The Distributional Impacts of EU-ETS 2 on Households: A Microsimulation Approach in Belgium

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Outline

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EU Regulation: *Fit for 55* package and ETS 2

- Under the Green Deal, the European Union is committed to reducing its GHG emissions by 55% between 1990 and 2030
- A key element of the *Fit for 55* package is the **Emissions Trading Scheme** (ETS)
  - Market-based instrument that prices emissions for large emitters from 2005
- It will be extended by 2027 into a new **ETS 2 for road transport and buildings**
  - Carbon price is capped at 45€/ton of CO2 during the first years of the scheme
- A quarter of ETS 2 revenues is used to finance the Social Climate Fund, in particular to protect **households vulnerable** to higher energy prices
  - It allows a redistribution towards the citizens

Literature: The Question of Public Acceptability

- Public acceptability of carbon pricing is highly dependant on the perceived **equity** of the reform (Dechezleprêtre *et al.*, 2023; Bergquist *et al.*, 2022)
- Households tend to **overestimate their expected loss** while a majority of them would gain from a tax & rebate reform (Douenne & Fabre, 2022)
- Addressing distributional concerns can help increase **social adhesion** (Dabla-Norris *et al.*, 2023)
- In particular, **revenue-recycling** can be used to mitigate the impact on households

Literature: The Determinants of Carbon Pricing Impact

- **Localisation** (urban versus rural) and **climate** matters (Rausch *et al.*, 2011)
- Importance of the **type of heating system** and the population **density** (Douenne, 2020)
- **Targeting** revenue recycling helps reduce energy poverty and/or make the reform progressive (Berry, 2019)

Example: Yellow Vests Movement in France

Research Questions

- What are the **distributive impacts** of carbon pricing in Belgium?
- What **characteristics** are associated with a higher carbon payment on transport and heating fuels?
- How the money collected can be used to **compensate** the most impacted households?

Methodology

- **Microeconomic** simulation
  - Based on the 2018 Household Budget Survey (HBS)
  - 6,000 households (HH) reported their monthly expenditures
- Microeconomic **Simulation**
  - 45€/ton of CO2 carbon price on fuel expenditures (heating and transport)
- **Hypotheses**
  - 2018 energy quantities
  - No wage uprating (indexation)
  - Companies are not represented here
  - No behavioral adaptation: *Day-after* effect

Macroeconomic results

Fuel	**Gasoline**	**Diesel**	**Heating Oil**	**Natural Gas**
Price increase	0.13 €/liter	0.14 €/liter	0.14 €/liter	9.5 €/MWh
Relative P. inc.	+ 8.7 %	+ 9.5 %	+ 20.2 %	+ 15.6 %
Total Revenues	€ 219 M	€ 273 M	€ 416 M	€ 365 M
Share by fuel	17.2 %	21.5 %	32.7 %	28.6 %

- Carbon pricing is expected to raise € 1,274 M of public funds annually

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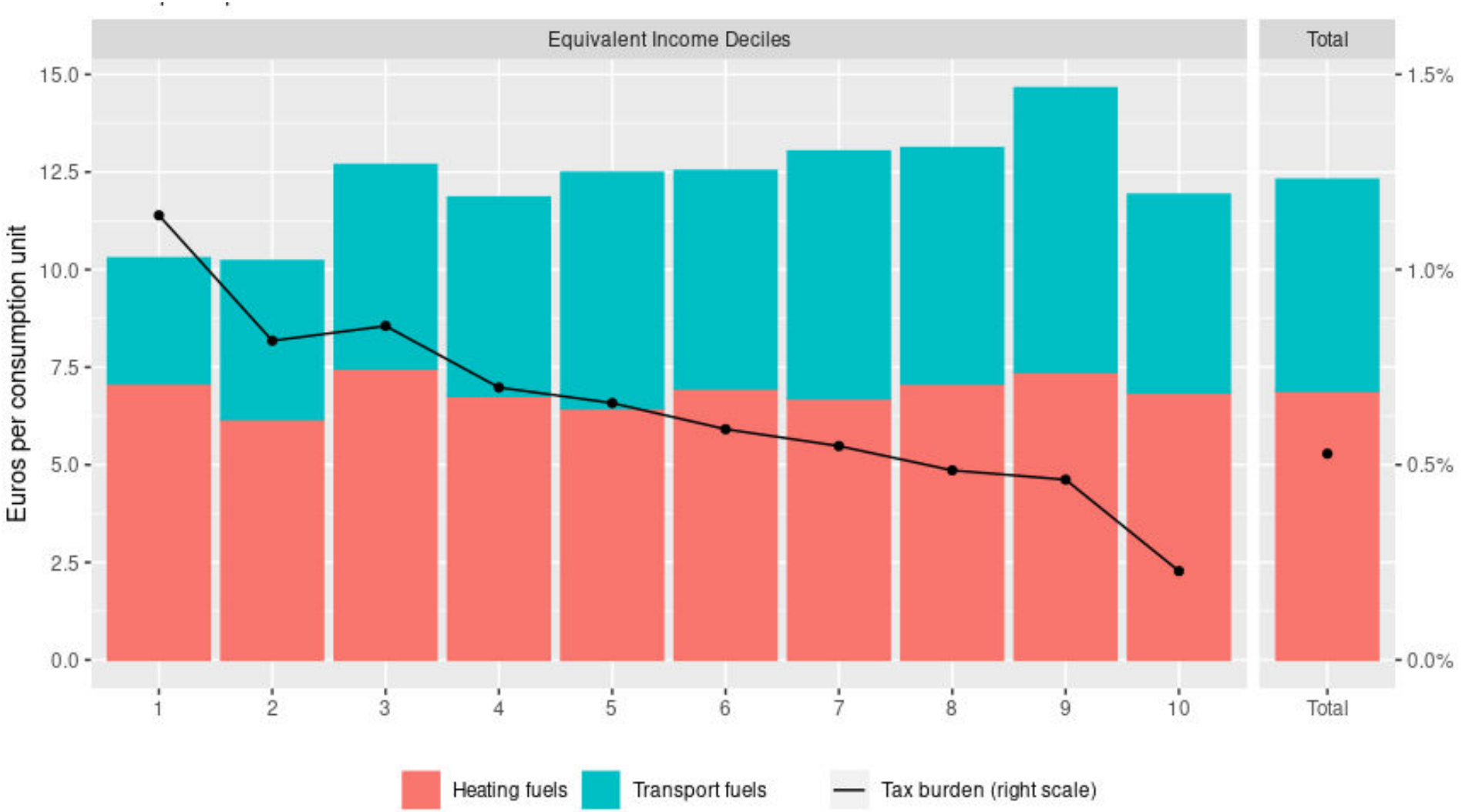
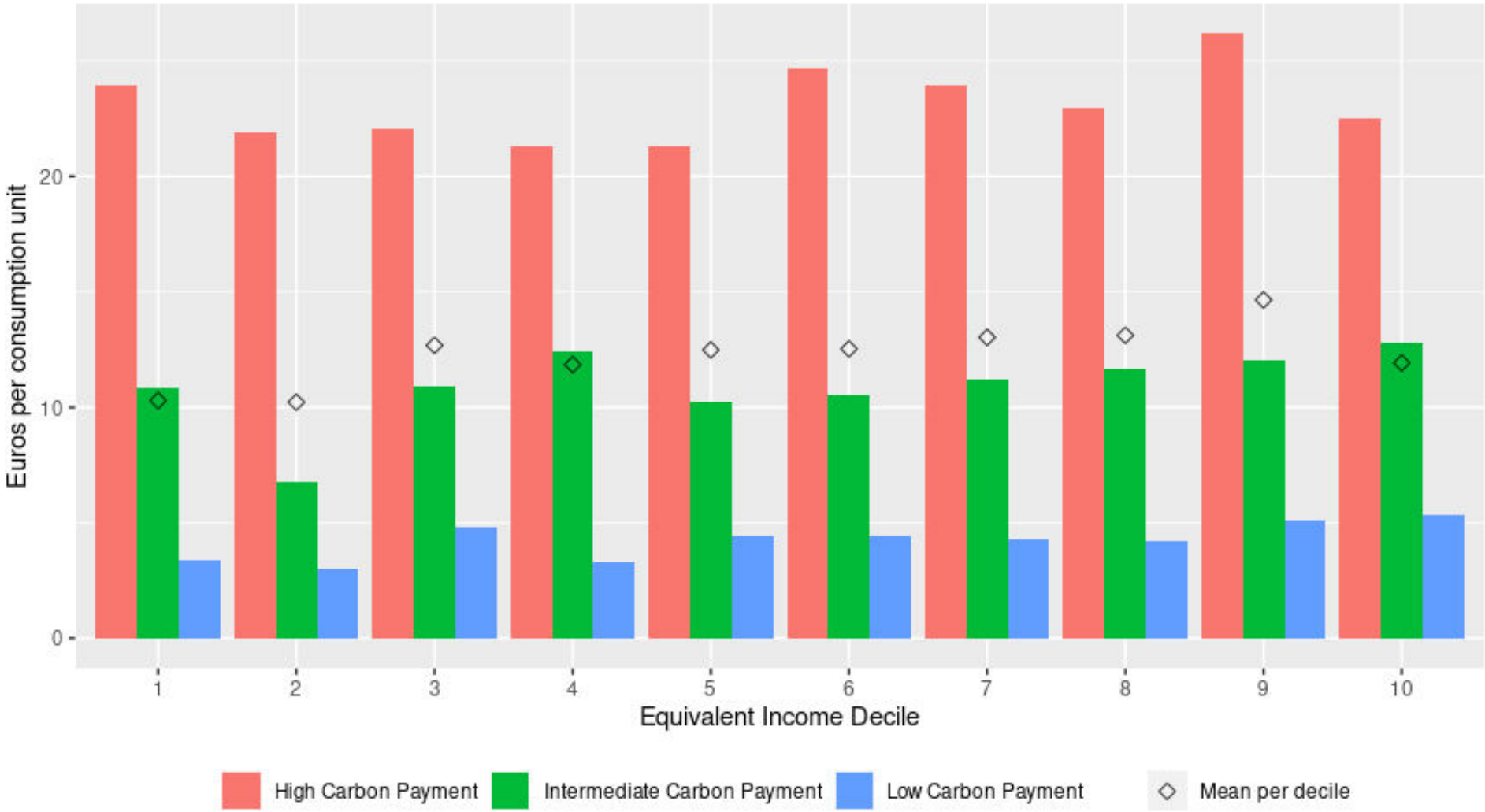
Vertical Equity: The Carbon Price is Regressive



Horizontal Equity: Important Intra-decile Disparities



Impacts by Socio-demographic Characteristics

Characteristic	Tax Per C.U	Tax Burden	Energy Poverty	Variation	Large Losers
Total	12.30	0.53 %	20 %	+ 3.3 p.p.	21.8 %
Age $<$ 65	11.84	0.49 %	15.3 %	+ 2.8 p.p.	18.7 %
Age $>=$ 65	15.58	0.84 %	43.5 %	+ 5.9 p.p.	37.3 %
Reg. Brussels	8.53	0.38 %	15.5 %	+ 2.4 p.p.	11.6 %
Reg. Flanders	11.21	0.45 %	17.2 %	+ 2.5 p.p.	16.9 %
Reg. Wallonia	15.45	0.74 %	26.4 %	+ 5 p.p.	33.9 %
Heating Other	5.18	0.24 %	14.1 %	+ 1.3 p.p.	4.6 %
Heating Gas	10.92	0.45 %	17.5 %	+ 3 p.p.	16.8 %
Heating Oil	20.44	0.91 %	30.1 %	+ 5.5 p.p.	46.1 %
Flat	8.51	0.44 %	22.8 %	+ 3.5 p.p.	18.6 %
House	13.21	0.54 %	19.1 %	+ 3.2 p.p.	22.6 %

Focus on the Type of Heating System

OLS Regression	**Carbon Price**	*N. Obs.* $= 6{,}124$		*Adjusted* $R^2 = 0.47$	
		Estimate	Std. Error	t value	Pr(>|t|)
	(Intercept)	-3.31	0.61	-5.45	0.000
Heating System	Oil	29.28	0.54	54.40	0.000
	Gas	10.07	0.45	22.18	0.000
Nbr. of Car(s)	2 or more	10.24	0.61	16.76	0.000
	1	5.01	0.48	10.49	0.000
Housing Type	House	4.17	0.43	9.63	0.000
Region	Wallonia	3.27	0.39	8.45	0.000
	Brussels	0.54	0.60	0.89	0.371
	Household Size	1.20	0.15	7.95	0.000

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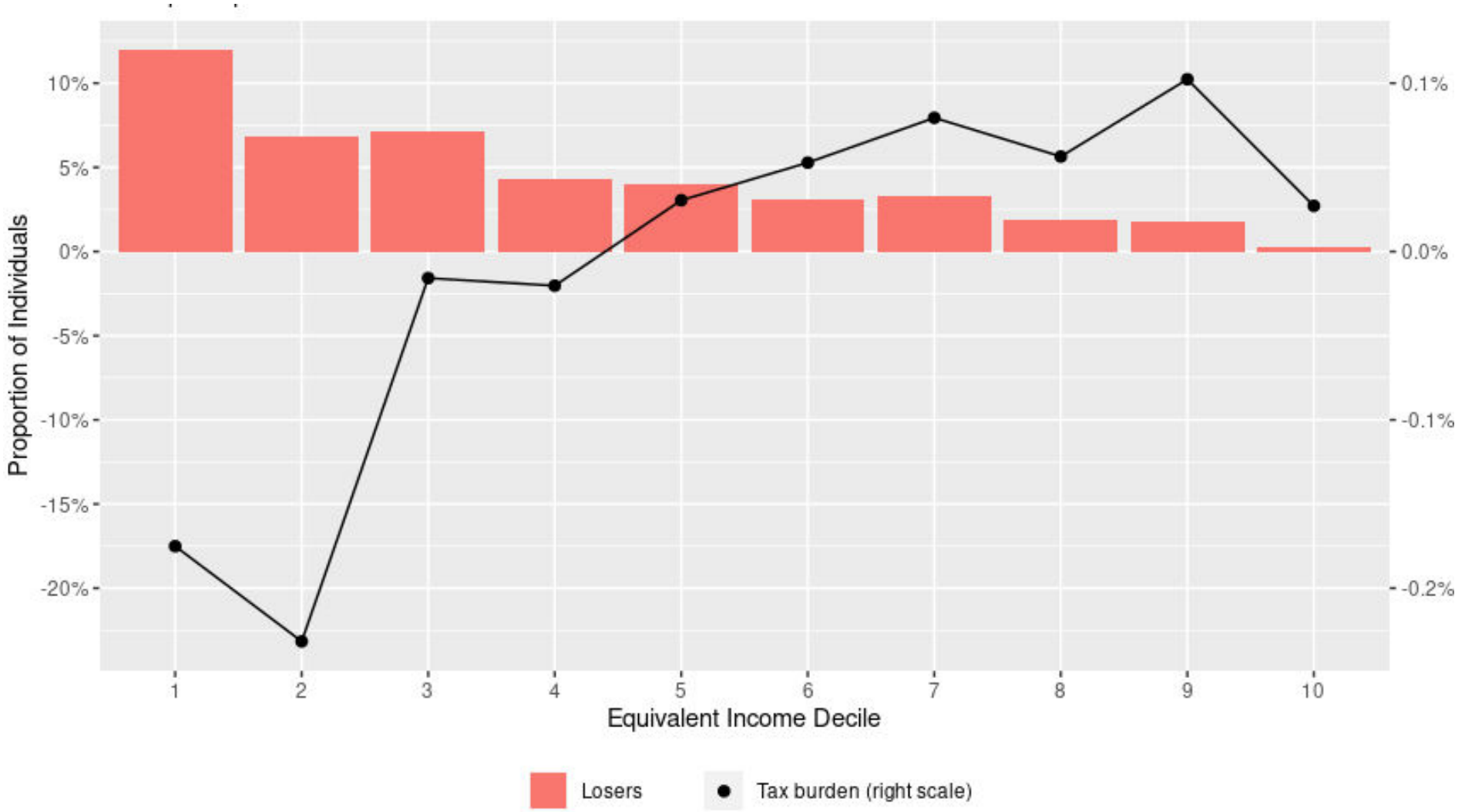
Lump-sum Design: Each Household Gets €23/month Back

- We redistribute all carbon price revenues back to citizens in a lump-sum fashion
- **Budget-neutral** tax reform
- Such a "carbon dividend" is quite **popular** among economists
  - Recommended by 3,000 US economists among which 28 Nobel Laureates
  - Implemented in Switzerland, Canada and Austria
- We obtain a *Net Tax Burden* at the HH level (% of income)
  - If <0, the HH benefit from the reform
- We compute the proportion of *"Large Losers"*
  - HH whose Tax Burden exceeds 1%

The Reform Becomes Progressive with Household Rebates



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Targeted Schemes: Why?

- Lump-sum does not compensate all **vulnerable household**
  - Carbon pricing could push some of them further into (energy) poverty
- To foster **public acceptability**
  - **Willingness to pay** for climate change policies increases with income (Hersch & Viscusi, 2006; Kotchen *et al.*, 2013); This results holds in the specific case of carbon taxation (Kotchen *et al.*, 2017; Rotaris & Danielis, 2019)
  - Recycling schemes that lower income inequality gather stronger political support because of **inequality aversion** (Kallbekken *et al.*, 2011)
- To support (energy-) poor household in their **energy transition**
  - *E.g.*, Through the use of subsidies for investments in cleaner durable goods (heat pumps, electric cars)

Targeted Schemes: How?

- We use **half** the revenues on a **targeted** scheme and the other **half** on **lump-sum** redistribution for all
- Targeted Groups
  - Households heating with oil or gas (TH)
  - Three first deciles (T30)
  - Five first deciles (T50)
- We look at the *Tax Burden* and proportion of *"Large Losers"*.

A Transfer Based on Heating Type Better Protects Vulnerable HH

Characteristic	Tax Burden /HH	Tax Burden TH	Large Losers /HH	Large Losers TH
Total	0 %	0 %	4.5 %	3.3 %
Age $<$ 65	0 %	0.01 %	3.6 %	2.9 %
Age $>=$ 65	-0.05 %	-0.08 %	8.6 %	5.6 %
Reg. Brussels	-0.27 %	-0.24 %	1.2 %	1.3 %
Reg. Flanders	-0.07 %	-0.03 %	2.8 %	2 %
Reg. Wallonia	0.18 %	0.13 %	8.5 %	6.3 %
Heating Other	-0.46 %	-0.09 %	0.1 %	0.9 %
Heating Gas	-0.08 %	-0.06 %	2 %	2.1 %
Heating Oil	0.49 %	0.2 %	13.5 %	8 %
Flat	-0.37 %	-0.29 %	1.9 %	1.7 %
House	0.1 %	0.08 %	5.2 %	3.8 %

Combining Heating and Income Criteria

	/HH	T30	T50	TH50
Large Losers	4.5 %	4.8 %	3.6 %	3 %
1st Quartile	9.1 %	2 %	4.2 %	2.1 %
2nd Quartile	4.7 %	8.6 %	1.7 %	1 %
3rd Quartile	2.9 %	6.1 %	6.1 %	6.1 %
4th Quartile	1.2 %	2.6 %	2.6 %	2.6 %
Energy Poverty	-0.8 p.p.	-3.2 p.p.	-2.5 p.p.	-2.7 p.p.

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Key Results

- A stand-alone carbon price is regressive
- We observe significant heterogeneity across households of comparable income
  - The burden falls disproportionately on those heating with oil (or gas), living in a house and owning cars
- Lump-sum redistribution at the household level makes the reform progressive
- Targeted transfers help mitigate the impact on vulnerable households and, as such, could increase the political acceptability of the reform

Further Research

- Exploit a density variable to consider "rural" targeted transfer (*e.g.*, Austria)
- Short-term behavioural adaptation to higher energy prices
  - Quadratic Almost Ideal Demand System (QUAIDS)
- Longer term choice of durable goods (*e.g.*, electric car, heat pump)
  - Discrete choice model

Thank you

Thank you!

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