Multilevel climate policies – The EU ETS and the heterogeneity of the Member States

Workshop: The road to Paris & multilevel carbon pricing:
Getting the “incentives right” at the global, European and national level

Berlin, 16 September 2015

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Climate policy at the EU-level

In 2005 implementation of the EU ETS

- total amount of EU-emissions fixed,
- permit price determined by the market,
- **equalizes marginal abatement costs** across the EU Member States,
- cost-efficient instrument to regulate GHG-emissions,
- **transfers** via initial allocation of allowances and redistribution of auction revenues.

Was the heterogeneity of the Member States efficiently considered in its design? Likely not ...

European situation

Climate and energy policies at the Member States level

Member States' keep modifying their policies even after the EU ETS implementation, e.g.

- **U.K.'s Climate Change Levy**
  includes minimum price in addition to EU ETS
- **German Energiewende**
  policy package supporting long-term mitigation
- **Sweden's carbon tax**
  shifted fiscal burden from labor to carbon emissions
  (with exemptions for the ETS-sector)

→ Member States' heterogeneity: different (higher) ability- and willingness-to-pay for mitigation.

Is the heterogeneity efficiently considered in the EU ETS?

Analysis based on two normative principles.

Solidarity

Transfers across Member States are implemented to **pursue a common goal,** like climate change mitigation.

Subsidiarity

In general, **national governments** can better address **local preferences**. Therefore, **EU policies** are only justifiable if they can **improve on the Member States' action**.

Theory

Member States' income heterogeneity

Based on Chichilnisky and Heal, 1994

Emissions trading

equalizes marg. abatement costs for all Member States $i=1,\ldots,N$. Thus:

$$p_{ETS} = \frac{1}{MRT_i} = -\frac{\sum_k \lambda_k \frac{\partial U_k}{\partial a}}{\lambda_i \frac{\partial U_i}{\partial c_i}} = -\frac{\sum_k \lambda_k \frac{\partial U_k}{\partial a}}{\lambda_{j \neq i} \frac{\partial U_j}{\partial c_j}}$$

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If the **income-level in Member States *i* is lower** than in Member State j, then:

$$\frac{\partial U_i}{\partial c_i} > \frac{\partial U_j}{\partial c_j}$$

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Requirement for allocative efficiency with ETS

- **Equalization of marg. social valuations of private consumption,**
- via optimal transfers from rich to poor countries, such that:

$$\frac{\lambda_i}{\lambda_j} = \frac{\frac{\partial U_j}{\partial c_j}}{\frac{\partial U_i}{\partial c_i}}$$

- E.g. by initial allocation of allowances or redistribution of auction revenues.

Design Principle 1

Efficiency, transfers and solidarity

To reach a common **European goal of emission reduction with an ETS**

- transfers from rich to poor Member States are crucial.
- These transfers need to significantly **alter the willingness-to-pay for mitigation in poorer Member States**.
- Otherwise, an **ETS is not efficient**.

If **significant (optimal) transfers cannot be implemented**, then

- **richer Member States shall pay higher carbon prices** than poorer Member States.

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Interaction between EU and Member States‘ policies

Climate policies at different governmental levels

- National governments can better address local preferences (principle of subsidiarity)
- The EU-level can better address (global) public good provision.
- **How to benefit from polycentric governance?**

So far

- **Member States' policies** (like taxes) **in addition to the EU ETS are cancelled out.** ETS nullifies expression of preferences.
- ETS transfers are impossible to be set optimal (Williams, 2012) if strategic Member States' policies are present.

→ **A price instrument at the EU-level can integrate the Member States' policies** (**additivity of prices**).

Design Principle 2

Multilevel policies and subsidiarity

- **Quantity instruments at the EU-level**, such as the EU ETS, **violate the subsidiarity principle.**

- As soon as the cap is set, national preferences cannot be expressed in an ETS, because the cap determines the level of total abatement.

- **An EU ETS minimum price or a carbon tax with appropriate transfers enables Member States to implement additional policies** according to their (more ambitious) preferences.

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Ongoing work on

Institutional design in a non-optimal world

We start from the Member States' perspective.

Can the EU level achieve a Pareto-improvement* using

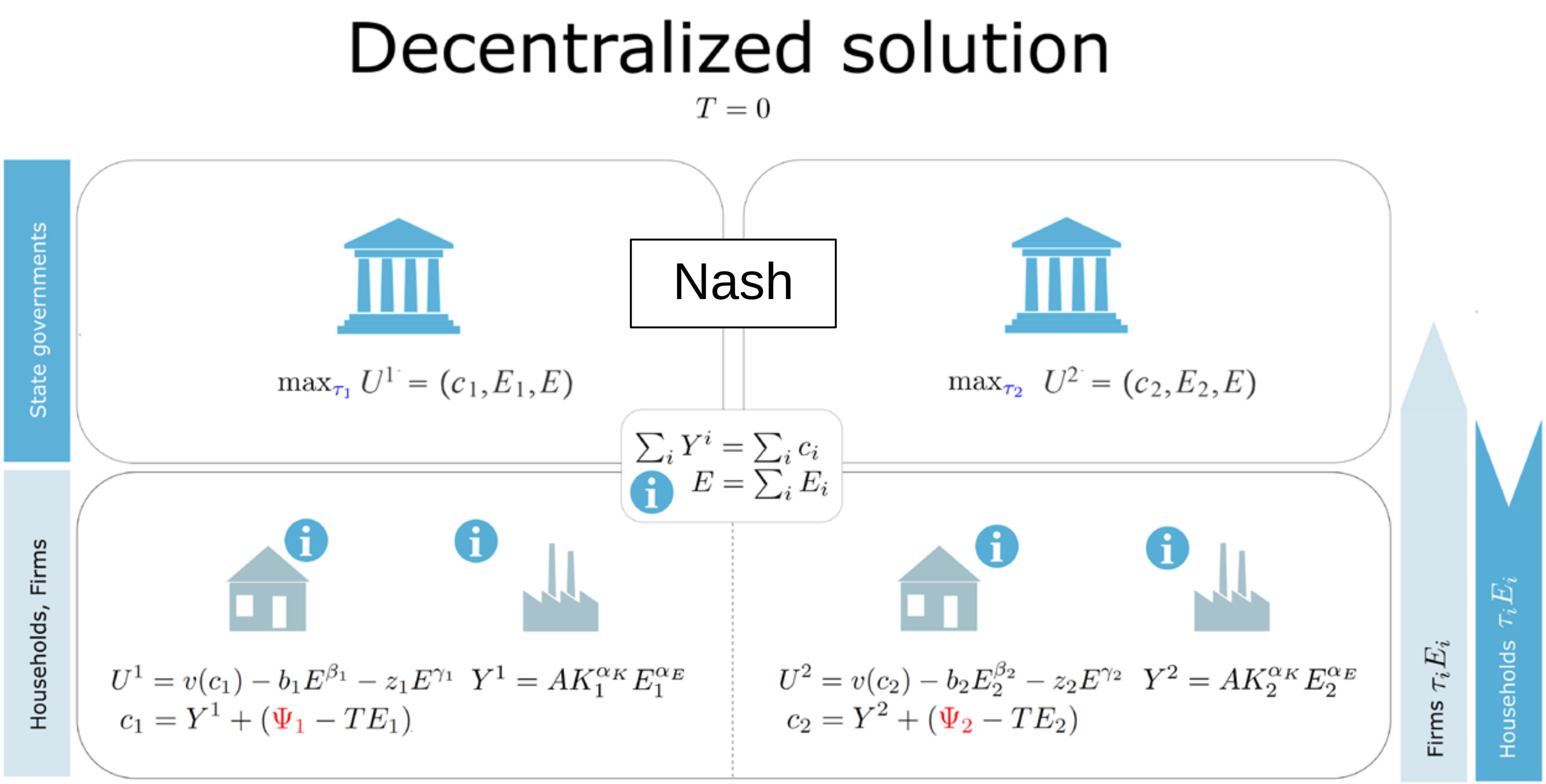
1. a **uniform** carbon price and
2. endogenous or **simple**** transfer schemes?

* make at least one state better off while the other state is not worse off.

** full state refund, equal per capita, historical emissions transfers

Outlook: ongoing work

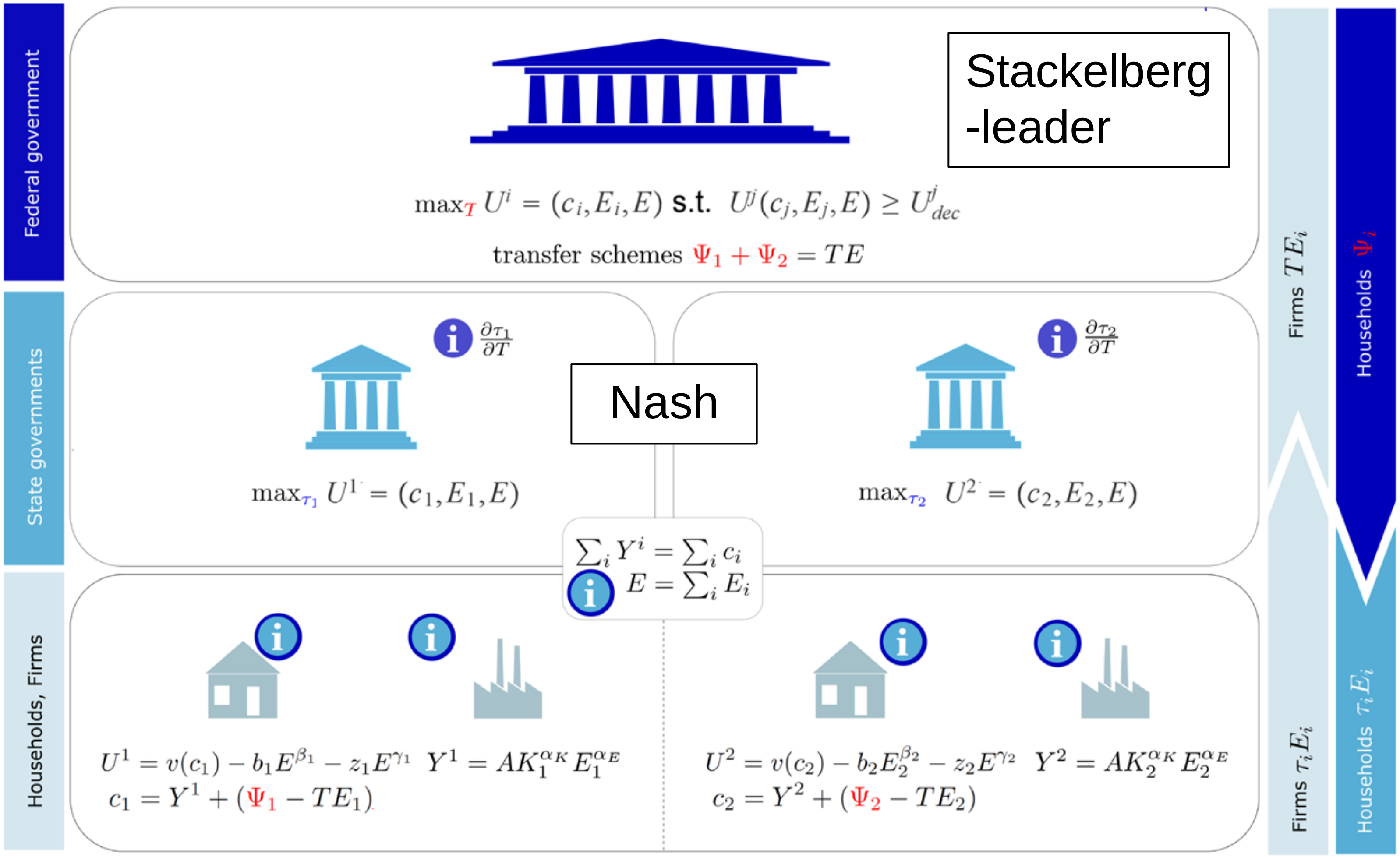
Member States' policies provide the starting point



(Roolfs, Gaitan, Edenhofer, Pahle and Knopf, in prep.)

Outlook: ongoing work

Role of EU-level: Improve on Member State policies



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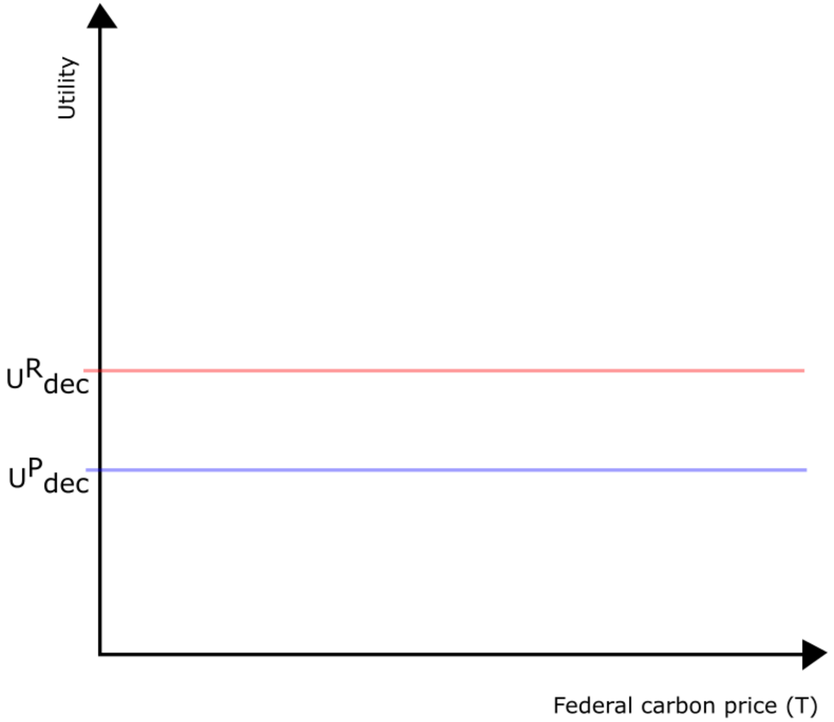
Equal per capita transfer, income heterogeneity

- **Member States** (rich R, poor P) set national carbon taxes (result in U^i_{dec})



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First results

Equal per capita transfer, income heterogeneity

- **Member States** (rich R, poor P)
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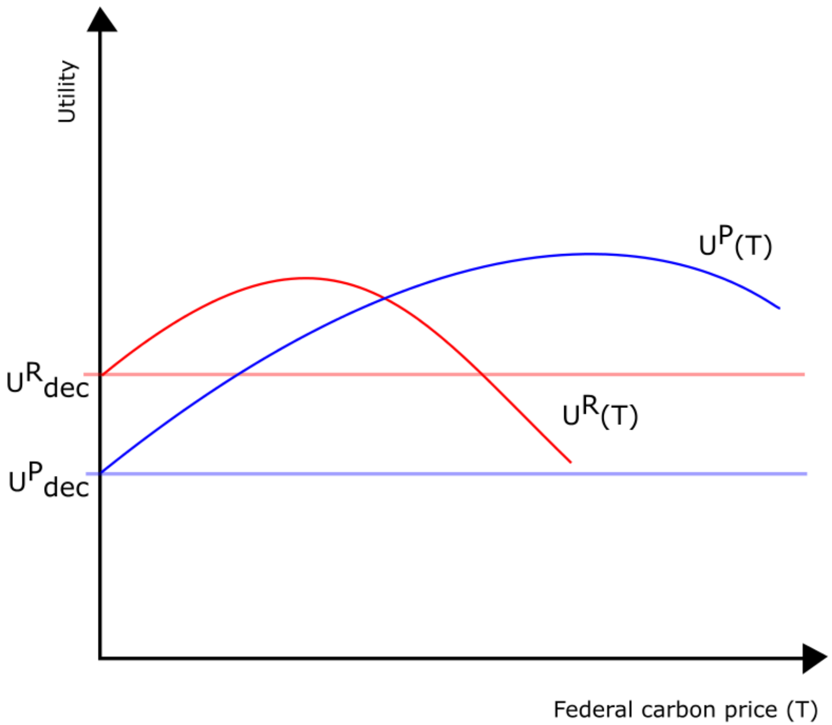
- **EU-level** (Stackelberg)**: Pareto-improvement**
  ($U^R \geq U^R{}_{dec}$ and $U^P \geq U^P{}_{dec}$)



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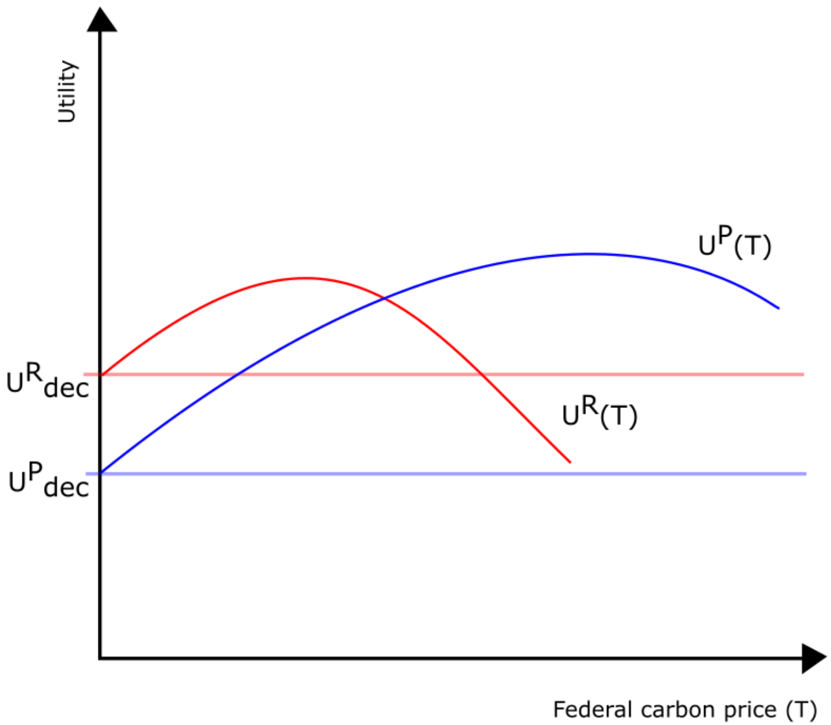
When is an equal per capita transfer and a uniform EU price (T) incentive compatible?



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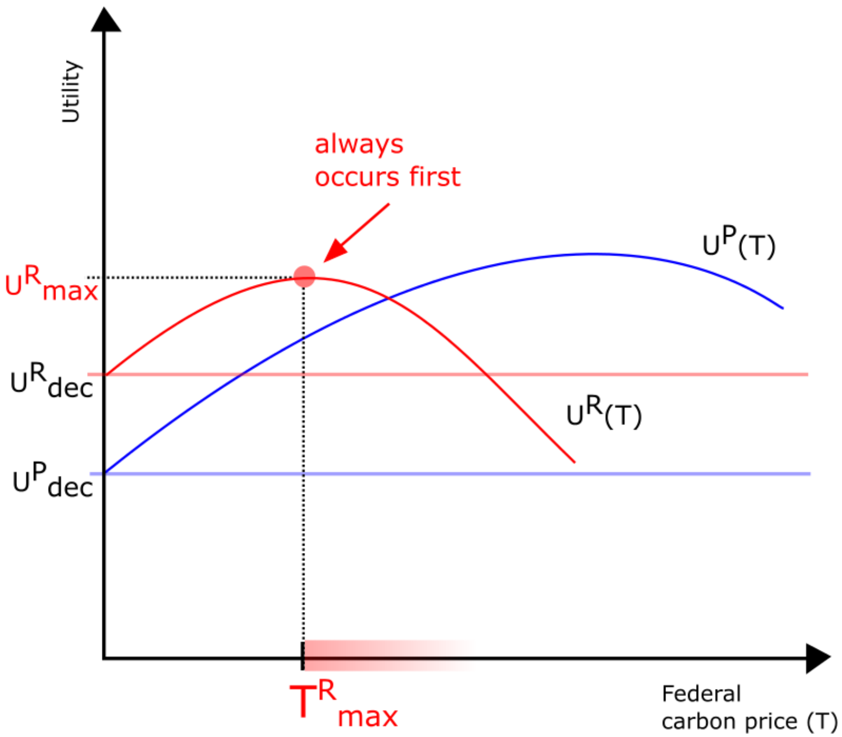
The rich State has higher mitigation cost due to large transfers, but

- **agrees** on equal per capita transfers
- **as long as** T^{min} maximizes its utility.



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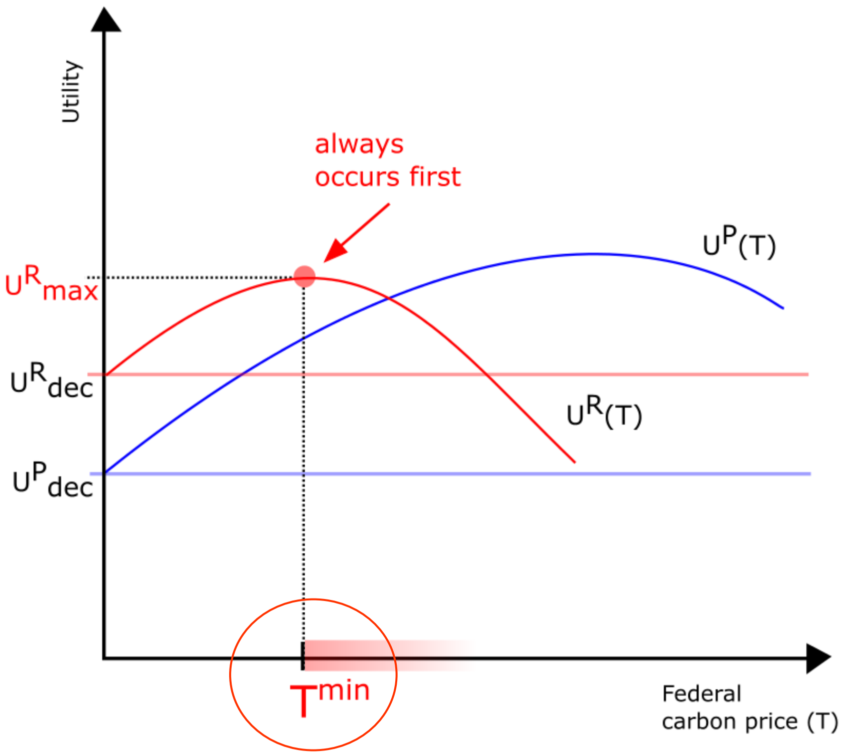
→ **Defines sufficient minimum price.**



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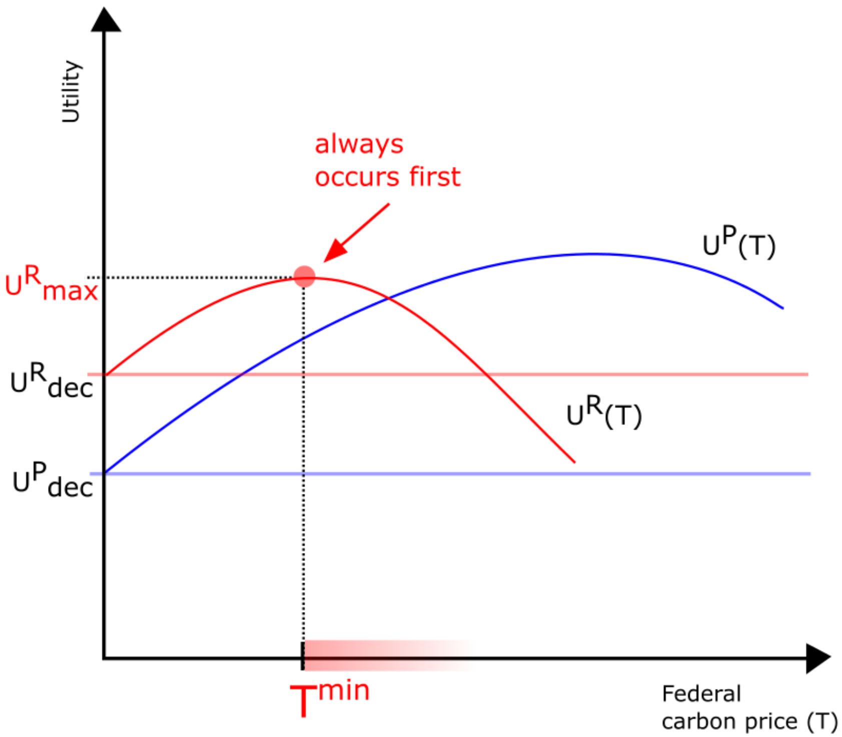
The poor State always benefits, due to

- income increase by transfers,
- externality internalization.



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... conclusion for the EU and the design of multilevel climate policies

EU ETS

- Equalizes marginal abatement costs,
- Member States' heterogeneity and national ambitions for higher mitigation-level are not efficiently considered.

Minimum price for the EU ETS – two advantages

- **Often overlooked: can integrate more ambitious (strategic) Member States' policies without undermining EU policy (allocative efficiency)**
- Known: stabilization effect

LIMES-EU *Long-term investment model of the electricity sector*

Objective

- minimizing cumulated costs of electricity provision
- optimal investment and dispatch decisions for generation, storage and transmission capacities

Technologies

- generation *[nuclear, hard coal (+ccs), lignite (+ccs), natural gas cc/gt, hydro, wind on-/offshore, solar pv/csp, biomass]*
- storage *[diurnal, seasonal]*
- transmission *[net transfer capacities between regions]*

Geographical scope & resolution

- EU28 countries w/o Malta & Cyprus
- plus Norway & Switzerland & Balkan

Temporal scope & resolution

- 5 year steps 2010 – 2050,
- representative days per year
- perfect foresight

Policies

- CO_2 prices / RES targets
- EU and Member State level

Exogenous parameters

- electricity demand per region
- nuclear / ccs policies
- investment costs and fuel costs

Nahmmacher et al. (2014)

Multilevel policy scenarios

until 2030

EU policy	**EU ETS cap and minimum ETS price of 5€ / 10€ / 15€**
German policy	**Effective national carbon price of 20€** Therefore, variable fee X = 15€ / 10€ / 5€ such that 20€ = EU policy + X

after 2030

EU policy	**EU ETS cap resulting in price of 20€ / 25€ / 30€ / 35€** subsequently rising by 5%/year until 2050

…resulting in 24 scenarios in total

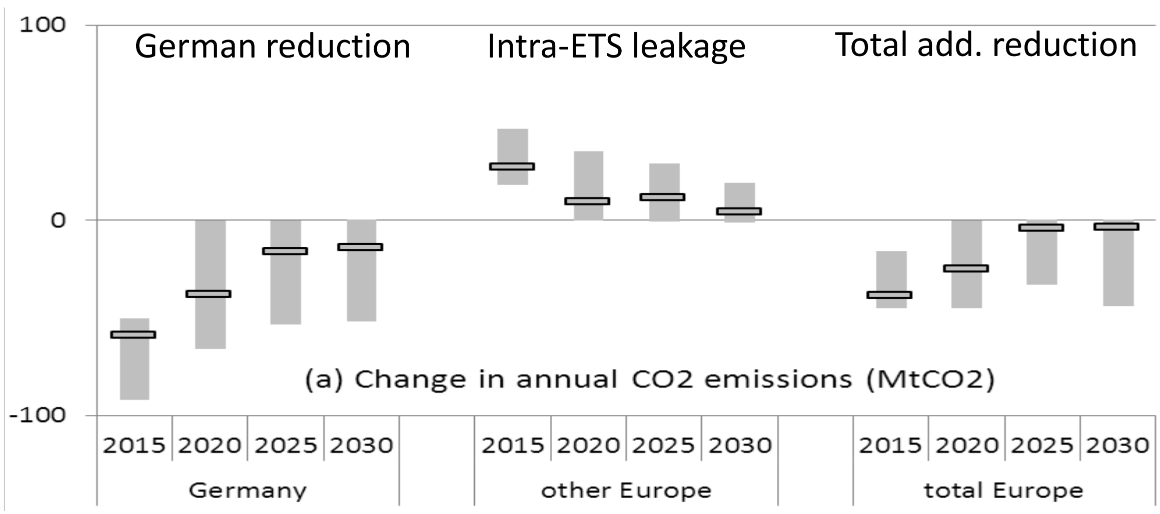
Carbon prices in €/tCO2

Illustration of EU ETS minimum price proposal

Effect of additional German policy on emissions

- **German emissions reduce strongly.**
- **Cushioning of intra-ETS leakage:**

  Emissions in neighboring countries increase, but less than decrease in Germany.
- **Levels of emission changes** depends on
  - **price gap** between EU and German policy, and
  - **expected** future carbon **price**.
- Overall effect of national policy positive.



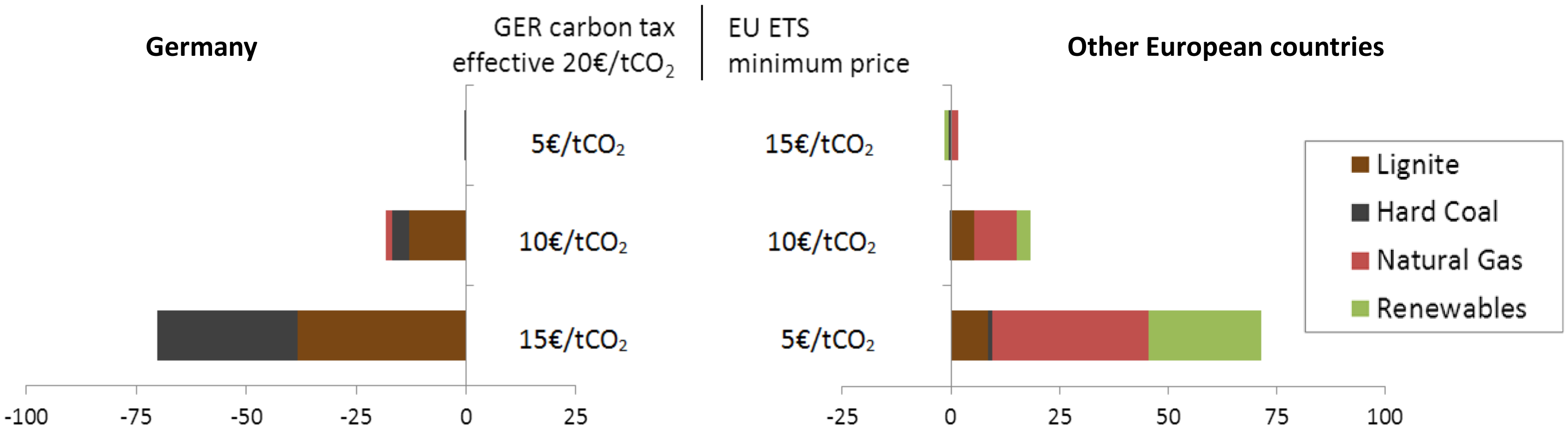
The figure gives the range (grey) and median (black) over all scenarios.

Illustration of EU ETS minimum price proposal

Shift in electricity production

European countries

- **replace** reduced German electricity production,
- **invest** in less CO_2-intensive technologies, if future EU carbon price is expected to be sufficiently high.



Change of electricity production (TWh): Illustrative model results[1] for 2020 with different EU minimum prices acc. to scenarios.

[1]Model results for scenarios with a common European carbon price of 30€/tCO_2 in 2030.

Conclusion from LIMES-EU simulations

- If Germany sets an additional carbon price while the EU ETS has implemented a minimum price **European mitigation increases**.

- The **smaller the price gap** between EU ETS minimum price and German carbon price **the lower the costs**:

EU ETS Minimum price:	5€/tCO_2	10€/tCO_2	15€/tCO_2
Extra costs[1] of GER policy:	35.4bn€	23.6bn€	11.9bn€

[1]Total system costs until 2050 discounted to 2010 values.

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Implications for an EU ETS reform

- **The Member States‘ heterogeneity**

  should be considered based on efficiency, solidarity and subsidiarity grounds.

- **A key element for success:**

  Appreciation and integration of **multilevel climate policies:**

  - **Benefit from price (or hybrid) instruments** on the EU level.
  - **Appropriate transfer design crucial element.**

- **Pareto-improvements are possible**

  with a minimum price, simple transfers and strategic States.

Concluding remarks

Implications for the COP 21 Paris

- **EU as a laboratory for multilateralism**

  Lessons can be learned for global climate policies

- **Success of EU ETS reform**

  can send **positive signal about plausibility** of multinational cooperation.

- **Coordination around a minimum price and appropriate transfers** enable Pareto-improving reforms towards increasing the level of climate policy ambitions.