Natural Gas Market Globalization Revisited

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Overview

The global natural gas market seems at crossroad regarding its future development. On the one hand, transition towards sustainable decarbonized economies worldwide, and on the other increasing energy demand in some parts of the world. In particular the rapid growth of natural gas demand by Asian countries illustrates the uncomfortable situation that the natural gas industry is currently in. Switching from carbon intensive coal-fired electricity generation in industry and building sectors to natural gas-fired technologies in order to reduce particulate emissions by national policy makes natural gas an attractive fuel, at least in the short run. Motivated by these developments this paper aims to shed light on price developments in the natural gas industry that has emerged as the frontrunner in discussions about industrial development and "low carbon" innovation. We revisit the contradictory hypotheses emitted a decade ago about the globalization of natural gas market (Siliverstovs et al., 2005). The global natural gas markets undergo radical restructuring through the development of major emerging LNG buyers and entrance of new suppliers (as well as technologies such as small scale LNG or floating offshore terminals), and raise new challenges for the global security of energy supplies. Motivated by these developments, we investigate the globalization of natural gas markets and contribute to the literature in at least two ways. First, we explore the cointegration relationship between import natural gas prices through the employment of a new unrestricted Error Correction Model, which is modified to capture underlying price relations on different ranges of the full conditional distribution. By doing so, we investigate simultaneously the short-run dynamics and long-run relationship, and account for potential asymmetric and nonlinear linkages between import natural gas prices. We find a quantile-dependent (time-varying) cointegrating relationship between import natural gas prices, particularly outside the interquartile range, which reflects periods of limited or excess supply flexibility. Second, by employing state of the art econometric techniques, we carefully consider structural breaks and parameter instabilities. To the best of our knowledge, only a few contributions so far have paid particular attention to this. The motivation for doing so stems from the fact that natural gas markets have been subject to many reforms, for instance, changing Asian and LNG demand projections, decarbonisation of the European energy system, pronounced increase in its natural gas import dependency, as well as shale gas developments in the U.S., which could further reshape global natural gas markets.

Method

We consider the cointegration relationship between import natural gas prices by employing a modified unrestricted Error Correction Model (ECM), which allows us to capture underlying price relations on different ranges of the full conditional distribution. By doing so, we investigate simultaneously the short-run dynamics and long-run relationship and account for any potential asymmetric and nonlinear linkages between import natural gas prices. Moreover, we overcome the need to assume a specific threshold level, since nonlinearity is endogenously defined, as well as the restrictive assumption that all variables under study are integrated of the same order, thus allowing for the possibility of them being fractionally integrated. Finally, our employed econometric methodology provides us with unbiased estimates even if some of the regressors are endogenous or the sample size is small.

Generalization of the unrestricted ECM in the context of quantile regression leads to the following model:

$$Q_{\Delta yt}(\tau|.) = a(\tau) + \gamma(\tau)y_{t-1} + \delta(\tau)x_{t-1} + \sum_{i=1}^{p} \varphi_i(\tau)\,\Delta y_{t-i} + \sum_{i=0}^{q} \rho_i(\tau)\,\Delta x_{t-i} + v_t(\tau)$$

where $\varphi_* = \sum_{i=1}^{p} \varphi_i$ is the cumulative short-term effect of past variations of y_t on the current variations of y_t, $\rho_* = \sum_{i=0}^{q} \rho_i$ represents the cumulative short-term effect of contemporaneous and past variations of x_t on the current variations of y_t, and γ and δ are the long-term integrating parameters for y_t and x_t, respectively [see more in Pesaran and Shin (1998) and Xiao (2009)].

For the empirical analysis, we use monthly import prices from the major gas-consuming regions such as Europe (pipeline gas and LNG), USA (pipeline gas and LNG), Japan (LNG), and Korea (LNG) that span the period from January 1992 to December 2017. These import gas prices are weighted averages of all import gas prices from the gas-exporting countries, as reported in USD/MmBtu by the International Energy Agency (IEA).

(Expected) Results

By employing an unrestricted Error Correction Model (ECM) within a quantile framework, we expect to provide evidence of an evolving global natural gas market, albeit of different magnitude contingent on shifts in demand and supply. Features of short-run dynamics and long-run relationships will be investigated in order to highlight the asymmetric and nonlinear linkages between import natural gas prices.

Conclusions

Global natural gas markets have been subject to many reforms during the last decade, the most notable being the development of major emerging LNG buyers and the entrance of new suppliers due to unconventional natural gas production. The flexible econometric framework employed in this analysis provides evidence of quantile-varying cointegrating relationship between import natural gas prices, thus highlighting that the underlying relations vary over time due to heterogeneous shocks at each point of time; in other words, periods of limited or excess supply flexibility in the global trade of natural gas.

Selected References

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