The redistributive effects of climate change mitigation policies

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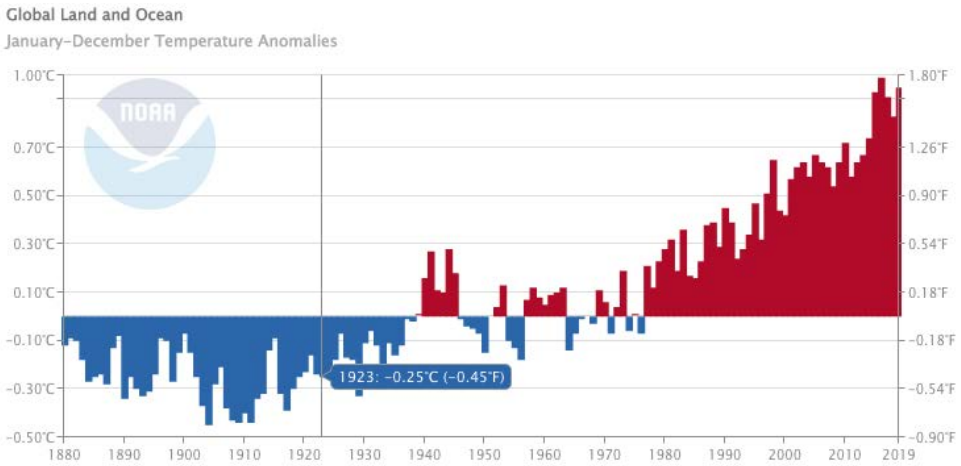
Agenda

1. Sitrep
2. The EUR 260 bn (a year) question
3. Evaluating the proposal of a carbon tax in Italy
4. Conclusions

1. Sitrep

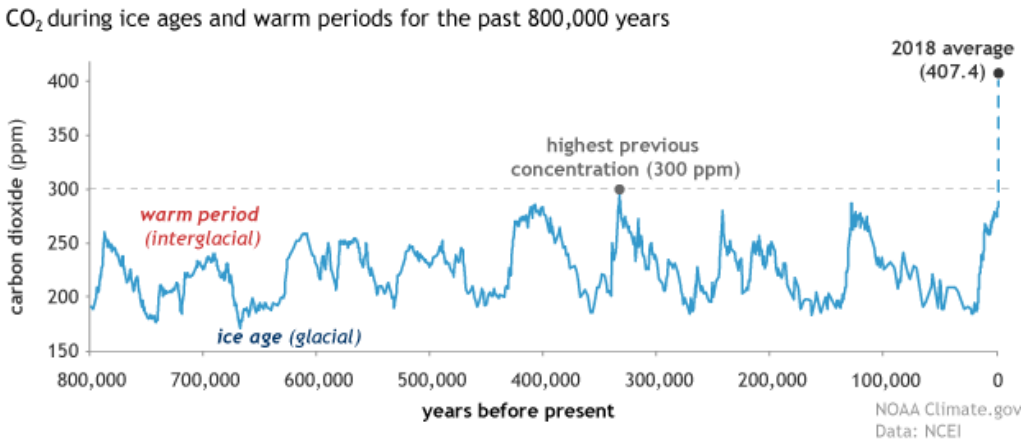
Climate change is underway….



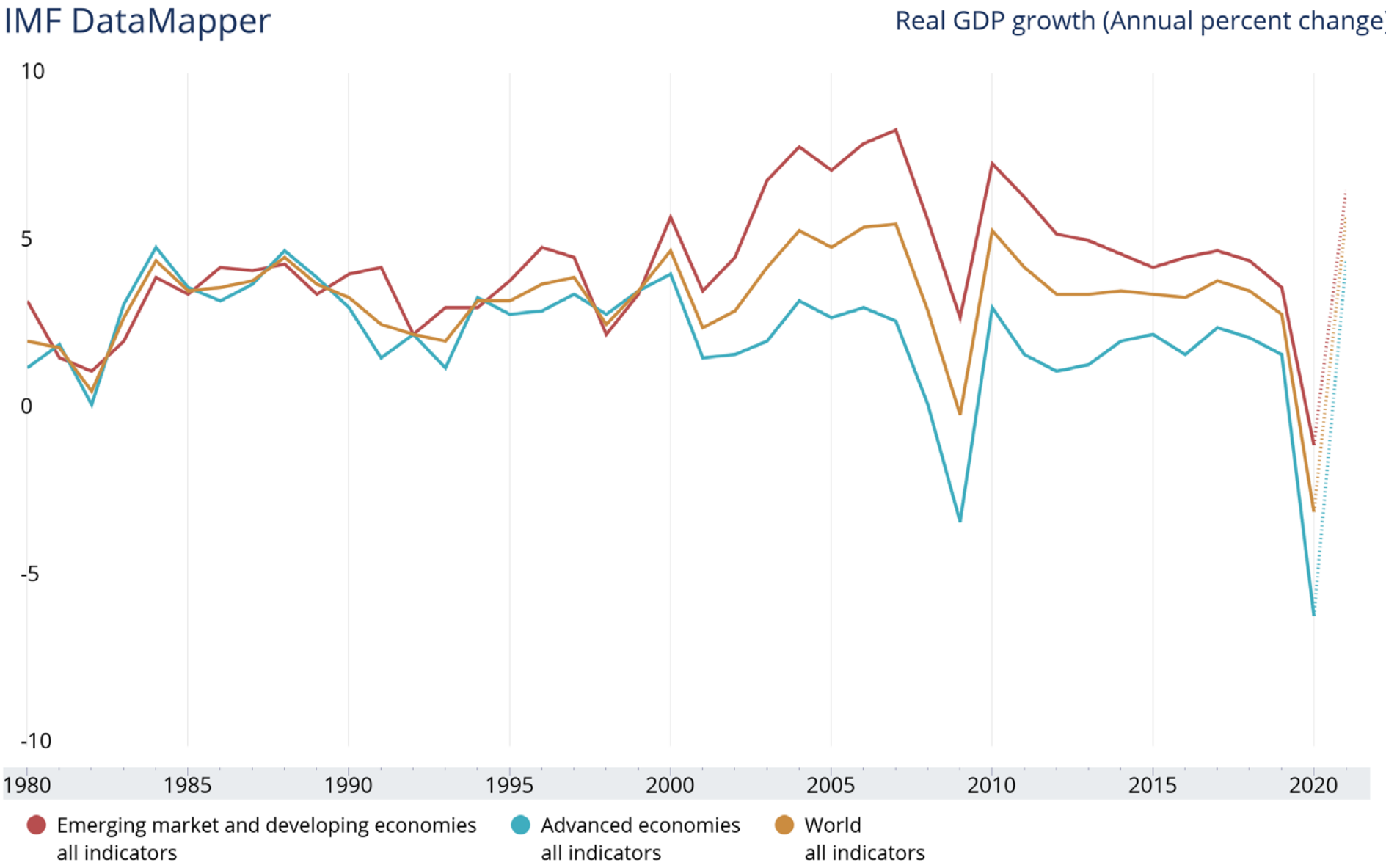
temperature anomalies have been increasing for years…

Fonte [NOAA, 2020]

… and this time is going to be tough….



… while the World is facing the steepest fall GDP in decades…



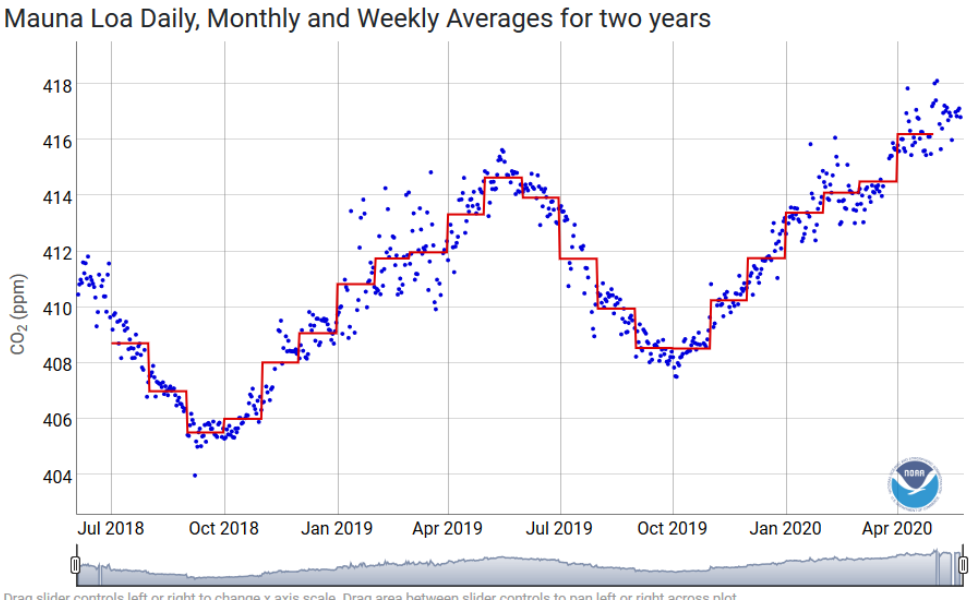
Energy demand and GHG emissions are falling…

- According to the Global Energy Review (IEA, 2020):
  - Expected severe decline in 2020 energy demand:
    - with full lockdown: -25%;
    - partial lockdown: -18%
  - but quick rebound in China..
  - Global energy demand : -6%, largest drop in 70yrs (7x Global financial crisis)

  - Global CO2 emissions expected in 2020: **-8%**

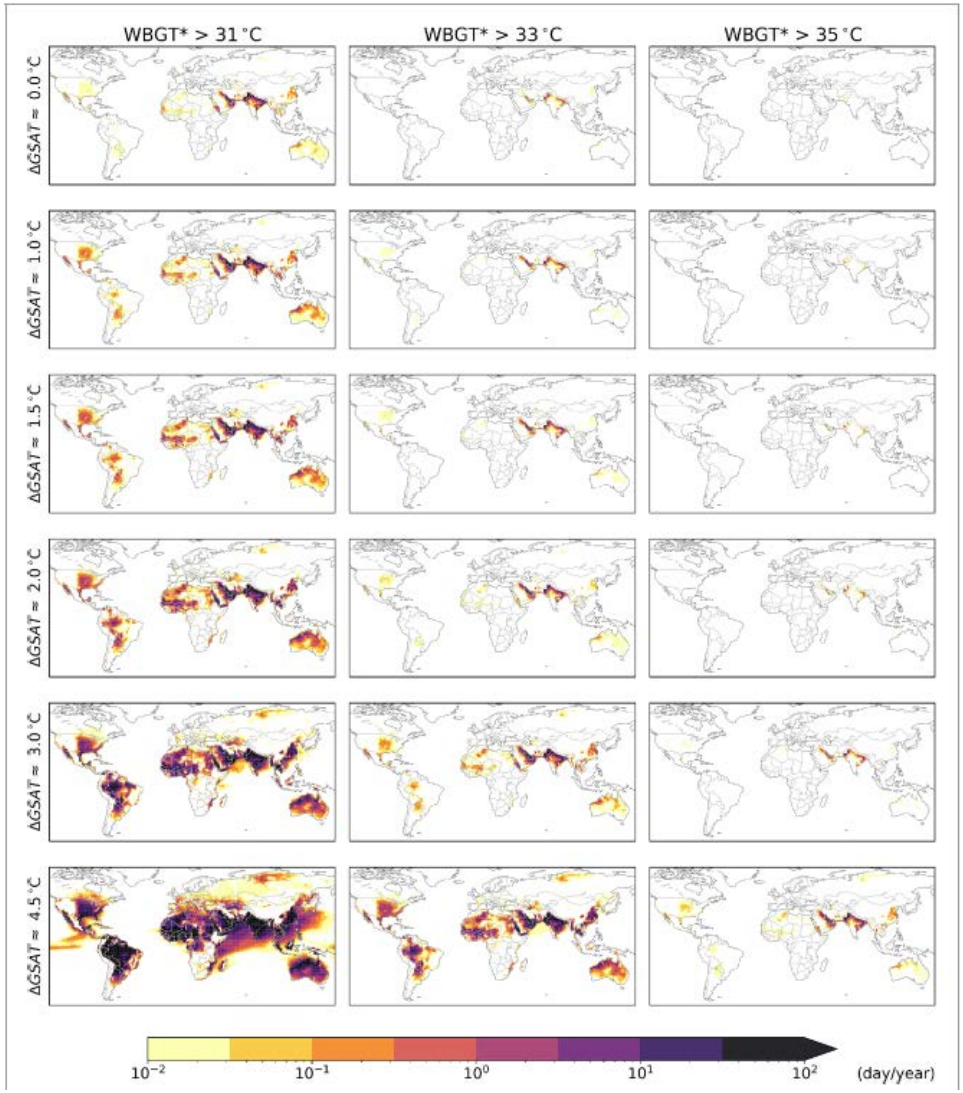
…but it is not enough…

- GHG concentration has been rising (416.21 ppm in April 2020, + 3 ppm YoY @ Mauna Loa);
- To meet 1.5°C Paris target, global emissions have to decrease by **7.6** percent/yr between 2020 and 2030



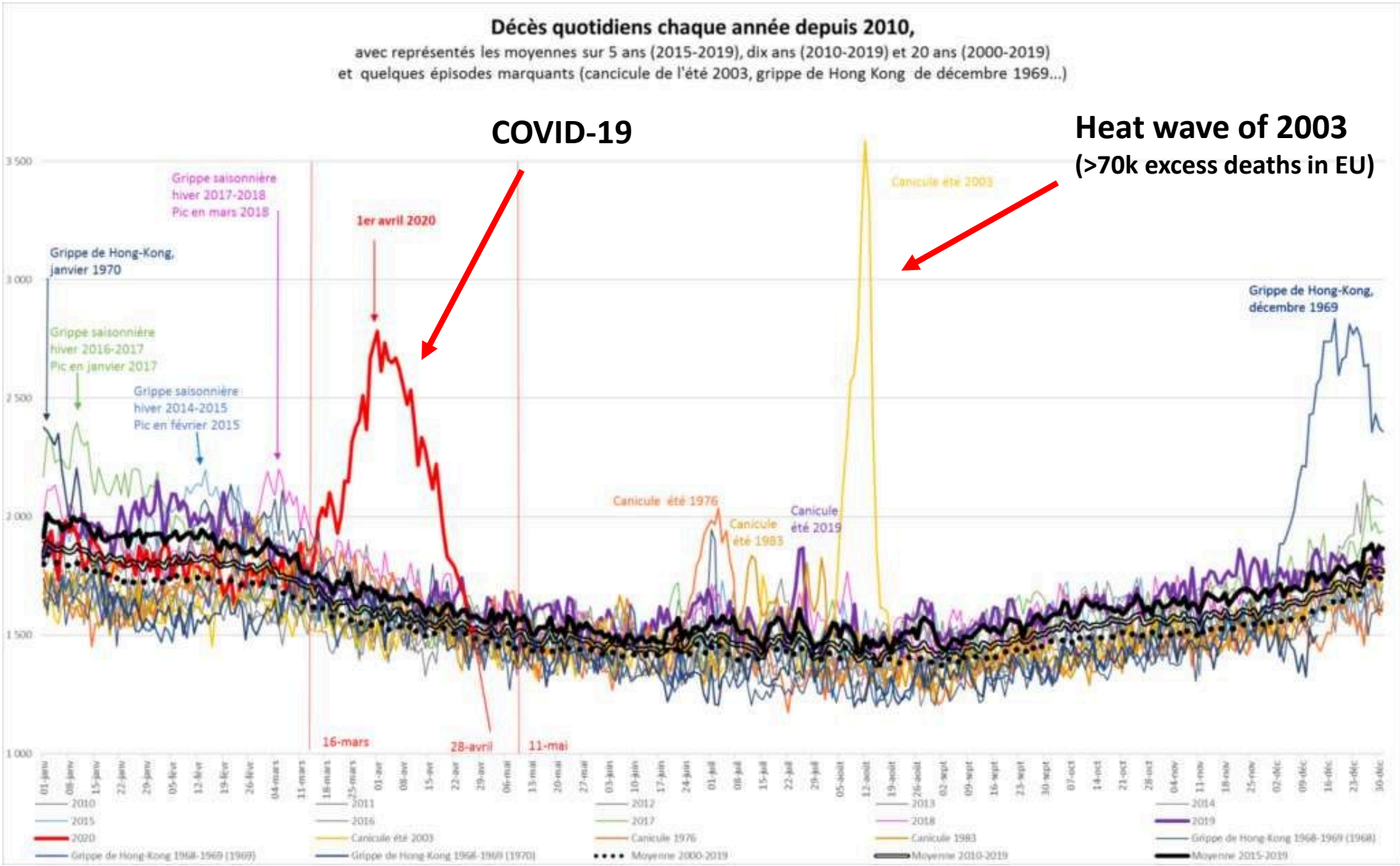
- Emissions for 2020 depend on future confinement policies (Le Quéré et al. 2020):
  - low estimate of –4% (–2% to –7%) if 'normal' conditions return by mid-June
  - high estimate of –7% (–3% to –13%) if some restrictions remain worldwide for all 2020.

Heat stress will increase, causing more deaths…



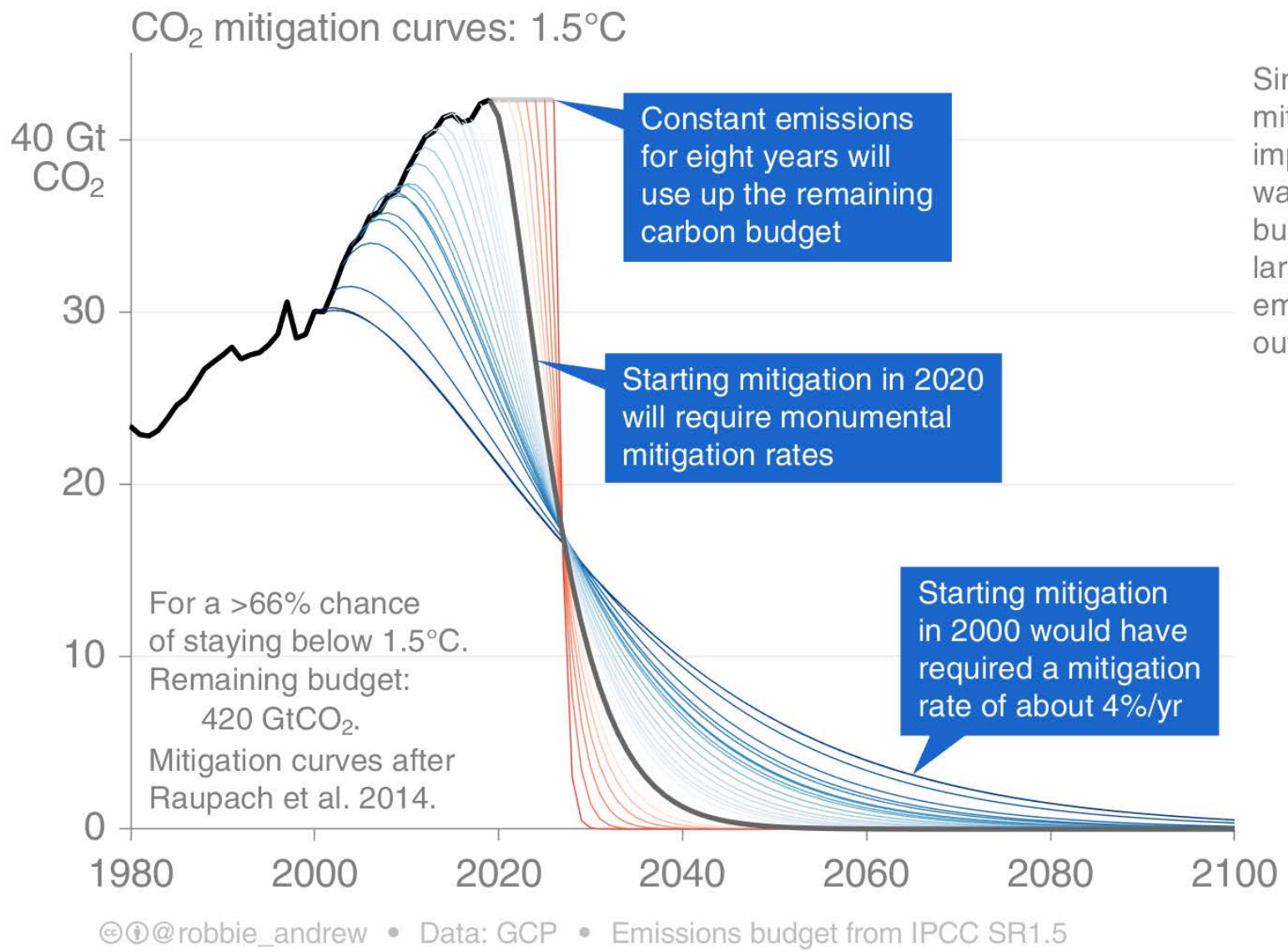
- Heat stress is a combination of extremes of heat and humidity
- Li et al (2020): days in Rome with conditions similar to 2003 Summer will increase to 3,5 days per year (ten fold increase)
- exposure to WBGT > 33°C will affect more people, and in particular:
  - + 508 mln if ΔGST +1.5 °C
  - + 780 mln with +2.0 °C
  - + 1.22 bn with +3.0 °C

… even more than recent events…



Can the World afford to cool down?

The longer we wait, the more expensive will be



Since such steep mitigation is impossible, the only way to achieve this budget is with very large "negative" emissions: pulling CO_2 out of the atmosphere.

2. The EUR 260 bn (a year) question

The EUR 260 (a year) bn question

"Above all, **the transition to a sustainable economy** will entail **significant investment** (…) reaching the current 2030 climate and energy targets alone would already require additional **investments of approximately €260 billion a year by 2030. " – (EC, 2020)**

So, the EUR 260 bn (a year) question is:

who is going to pay (and how) for climate change adaptation/mitigation policies?

IMF's proposal for a carbon tax (2019)

- Carbon tax as the most efficient way to fight climate change
- IMF's proposal: a carbon tax of USD 75 per tCO2eq by 2030; (currently at USD 2 per tCO2eq)

	Natural gas	Electricity	Gasoline
	H1: Carbon Tax of USD 75 per tCO2		
Italy	50	18	9
Average	68	43	14
	H2: Carbon Tax of USD 50 per tCO2		
Italy	33	13	6
Average	45	32	9
	H3: Carbon Tax of USD 25 per tCO2		
Italy	17	8	3
Average	23	19	5

TABLE 3—PRICE VARIATION AT 2030 IN ITALY DUE TO CARBON TAX

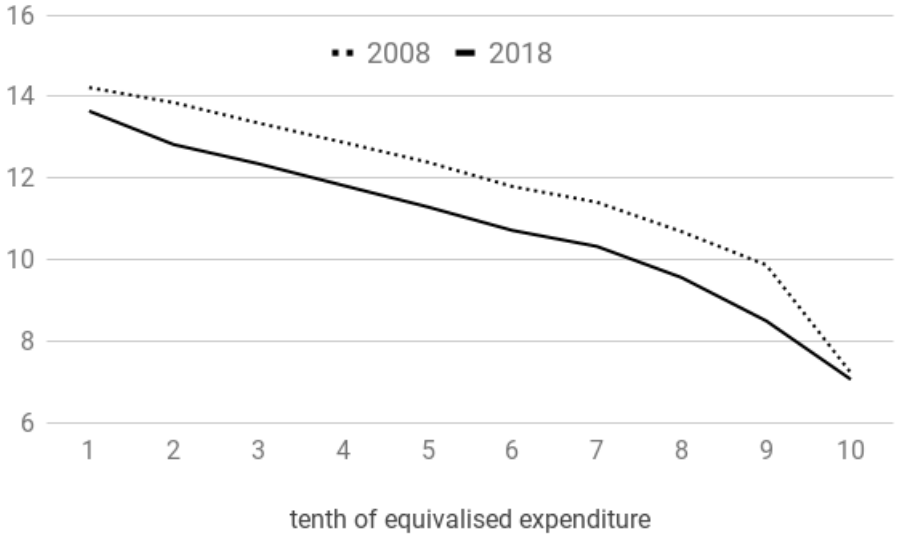
Policy design matters!

- Total exp ~ 10% ; transport fuels takes half;
- Poorer HHs assign larger share of their budget

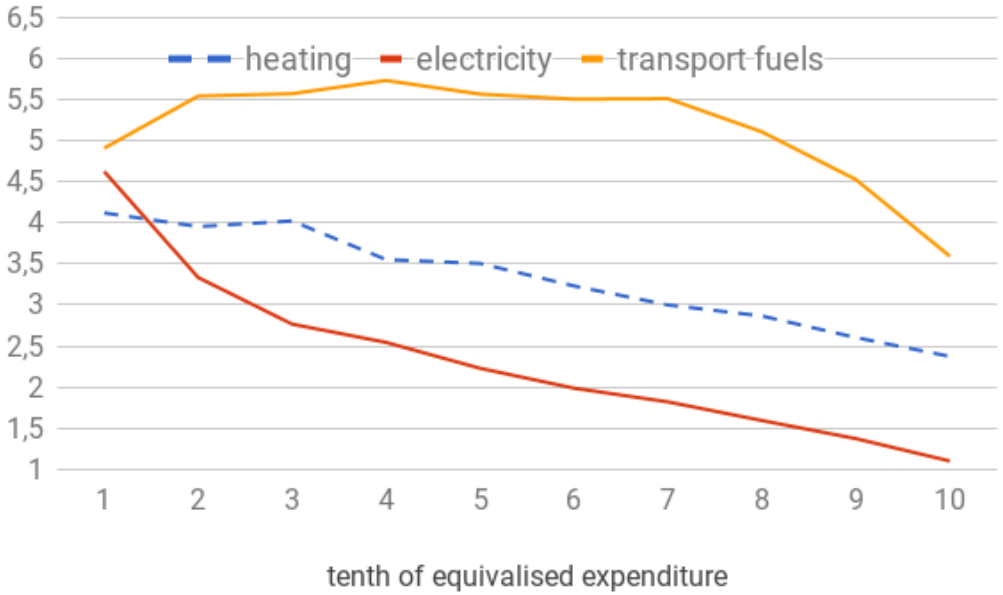
- 37% of HHs in the first decile had no car in 2018
- Prob of consuming fuels decreases with age or unemployment

<u>Bottom line, be careful about the targeted/affected population!</u>

Share of energy expenditure over time



Share of energy exp. by decile



3. Evaluating the proposal of a carbon tax in Italy

Assessing the effects of a carbon tax

Faiella and Lavecchia (work in progress) attempt to estimate the effects of a carbon tax on **Italian households** with the following approach:

1) estimate the energy demand elesticities
2) apply the price shock induced by the IMF (2019) proposal;
3) assess the distributional effects

Step 1) - Estimating energy elasticities (1)

Sub 1, we need:

a) energy prices; and
b) energy demand for electricity/heating/transport fuels

<u>all at household level, over time!</u>

Electricity and heating* expenditure for the *i-th* HH at time *t* is:

$$E_{i,t}^{E} = (P_{it}^{vE} Q_{i,t}^{E} + P_{i,t}^{fE})(1 + T_t)$$

… solving for quantity:

$$Q_{i,t}^{E} = (\frac{E_{i,t}^{E}}{1 + T_t} - P_{i,t}^{fE}) * \frac{1}{P_{i,t}^{vE}}$$

Step 1) - Estimating energy elasticities (2)

What we have: avg. prices from Istat and HHs' expenditure from Istat's Household budget survey (1996-2018).

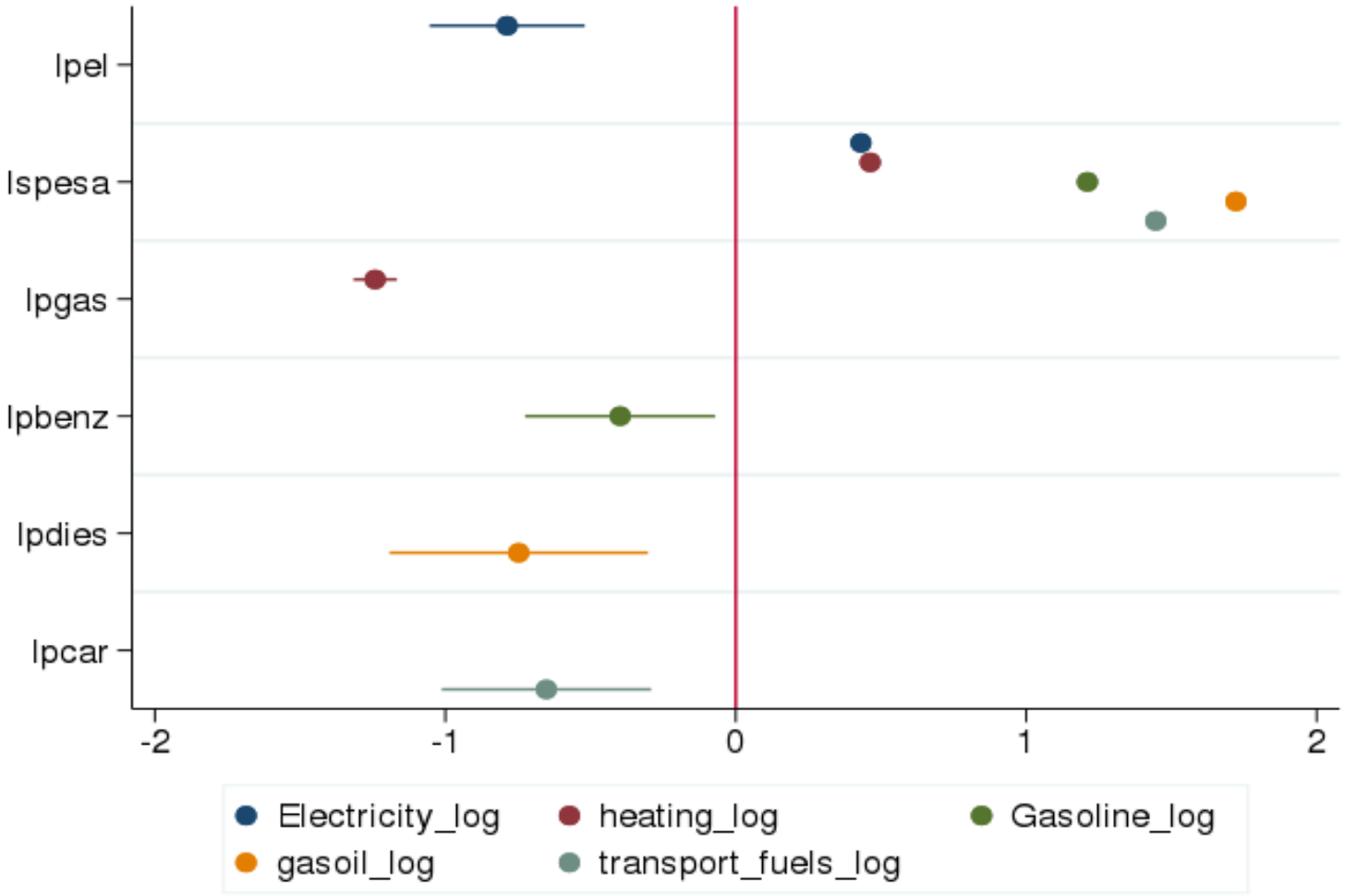
Problem #1 - HBS is not a panel; we refer to Deaton (1985) *quasi panel* approach, i.e. follow over time a *stratum* (in our case, quarter of eq. expenditure distribution AND type of households* or 4x9=36 strata x 22 years = 792 cells).

Then we estimate demand elasticity:

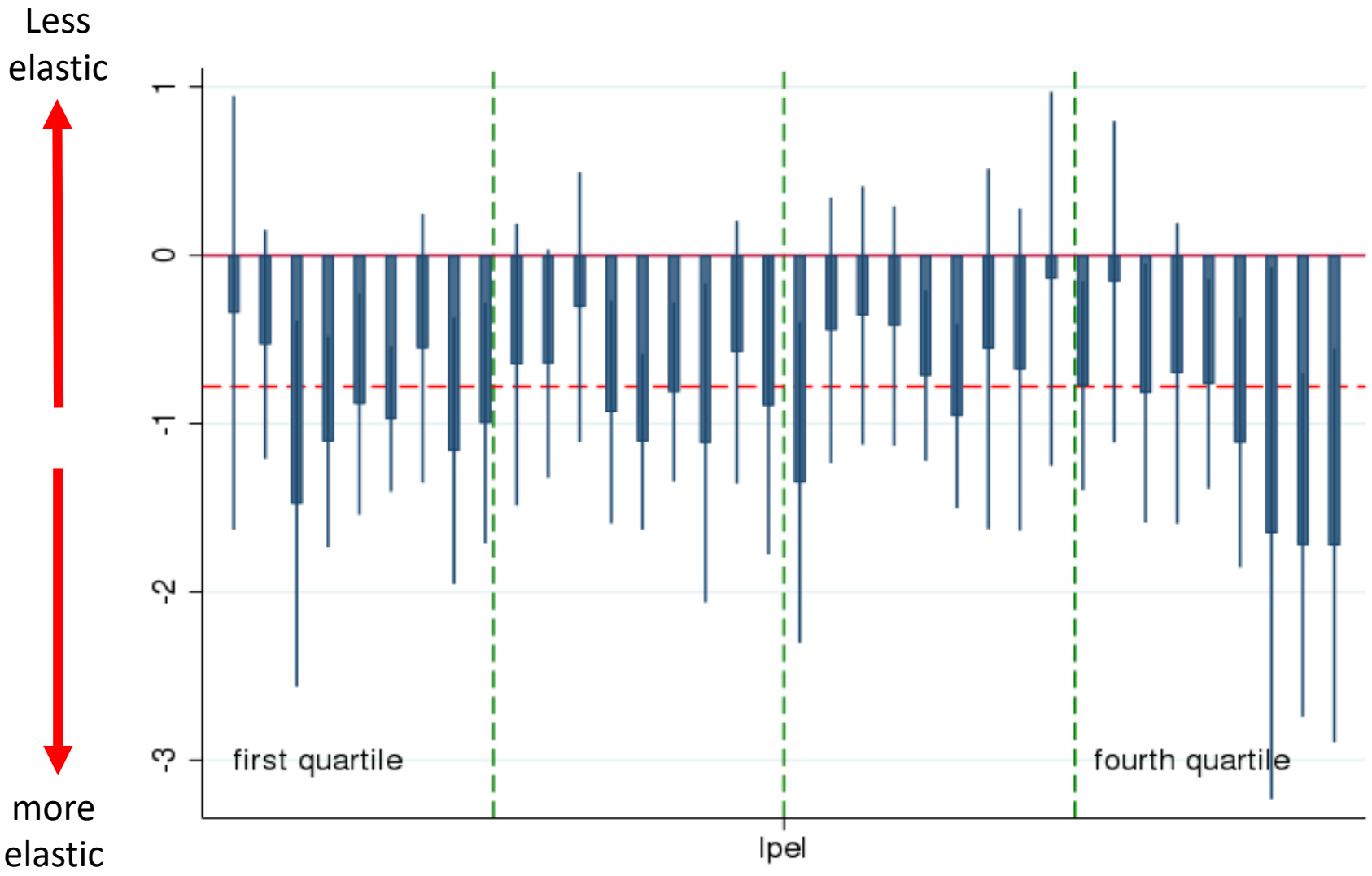
$$logQ^z_{s,t} = \alpha + \beta_s logP^z_{s,t} + \gamma logE_{s,t}E + d_t + \epsilon_{s,t}$$

*These groups are: 1) single, aged less than 64 years; 2) single, aged 65 or more; 3) couple without children and respondent person aged less than 64 years; 4) couple without children and respondent person aged 65 years or more; 5) couple with 1 child; 6) couple with 2 children; 7) couple with 3 or more children; 8) single parent; 9) other

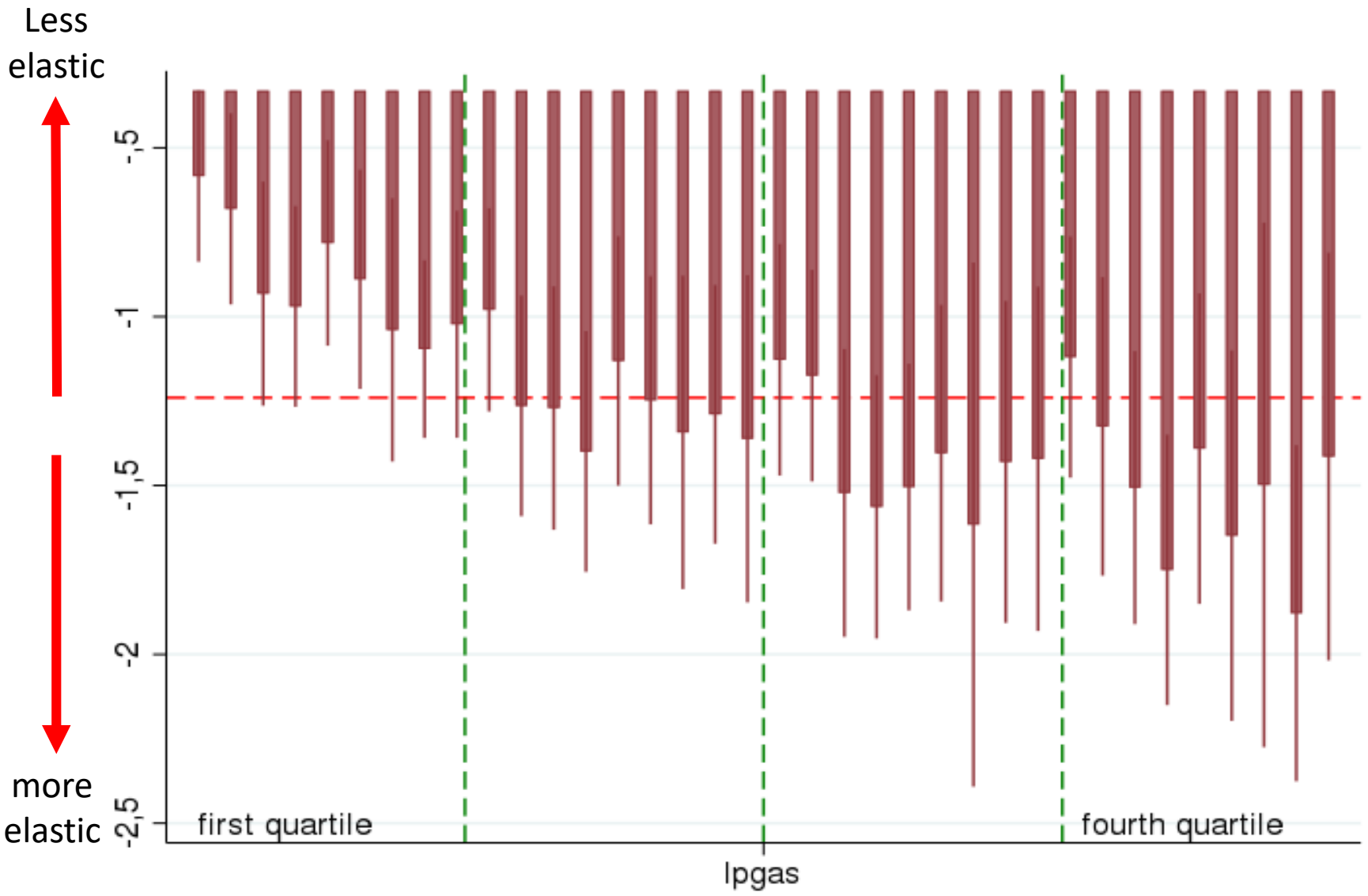
Step 1) - Estimating energy elasticities (3)



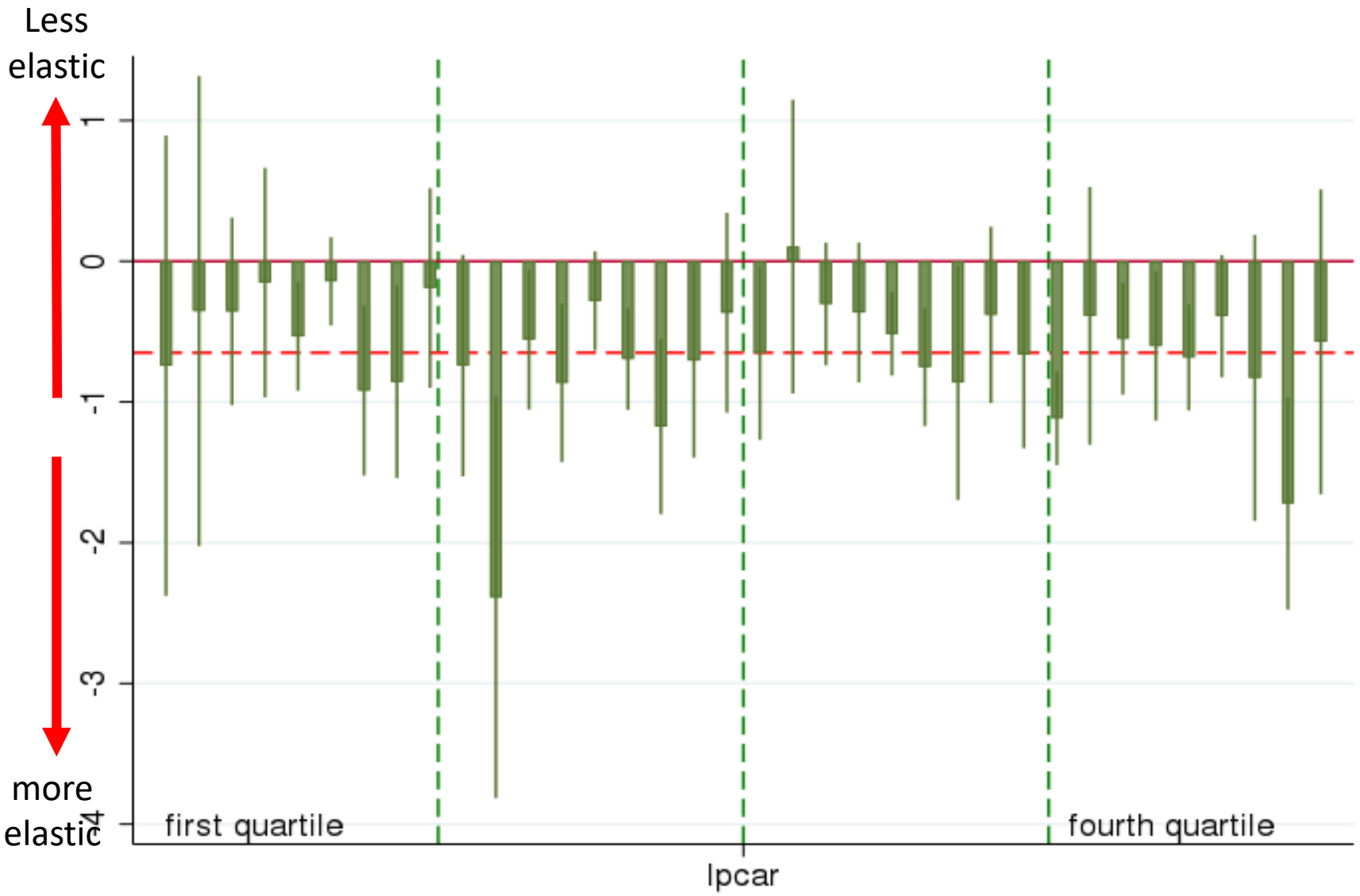
Short run electricity elasticities by stratum



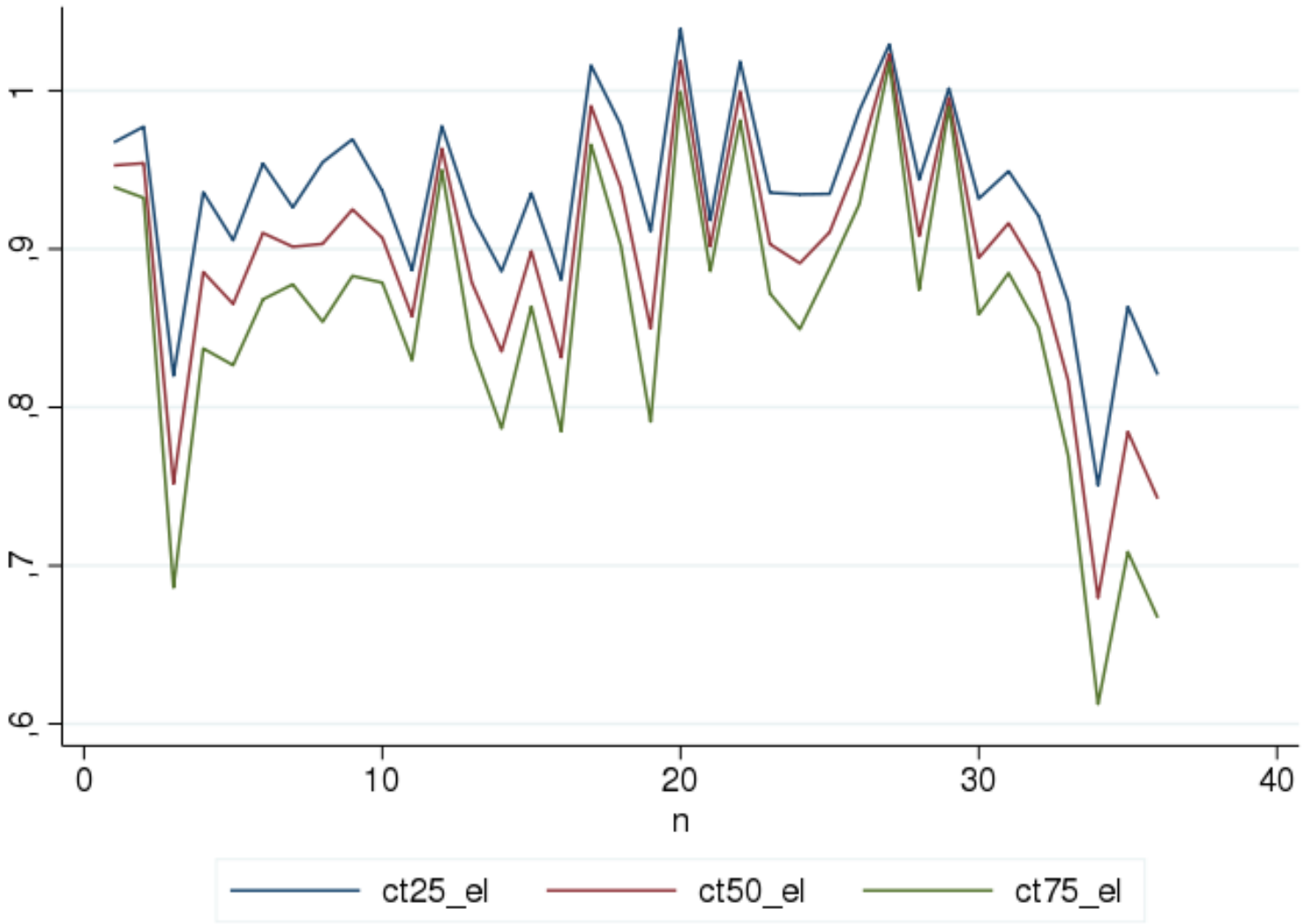
Short run heating elasticities by stratum



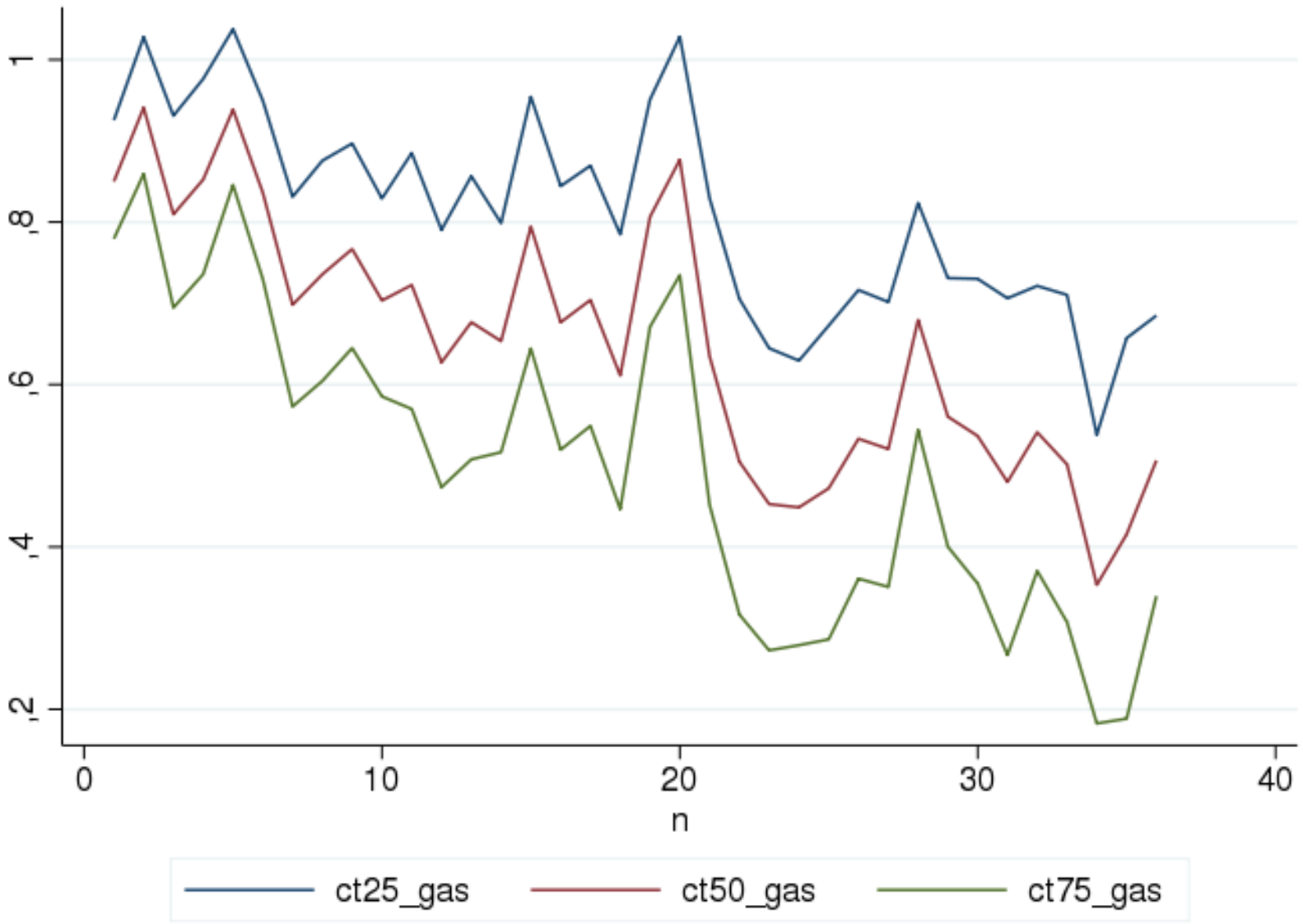
Short run transport fuels elasticities by stratum



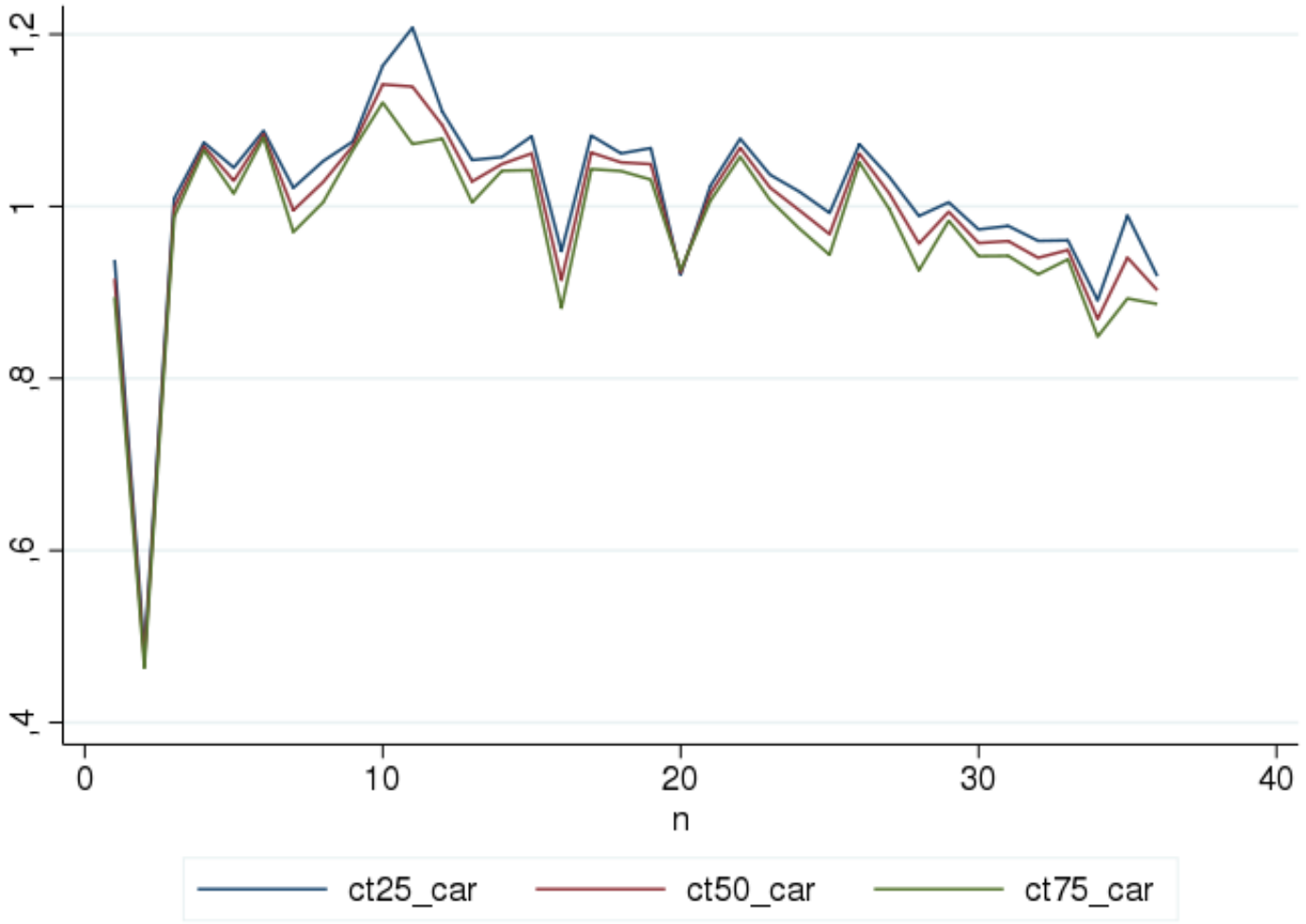
Electricity demand by stratum and carbon tax



Heating demand by stratum and carbon tax



Transport fuels demand by stratum and carbon tax



Energy demand at 2030

Carbon tax at 2030	25 USD	50 USD	75 USD
	as share of 2018 levels		
Electricity	0.94	0.90	0.86
Heating	0.80	0.64	0.48
Transport fuels	1.02	1.0	0.99

TABLE 4—ENERGY DEMAND AT 2030 UNDER 3 CARBON TAXES

Conclusions

- Climate change mitigation requires lots of money
- Policymaker has to be very careful in designing policies (how to raise and spend the money)
- Distributional effects are complicated and not straightforward – political backlashs are likely (e.g. *gilet jaunes*)
- Poorer HHs have rigid demand – higher prices translate 1-to-1 to higher exp therefore they might squeeze consumption somewhere else (food? Health? Housing?)

Thank you!

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