rich countries are more in favor of the egalitarian principle

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5. Do countries or regions support different equity principles? (cont.)

<u>Lange, Löschel, Vogt and Ziegler (2010):</u>

- Use the same survey and also economic costs from the POLES model

- Support of different equity rules by regions may be explained by the ranking of their economic costs

5. Do countries or regions support different equity principles? (cont.)

- Brick and Visser (2015):
  - Threshold public good game. Experiment among students and "practitioners" from USA, EU, China, India, South Africa
  - Participants have to choose between different burden sharing principles
  - When participants represent their own country, the use of burden sharing principle reflect material self-interest (US and China)
  - No evidence of self-interest among EU participants
  - Veil of ignorance: participants from US and China choses a maxmin strategy.

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6. Should distributional effects be taken into account when designing policy instruments?

- <u>In economics:</u> Efficiency (optimal emissions reductions) and distribution are separate problems that should be solved by separate policy measures
  - Transfers from rich to poor countries, or between heterogeneous households
- <u>But:</u> Policy measures are often not available to solve income inequalities following from climate change policies or damages.

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6. Should distributional effects be taken into account when designing policy instruments? (cont.)

- Stern-Stiglitz High-Level-Commission on Carbon Prices (2017) (see also Stiglitz (2019)):
  - departed from the "single price of carbon in all places, dates and uses" (the standard first-best model) when all instruments are not available.
    - Several reasons for this, among them distribution (weight distributional benefits against efficiency loss):
      - Regulation in addition to carbon tax: regulation on carbon intensive sector drives down carbon taxes on other sectors
      - Charge a higher carbon tax on goods used by the rich (e.g., aviation)

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6. Should distributional effects be taken into account when designing policy instruments? (cont.)

- A large literature show that inequality influences the level of social cost of carbon (SCC) if policy makers has preferences for equity and distribution policies are not available or optimal
  - Even national inequality matters for global SCC (Kornek, Klenert, Edenhofer and Fleurbaey, 2019)

7. Social preferences affects climate policies

- People and policy makers may have preferences about inequality. Thus, the climate policy of a nation may reflect these preferences (unless global inequality can be reduced in other ways).

- One way of modelling this is to model *inequality aversion*:

  - Fehr and Schmidt (1999): People enjoy a high payoff, but dislike having higher payoffs than others, and dislike even more to have lower payoffs.

  - Bolton and Ockenfels (2002): Relative (not absolute) inequality matters.

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7. Social preferences affects climate policies (cont.)

- Several economic studies use inequality aversion when studying coalitions in international climate negotiations (Vogt, 2003; Lange, 2006; Kolstad, 2011)

- Parameters in the Fehr-Schmidt model have also been calibrated based on an experimental climate negotiation game between participants in climate negotiations (Dannenberg, Sturm and Vogt, 2010)
  - They dislike mostly having higher payoffs than others
  - No significant differences between individuals
  - Differences in climate policy more likely to be caused by national interests

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7. Social preferences affects climate policies (cont.)

- Kverndokk, Nævdal and Nøstbakken (2014) study how globally optimal policies differ with and without inequality aversion based on Fehr and Schmidt:
  - Two regions, North and South, that both have inequality aversion
  - Two externalities: consumption externality (inequality aversion) and environmental externality (climate change)
  - As dirty technology is more efficient (cheaper), this gives incentives to higher investments in dirty technology in the South and cleaner technology in the North
  - Thus we get lower pollution in the North and higher in the South compared to the standard model

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7. Social preferences affects climate policies (cont.)

- There are also other ways of modeling social preferences in climate economics.

- Anthoff and Tol (2010) show that the SCC varies substantially dependent on how the national intertemporal welfare functions are specified:

  - *Sovereignty* –countries are only concerned about their own consumption

  - *Altruistic* – welfare of all other countries also matter

  - *Good neighbor* – cares about harm imposed on others

  - *Impacts abroad are compensated* – obligation to compensate harm

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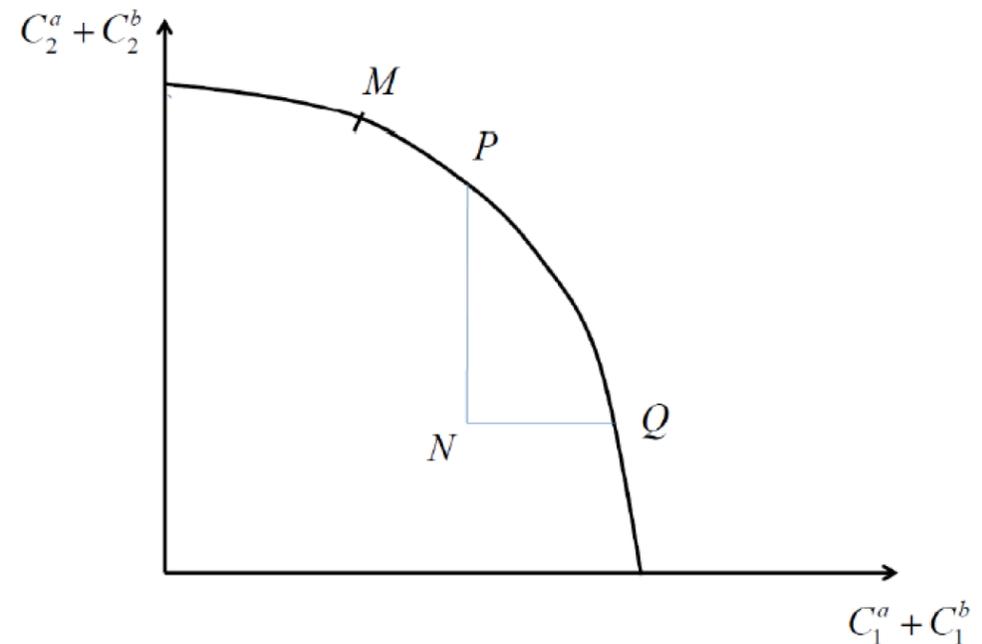# 8. Intergenerational equity – Pareto improving climate policy

<u>Foley (2009):</u>

- Present generation: $Y = C + K + E$,

  K = conventional capital, E = environmental (climatological) capital

- Future generation benefits of both K and E

- What matters is the future generation's marginal value of a lower stock of atmospheric GHGs compared to an increase in conventional capital.

- The present generation does not have to reduce consumption due to climate policy ($K\downarrow$ and $E\uparrow$)

- Borrowing to finance E may protect C and drive up the interest rate $\rightarrow K\downarrow$

- The role of discounting is to determine the distribution of consumption between present and future generations (the overall size of investments).

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8. Intergenerational equity – Pareto improving climate policy (cont.)

- Hoel, Kittelsen and Kverndokk (2019):

- Two periods with transfers: max $C_1^a + C_1^b$ given $C_2^a + C_2^b$

- *M* is social optimum which is Pareto efficient, but not on the Pareto improving frontier.

- BAU (*N*) is not Pareto efficient.

- Moving up and to the left on the frontier means C in period 1 goes down: higher investments and/or lower emissions.

→ **Pareto improving policies may give higher emissions.**

8. Intergenerational equity – Pareto improving climate policy (cont.)

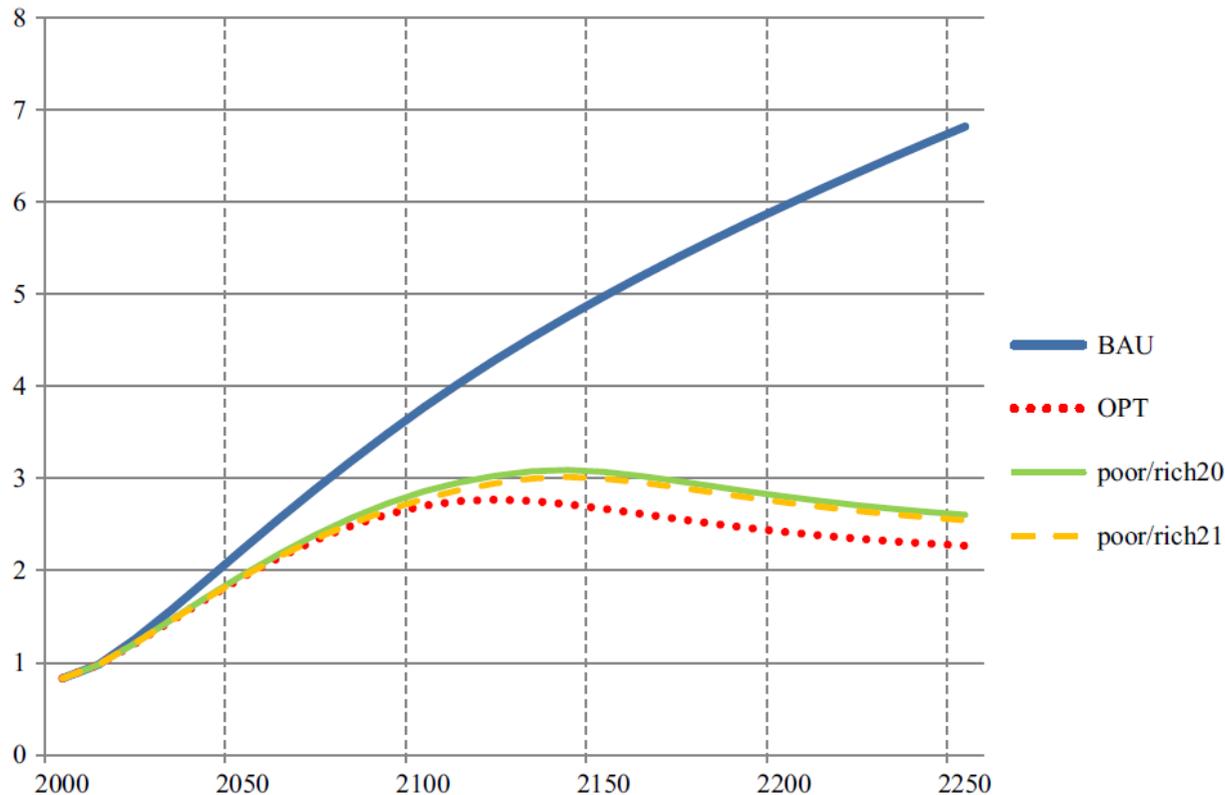- This is confirmed by simulations on RICE

Fig. 3 Development of global mean temperature compared with the preindustrial temperature under the different scenarios. Consumption transfers allowed

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9. Transfers between poor and rich countries

- Transfers can be justified on several reasons
  - Distinguish between efficiency and distribution
  - Strategic reasons for climate policy
    - May be beneficial even without an agreement
    - Securing an international agreement
    - Reduce carbon leakage
    - Expand market for trade
  - Because we care about poor countries: ethical reasons
    - E.g., *retributive justice* (Paterson, 2001): "Those who cause the problem have the responsibility to make amends for it" → compensation

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10. Climate finance

- COP15 in Copenhagen: Climate finance of $30 billions for the period 2010-12, and $100 billions per year from 2020 (Copenhagen Accord).
  - It refers to funding from the rich to the poor world and includes climate specific support mechanisms and financial aid for <u>mitigation</u> and <u>adaptation</u> activities
- This should be on the top of other transfers such as development aid.
- Climate transfers are confirmed by the Paris treaty (COP21)

10. Climate finance (cont.)

- Some questions from a North – South perspective:
  - Would the North have incentives for such transfers?
  - Are they efficient?
  - Do they interact?

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11. Mitigation technology transfers

- Standard model – self interest (Yang, 1999):
  - Unilateral transfers of mitigation technology in a North-South model.
  - The North will benefit from lower GHG emissions
  - Assumes that the South will not mitigate without transfers
  - Mitigation at home and technology transfers are substitutes; if a technology can mitigate more effectively in the South, transfers will be made.
  - In optimum, the marginal costs of mitigation is the same in the two regions.

11. Mitigation technology transfers (cont.)

- This simple model may not describe all relevant mechanisms

- Negative environmental impacts of transfers
  - The transfers may make the poor region more effective in producing polluting goods, and it may therefore increase its production
  - Sarr and Swanson (2017): Mitigation transfer means that the resource intensity falls. But the transfer has a wealth effect $\rightarrow$ demand more goods
  - Glachant, Ing and Nicolai (2017): Global production more effective, prices on polluting goods fall.

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12. Adaptation technology transfers

- *While mitigation* is a public good, *adaptation* is basically a private good (Kane and Shogren, 2000)
- There may be some mechanisms that relax the private good character by creating externalities
    - Affects trade through economic growth and terms of trade (e.g. food prices)
    - International security, conflicts
    - May affect stability of climate coalitions
    - May interact with mitigation
    - Climate migration

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12. Adaptation technology transfers (cont.)

- How does mitigation and adaptation interact?
- Boub and Stephan (2013):
  - Adaptation is a private good, but may interact with mitigation
  - North has a mitigation target, but not the South (m)
  - Both regions can adapt (a)
  - North can fund adaptation in the South (a^N_S)
  - Conventional income is exogenously given
  - North: Aim maximize utility
  - Stackelberg game: North leader and South follower

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12. Adaptation technology transfers (cont.)

– Some results:

$$\frac{dm_S}{d\bar{m}_N} \in (-1, 0), \qquad\qquad (4)$$

$$\frac{da_S^S}{d\bar{m}_N} \begin{cases} > 0, & \text{if } F_S^{a_S, M} > 0 \\ = 0, & \text{if } F_S^{a_S, M} = 0 \,. \\ < 0, & \text{if } F_S^{a_S, M} < 0 \end{cases} \qquad\qquad (5)$$

$$\frac{da_S^S}{da_N^S} \in (-1, 0), \qquad\qquad (6)$$

$$\frac{dm_S}{da_S^N} \begin{cases} > 0, & \text{if } F_S^{M, a_S} > 0 \\ = 0, & \text{if } F_S^{M, a_S} = 0 \,. \\ < 0, & \text{if } F_S^{M, a_S} < 0 \end{cases} \qquad\qquad (7)$$

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12. Adaptation technology transfers (cont.)

- What matters is if mitigation and adaptation are complements or substitutes.

  - Providing adaptation support may harm the North if they are substitutes

- The North only has an incentive to fund adaptation if they are complements

  - Ex. of substitutes: Compete for same resources, reduces impacts of climate change

  - Ex. of complements: Planting trees for coastal protection

12. Adaptation technology transfers (cont.)

- May adaptation transfers still play a role if they are substitutes?

- *Fairness considerations* may have an impact. Adaptation support may be a way to correct unfairness due to past contributions to global warming (Pittel and Rübbelke, 2013a). Thus, it may influence the outcomes of international negotiations.

- Adaptation support may have a similar role as *pure monetary transfers*. Crowding out adaptation at in the South will increase resources available for consumption and conventional capital accumulation.

- However, North may distrust institutions in the South; waste of resources

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12. Adaptation technology transfers (cont.)

- Considering crowding out: Could North still influence adaptation in the South?
    - <u>Conditional support</u> (e.g. matching grant) – condition on mitigation or adaptation effort (Pittel and Rübbelke, 2013b): May help overcome the distrust that resources "disappears" and also increase total adaptation effort
    - <u>Give adaptation support to the very poor</u> (struggling to meet the minimal subsistence level): Consumption crowds out adaptation effort. Adaptation support may give more adaptation (Eyckmans, Fankhauser and Kverndokk, 2016)

13. Development aid

- How does development play a role for climate policies?
- Thomas Schelling (1992):
  - Developed countries are not so vulnerable to climate change
  - Developing countries are much more vulnerable
  - We can reduce the vulnerability of climate change by letting developing countries grow
  - → This means that damage from climate change will likely be low
- Bowen, Cochrane and Fankhauser (2012): Not all growth reduce vulnerability
  - Investments in skills and access to finance can reduce vulnerability

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13. Development aid (cont.)

- Does climate policies have a growth effect (help development)?
  - That depends on the *assumptions* in the model!
  - Many models assume a production (GDP) path that is independent on climate polices (e.g. Eyckmans, Fankhauser and Kverndokk, 2016)
  - Bretschger and Suphaphiphat (2014): Assumes that climate damages affects conventional capital through higher depreciation → lower emissions increases economic growth via a positive effect on capital stock

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14. Climate migration

- Climate migration: Transfer of people from the South to the North

- Climate migration may work as an adaptation strategy

- Climate migration from poor to rich countries may not be considered a benefit for the rich countries
  - It gives an incentive for a *higher carbon tax* (Mason, 2017)
  - *Adaptation* in the South is no longer a private good, thus it gives an incentive for *adaptation transfers*.