

The Distributional Implications and Public Acceptability of Carbon Pricing in Belgium

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9th World Congress of the IMA



Outline

Introduction

Carbon Pricing and Household Characteristics

The Choice of Revenue-recycling

Lump-sum Design

Targeted Schemes

Conclusion

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The Public Acceptability of Carbon Pricing

- ▶ 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

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)
- ▶ Carbon price is capped at 45€/ton of CO₂ during the first years of EU-ETS 2

▶ EU Regulation

▶ **Hypotheses**

- ▶ 2018 energy quantities
- ▶ No wage uprating (indexation)
- ▶ Companies are not represented here

▶ Macroeconomic results

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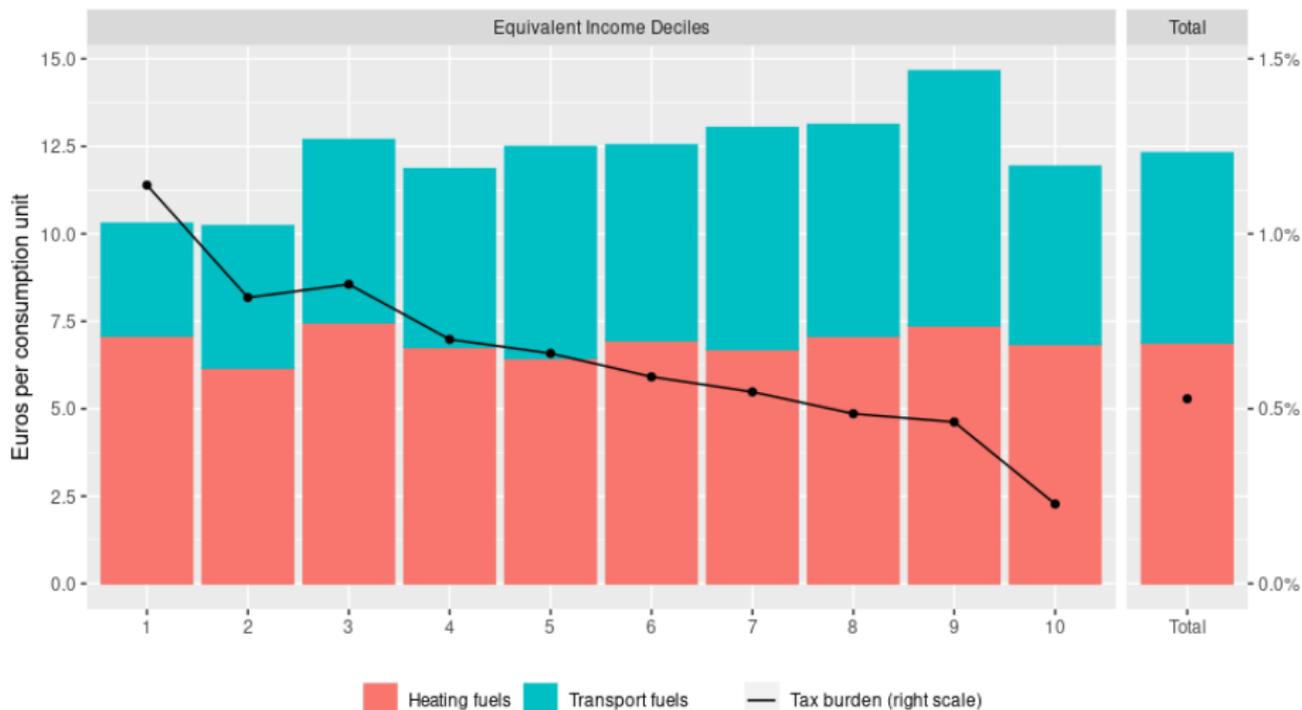
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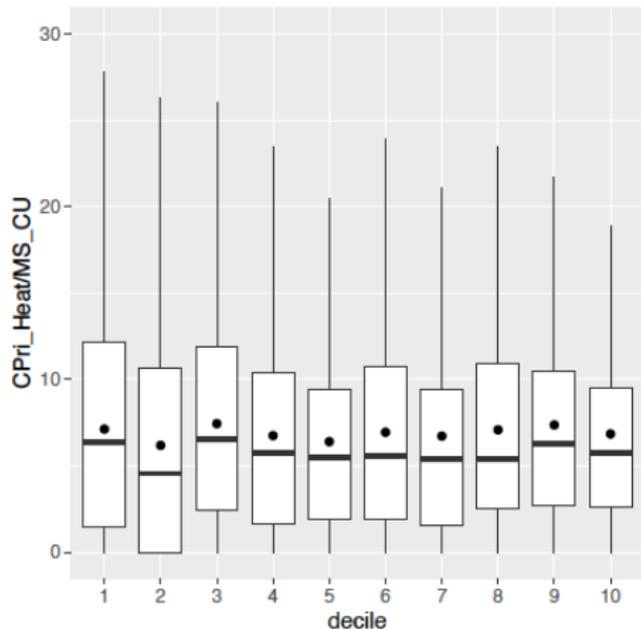
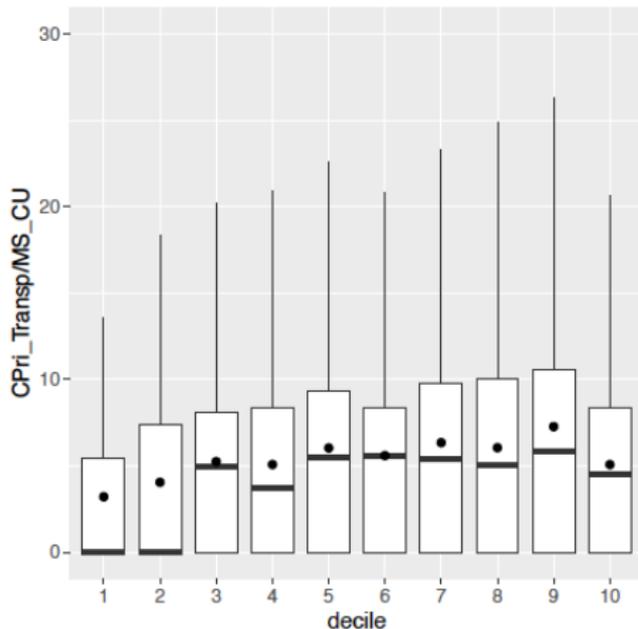
Conclusion

Vertical Equity: The Carbon Price is Regressive



Horizontal Equity: Important Intra-decile Disparities

Per C.U. transport (left) and heating (right) carbon payment, intra-decile distribution



Impacts by Socio-demographic Characteristics

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

Regression Analysis

	Carbon Payment / C.U.		Prob(Large Loss) in %
(Intercept)	2.37 *** (0.73)	(Intercept)	-1.48 (1.84)
Heating Oil	14.97 *** (0.32)	Heating Oil	12.47 *** (0.81)
Heating Gas	6.31 *** (0.27)	Heating Gas	2.13 *** (0.69)
Nbr.Cars 2 or more	6.21 *** (0.38)	Nbr.Cars 2 or more	0.55 (0.97)
Nbr.Cars 1	4.34 *** (0.33)	Nbr.Cars 1	1.30 (0.84)
Housing_Type House	3.12 *** (0.29)	Housing_Type House	2.07 *** (0.72)
Region Brussels	0.81 ** (0.38)	Region Brussels	-0.02 (0.95)
Region Wallonia	2.02 *** (0.23)	Region Wallonia	2.67 *** (0.59)
Fam_>1 Adults, no child	1.41 *** (0.28)	Fam_>1 Adults, no child	0.63 (0.70)
Fam_One Adult, child	0.27 (0.46)	Fam_One Adult, child	-0.84 (1.15)
Fam_One Adult, no child	4.63 *** (0.47)	Fam_One Adult, no child	3.58 *** (1.17)
MS_CU	-3.08 *** (0.28)	MS_CU	-1.30 * (0.69)
N	6125	N	6125
R2	0.40	R2	0.08

*** p < 0.01; ** p < 0.05; * p < 0.1.

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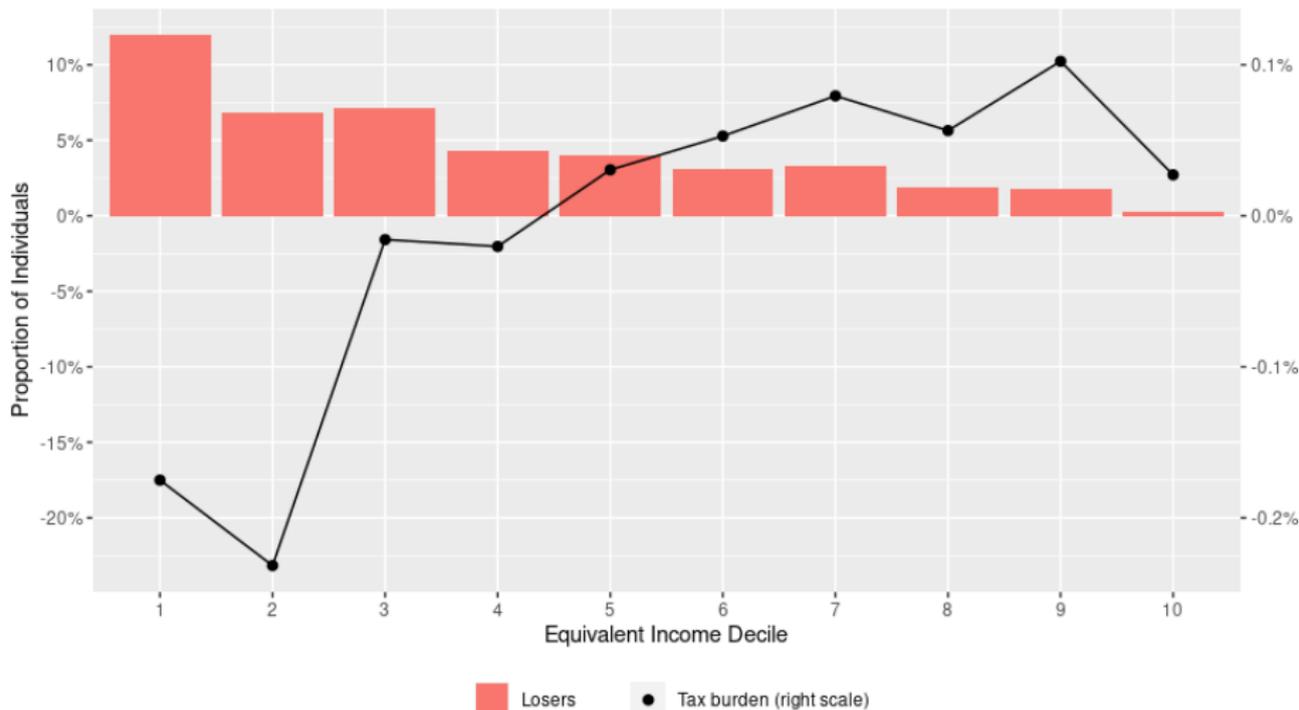
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Lump-sum Design: Each Household Gets €23/month Back

- ▶ We redistribute all carbon price revenues back to households in a lump-sum fashion [▶ Lump-sum Design](#)
- ▶ **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 Net 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 *Net Tax Burden* and proportion of "*Large Losers*".

A Transfer/Subsidy Based on Heating Type Better Protects Vulnerable HH

Characteristic	Net Tax Burden		Large Losers	
	/HH	TH	/HH	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 Performs Well

In the *TH50* scenario, half of total revenues is spent on households in the 5 first deciles heating with oil or gas

	/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 (e.g. subsidies) 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
 - ▶ Through the use of exogenous price elasticities [▶ Here](#)
 - ▶ 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!

References

- ▶ Bergquist, Magnus, Nilsson, Andreas, Harring, Niklas & Jagers, Sverker C. 2022 Meta-analyses of fifteen determinants of public opinion about climate change taxes and laws. *Nature Climate Change* 12 (3), 235–240.
- ▶ Berry, Audrey 2019 The distributional effects of a carbon tax and its impact on fuel poverty: A microsimulation study in the french context. *Energy Policy* 124, 81–94.
- ▶ Dabla-Norris, E., Helbling, T., Khalid, S., Khan, H., Magistretti, G., Sollaci, A. & Srinivasan, K. 2023 Public perceptions of climate mitigation policies: Evidence from cross-country surveys. *Staff Discussion Notes* 2023 (002).
- ▶ Dechezleprêtre, A., Fabre, A., Kruse, T., Planterose, B., Chico, A. S. & Stantcheva, S. 2022 Fighting climate change: International attitudes toward climate policies (1714).
- ▶ Douenne, Thomas 2020 The vertical and horizontal distributive effects of energy taxes: A case study of a french policy. *The Energy Journal* 41 (3).
- ▶ Douenne, Thomas & Fabre, Adrien 2022 Yellow vests, pessimistic beliefs, and carbon tax aversion. *American Economic Journal: Economic Policy* 14 (1), 81–110.

References

- ▶ Hersch, J. & Viscusi, W. K. (2006). The generational divide in support for environmental policies: European evidence. *Climate Change*, 77, 121-136.
- ▶ Kallbekken, S., Kroll, S., & Cherry, T. (2011). Do you not like Pigou, or do you not understand him? Tax aversion and revenue recycling in the lab. *Journal Of Environmental Economics And Management*, 62(1), 53-64.
- ▶ Kotchen, M. J., Boyle, K. J. & Leiserowitz A. A. (2013). Willingness-to-pay and policy-instrument choice for climate-change policy in the United States. *Energy Policy*, 55, 617-625.
- ▶ Kotchen, M. J., Turk, Z. M. & Leiserowitz A. A. (2017). Public willingness-to-pay for a US carbon tax and preferences for spending the revenue. *Environ. Res. Lett.*, 12 (9).
- ▶ Rausch, Sebastian, Metcalf, Gilbert E. Reilly, John M. 2011 Distributional impacts of carbon pricing: A general equilibrium approach with micro-data for households. *Energy Economics* 33, S20–S33, supplemental Issue: Fourth Atlantic Workshop in Energy and Environmental Economics.
- ▶ Rotaris, L. & Danielis, R. (2019). The willingness to pay for a carbon tax in Italy, *Transportation Research Part D: Transport and Environment*, 67, 659-673.

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

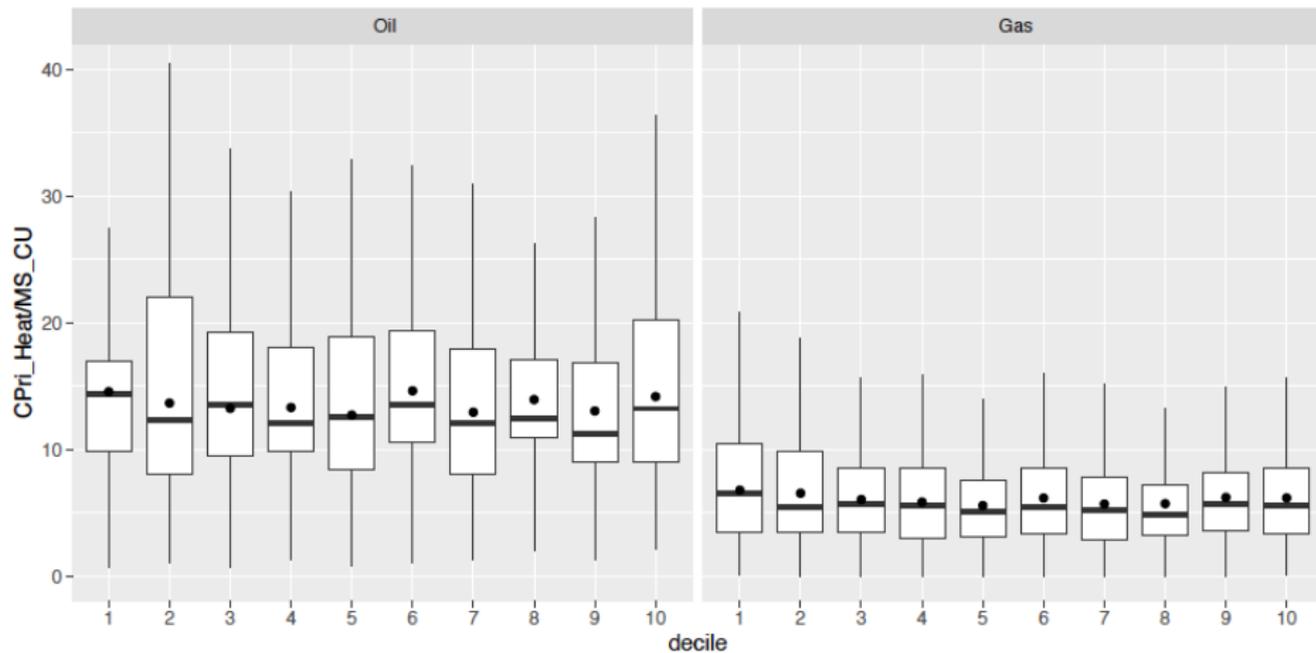
- ▶ Under the Green Deal, the European Union is committed to reducing its GHG emissions by 55% between 1990 and 2030
- ▶ A key element of the *Fit for 55* package is the **Emissions Trading Scheme (ETS)**
 - ▶ Market-based instrument that prices emissions for large emitters from 2005
- ▶ It will be extended 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

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

Focus on the Type of Heating System



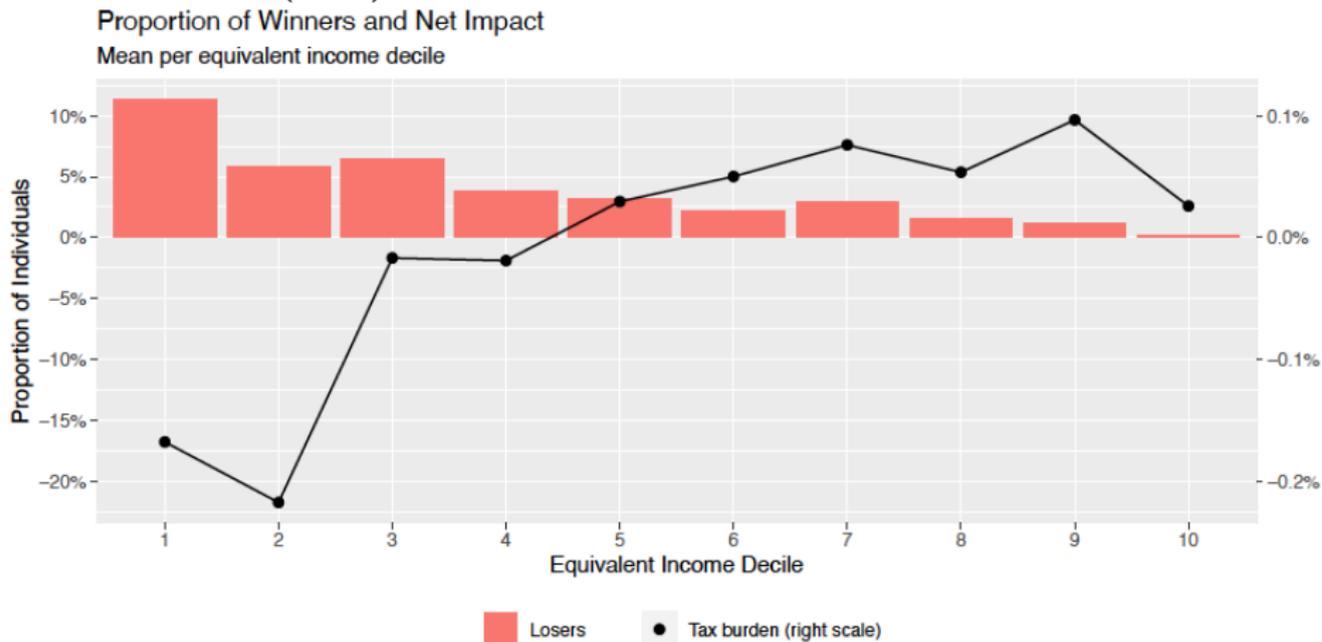
The Lump-sum Design Matters

	/HH	/Capita	/Adult	/CU
Large Losers	4.5 %	5.9 %	5.1 %	4.7 %
1st Quartile	9.1 %	12.1 %	10.4 %	9.6 %
2nd Quartile	4.7 %	6.4 %	5.5 %	5.1 %
3rd Quartile	2.9 %	3.3 %	3.1 %	3 %
4th Quartile	1.2 %	1.8 %	1.2 %	1.3 %
Energy Poverty	-0.8 p.p.	-0.5 p.p.	-0.5 p.p.	-0.6 p.p.

Table: Different Lump-sum Designs

Transport Elasticity = 0.4 ; Heating Elasticity = 0.25

Elasticities are chosen within a range provided by a meta-analysis conducted by Labandeira *et al.* (2017)



Transport Elasticity = 0.8 ; Heating Elasticity = 0.5

Proportion of Winners and Net Impact

Mean per equivalent income decile

