Estimation of the efficiency of policy measures targeting a more integrated gas market

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Introduction

● **Context:**
  - An integrated market improves possibility to forecast and can preserve the market from disturbances and reinforce the security of supply
  - In order to achieve an integrated gas market policy makers need to find efficient measures aiming at an increase in liquidity on gas trading hubs

● **Goal of the paper:**
  - To analyse the efficiency of a policy targeting a more integrated gas market

● **Motivation:**
  - French case offers an example of such policy
  - The efficiency of this policy has not been evaluated yet
  - According to European initiatives to create an integrated, efficient and liquid gas market further mergers of trading zones are proposed

● **Question:**
  - Whether the merger of two zones has helped to get a more integrated and efficient gas market?
French case: gas markets after liberalization

- **Gas balancing zones:**
  - Entry-exit system for gas transmission tariffs based on division into balancing zones
  - The number of zones has been gradually reduced after a series of mergers
  - Currently 2 gas trading regions:
    - North: PEG Nord
    - South: TRS

- **North PEG:**
  - Mostly pipeline supply
  - Higher liquidity

- **TRS:**
  - Mostly LNG supply
  - Lower liquidity


Literature

- **Historical definition of integration:**
  - Two geographical markets for a tradable good are integrated if the price difference between these two markets equals the unit transportation cost

- **Empirical approach:**
  - Interrelations between prices in different locations:
    - co-movements, correlation, Granger causality (Doane & Spulber, 1994),
    - cointegration (De Vany & Walls, 1993; Serletis, 1997; Asche et al., 2002, 2013 and Siliverstovs et al., 2005),
    - stationarity of pairwise price differentials (Cuddington & Wang, 2006),
    - short term and long term relations (Park et al., 2008; Brown & Yücel, 2008; Schultz & Swieringa, 2013; Olsen et al., 2015)
    - Kalman filter approach and time varying degree of price convergence (King & Cuc, 1996; Neumann et al., 2006; Neumann, 2009 and Renou-Maissant, 2012),

- **Spatial equilibrium approach:**
  - Spatial efficiency of the market: in equilibrium all arbitrage opportunities are being exploited
    - Spatial equilibrium theory (Enke, 1951; Samuelson, 1952; Takayama & Judge, 1971 and Harker, 1986)
    - Parity bounds model with arbitrage equilibrium, autarchic and barriers to trade regimes (Spiller & Huang, 1985; Sexton, Kling & Carman, 1991; Barrett & Li, 2002; Negassa & Myers, 2007; Massol & Banal-Estañol, 2016)
Methods

- **Spatial equilibrium model:**
  - Parity bounds model with policy dummies which estimates probabilities (by maximum likelihood method) to be in one of three trade regimes:
    - Spatial equilibrium with zero arbitrage rent \( (R = 0) \): \( \Delta P_{ijt} - C_{ijt} = e_t \)
    - Barriers to trade with positive arbitrage rent \( (R > 0) \): \( \Delta P_{ijt} - C_{ijt} = e_t + u_t \)
    - Autarchic with negative arbitrage rent \( (R < 0) \): \( \Delta P_{ijt} - C_{ijt} = e_t - u_t \)
  - Where \( R_t = \Delta P_{ijt} - C_{ijt} \) represents marginal rent from arbitrage, \( e_t \) is a random shock, assumed to be normally distributed with zero mean and standard deviation \( \sigma_e \) and \( u_t \) is non-negatively valued random variable assumed to be half-normal and distributed independently from \( e_t \) with standard deviation \( \sigma_u \)
  - Ex-post assignment of the regime for each observation in order to analyse the relation between the regimes and the infrastructure use
Results

- Parity bounds model estimation:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Before zone merger</th>
<th>After zone merger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regime</td>
<td>R=0, R&gt;0, R&lt;0</td>
<td>R=0, R&gt;0, R&lt;0</td>
</tr>
<tr>
<td>Probability</td>
<td>0.51, 0.20, 0.30</td>
<td>0.72, 0.12, 0.16</td>
</tr>
<tr>
<td>Z statistics</td>
<td>26.89, 14.44, 18.07</td>
<td>30.20, 7.29, 8.57</td>
</tr>
</tbody>
</table>

- Higher probability to observe the spatial equilibrium regime (market became more spatially efficient)

- Reduced probability of the regime “barriers to trade” (less unexploited arbitrage opportunities observed after the policy)

- Decrease in probability to be in the autarchic regime (decrease in trade when the trade is not profitable)
Arbitrage rent vs Load rate analysis

- **Before the policy:**
  - Pipeline fully loaded in the autarchic regime
  - Not fully loaded in barriers to trade and equilibrium regimes

- **After the policy:**
  - Higher load in equilibrium, lower load in the autarchic regimes
  - Signs of increased liquidity
  - Fully loaded in the barriers to arbitrage regime
  - Improvement in the efficiency of the infrastructure use
Conclusions

- The study allowed us to estimate the efficiency of a policy measure targeting a more integrated gas market using spatial equilibrium framework.

- A parity bounds model is applied to measure the impact on spatial efficiency of the market of a policy decision to merge two gas trading zones in the South of France.

- The model shows increased market integration and improved market efficiency after the policy implementation.

- The analysis of the infrastructure load rate indicates an increase in liquidity on the market and an improvement in the efficiency of the infrastructure use.
THANK YOU!