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RETAIL PRICE CONVERGENCE ACROSS EU ELECTRICITY AND NATURAL GAS MARKETS

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Overview

Building a fully integrated internal energy market is one of the five dimensions of the Energy Union Strategy. In a fully integrated internal energy market, energy can be produced in one EU country and delivered to industrial consumers and households in another, thus creating competition between energy suppliers and promoting convergence in wholesale and retail prices (Böckers and Heimeshoff, 2014; Ciferri et al., 2020). The impact on national prices of the EU market integration process has spurred increasing academic research. From a theoretical perspective, the main argument refers to the law of one price, which is deemed to hold in perfectly competitive markets (Helpman and Krugman, 1985; Miljkovic, 1999). As other tradable goods, electricity and natural gas are expected to have the same price in unified energy markets, once transaction and transportation costs are accounted for (Bastianin et al., 2019; Dreger et al., 2007). On this ground, the empirical literature has been mainly devoted to estimate whether the European single market has reduced average prices and price dispersion as it is expected according to the theory. However, results remain mixed (Batalla et al., 2019; Bower, 2002; Castagneto-Gissey et al., 2014; Dreger et al., 2007; Robinson, 2007; Saez et al., 2019; Telatar and Yaşar, 2020; Zachmann, 2008).

Method

To investigate price convergence in the energetic European market, the trends of retail prices of electricity and natural gas are determined for each EU country, as required by the club-convergence analysis. To this end, a low-pass filter is used to extract the long- term fluctuations from each price series and removing the shorter-term cyclical components. In details, the Hodrick-Prescott (HP) filter, which is widely used in the literature and represents a standard tool in macroeconomics, has been employed for this scope. The HP filter, first introduced by Whittaker (1923) and popularized by Hodrick and Prescott (1997), has been recently applied in the energy field by Bastianin et al. (2019).
The club convergence measures the tendency to converge to multiple steady-state equilibria (Apergis et al., 2012).
The notion of club convergence was initially introduced by Baumol (1986) and further extended by Phillips and Sul (2009, 2007) which proposed a time- varying factor model for controlling individual and transitional heterogeneity in the identification process of convergent economies or clubs. This convergence allows for periods of transitional divergence given that it evaluates the long-run trend.

Therefore, it has been used to investigate convergence patterns among many markets, such as labor markets, productivity measures, equity markets, etc. (Apergis et al., 2014) as it has many advantages, including allowing for different transitional paths, endogenous determination of convergence clubs and no need for stationary assumption. In case the full panel of countries under scrutiny does not converge to a common steady state, this methodology allows to identify groups of countries that converge to different equilibria, while leaving individual countries to diverge.
According to Phillips and Sul (2007), a non-linear panel model for prices is proposed to test for convergence. Then, a time series P_{it} for country i is decomposed as follow

$$P_{it} = \delta_{it}\mu_t$$

where μ_t is a common path (or a deterministic trend) while δ_{it} is a time varying idiosyncratic component which captures the deviation of country i from the common path μ_t. Here δ_{it} is a vector of weights that measure the distance between the PPP of the energy market in country i and the common deterministic trend μt. Club convergence exists if the following limit in probability for $i \neq j$ holds true

$$\operatorname{plim}_{t\to\infty} \frac{P_{it}}{P_{jt}} \to 1.$$

The above hypothesis can be tested by considering the following regression model:

$$\log\left(\frac{H_1}{H_t}\right) - 2\log(\log t) = \alpha + \beta \log t + \varepsilon_t$$

where

$$H_t = \frac{\sum_{i=1}^{N}(h_{it} - 1)^2}{N}$$

is the sample transition distance and

$$h_{it} = \frac{P_{it}}{(1/N)\sum_{i=1}^{N} P_{it}}$$

is the relative transition curve (namely the relative measure which captures the transition path with respect to the panel average) for
$t = \lceil rT \rceil, \lceil rT \rceil + 1, \ldots, T$ for $r = 1/3$ which represents the trim time suggested by Phillips and Sul (2009, 2007).

The null hypothesis of convergence for all i is: H_0: $\beta \geq 0$ vs H_1: $\beta < 0$ and can be tested with a standard one-sided t-test based on heteroskedasticity and autocorrelation consistent standard errors (Newey and West, 1987).

Results

To investigate the club convergence, a log-t test is firstly implemented over the whole sample of the price filtered series in four markets. The log-t test assumes convergence under the null and it has power against forms of club convergence (Phillips and Sul, 2009, 2007).
The null hypothesis of convergence is: rejected since the t-value is equal to -99.145 and the associated p-value is less than 0.0001 in the household electricity market; rejected since the t-value is equal to -23.987 and the associated p-value is less than 0.0001 in the non- household electricity market; rejected since the t-value is equal to -1113.635 and the associated p-value is less than 0.0001 in the household gas market; rejected since the t-value is equal to -16.683and the associated p-value is less than 0.0001 in the non-household gas market.

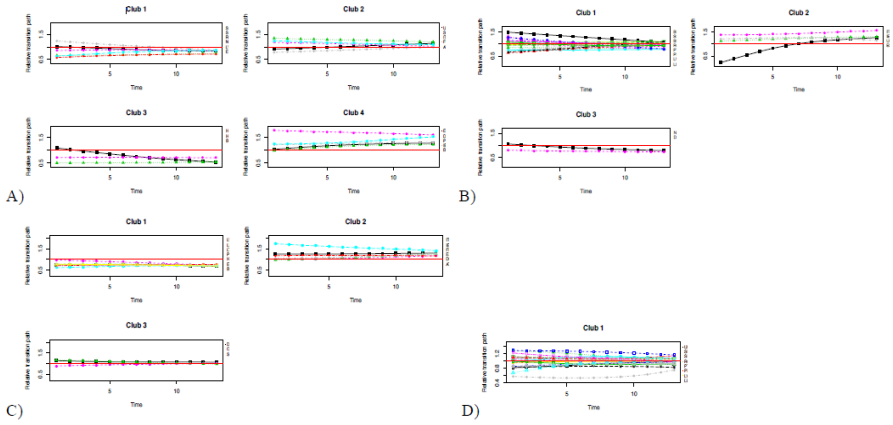

Figure 1: Transition paths of the clubs within A) household and B) non-household electricity market and C) household and D) nonhousehold gas markets

These empirical results confirm that an overall price convergence in the EU energy markets is absent when studying the price trends. This is the condition to evaluate the presence of clubs, given that different paths of price convergence can be identified within each club. Figure 1 shows the resulting groups of countries, across the different energy markets, based on the use of the price filtered series and a suggested trim time of 1/3 (Phillips and Sul, 2009, 2007).

As can be noted, while a single club characterizes the non-household gas market, more than two clubs of relative convergence emerge within the other markets. Four clubs emerge in the household electricity market, and three clubs in non-household electricity market and in household gas market. Moreover, all clusters exhibit divergent units, apart from the non-household electricity market. We have checked the robustness of this results using the Phillips-Sul merging algorithm

Conclusions

Taken together, the results from our analysis indicate that the electricity and natural gas prices across the EU-28 member states have not converged at retail level, despite significant efforts in market integration and regulatory harmonization. Our findings suggest that some key characteristics of energy markets, rather than simple wholesale market integration, geographical proximity and cross-border exchanges, may help to explain the difficulties of the convergence process at a retail price level.

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