Discussion of

Geography versus Income: The Heterogeneous Effects of Carbon Taxation

by Charles Labrousse and Yann Perdereau

Nicolò Gnocato

Bank of Italy[1]

Macroeconomic Modelling Frontiers
for Research and Policy in Central Banks

28 November 2024

[1]The views expressed here are those of the author and should not be attributed to the Bank of Italy.

The Paper

A simplified framework (technically: CES Stone-Geary → will come back to that)

Data

1. Energy is a necessity good:
   geography-specific min. subsistence requirement $\overline{e}_k$, $k \in \{rural, urban\}$
2. Rural households use more energy & a browner energy mix:

$$p_{e,rural}\,\overline{e}_{rural} > p_{e,urban}\,\overline{e}_{urban} \xrightarrow{\text{carbon tax}} p'_{e,rural}\,\overline{e}_{rural} >> p'_{e,urban}\,\overline{e}_{urban}$$

$\Rightarrow$ Heterogeneous effects of carbon taxation: Geography trumps income

$$\downarrow\downarrow\downarrow \quad u_{i,rural} = y_i - p'_{e,rural}\,\overline{e}_{rural}$$
$$\downarrow \quad u_{i,urban} = y_i - p'_{e,urban}\,\overline{e}_{urban}$$

$$\downarrow\downarrow \quad u_{poor,k} = y_{poor} - p'_{e,k}\,\overline{e}_k$$
$$\downarrow\downarrow \quad u_{rich,k} = y_{rich} - p'_{e,k}\,\overline{e}_k$$

$$\Delta(u_{poor,k} - u_{rich,k}) = \Delta(y_{poor} - y_{rich}) \approx 0$$
$$\Delta(u_{i,rural} - u_{i,urban}) = -\Delta(p_{e,rural}\,\overline{e}_{rural} - p_{e,urban}\,\overline{e}_{urban}) << 0$$

My take

- Tremendous work in disciplining the model with microdata;
- Impressive job in matching so many dimensions between the model and the data:
  income distribution (also across regions), energy shares (for households and firms and across regions), MPCs, taxation structure, ...
- Delivering a sharp, path-breaking message:
  Heterogeneous effects of carbon taxation: Geography trumps income!

Two main / big picture thoughts:

(1) Direct and indirect effects on welfare

(2) Optimal policy trade-offs

... Plus some minor / technical ones:
i) investment; ii) leisure; iii) housing; iv) non-homotheticity; v) aggregation.

(1) Direct and Indirect Effects on Welfare

1. **Direct Effect** (from carbon tax on households τ_t^h)

$$u_{i,k} = y_i - \underbrace{p_{e,k}\,\overline{e}_k}_{\uparrow\uparrow}$$

2. **Indirect Effect** (from carbon tax on firms τ_t^f)

$$u_{i,k} = \underbrace{y_i}_{\downarrow\downarrow} - p_{e,k}\,\overline{e}_k$$

   y_i derived from more carbon-intensive production in rural areas.

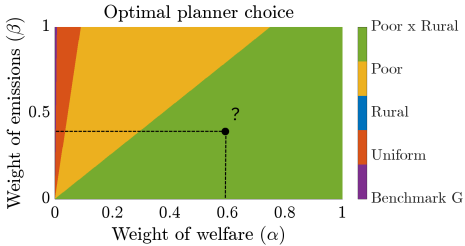
- In the paper: (1) and (2) explored either jointly, or one at a time.
- Possible to quantify relative contribution to overall ΔCE of **direct** and **indirect** (and transfers) when jointly present?

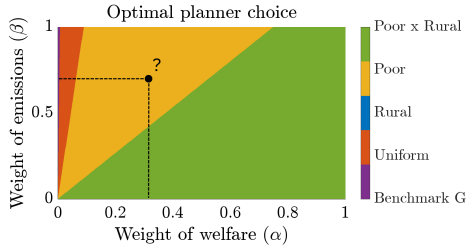
2 Optimal policy trade-offs

Welfare objective:

$$\mathbb{W} = \alpha \times \text{Welfare change} + \beta \times \frac{1}{T} \sum_{t=1}^{T} \text{Emissions reduction}_t$$

1. Possible to model the social cost of emissions to microfound α and β?
2. What is *the* optimal policy trade-off (aside from political economics considerations) once we pin down α and β?





Minor/technical comments (I)

i. **Investment in energy efficiency**: what if households can invest in energy efficiency, which might be easier in rural areas (e.g. solar panels on roof)?

   $\overline{e}_{rural} \downarrow\downarrow$, $\overline{e}_{urban} \downarrow$ in the medium- long-run?

ii. **Leisure**: currently not modeled, but might be relevant for welfare comparisons?

   e.g. urban commuting time $>$ rural commuting time $\Rightarrow$ $leisure_{urban} < leisure_{rural}$

iii. **Housing**: might also be relevant for welfare comparisons?

   a. Housing is a necessity (Data);

   b. $P_{H,urban} > P_{H,rural}$

   $\Rightarrow$ Urban households not that better-off to start with.

Carbon taxation might end up being progressive?

Minor/technical comments (II)

More technical:

iv. **Structure of non-homothetic preferences**: why 2 layers of non-homothetiticity to model higher energy shares for poor/rural?

1. Stone-Geary CES (with geography-specific min. subsistence requirement)
2. Comin et al. (2021)

Not very transparent why you need both:

- *Qualitatively*, (1) sufficient to get higher energy shares for poor & rural.
- Need to nest (1) into (2) to get enough curvature to *quantitatively* match the data?

v. **Aggregation for CE computation**: how do you weigh heterogeneous households to compute the aggregate measure?

Backup Slides

Energy expenditure shares

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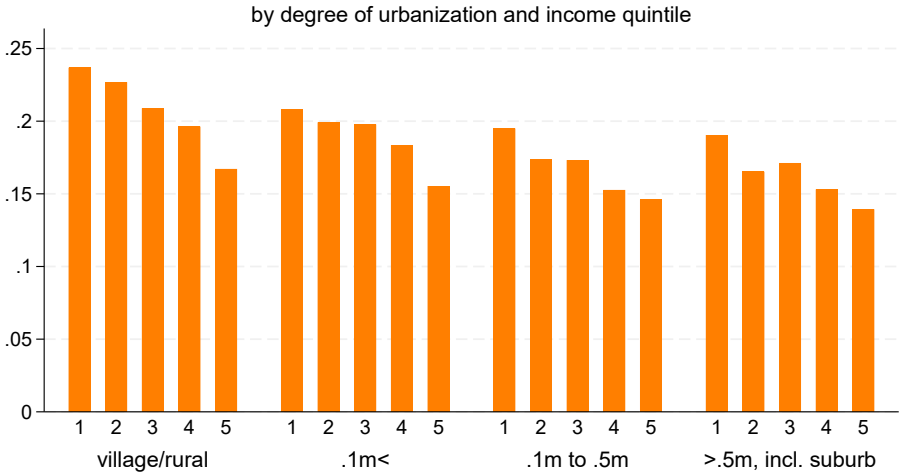

Notes: share of utilities and transport services in total consumption expenditure.
Source: ECB Consumer Expectations Survey; data for 2024 Q1 and Q2.

Housing expenditure shares

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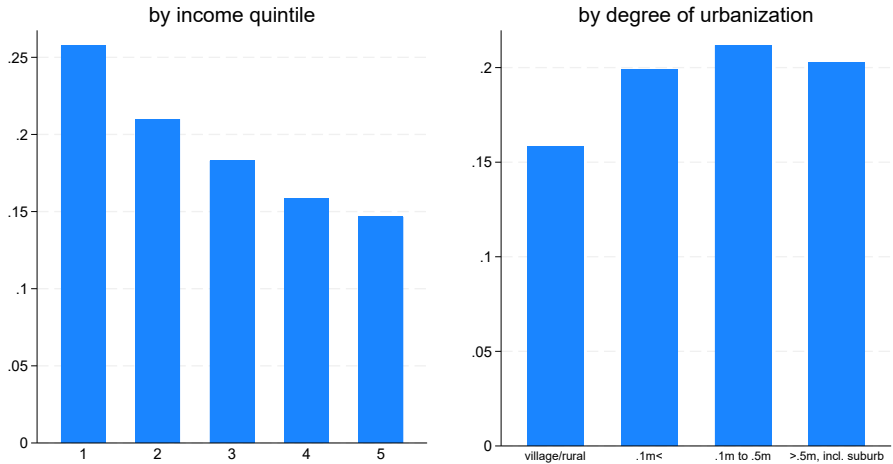

Notes: share of housing (rent, maintenance/repair costs, home owner/renter insurance, but excluding mortgage payments) in total consumption expenditure. Source: ECB Consumer Expectations Survey; data for 2024 Q1 and Q2.