Incidence Analysis of National Climate Policies: Estimates and Implications for Austrian Households

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Relevance of climate policy incidence

General wisdom, that carbon or fuel taxes are regressive as low income households spend a larger portion of their income on energy and fuels.

Figure 1  Average U.S. household energy expenditure as a percentage of total expenditure by expenditure decile.
Notes: Decile 1 is poorest, 10 is richest. 
Channels of incidence and modelling approaches

• Different **channels** through which incidence is affected:
  – Income use: direct effect from fuel and energy use
  – Income use: indirect effect
  – Income source: factor income in general equilibrium

• Correspondingly, different **approaches** (that imply increasing complexity) are able to cover these incidence channels to different extents:
  – Household budget survey analysis
  – Input-Output analysis (e.g. carbon footprints)
  – Macroeconomic modelling (CGE modelling)
Short literature overview

All of the incidence approaches are used in earlier and recent studies to estimate climate policy incidence

- All of them acknowledge incidence channels covered and excluded
- Main body of the literature investigates carbon pricing instruments in developed countries
  - Revenue recycling may compensate regressivity
  - Effectiveness of recycling may be limited by within group variation (horizontal equity)

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<th>Incidence channel</th>
<th>Study</th>
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1. Different approaches
   - What is the climate policy incidence from each channel of direct and indirect income use as well as income source effect for Austria?
   - I.e. what is the „error“ when neglecting a channel by using different approaches?

2. Horizontal equity
   - How relevant is horizontal equity for revenue recycling when considering direct and indirect income use channels?

3. Different policy instruments
   - How does the incidence transmitted through each channel look for different national policy instruments?
Approaches and data used

- Household budget survey (HBS) analysis
  - Austrian HBS 2014/15 (Statistik Austria 2016a)
  - Representative sample of 7,162 households

- Income deciles (1=lowest income, 10=highest income)
  - Lifetime income (expenditure proxy) (Poterba 1991)
  - Household equivalents (i.e. per capita)
Approaches and data used

- Household budget survey (HBS) analysis

- On average higher budget share for fuels in low income households than for high incomes

- Within-group variation is larger for low income groups (cf. also Pizer and Sexton 2019)
Approaches and data used

- Input-Output (IO) approach for embodied emission calculation
  - EE-MRIO based on GTAP database
    \[ e^* = e \hat{x}^{-1} (I - Z\hat{x}^{-1})^{-1} \hat{y} \]
  - Regional and sectoral sources by using diagonialized vector of region-specific sectoral emission intensities \( e_r \hat{x}_r^{-1} \)
  - Total Austrian emissions in the supply chain of Austrian final household demand
  - HBS 2014/15 (Statistik Austria 2016a)
Approaches and data used

• Input-Output (IO) approach for embodied emission calculation

Emission embodied in consumption:
➢ Account for 70%-80% of total household emissions
➢ Are more equally distributed than direct fuel emissions
Approaches and data used

- Input-Output (IO) approach for embodied emission calculation

Emission embodied in consumption:
- Account for 70%-80% of total household emissions
- Are more equally distributed than direct fuel emissions
- Within-group variation of total emissions is lower than for fuels and more equal across income groups
Approaches and data used

• Computable General Equilibrium (CGE) modelling
  – Multi-sector multi-regional CGE model of explicit global trade
    • Based on GTAP data
  – Simulation of...
    • Consumption responses of households
    • Production responses of firms
    ... via constant elasticity of substitution (CES) functions
  – Household representation in income quartiles
    • Income use: HBS 2014/15 (Statistik Austria 2016a)
    • Income source: EU-Silc (Statistik Austria 2016b)
      – Capital, high- and low-skilled labour, transfers
    • Subsistence consumption by Stone-Geary utility functions
Approaches and data used

- Computable General Equilibrium (CGE) modelling
  - Household representation in income quartiles
Investigated climate policies - overview

- Economy-wide fossil fuel tax increase
  - With proportional-to-income revenue recycling

- Building code adaptation
  - to allow for an increased use of wood-based building structures

- Company mobility plans
  - to increase environmental friendly commuting
  - implemented as obligation for large companies (>50 employees)

- Calibrated to equal emission reductions across policies
Incidence estimates of a fuel tax increase

- **HBS**: direct burden of transport and heating fuel price increase including proportional-to-income revenue recycling
- **IO**: direct and indirect burden of fuel price increase including proportional-to-income revenue recycling
- **CGE**: direct and indirect income use and income source effects
Incidence channels of a fuel tax increase

- CGE decomposition into income use and income source channels
Incidence estimates of a building code adaptation

- **HBS**: direct burden of price increase for real and imputed rents, induced by construction price change
- **IO**: direct and indirect burden of price changes induced by construction technology
- **CGE**: direct and indirect income use and income source effects from adapted construction technology
Incidence channels of a fuel tax increase

- CGE decomposition into income use and income source channels
Incidence estimates of a building code adaptation

- **HBS**: direct burden of public transport subsidy
- **IO**: direct and indirect burden consumer price changes induced by total investment costs of firms
- **CGE**: direct and indirect income use and income source effects from firm investment
Incidence channels of a fuel tax increase

- CGE decomposition into income use and income source channels
Conclusion

• Fuel tax policy
  – Incidence estimate from HBS is more regressive than from IO or CGE
  – IO and CGE estimate similar incidence, as factor incomes hardly change

• Building code adaptation
  – Dominating income source side effects from factor incomes

• Company mobility plan policy
  – Strong interaction of income use and income source side effects

➢ Household incidence strongly varies across policy instruments
Discussion

• Applicability of HBS estimates is rather limited

• IO estimates can be useful when income source effects are small or interpreted as short-term estimates

• Horizontal equity is less an issue for economy-wide taxes, when considering total embodied emissions instead of fuel consumption
Discussion

• In general, incidence of climate policies is determined by
  ➢ the consumption patterns of households (income use)
  ➢ the corresponding emission intensities of consumption
  ➢ the existing distribution and composition of income (income source)
  ➢ the specific policy and policy design

• Evaluation of policy incidence should cover all these aspects to give best information basis for decision makers and public.
Thank you!

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