

Spatial Inequality in the European ETS-2 Market

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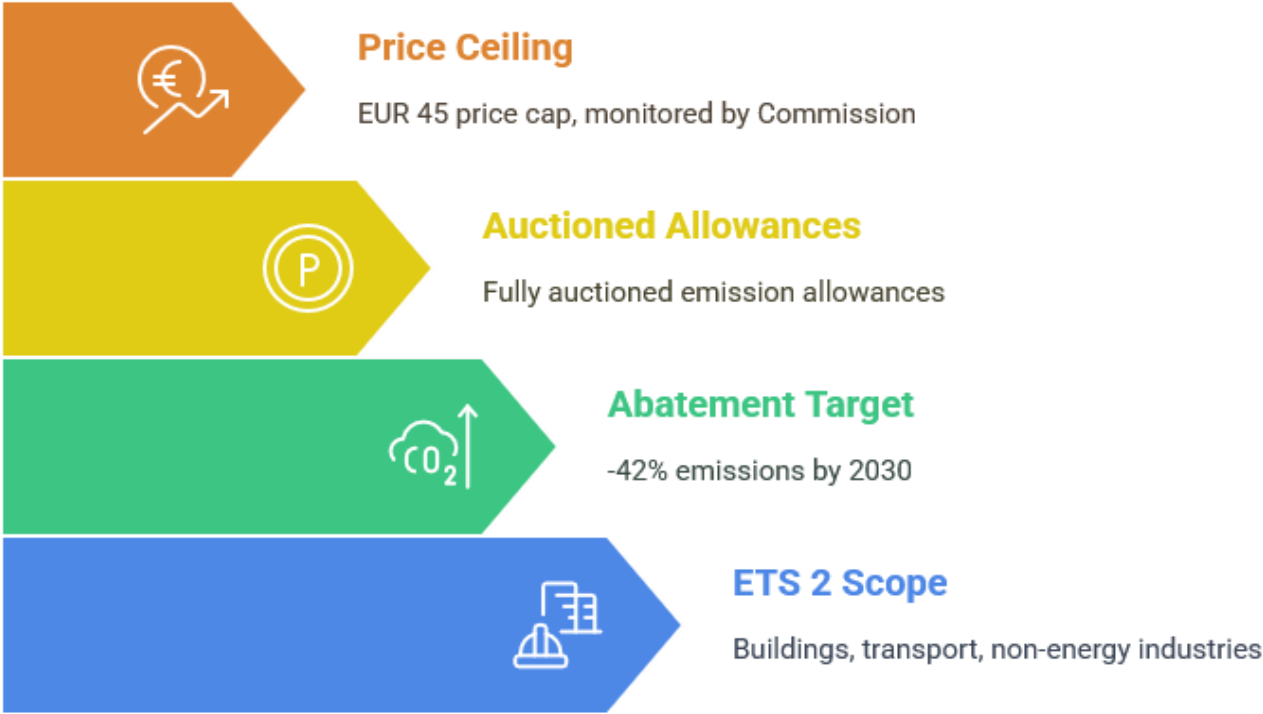
- 💎 The EU ETS-2, by putting a CO₂ price on heating and transport fuels, is a game-changing policy
 - Ensures a level playing field across EU countries
 - It Complements and (Replaces) Fragmented National Policies
- 💎 Thomas Douenne et al. show, in a series of papers on the Yellow Vests movement (based on a CO₂ price of €44.6/tCO₂), that horizontal distributive effects — disparities between households with similar incomes — are considerably larger in magnitude than the vertical distributive effects across income groups.

💎 Research Question:

What will be the impacts of the ETS-2 on regional disparities?

Work is part of our research theme Mapping the Transition

ETS 2 Framework



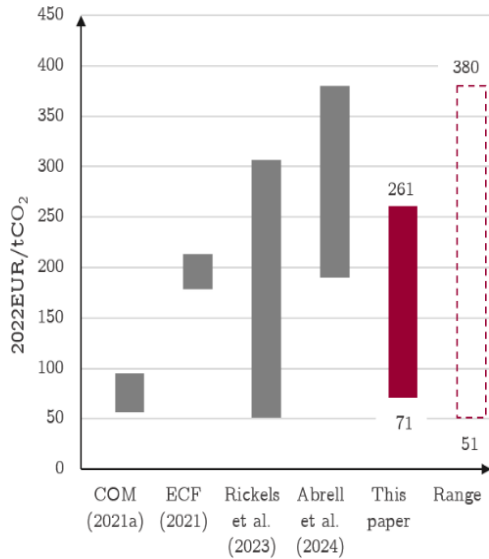
- ❖ **Most of the European Economic models have Member States granularity**
- ❖ **Few models offers sub-national resolution: RHOMOLO, GEM-E₃-R and ICES**
- ❖ **Instead of building a full regional model, our goal is to build an interface that can be coupled with existing tools (see S. Perdana presentation)**



Methodological Approach

DIAMOND

ETS-2
Assumption Price

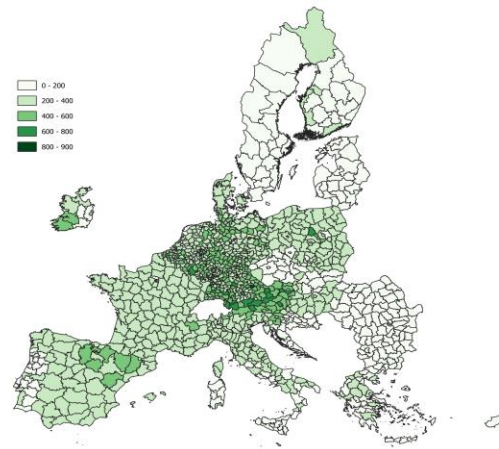


ETS-2 Price Estimations



IEA Energy
Prices

iea
International
Energy Agency



EU NUTS-3
Map



Households
Budget Survey



Impact on
Households



Econometric
Modelling

Table 5

Regression on heating expenditure ($\ln(E_H / HDD)$) with country-specific effects.

Variable	Coefficient	t-Statistic
$\ln(I)$	0.9266	190.0***
U_r	-0.3107	-116.1***
F	0.1117	49.8***
ESP	3.0344	427.4***
SVK	2.5969	347.6***
PRT	2.5371	163.8***
POL	3.4710	375.0***
LUX	2.2941	162.1***
LTU	1.6179	125.8***
LVA	1.7542	207.0***
IRL	1.8930	252.2***
HUN	3.5585	314.9***
GRC	2.5710	279.1***
DEU	2.6985	337.0***
FRA	2.6283	152.5***
FIN	0.3712	45.5***
EST	1.5588	191.6***
DNK	2.3034	282.4***
CZE	2.8996	374.4***
CYP	2.2343	149.5***
HRV	2.8926	324.3***
BGR	2.1920	169.3***
BEL	2.6012	415.5***
Const	-15.4971	-321.4***
R-squared	0.99	
F-Statistic	92.420	
Degrees of freedom	1236	

Significantly different from 0 at *** 0.1 %, ** 1 %, * 5 %.



Geospatial
Analysis



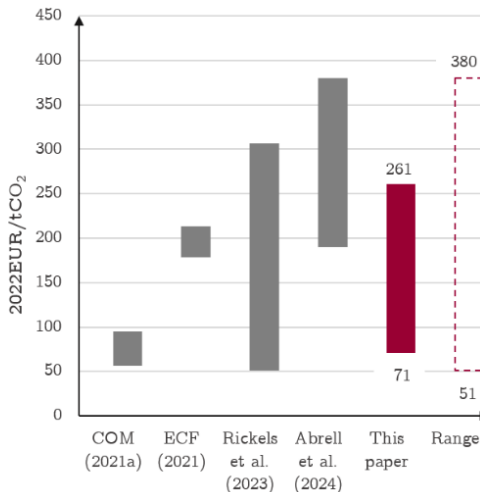
eurostat



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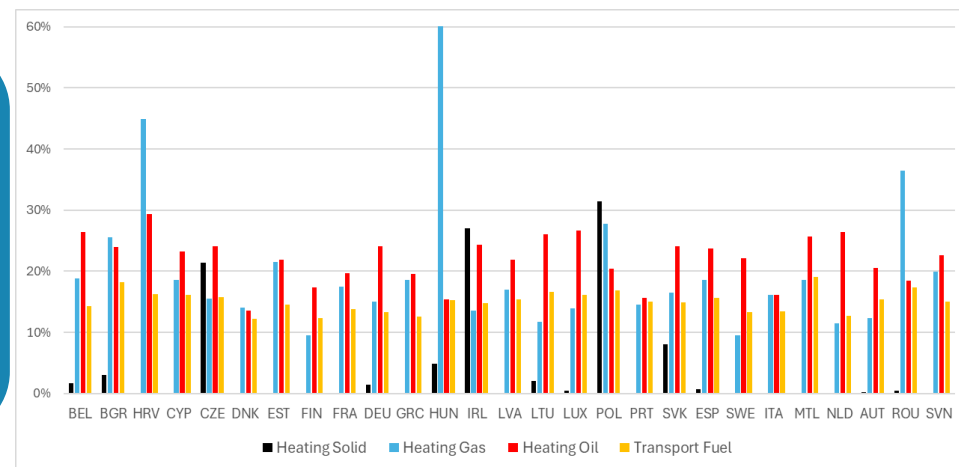
ETS-2 Price estimations



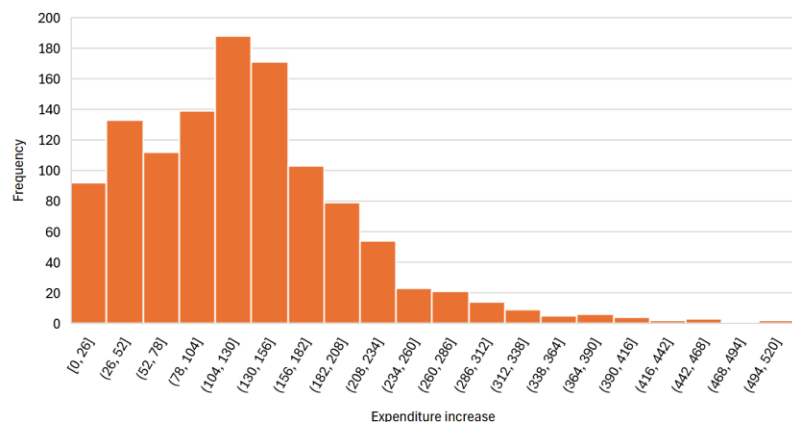
Source: Günther C. et alii (2025), *Climate Policy*

ETS-2 price and energy price increase

- ETS-2 price = 100€ per ton of CO₂
- Households' Energy prices based on IEA statistics and year 2023 (including existing indirect taxation)

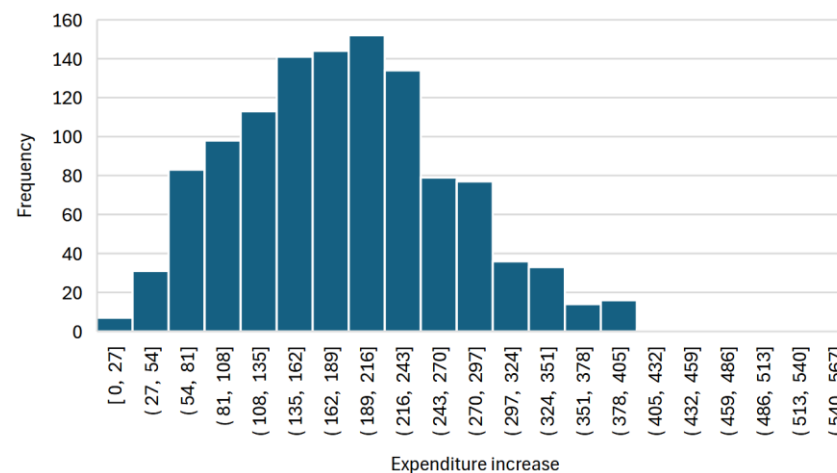


- 1160 European regions
- Data coming from Eurostat
- Extensive harmonization and consolidation work to fill missing variables, changes in region definition; ...



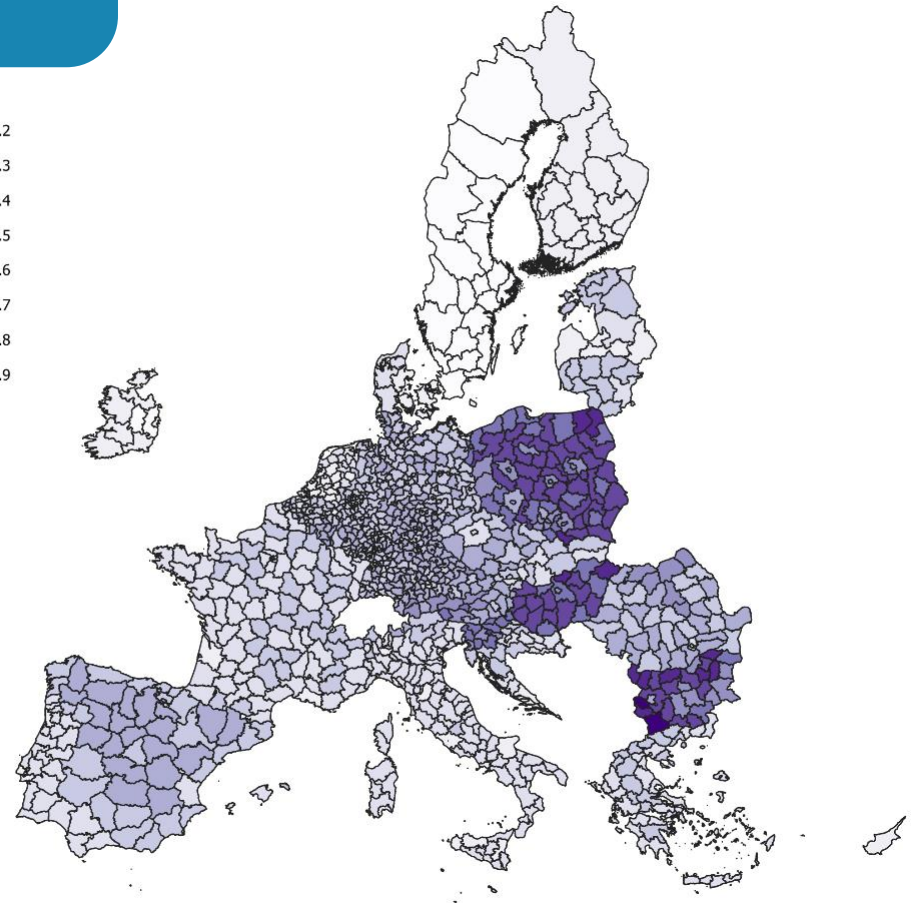
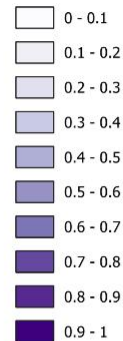
Heating expenditure
Min=0 € Max=511 €
Average=125 €

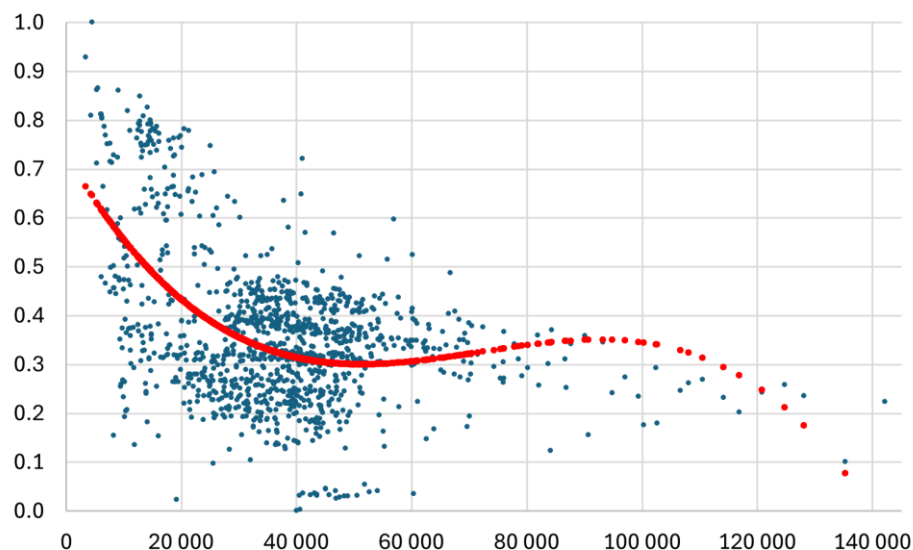
Transport expenditure
Min=17 € Max=511 €
Average=185 €



Exposure : $E_r = \frac{\text{Total expenditure increase}}{\text{Disposable Income}}$

Exposure Index: $I_r = \frac{E_r - E_{Min}}{E_{Max} - E_{Min}}$






Relationship between Exposure & Income per-capita in €

- **Blue point** → computed exposure index
- **Red point** → estimated exposure index with polynomial degree 3

Table 10: Top exposed regions by country

	Top 10%	Top 20%	Top 30%	Number of regions
Austria	6	19	26	35
Belgium	0	5	12	44
Bulgaria	22	27	28	28
Croatia	0	0	0	21
Cyprus	0	0	0	1
Czech Republic	0	1	6	14
Denmark	0	0	0	11
Estonia	0	0	0	5
Finland	0	0	0	19
France	0	0	0	96
Germany	0	42	125	400
Greece	0	0	0	52
Hungary	19	20	20	20
Ireland	0	0	0	8
Italy	0	1	1	107
Latvia	0	0	0	5
Lithuania	0	0	0	10
Luxembourg	0	0	0	1
Malta	0	0	0	2
Netherlands	0	0	0	40
Poland	57	73	73	73
Portugal	0	0	0	26
Romania	2	22	25	42
Slovakia	0	0	0	8
Slovenia	10	12	12	12
Spain	0	10	20	59
Sweden	0	0	0	21
EU27	116	232	348	1160

- ❖ **We do not take existing CO₂ taxes into account (e.g., the German National ETS, French carbon tax, etc.)**
- ❖ **We do not account for the recent penetration of CO₂-free technologies in heating, and transportation, such as heat pumps, hybrid cars, or electric vehicles**
- ❖ **More broadly, mechanisms for substituting CO₂ taxation are not taken into account**
- ❖ **The study does not evaluate any redistribution mechanisms for ETS-2 revenues.**

- ❖ **The regressive nature of ETS-2 disproportionately affects lower-income households**
- ❖ **Regions with fossil fuel reliance and limited low-carbon infrastructure face high burdens**
- ❖ **Regions from Bulgaria, Hungary, and Poland are the most exposed regions**
- ❖ **Vulnerable regions need direct subsidies and renewable energy incentives**  **Social Climate Fund**
- ❖ **Long-term solutions include energy-efficient housing and better public transport**

Thank You

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