Policy measures targeting a more integrated gas market: impact on prices and arbitrages

Ekaterina Dukhanina, MINES ParisTech
François Lévêque, MINES ParisTech
Olivier Massol, IFP School & City University of London

15th IAEE European Conference - Vienna 2017

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

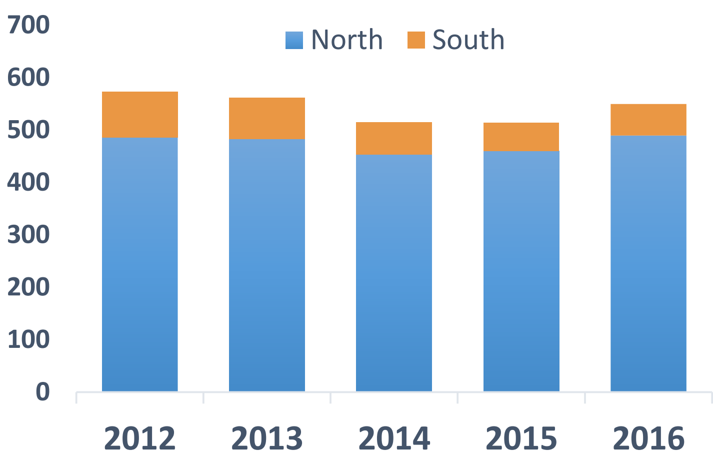
- **Motivation:**
  - French case offers an example of such policy
  - The efficiency of this policy has not been evaluated yet
  - According to European initiatives to create an integrated, efficient and liquid gas market further mergers of trading zones are proposed

- **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
  - Since April 2015: 2 gas trading regions: North & South

Gas & LNG supply (TWh)



Source: GRTGaz

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 (price spread net of transportation costs), e_t is a random shock, assumed to be normally distributed with zero mean and standard deviation σ_e and u_t is non-negatively valued random variable assumed to be half-normal and distributed independently from e_t with standard deviation σ_u

- Ex-post assignment of the regime for each observation in order to analyse the relation between the regimes and the infrastructure use

Results

- **Data:**

- End of the day price spread
- Study period: July 2011 – February 2017

- **Parity bounds model estimation:**

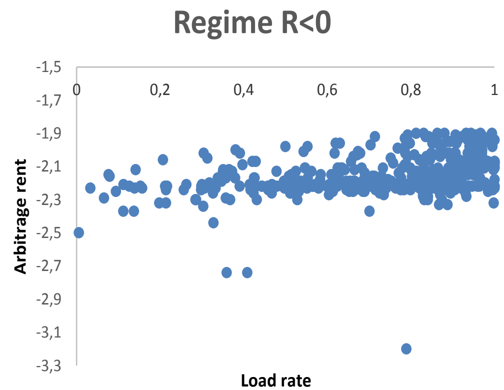
Period	Before zone merger			After zone merger		
Parameters	λ1	λ2	λ3	γ1	γ2	γ3
Regime	R=0	R>0	R<0	R=0	R>0	R<0
Probability	0,55	0,40	0,05	0,92	0,07	0,01
Z statistics	26,89	16,14	6,12	72,86	5,33	2,59

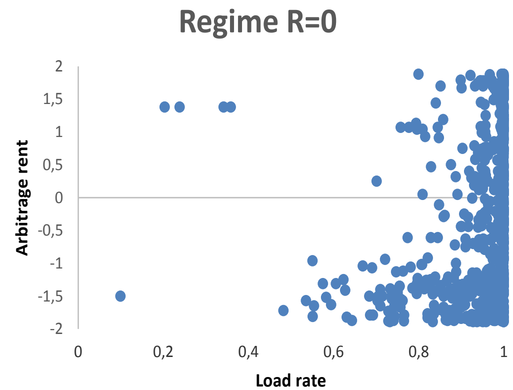
- Higher probability to observe the spatial equilibrium regime (market became more spatially efficient)
- Reduced probability of the regime “barriers to trade” (less unexploited arbitrage opportunities observed after the policy)
- Decrease in probability to be in the autarchic regime (decrease in trade when the trade is not profitable)

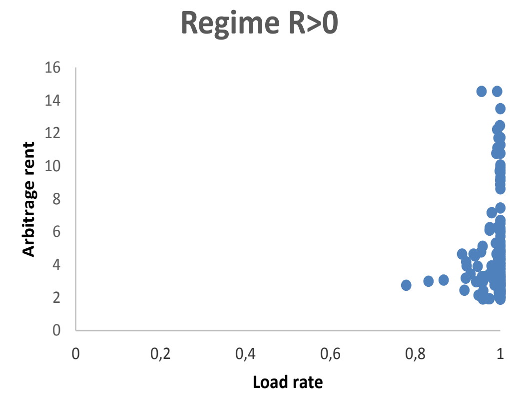
Relation between the regimes and infrastructure load

- **Before the policy:**

- Pipeline fully loaded in autarchic, not fully loaded in barriers to trade and equilibrium regimes

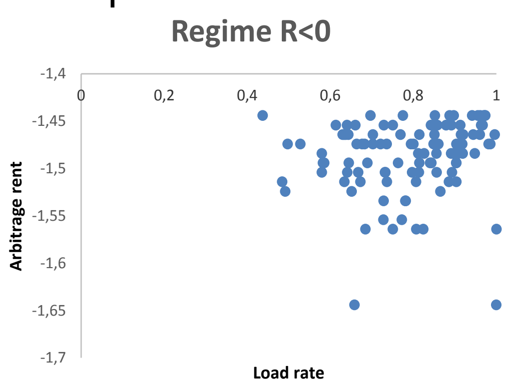


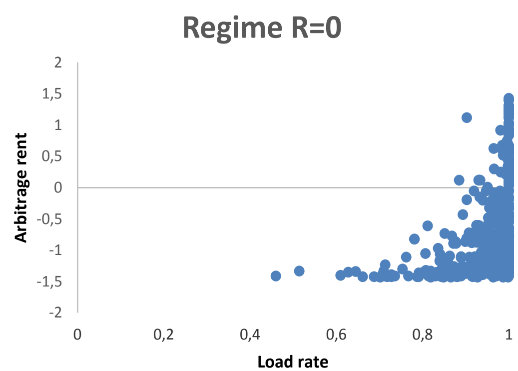


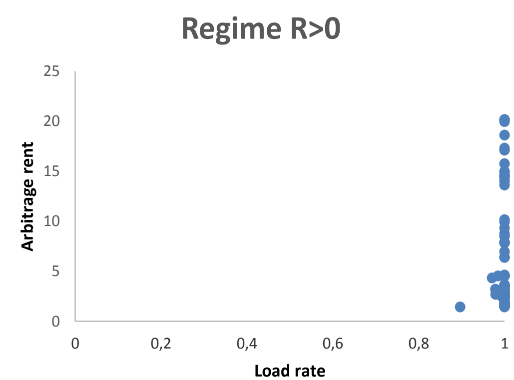


- **After the policy:**

- Lower load in autarchic, fully loaded in ‘barriers to trade’, higher load in equilibrium regimes
- Signs of increased liquidity
- 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!