

Integration of natural gas markets: spatial equilibrium approach

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Abstract

The liberalization reforms conducted in different regions have stimulated the emergence of spatially localized spot natural gas markets worldwide interconnected through the pipeline network or via Liquefied Natural Gas (LNG). The spatial arbitrage performed between these markets plays a crucial role in the determination of local prices. The spatial equilibrium theory suggests that on integrated markets the spatial price spread equals the intermarket arbitrage costs, whatever the nature of the arbitrage (i.e., via pipeline or LNG).

Taking into account the fact that the degree of market integration impacts strategic decisions for industrials and policy makers, the paper applies a new methodology to estimate the degree of spatial integration between natural gas markets based on the spatial equilibrium theory. The study focuses on arbitrage activity performed between different gas markets and on the role played by arbitrage costs.

This work is based on a switching regime model derived in Spiller and Huang (1986) and extended by Sexton et al. (1991), Barrett and Li (2002) and Massol and Banal-Estañol (2018). This methodology suggests that the market integration can be time varying: we can observe (i) autarky periods, during which the transaction costs exceed the spatial price difference, (ii) perfectly integrated equilibrium periods, meaning that the price spread corresponds to the arbitrage costs, and (iii) imperfectly integrated equilibrium or barriers to trade, when the price spread is higher than the transaction costs.

The constructed spatial equilibrium model uses both price and non-price data and accounts for market conditions and infrastructure-specific constraints. The output provides insights into profitability of arbitrage, detects periods of integrated equilibrium and points out barriers to trade or other market inefficiencies. The model enables detection of market power and allows assessment of efficiency of policy measures.

The model is applied to the global gas market to examine the degree of integration between spot markets for wholesale natural gas in different regions (i.e., Europe, North America, and Asia) provided their heterogeneity in terms of gas supply infrastructure (e.g., markets interconnected via pipelines or liquefied natural gas).

Another application assesses the efficiency of a policy targeting a more integrated gas market. In particular, we analyze the market integration and market efficiency before and after a merger of two gas trading zones in France.

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