

International Natural Gas Market Integration

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The recent past has seen evolution in the natural gas markets around the globe. The evolution within these regional markets has led to growing interest in whether or not they are tending toward a globally integrated marketplace similar to that for crude oil. In this paper we study the markets of North America, Europe, and Asia to discern whether or not integration has occurred or is underway. We employ a relatively new econometric methodology for assessing the convergence of markets, and we are able to identify previously un-noted characteristics of the evolutions discussed by recent research. Credit for these new observations is due primarily to the convergence technique, which is better suited to these questions in a dynamic and evolving world, and it is helped by also being able to employ more recent data; we examine the period from January 1997 to May 2011.

To our knowledge, the convergence testing methodology (Phillips-Sul, 2007) we employ has not previously been applied to international natural gas markets. The methodology is well suited to market integration analyses, which typically are grounded in the law of one price. And we believe it is superior to either cointegration or Kalman filtering when faced with the dynamic nature of the markets over the period under study. Moreover, this methodology accommodates analyses of time-varying parameters in a multivariate environment critical to the question of the integration of several geographically distinct and separated regional markets.

Some of the recent changes in regional natural gas markets are due to the application of technologies that have unleashed natural gas production capacity that was not generally expected to exist as recently as even five years ago. Where recent research has found that the Atlantic region was becoming more integrated as a result of increased competition between the USA and European importers for the trade of natural gas in the form of LNG, we find that this apparent market convergence was short lived. As soon as the USA managed to significantly increase its domestic production employing the combination of hydraulic fracturing and horizontal drilling, the apparently developing integrated Atlantic-basin market disintegrated. Nevertheless, our observations may also be seen as evidence that the various natural gas markets around the world are ripe for integration once competition and arbitrage opportunities open.

We find that the shale gas developments in the USA have virtually eliminated the move toward integration across the Atlantic. However, since the earlier move to integration was motivated by the competition for traded LNG volumes, our results suggest that as soon as North

America begins to export natural gas in the form of LNG there is every likelihood that a move to convergence will return, albeit with a different character than that which occurred earlier.

In Asia, we also discover relationships that we believe have not been identified previously. While Japan has dominated the global LNG trade as the first and largest importer, we find that prices in Japan have been reacting to price changes in South Korea and Taiwan, rather than leading, over the recent period under study. We conclude that this relationship is due to the long-term nature of existing contracts where relatively sticky pricing terms are only slowly altered to reflect more recent market changes. The growth of South Korea and Taiwan as significant importers of LNG over the period has been accompanied by new contracts for the new volumes with pricing terms that reflect the market conditions (and expectations) at the time the newer contracts were negotiated, and the older Japanese contracts appear to react only slowly to bring their pricing terms into line with the changes.

We also find support for an apparent convergence between Europe (represented by the NBP price in our analysis) and Asia. While this observation is not new, this linkage appears not to be primarily the result of inter-regional competition and arbitrage. Rather it appears to be due to the fact that over most of this period natural gas prices in both regions were contractually linked to oil prices. The observed linkage is less than perfect in large part due to Asian prices being linked to crude oil prices while European prices tend to be linked to refined oil product prices. Nevertheless, there are indications that “real”, economics-based convergence may be underway. The NBP, in particular, has had its linkage to oil prices weakened. And, over the

period there was a significant increase in LNG imports into the UK as a share of total natural gas, and the LNG imports originated from countries also exporting to the Asian counterparts.

Our empirical results lead us to conclude that there is not yet an integrated international market for natural gas. Over the study period, North America began and finished as a separate market, while Europe and Asia gave the appearance of convergence, albeit driven primarily by contractual linkages to oil prices. Our results also imply that gas-on-gas pricing is not integrated with oil-indexed pricing, suggesting that natural gas and oil markets are not integrated in the absence of contractual links. Nevertheless, the observed effects on pricing from Atlantic-basin competition within our study period and the increase in European and Asian imports from common exporters suggest that enhanced integration in the future has strong potential.