MARKET REFORMS AND THE INTEGRATION OF EU NATURAL GAS MARKETS

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Overview

In the 1990s, the European Union and its member states decided to liberalize the energy markets and break down monopolies in the regional markets. In 1998, the first Gas Directive (98/30/EC) was adopted to gradually introduce competition to EU gas markets. The second Gas Directive (2003/55/EC) in 2003 accelerated the movement towards opening gas networks to third parties. According to the second directive, transport networks of gas must be independent from production and supply. It allowed the industrial clients and domestic customers to freely choose their gas suppliers in a competitive market. In July 2009, the EU adopted the third Gas Directive (2009/73/ EC) which aimed to tighten the requirements for separation of networks and to clarify the roles and responsibilities of national regulators to ensure greater transparency in market operations.

The integration of natural gas markets is seen as important because forming an alliance of the EU countries will not only increase the efficiency and security of gas supply, but also increase the bargaining power of EU energy buyers against suppliers like Russia. The objective of this paper is to revisit the topic of natural gas market integration across Europe. In particular, we focus on three main research questions:

- Has the EU natural gas market achieved integration?
- Was the reform adopted by the EU effective for integrating the natural gas markets?

Methods

We adopt the spillover index approach by Diebold and Yilmaz (2009, 2012) to analysis the contagion and interdependence among markets and examine if the EU markets for natural gas are integrated. The Diebold and Yilmaz (2009, 2012) spillover index is based on forecast error variance decompositions in a vector-autoregressive (VAR) framework (see Koops et.al, 1996 and Pesaran and Shin, 1998). This quantitative method can measure the intensity and direction of spillovers over time across different markets. In addition, this approach allows us to observe the movements of spillover over time following market and/or policy shocks. Following Diebold and Yilmaz (2009), total spillover is defined as:

$$S^g(H) = \frac{\sum_{i,j=1,i\neq j}^{N} \tilde{\theta}_{ij}^g(H)}{\sum_{i,j=1,}^{N} \tilde{\theta}_{ij}^g(H)} \times 100 = \frac{\sum_{i,j=1,i\neq j}^{N} \tilde{\theta}_{ij}^g(H)}{N} \times 100$$

where i, j, …, N denote the individual markets and $\tilde{\theta}_{ij}^g(H)$ are elements of the normalized H-step ahead forecast error variance decomposition matrix. The spillover index measures how much of the forecast error variances are explained by spillovers. The directional spillovers received by variable i from all other variables j are defined as:

$$S_{j\to i}^g(H) = \frac{\sum_{j=1,i\neq j}^{N} \tilde{\theta}_{ij}^g(H)}{\sum_{j=1,}^{N} \tilde{\theta}_{ij}^g(H)} \times 100$$

And similarly, the directional spillover transmitted by variable i to all other variables j as:

$$S_{i\to j}^g(H) = \frac{\sum_{j=1,i\neq j}^{N} \tilde{\theta}_{ij}^g(H)}{\sum_{j=1,}^{N} \tilde{\theta}_{ij}^g(H)} \times 100$$

Finally, net spillover from market from market i to all other market j is obtained by:

$$S_i^g(H) = S_{i\to j}^g(H) - S_{j\to i}^g(H)$$

Daily data for UK NBP, Belgium Zeebrugge and Dutch TTF day-ahead natural gas prices covering 2005 to 2017 are obtained from datastream. Price returns and empirical volatility as measured by the variance of a GARCH (1,1) process of the price return are both used in the empirical estimation.

Results

According to the full sample estimation of price return and volatility spillovers, NBP has strong influence on ZEE, explaining around 70% of the forecast error variance. Total contribution to and from others for TTF are both less than 10%. The full sample total spillover index is 28.95% for price return and 27.92% for volatility. Turning to net spillovers, NBP price return has positive net spillovers (79.15%) while ZEE (-13.2%) and TTF (-65.95%) have negative net spillovers. This reflects the role of NBP as a benchmark due to its large trade volume and good connectedness to global markets. Fig.1 and 2 show the 50-week rolling-sample spillover index for price return and volatility. The figures show similar cyclical movements in the study period. It is most evident from the volatility spillover index that the EU natural gas market has become more integrated, with the index rising from around 30% in 2007 to just below 60% in 2017.

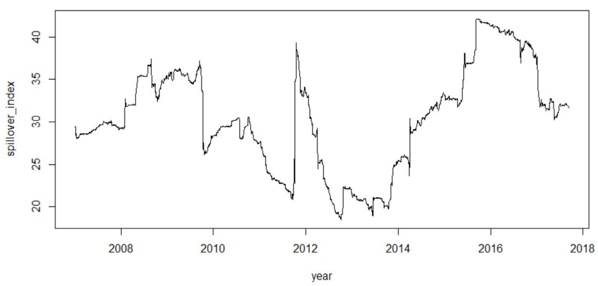

Fig 1: Rolling-sample return spillover

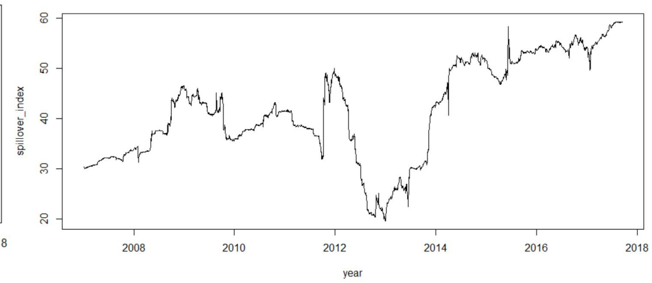

Fig 2: Rolling-sample volatility spillover

Conclusions

Market integration is an on-going process. Our empirical results show that the EU natural gas market has achieved some level of integration to-date. The with the degree of connectedness between markets as measured by return and volatility spillovers fluctuates, but appear to be strengthening over time. These results are largely in line with Renou-Maissant (2012), who found an emerging and on-going convergence between industrial gas prices in western Europe between 2001 and 2009.

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