Carbon taxes: efficient, inequitable, disliked?

CER-CEPE Friday Seminar at ETH Zürich

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Econability & EPFL

Approaching the topic

- Topic
  - social aspects of carbon tax reform and revenue recycling
  - public acceptability
  - suitable topic for a policy discussion
- Methods
  - CGE simulations
  - representative choice experiment and other surveys
- State of the project
  - CGE results
  - working paper on the choice experiment
  - SFOE report
  - no CGE paper yet

Structure of the talk

- The project: SEPIA
- Literature on carbon taxes and income distribution
- Model and data
- Scenarios
- Results
- Carbon taxes: efficient? inequitable? disliked?
- How (not) to design and promote carbon taxes in Switzerland

The SEPIA project

- Title: Social Cushioning of Energy Price Increases and Public Acceptability
- Project components:
  - Simulations with the computable general equilibrium (CGE) model GENESwIS:
    - How do revenue recycling options affect income distribution and efficiency?
  - Representative national survey (choice experiment) with 1200 respondents:
    - What design of CO_2 levies is most acceptable to citizens?
  - Integrated analysis:
    - Respondents are informed about the simulation results.
    - Search for acceptable, environmentally effective and efficient designs.

Project partners:

Econability (lead): Frank Vöhringer, Dario Stocker, Wolfgang Knoke, Sophie Maire

Haute Ecole de Gestion de Genève: Stefano Carattini, Andrea Baranzini

Université de Genève: Frédéric Varone

EPFL-LEURE: Philippe Thalmann

Financing: Swiss Federal Office of Energy (SFOE), research programme “Energy – Economy – Society”

Distributional effects depend on recycling

A carbon tax is regressive
USA, Metcalf 1999

Revenue recycling can help
10 EU Member States, Barker and Köhler 1998
USA, Rausch et al. 2011

Revenue recycling by:

- income tax reduction ⇒ regressive
- lump-sum per capita ⇒ progressive

... and on the region

A carbon tax is mildly progressive with revenue recycling through the income tax

USA regional, Oladosu and Rose 2006

- source of income effect is progressive

A carbon tax is highly progressive even before revenue recycling

British Columbia (Canada), Beck et al. 2015

- use of income effect is small (electricity mostly from hydro)
- source of income effect dominates (high income households with a higher share of labor income; capital mobility assumed)

Developing and emerging economies

Fuel taxation is highly progressive in developing and emerging economies

anthology, Sterner 2011

e.g. in Indonesia:

Yusuf/Resosudarmo

use of income effect is progressive

- higher income households spend more on vehicle fuels
- lowest income households cannot afford public transport

source of income effect is progressive

- higher income households receive factor income from sectors strongly affected by fuel tax reform

Revenue recycling lump-sum per capita is the (only) progressive option

Ecoplan 2012 and Imhof 2012

- But: trade-off between efficiency and equity
- Imhof 2012: “If distributional equity is considered as well, per-capita lump-sum rebatement leads to a progressive tax reform at a moderate cost”
- Ecoplan 2012:
  - households with kids benefit strongly from lump-sum payments
  - no significant influence of rural or urban place of residence

GENESwIS

- computable general equilibrium model
- dynamic-recursive version
- multi-sectoral single country model with Armington trade
- 15 private household categories
- taxes, public budget & equal yield constraint
- putty-clay capital structure
- emissions trading

GENESwIS: sectoral aggregation

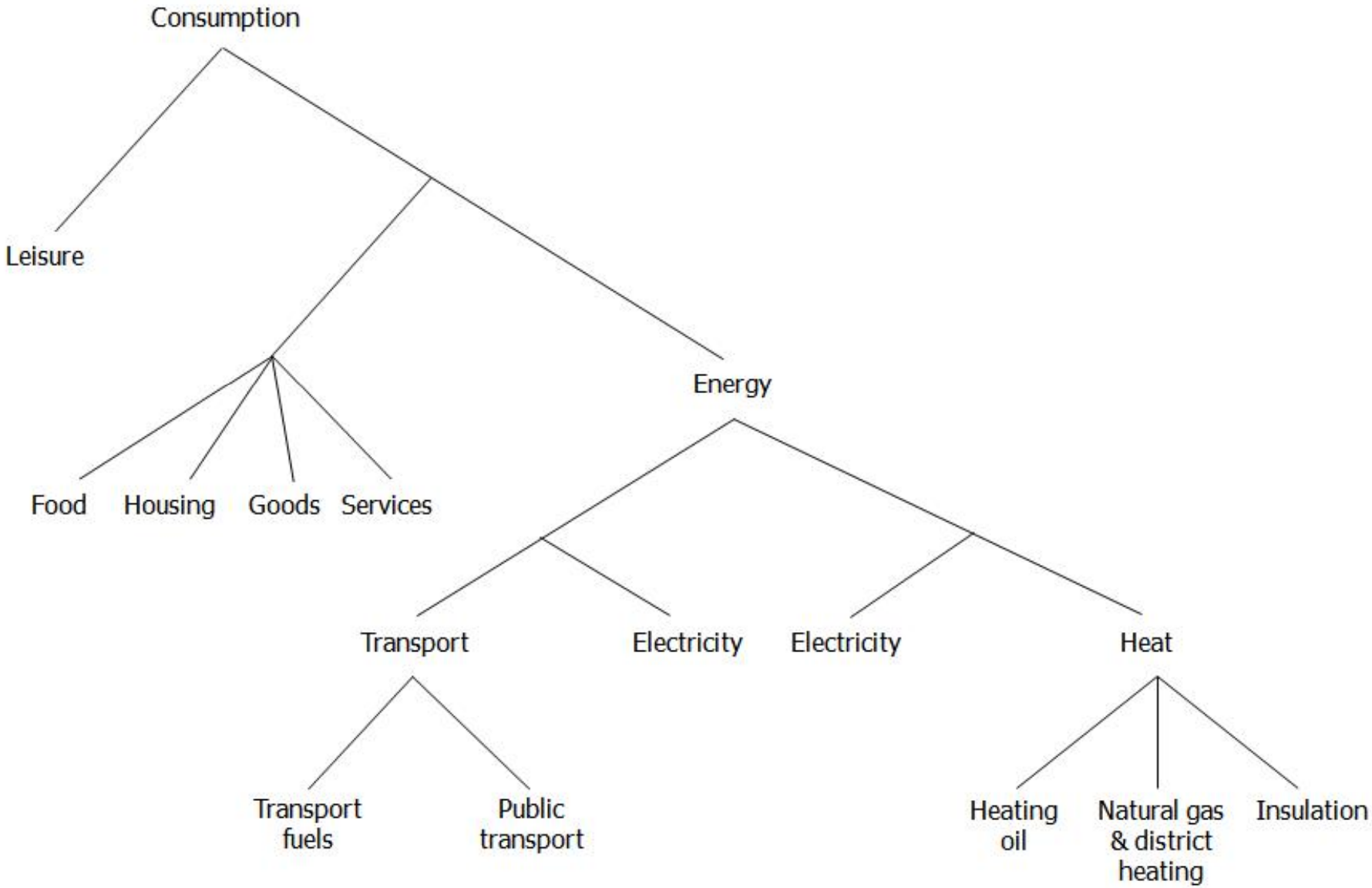
- Sectors

Energy	Other
Electricity	Food and beverages
Natural gas and district heating	Housing and real estate
Refineries	Transport
	Other emission trading sectors
	Rest of industry
	Rest of services

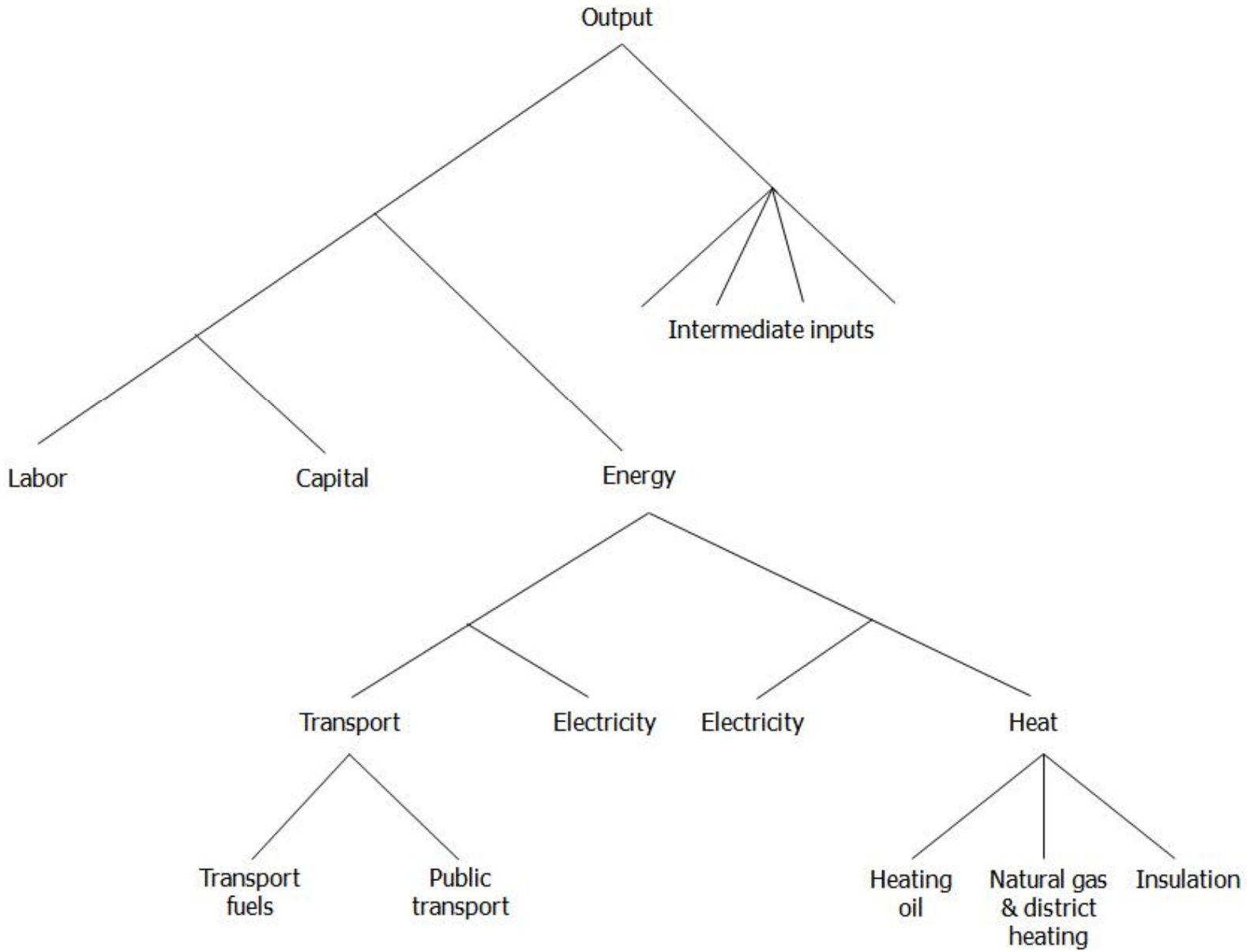
- Commodities

Energy	Other
Electricity	Food and beverages
Natural gas and district heating	Housing and real estate
Crude oil	Transport services
Heating fuels	Rest of industry
Transport fuels	Rest of services

GENESwIS: household expenditure



GENESwIS: sectoral cost functions



GENESwIS: Elasticities of substition

- Industry & services: Mohler/Müller 2012 & Ban/Okagawa 2008
- Doubling in 25 years

Nest	Sector	2015	2025	2035
KL	Other emissions trading sectors	0.303	0.505	0.707
	All other sectors	0.319	0.745	1.170
KL,E	Rest of industry	0.296	0.691	1.805
	Other emissions trading sectors	0.312	0.728	1.144
	Electricity / gas/ mineral oil	0.102	0.204	0.306
	Food and beverages	0.180	0.359	0.539
	Transport	0.112	0.224	0.336
	Rest of services / housing	0.091	0.364	0.819

- Armington: Hertel 1997 & Burniaux/Truong 2002

Commodity type	
Electricity	2.8
Fossil fuels	1.9
Food and beverages	2.2
Rest of industry	2.5
Services	1.9

Household data

- Household categories
  - families:
    - working population with vs. without children, retired population
    - each group differentiated into 5 groups of standard of living
  - spatial differentiation:
    - inner cities, agglomerations, rural households
    - each group differentiated into 5 groups of standard of living
- Data from household budget surveys 2007/2008
  - aggregated by Ecoplan (Ecoplan 2012) to fit 2008 energy IO table (Nathani et al. 2013)
  - substantial data manipulation necessary

Household data: some observations

- The share of expenditure for energy decreases in income.
- Tax and contribution ratios are U-shaped in income.
  - Main reason: health insurance.
  - The tax system is mildly progressive (with large cantonal differences).
- Pensioners have
  - a higher per capita income,
  - a higher tax ratio (but they hardly pay social security contributions),
  - a higher expenditure share of heating fuels (3.6% vs. 2.3%),
  - a lower expenditure share of transport fuels (1.4% vs. 2.3%).
- Rural households have
  - a lower per capita income,
  - a higher expenditure share for transport fuels than inner city households (2.3% vs. 1.5%),
  - but a lower expenditure share for heating fuels (2.1% vs. 3.1%).

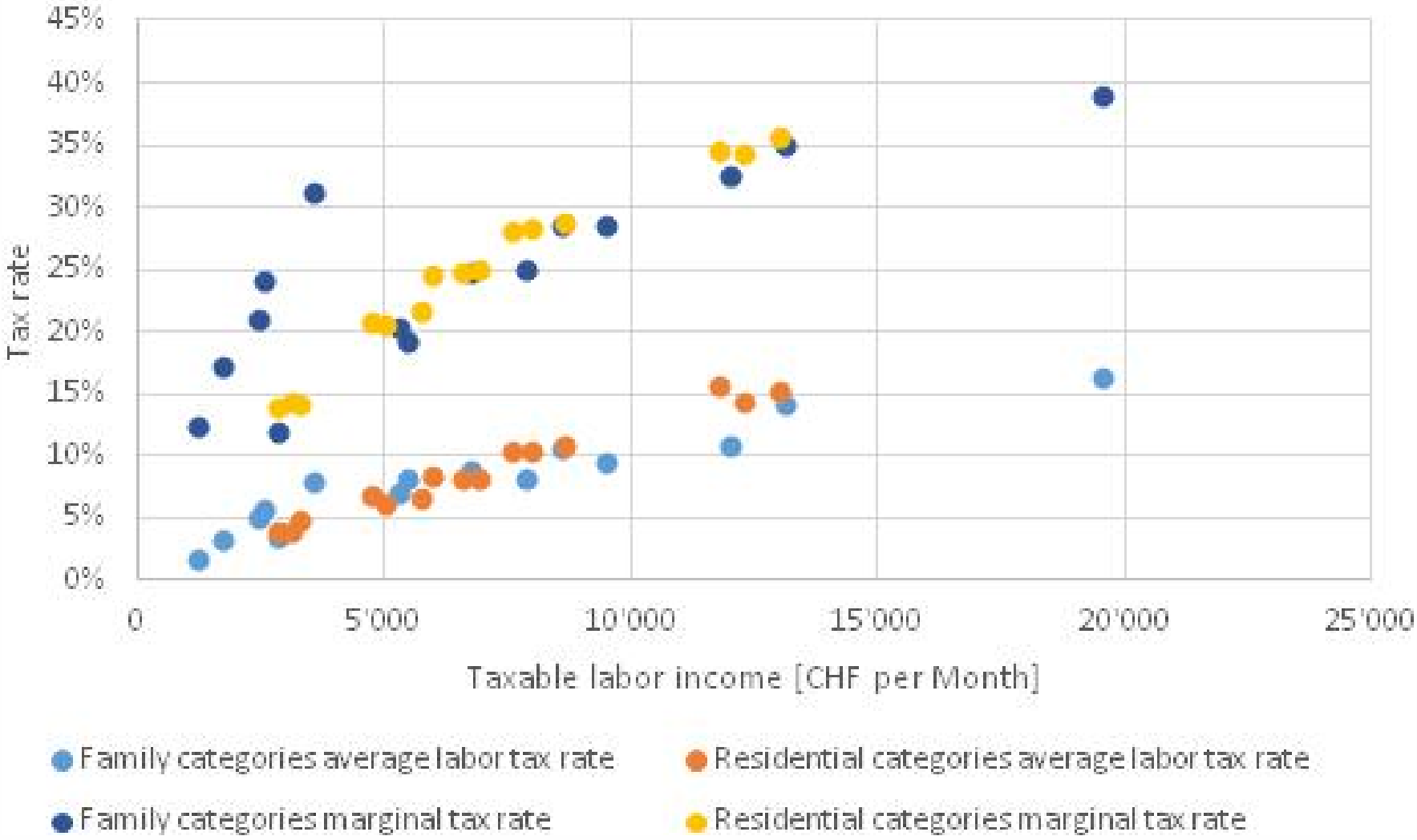
Household data: children

- Having children increases the probability of belonging to the bottom quintile as well as to the two bottom quintiles:

	bottom 20%	bottom 40%
kids	26.3%	54.0%
no kids	10.0%	25.6%

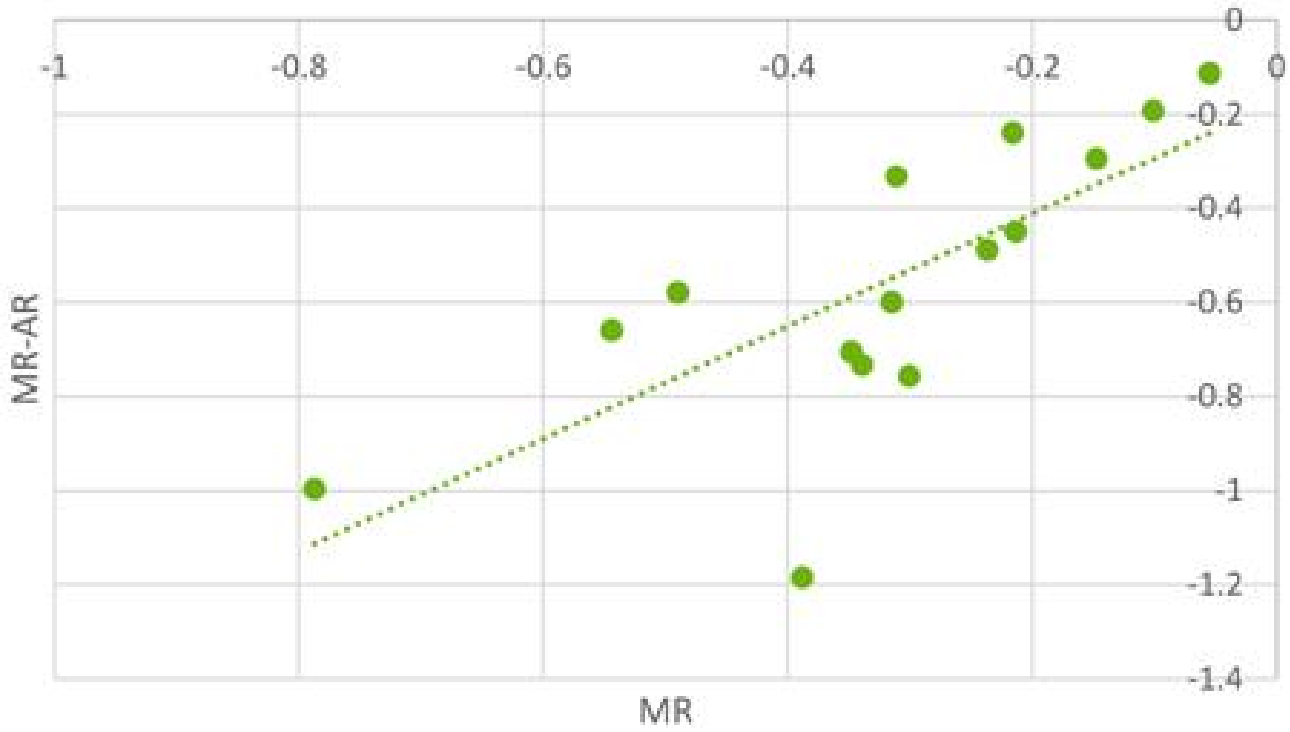
- The share of labor income is higher (79.8% vs. 63.9%)
- The income share of social benefits is lower (14.0% vs. 24.9%)

GENESwIS: Marginal tax rates



GENESwIS: Endogenous tax rate changes

- The model taxes activities at marginal rates.
- Transfers ensure that tax payments correspond to average rates.
- Equal yield: marginal tax rates are endogenous.
- Average tax rates also need to be endogenous -> adjust transfers.

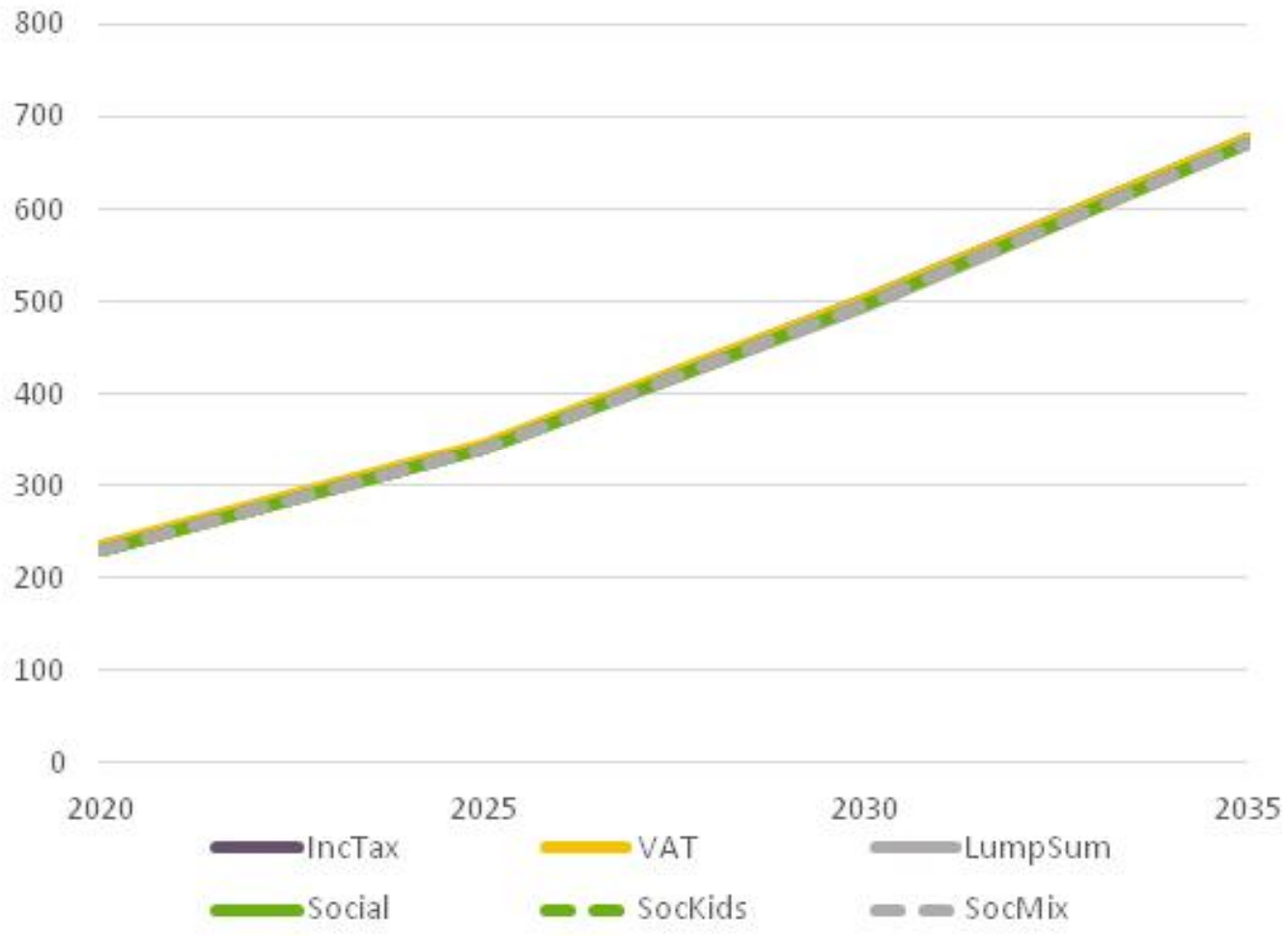


Scenarios and recycling variants

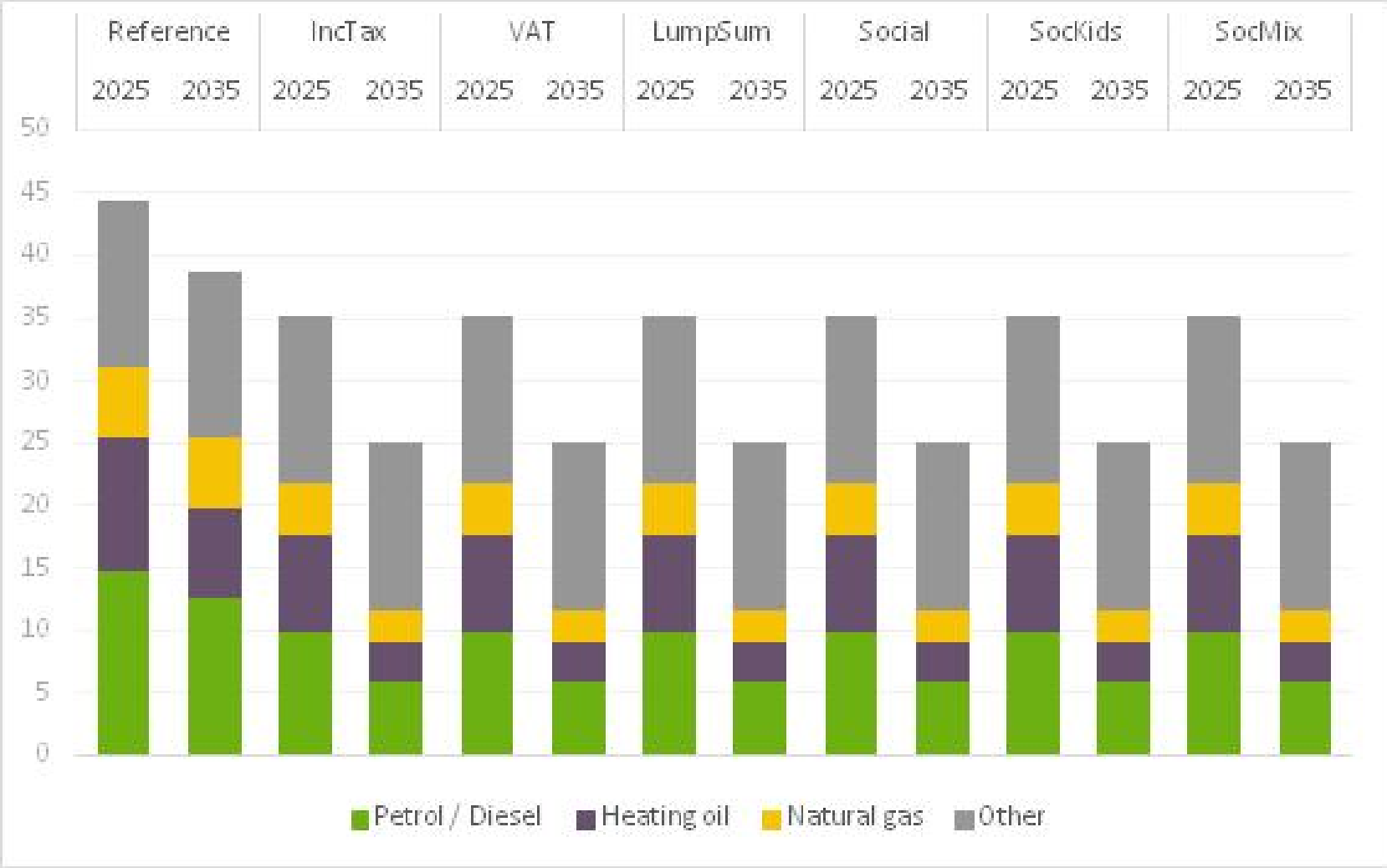
Recycling through taxes	
Income tax	IncTax
Value added tax	VAT
Lump-sum recycling	
Lump-sum per capita	LumpSum
Social benefits	Social
Social benefits + child benefits	SocKids
Social + child + retirement benefits	SocMix
Recycling through imported carbon offsets	
Offsets counting to domestic target	Offsets
Offsets for additional abatement	Abate

- Baseline: “weiter wie bisher” (Prognos 2012)
- Policy scenario: CO_2 targets of the new energy policy
- International offset prices: 10 CHF/t in 2015; +10% per year
- Imperfect social targeting: 70% - 25% - 5% - 0% - 0%

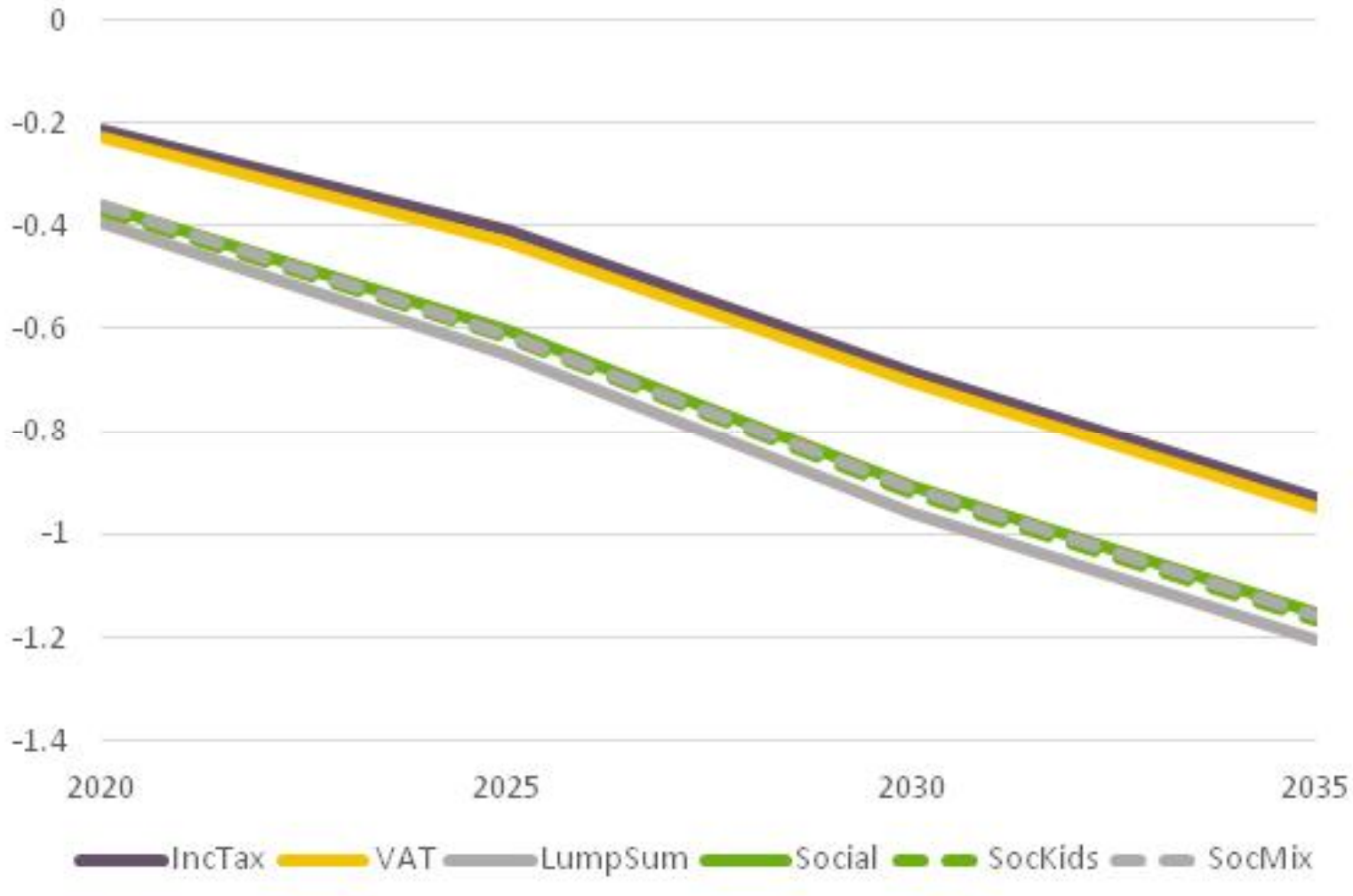
CO_2 tax rates (CHF_{2008} / t)



GHG emissions (in Mt CO_2e)



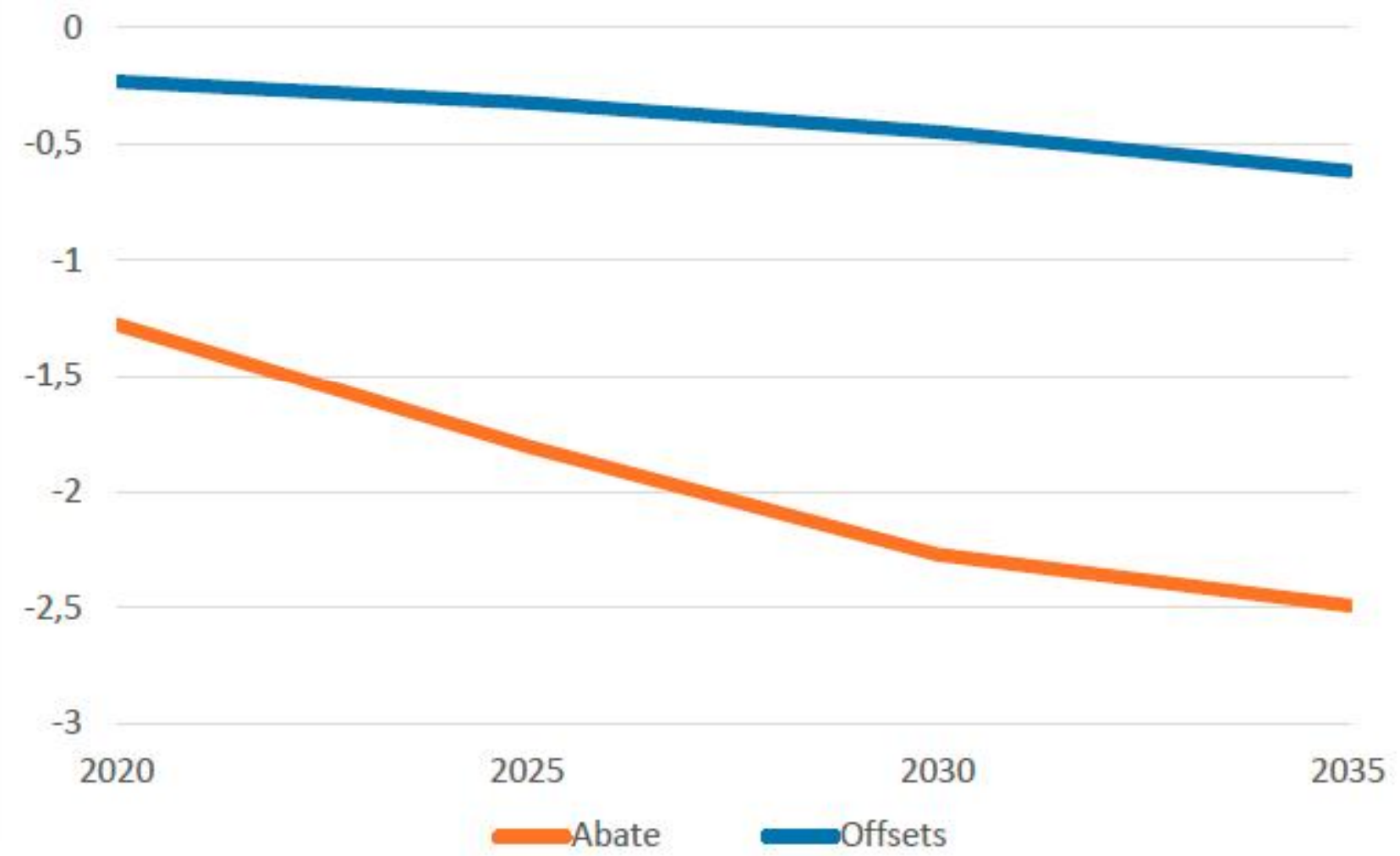
Impact on aggregate welfare



Welfare changes (in % in 2035)

GHG emissions (offset scenarios, in Mt CO_2e)

Impact on aggregate welfare (offset scenarios)



Insights from the surveys

- very little support for high carbon tax rates
- very little support for pure tax reforms
- in the setting of a choice experiment, information is key to the acceptability of efficient and equitable designs
  - Informing about the environmental effectiveness of the CO_2 levy reduces the (generally strong) demand for environmental earmarking of revenues.
  - Informing about distributional effects leads to demands for progressive designs.

Example of a choice card

Tax rate: CHF 150 / ton of CO_2

Use of revenues: income tax rebates

Order of magnitude of impacts:

• Increase in energy prices (gasoline, diesel, heating fuel)	14-16 cents per liter
• CO_2 emissions abatements in Switzerland	15%
• Purchasing power of all households	–0.2%
• Purchasing power of low-income households	⊖⊖

☐ VOTE

SEPIA references on acceptability

- Carattini, S., A. Baranzini, P. Thalmann, F. Varone and F. Vöhringer (2016): Green taxes in a post-Paris world: are millions of nays inevitable?
  (based on a representative choice experiment)
- Baranzini, A. and S. Carattini (2016): Effectiveness, earmarking and labeling: testing the acceptability of carbon taxes with survey data
  (based on an unrepresentative survey in Geneva)
- Baranzini, A., M. Caliskan and S. Carattini 2014: Economic Prescriptions and Public Responses to Climate Policy (based on interviews)
- Philippe Thalmann 2016: Quelle est l'utilisation préférée de la recette d'une taxe sur l'énergie?
  (analysis of the VOX survey on the Greenliberals' energy tax initiative)
- All included in the report: Vöhringer et al. (2016): Social Cushioning of Energy Price Increases and Public Acceptability, Swiss Federal Office of Energy.

Efficient? Inequitable? Disliked?

- Efficient? Rather: potentially cost-effective.
  - No double dividend for high tax rates (although they are needed for ambitious targets, including the taxation of transport fuels).
  - Good news from other studies: secondary benefits can be substantial.
  - Marginal cost deviations due to voluntary commitments and emissions trading are an issue for cost-effectiveness.
- Inequitable? Not necessarily.
  - No serious social issues with CO_2 tax reform: Setting aside a small portion of the revenues for lump-sum recycling is sufficient to address them.
  - No serious issues for the urban/rural divide (although rural households spend more on transport fuels and less on heating fuels)
- Disliked? Yes.
  - Especially when proposed tax rates are high.
  - Serious doubts about the effectiveness.
  - Serious fear for detrimental impacts on competitiveness.
  - The concept of the double dividend is not understood.

Considerations for Switzerland: equity

- Transfers can be designed such that any distribution goal can be reached (this study & 2nd theorem of welfare economics).
  - Some instruments:
    - health insurance lump sum payments or premium reductions
    - child benefits
    - old age pensions
    - AVS/AHV contributions
  - Difficulties:
    - losers needed (no double dividend)
    - difficult distributive politics due to apparent beneficiaries
    - federalism: Who gets the tax revenues? Who pays the transfers?
    - increased (federal) budget
    - affected sectors (e.g. transport, natural gas and mineral oil)
    - preference for ecological use of tax revenues

Environmental earmarking

- clearly preferred by voters
  - but less efficient (domestically) or equitable
    - rescue through secondary benefits of domestic abatement?
    - environmental programs with high benefits?
  - existing domestic (compensation) schemes
    - lack of projects?
    - delineation between programs (Klik, EnAW, Cleantech)
  - international offsets
    - when counted towards the CH goal: cheaper than domestic abatement
    - mind the domestic CH goals (-30% in 2030 w.r.t. 1990)
    - buying additional abatement is cheap and effective
    - but: trust issues with international offsets
    - not necessarily the type of ecological earmarking which has high acceptance

How (not) to design and promote carbon taxes in Switzerland (to be discussed)

- Talk about climate and environment, not double dividends.
- Inform about the effectiveness of carbon taxes.
- Inform about the compatibility of carbon taxes with economic and social objectives.
- Finance environmental programs (but which ones?).
- Set aside some revenue for lump-sum recycling to address social concerns.
- Also reduce taxes to improve the efficiency of the reform (too complicated?).
- Make the lump-sum recycling visible (send a check or at least let Parliament discuss about it).
- Communicate about bonuses for desirable environmental behavior (instead of punishment through taxes, e.g. “Lenkungsabgabe”).