How far we are from a price convergence in the EU energy markets?

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The state of art

- Energy Union Strategy → construction of a fully-integrated internal energy market enabling the free flow of energy across the EU countries.
- Competition between energy suppliers should thus force down prices and foster their convergence (Ciferri et al., 2020).
- Improvement of the design of energy markets and cross-border exchanges (Fifth report on the State of the Energy Union).
- Retail price convergence is more pronounced for industrial consumers than for households.
The state of art

- As other tradable goods, electricity and natural gas prices are expected to have the same price in unified energy markets (Bastianin et al., 2019; Dreger et al., 2007).
- Estimates of the reduction of average prices and price dispersion in single EU markets show mixed results (see e.g. Batalla et al., 2019; Saez et al., 2019; Telatar and Yasar, 2020,…).
- Less attention has been paid to price convergence in European gas markets (Bastianin et al., 2019; Robinson, 2007)
The methodological proposal

A three-step procedure to define a composite index of electricity and natural gas prices

1. CPD (Diewert, 2005; Rao and Hajargasht, 2016) index, used by the International Comparison Program at the World Bank;
2. cluster analysis of EU countries;
3. HP filter.

→ Evaluate price convergence.
The basic idea of the CPD index

Within the stochastic approach, let:

- $p_{ij}$ be the real price of the $i^{th}$ commodity ($i = 1, \ldots, N$) in the $j^{th}$ country ($j = 1, \ldots, M$).
- $PPP_j$ be the purchasing power parity (PPP) of the currency of country $j$ with respect to a reference country currency, $M$.

The CPD model, in its additive form, is

$$\ln p_{ij} = \ln p_i + \ln PPP_j + \ln u_{ij}^* = \eta_i + \pi_j + \varepsilon_{ij}$$

$$= \sum_{i=1}^{N} \eta_i D^P_i + \sum_{j=1}^{M-1} \pi_j D^C_j + \varepsilon_{ij}$$  \hspace{1cm} (1)$$

where $\varepsilon_{ij}$ is a random error term and $D^P_i, D^C_j$ are binary variables. The former takes values 1 for commodity $i$ and 0 otherwise, while the latter is equal to 1 for country $j$ and 0 otherwise.
The basic idea of the CPD index

The model in Eq. 1 has been estimated with the ordinary least squares (OLS). The OLS estimator of \( \pi_j \) is

\[
\hat{\pi}_j = \frac{1}{N} \sum_{i=1}^{N} \ln p_{ij} - \ln p_{iM}
\]

and, accordingly \( PPP_j = e^{\hat{\pi}_j} \).
The dataset

- **Source**: the official Eurostat statistics.
- **Prices**: Average national prices without taxes paid for **electricity** and **natural gas** by:
  - medium size **industrial** consumers (respectively with annual consumption between 500 - 2000 MWh and 10000 - 100000 GJ)
  - **domestic** consumers (respectively with annual consumption between 2500 - 5000 kWh and 20 - 200 GJ).
- **Period**: 2008–2018 for a total of 44 observations per country.
- **Commodities**: electricity and gas for household and non-household consumers.
- **Base country**: EU28.
- **Sample**: 25 EU countries are considered (Greece, Malta and Republic of Cyprus are excluded and the UK is still included).
Results: two-step procedure

Figure 1: a) Heatmap - hierarchical clustering (Ward’s method) of the PPPs; b) Cluster map

- Cluster 1 - Low-priced; Cluster 2 - Low average-priced;
- Cluster 3 - High average-priced; Cluster 4 - High-priced.
Results: PPP trend via HP filter

Figure 2: a) PPP over time given clusters; b) Trend component of the PPP estimated via the HP filter with smoothing parameter equal to 100 (Ravn and Uhlig, 2002)
Results: trend in electricity prices

Figure 3: Electricity prices and trend (household vs non-household)
Results: trend in natural gas prices

Figure 4: Natural gas prices and trend (household vs non-household)
Further research

- Further convergence studies
- Application of other price indexes such as the MPL
- Stock energy markerts
- ...

Thank you!


