ETH zürich

Efficiency and distributional impacts of Swiss energy policies

SimLab

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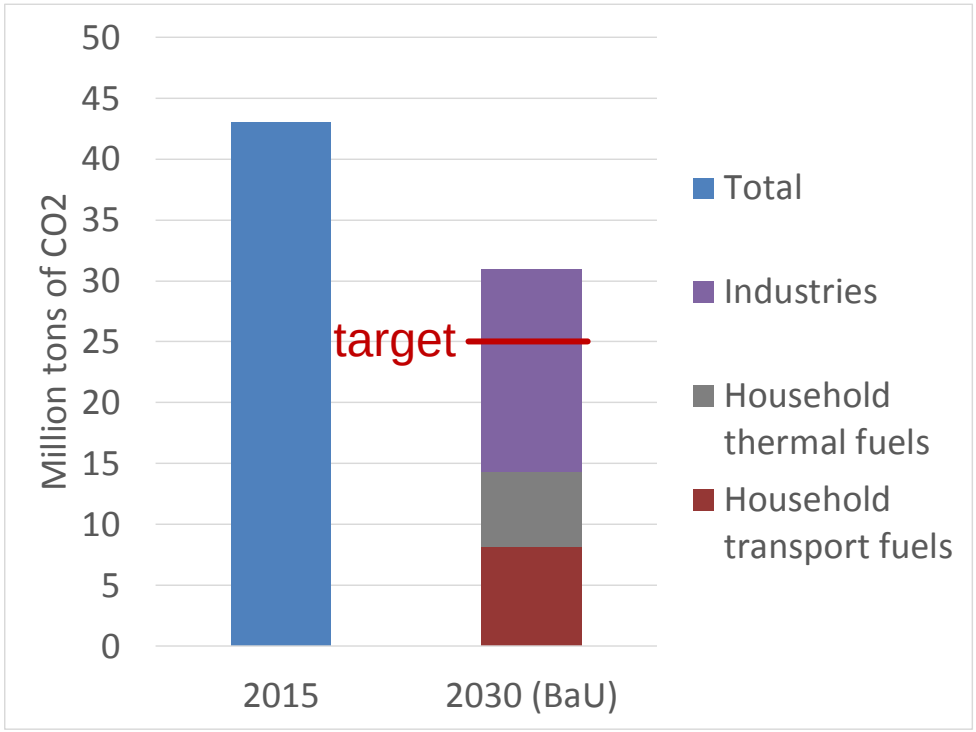
Motivation

CO_2 reduction target for 2030: 40% relative to 1990



- Regulatory strategies to reach target should be
  - Economically efficient
  - Socially fair
  - Politically feasible

➔ Which instrument(s) should we chose?

Instruments to reduce CO_2 emissions

Four instruments to reduce CO_2 emissions in Switzerland

- Buildings sector
  - CO_2 tax on thermal fuels
  - Subsidy for buildings insulation («Gebäudeprogramm»)
- Transport sector
  - CO_2 tax on transport fuels
  - Emissions standard for new passenger vehicles

Previous Literature and Research Gaps

- Efficiency perspective
  - First-best setting: taxes most cost-effective (Goulder and Parry 2008)
  - Pre-existing taxes: other instruments may be better (Goulder 2013)

- Distributional aspects
  - Focus on expenditure side
  - Few studies on impact on consumer income (Rausch et al. 2010)
  - Focus on market-based instruments, little focus on alternative instruments

- Switzerland
  - No quantitative empirical economic study for Swiss context (only for tax systems, not for other instruments) (Ecoplan 2012)

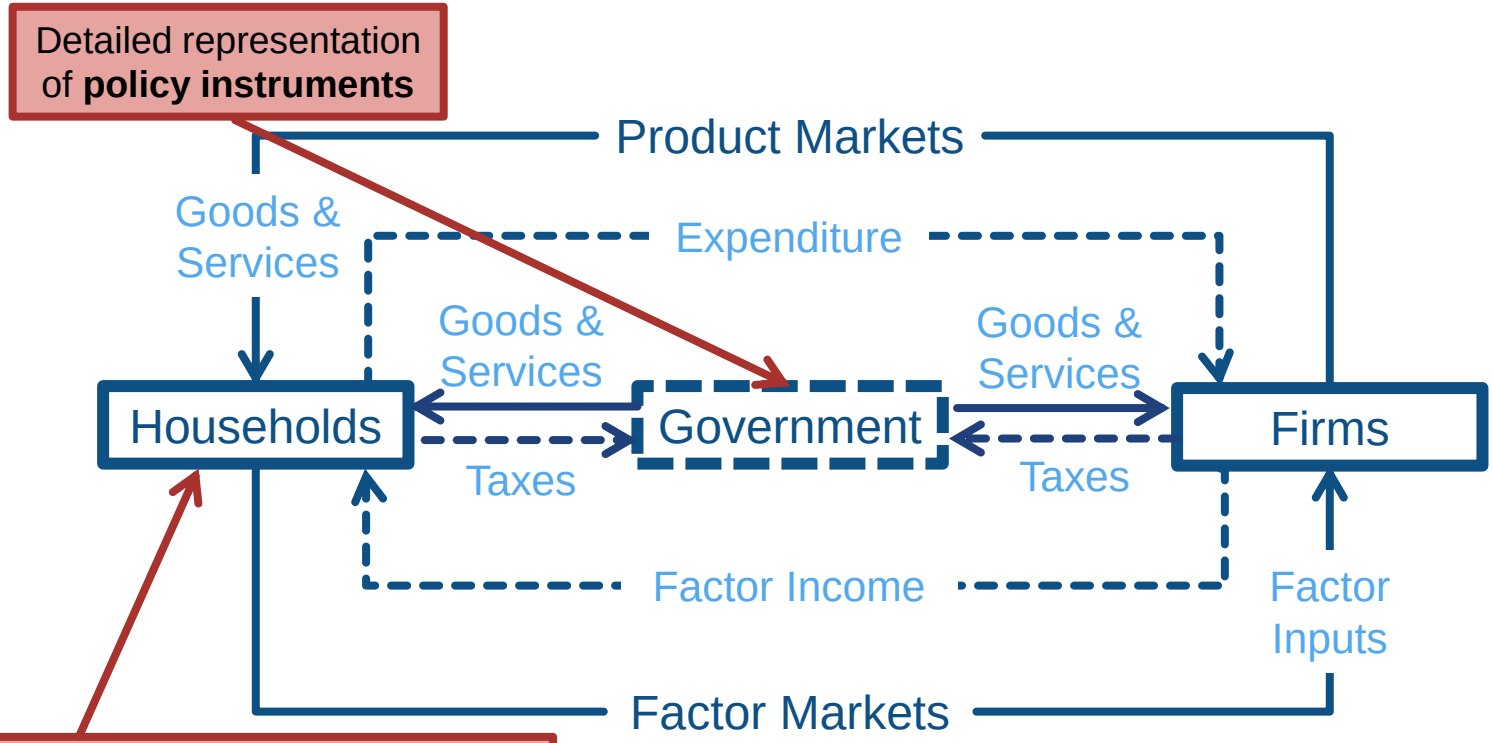
Research Questions

In the context of Swiss energy policy we address the following two questions:

- Under what circumstances – if any – can alternative instruments be better than a tax?
- How are different types of households affected by different policy instruments?

Method and Data

Computable General Equilibrium (CGE) model with integrated micro-household data



Detailed representation of **policy instruments**

Rich representation of **household heterogeneity** based on **micro-household survey data (HABE)** for 9'000 Swiss households

Goods and factors

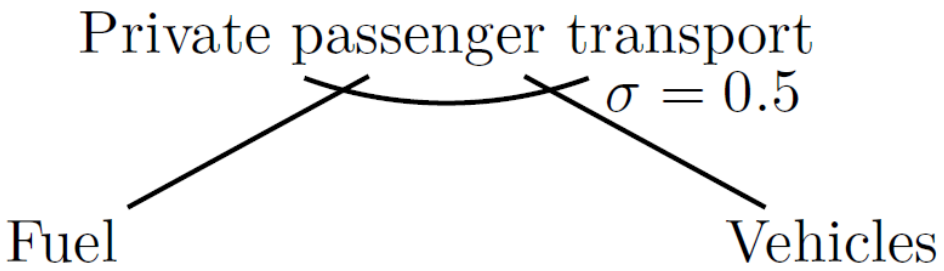
Payments

Intersectoral linkages, price-dependent market feedbacks, information on origination and spending of income

CO_2 emissions standards for new passenger cars

- CO_2 emissions from new cars cannot exceed an average of 130 g/km
- Importers required to meet specific CO_2 target for their vehicle fleet
- Importers may form an emissions pool
- Penalty payments if CO_2 emissions exceed target
- Until 2020: 95 g/km

Model implementation of efficiency standards

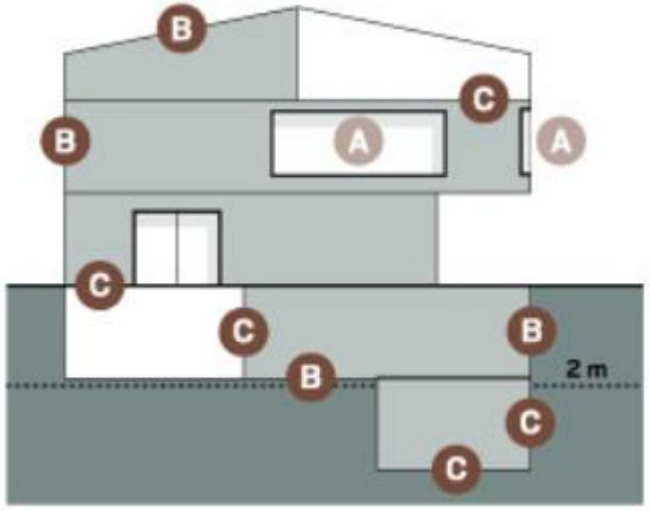


- Tradable certificates (PSTD)
- One certificate per «vehicle kilometre» (PS)

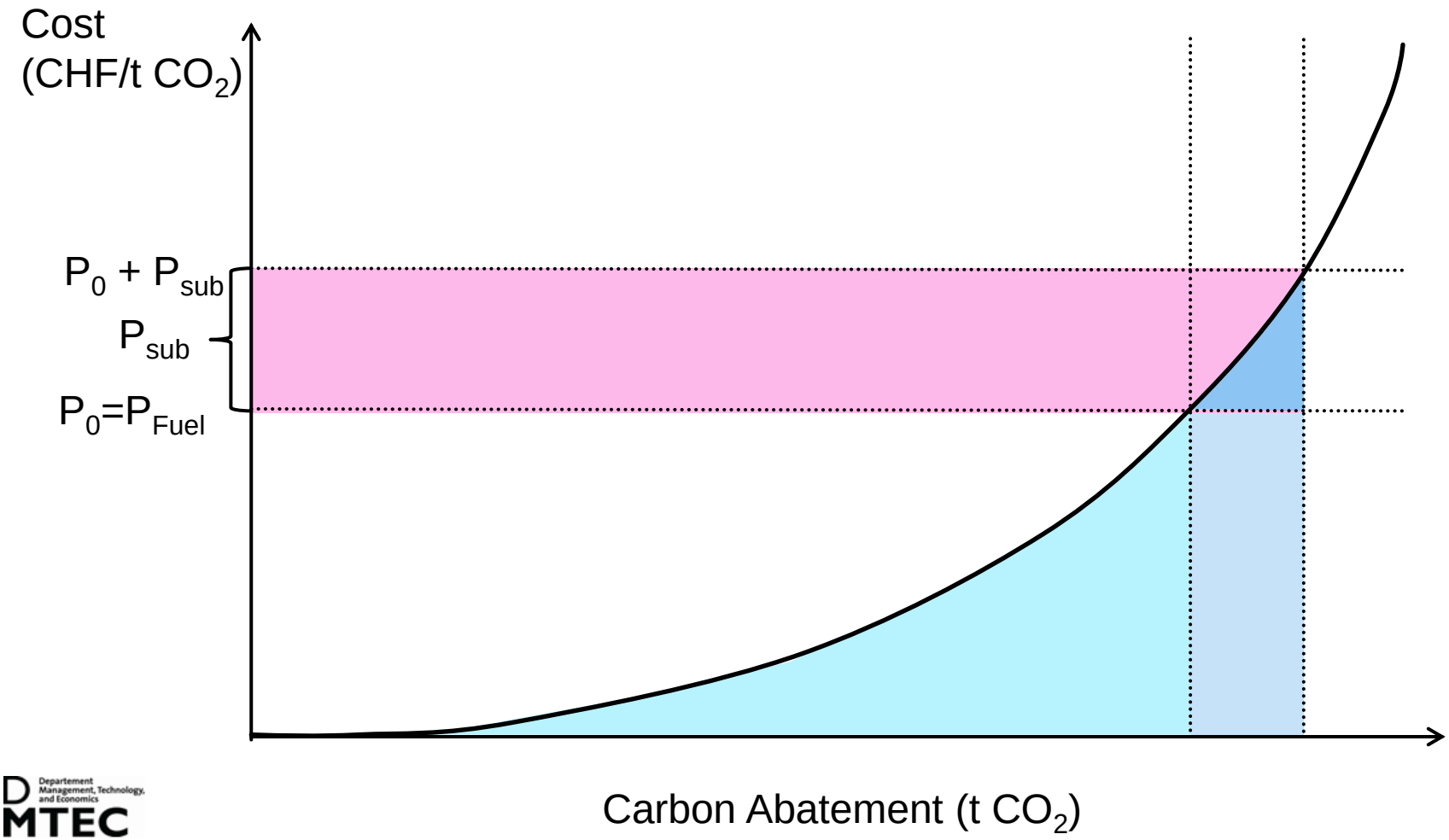
→ Efficient cars become relatively cheaper

Subsidy for buildings insulation «Buildings program»

- Subsidy for insulation measures
- Owners of buildings may apply for support when they undertake renovations
- CHF/m^2 (depending on measure)
- Financed through CO_2 levy (max. one third of revenues)
- 2016: ~ 300 Mio. CHF



Subsidies for buildings insulation

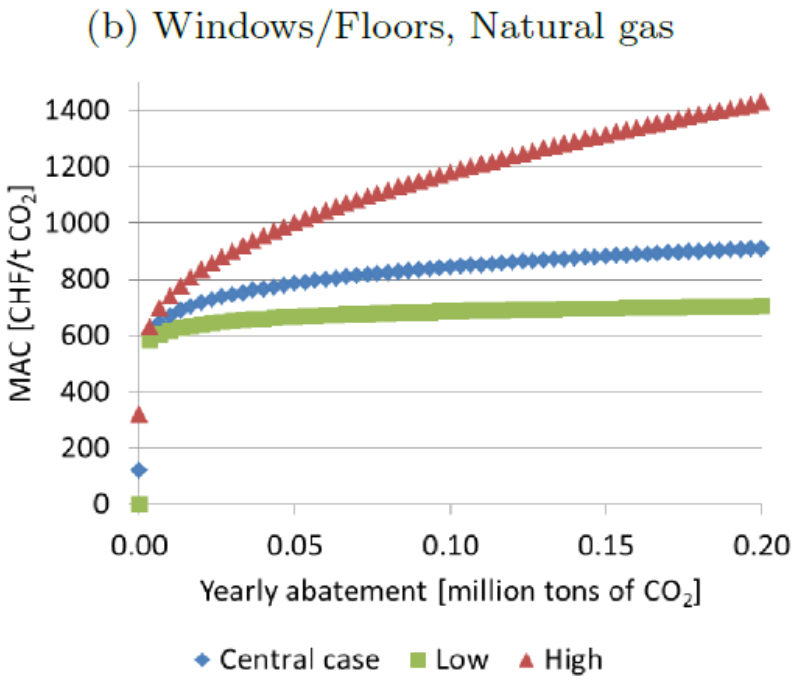


Calibration of MAC Curves

- Historic data on CO_2 reduction and cost
- Four different MAC curves for different measures

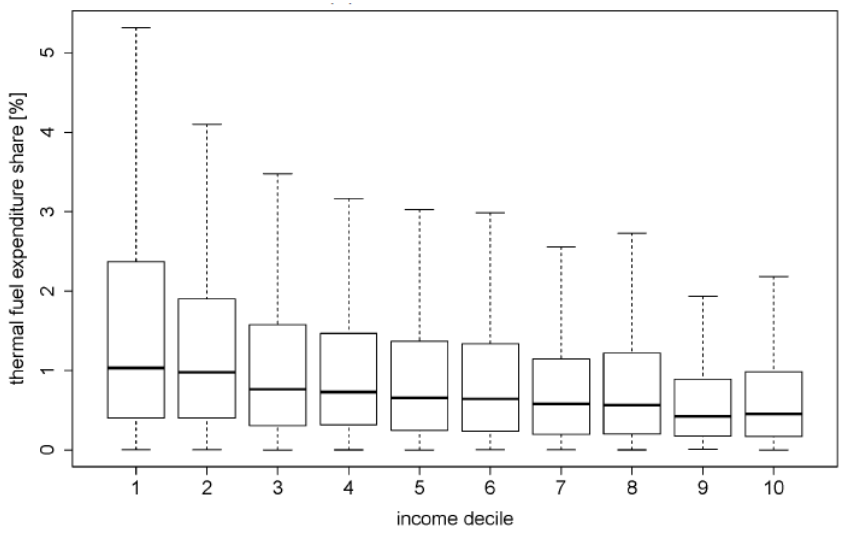
→ Different payments per t CO_2

- Include free-riding effects (about 37%)
- Many uncertainties about future potential and cost
  → sensitivity analysis



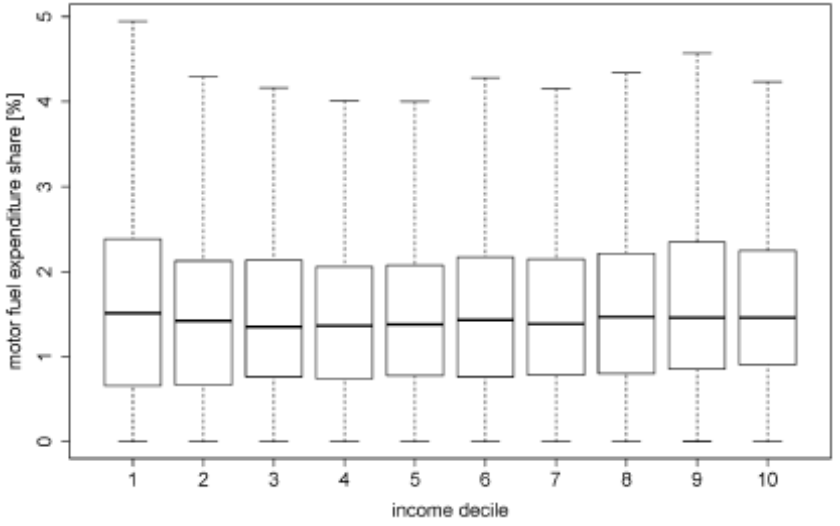
Household data: Energy expenditures

Thermal fuel expenditure shares



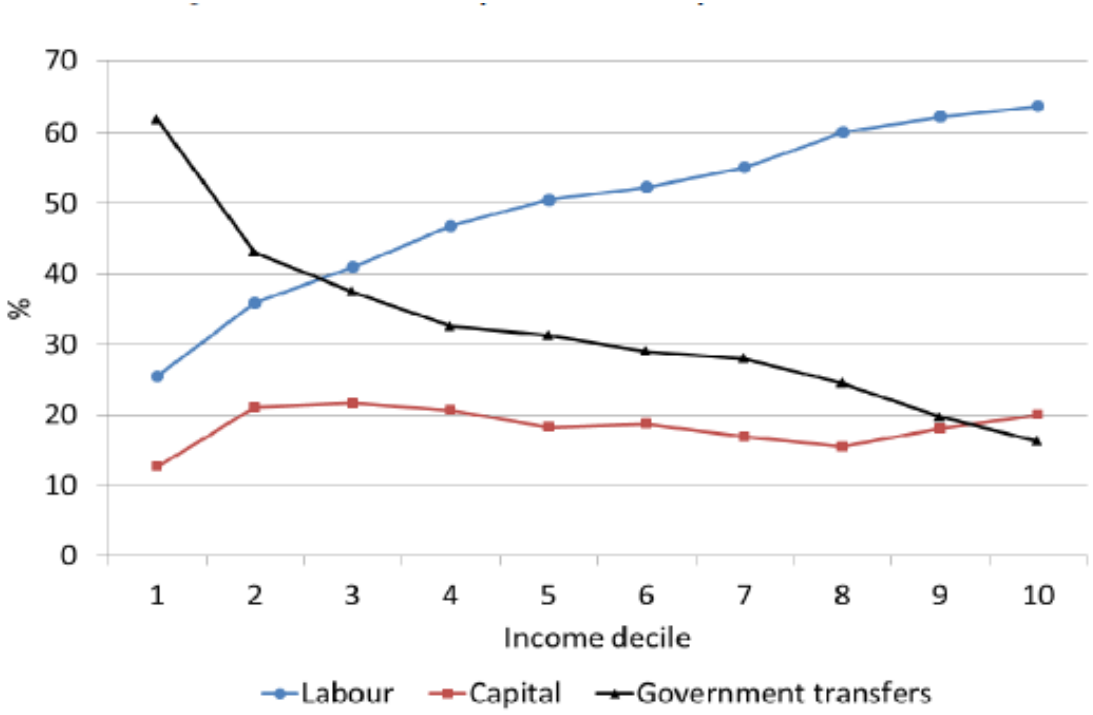
- Higher share for poorer Households

Transport fuel expenditure shares



- Share does not depend on income class

Household data: Income



- Poor Households: High share of transfer income
- Rich Households: High share of labour income

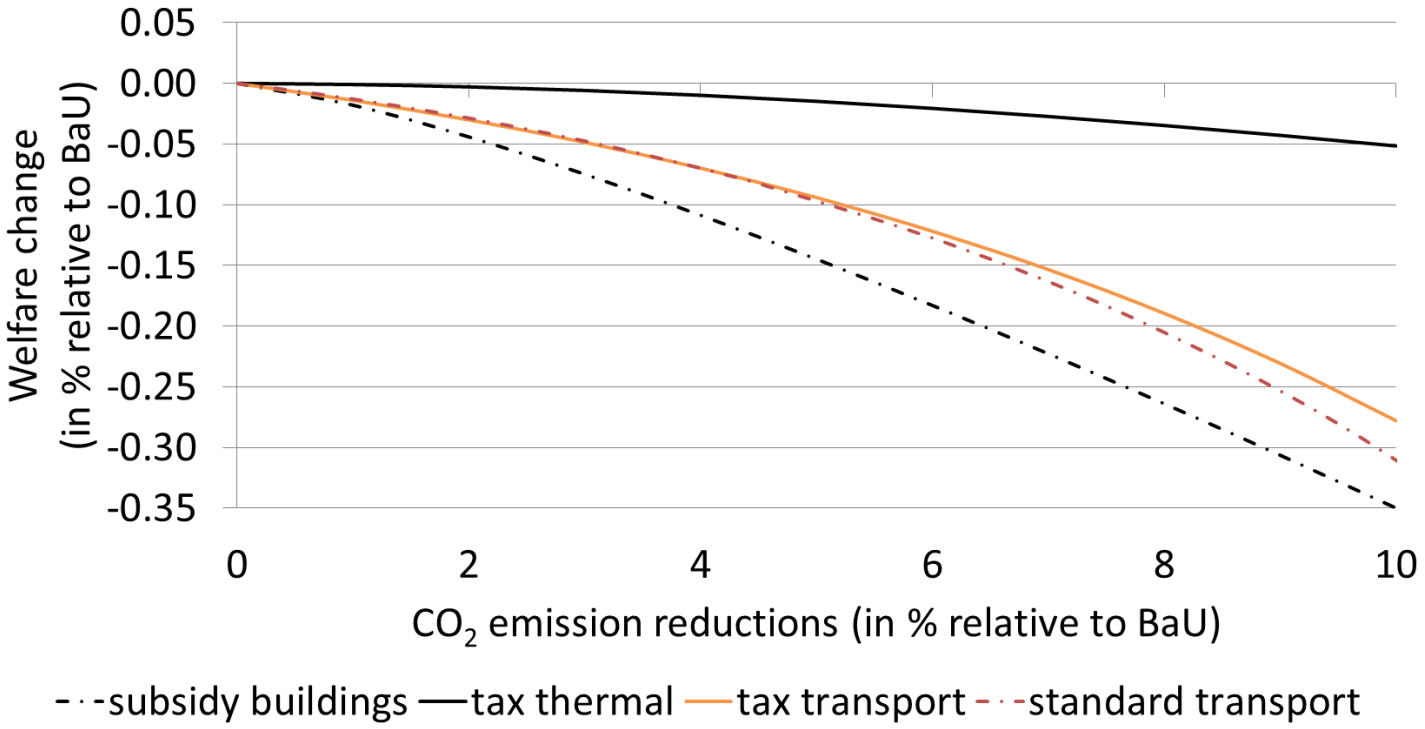
Scenarios and Results

Scenarios

- Four instruments
  - Tax on CO_2 emissions of transport fuels
  - Tax on CO_2 emissions of thermal fuels
  - Emissions standard for new passenger vehicles
  - Subsidies for buildings insulation

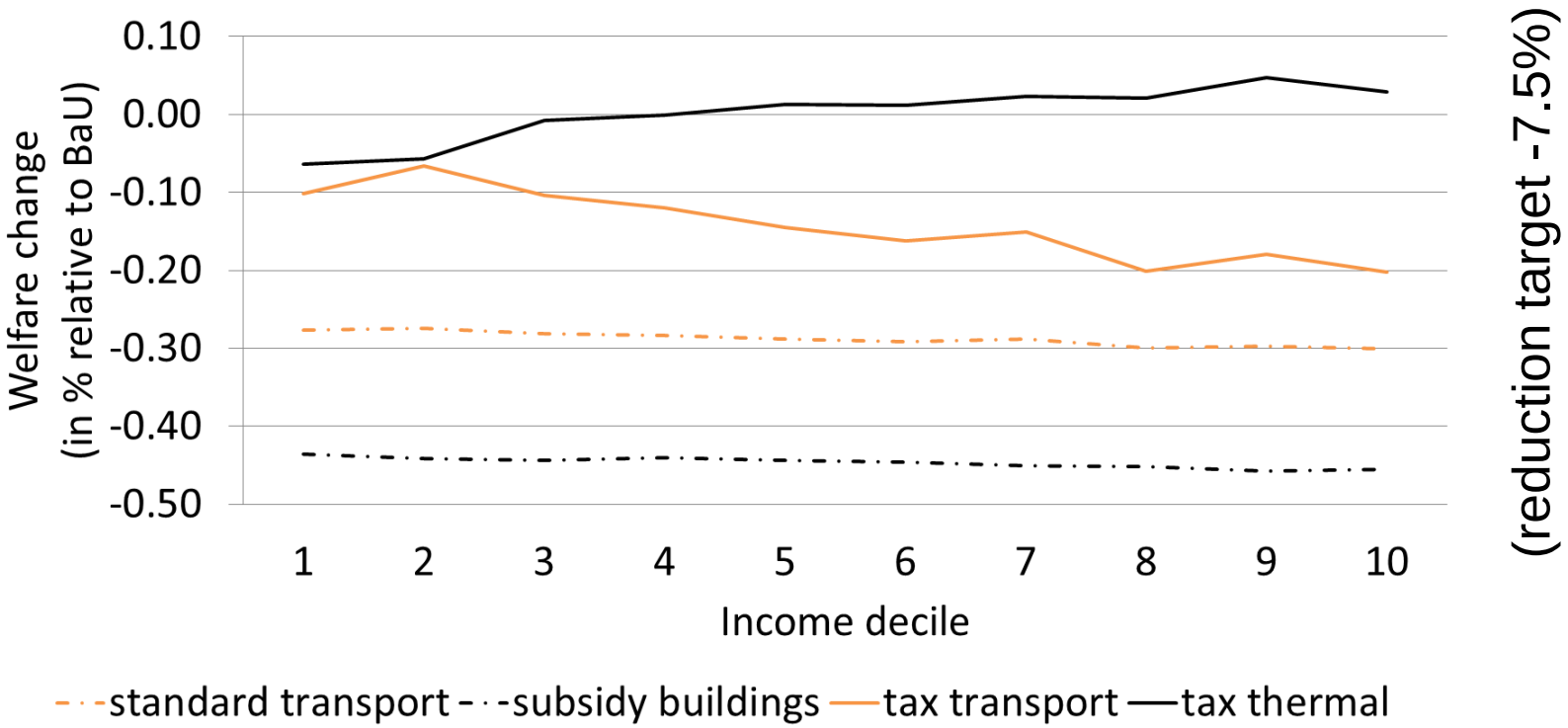
- Redistribution of revenues proportional to household income, i.e., neutral incidence of revenue recycling
- Evaluation relative to «business as usual» (BaU) scenario in 2030

Welfare loss for different reduction targets



- Thermal fuels: Tax clearly better
- Transport fuels: Results depend on reduction target

What about distributional effects?



- Tax thermal: Poorer households more affected
- Tax transport: Richer households more affected
- Standard/Subsidy: Almost neutral incidence

Impact on different socio-economic groups

Mean welfare impacts on households (in % relative to BaU)

	Retired	Working	Owner	Renter	Urban	Agglo	Rural
Tax transport	0.38	-0.24			0.05	-0.14	-0.29
Standard	-0.18	-0.31			-0.25	-0.29	-0.31
Tax thermal			-0.05	0.05			
Subsidy			-0.40	-0.47			

- HH with high transport expenditure shares more affected
- House owners can profit more from subsidies
- Differences between groups larger in case of a tax

Price changes

Price changes induced by the policies (in % relative to BaU)

	Consumer price index	Tax-inclusive price for transport / thermal fuels	Capital price	Labour price
Tax transport	1.2	81.6	-1.2	-1.1
Standard	0.2	-0.1	-0.2	-0.2
Tax thermal	0.3	~ 35	-0.3	-0.3
Subsidy	0	0	0	0

- Fuel prices increase due to tax
- Consumer price index increases most for transport tax
- Relative factor prices decrease

Distributional impacts driven by price changes

- Energy becomes more expensive

→ HH with high energy expenditure shares more affected

- Factor prices become relatively lower

→ HH with high factor income (rich) more affected

- Transfers are indexed to inflation

→ HH with high transfer income (poor) less affected

- Tax induces higher price changes

→ Tax leads to more dispersed distributional impacts

Conclusions

Summary and Conclusions

- Under what circumstances – if any – can alternative instruments be better than a tax?

→ Transport: For low reduction targets, a performance standard can be more cost-effective than a tax

→ Buildings: Tax is always more efficient than subsidies

- How are different types of households affected by different policy instruments?

→ Tax leads to more dispersed distributional impacts

→ Households with high energy expenditure shares more affected