

## The effect of LNG on the relationship between UK and Continental European natural gas markets

EPRG Working Paper 1225

Cambridge Working Paper in Economics 1253

**Philipp Koenig**

The North West (NW) European natural gas markets are deeply divided into two competing pricing mechanisms. In Continental Europe, gas supplies are predominantly governed by long-term supply contracts, indexed to the price of oil products. In contrast, the UK market underwent liberalization in 1995 and by now is characterized by full gas-on-gas competition and single hub pricing. That is, UK long-term supply contracts, in contrary to the European Continent, use spot gas prices as a benchmark for indexation and not oil product prices. Following Melling (2010), the difference between the two pricing systems has become increasingly pronounced since 2006 when a large share of UK long-term contracts expired and were rolled over to contracts with spot gas price indexation. By 2010, spot gas price indexation accounted for approx. 90% of all gas sales in the UK, whereas only for 25% in Continental Europe. This growing divide between the two markets results in large tensions only if spot prices diverge significantly from oil-indexed prices. Two situations might arise. Spot prices might exceed oil-indexed prices for a considerable period, hence pricing a physical shortage in the market. In this case, gas consumers locked into long-term supply contracts might face upwards price revisions by their suppliers. In the reverse case, when spot gas trades at a significant discount to oil-indexed prices, pricing an oversupply of spot gas, Continental European gas consumers are locked into their long-term positions and cannot benefit from lower spot prices, a situation which has prevailed in the market since summer 2008. It becomes obvious that the stress between the two pricing systems is an increasing function of the price differential.

However, even in the absence of a contractual linkage between the UK hub prices and the price of crude oil (or oil products), the two are not independent. UK spot prices are influenced by

storage arbitrage with the Continental European markets during the summer, and demand/supply imbalances during the winter, facilitated to a large extent by trade flows across the Interconnector (IUK) pipeline, linking the UK with Belgium and therefore the Continental European markets, Heather (2010). This arbitrage between the UK and Continental Europe has helped prevent a structural price divergence between the two markets, and hence kept the tension between them small.

Since 2005, the UK has expanded its import infrastructure for natural gas by adding two import pipelines as well as significant LNG regasification capacity. As a result, Heather (2010) maintains that the UK has become subject to global arbitrage for the marginal supply of natural gas. That is, given demand and supply imbalances in the UK market, the marginal supply might not be priced against Continental European oil-indexed gas, but against global spot LNG prices. This has the potential to significantly change the long-term relationship between the UK and Continental European markets. This view is confirmed by Stern and Rogers (2011). They argue that even if market fundamentals ensure that the price differential between oil-indexed and hub priced gas is small, there is a threat of a widening differential in an increasingly uncertain LNG-connected global gas system. In particular, if the addition of UK LNG import capacity has weakened the long-term relationship between the UK spot price and the oil-indexed price on the Continent, by affecting the arbitrage dynamics across the IUK pipeline, then the price differential between UK hub and oil-indexed prices could widen. The resulting friction will then increase the tension between the two markets even further.

The empirical investigation of this potential weakening lies at the core of the present study. The following analysis determines the dynamic behaviour of the long-term relationship between UK NBP hub and NW European gas prices, predominantly oil-indexed, which is conventionally measured in a cointegration framework. Importantly, the possibility of a price decoupling is examined. Following the spirit of Ramberg and Parsons (2012), the present study aims to answer the question whether the extension of natural gas import infrastructure in the UK has led to any of the three forms of price decoupling: (i) prices have temporarily deviated from their long-term relationship to which they will return later; (ii) prices have permanently deviated from the old relationship and moved into a new long-term relationship; or (iii) the two prices no longer maintain a long-term relationship with each other at all.

The contributions of this study are threefold: (i) to the best knowledge of the author, this is the first study to take into account important UK spot gas market drivers such as seasonality, temperature and gas storage injection/withdrawal behaviour when examining the structural

relationship between UK and Continental European markets. (ii) The effect of import capacity extensions (pipeline/LNG) on the long-term relationship between UK spot and Continental European oil-indexed gas prices will be analyzed. In doing so, this study is the first to use a direct measure of oil-indexed gas prices in the NW European market, the Average German Import Price (AGIP), rather than price for crude oil. The second contribution is of particular importance for two reasons. First, it determines whether the opening of the UK to global LNG trade has permanently broken the long-term relationship between UK and NW European gas markets, or whether this relationship still exists, yet maybe in a changed form. This information about the dynamic properties of the price differential between spot and oil-indexed gas prices appears somewhat critical to large-scale consumers of natural gas, if positioned in long-term oil-indexed supply contracts. Further, it informs exporters of natural gas into the NW European market, as price decoupling increases the pressure to move away from oil-indexation. Second, it provides an improved understanding of how the UK domestic gas market is exposed to global (exogenous) oil price movements. (iii) The empirical analysis is based on a larger dataset compared to previous research, which covered data up until and including 2005. This will provide the basis for re-examining the long-term structural relationship between the UK and Continental European markets.

Two approaches were taken to determine the stability of the relationship between the UK NBP and AGIP over time. First, an endogenous break-date estimation was performed in the Gregory and Hansen (1996) framework. Hereby, the cointegrating relationship between the two markets was estimated controlling for the effect of temperature and storage as well as allowing for the presence of a break in both constant and slope parameters. The test results confirmed cointegration of both prices and suggested a break date in the middle of 2006. Allowing both the slope and constant parameters in the cointegrating regression to vary around this break-date improved the model fit considerably, explaining between 8-10% more of UK NBP price volatility. The results show a significant weakening of the long-run relationship from 2006 onwards, mainly driven by a substantial decrease in the constant term in the post-break sample. The new relationship suggests that after the break in 2006, the range of UK NBP prices which correspond to a given range of the AGIP is much narrower in equilibrium.

Second, the price differential was analyzed in an unobserved components framework to account not only for the effects of temperature and storage but also for time-variant seasonality. As expected, the stochastic trend component exhibits a significant departure from zero starting in the middle of 2006. This suggests a break of the previously stable cointegrating relationship in the year in which additional UK

import pipelines came online. The seasonal pattern was found to decline slightly over time, indicating a reduced effect of seasonal arbitrage on the price differential. In addition to a break in 2006, this methodology also confirmed a significant change in the cointegrating relationship from November 2008, the point in time in which UK LNG imports picked up. Estimating the model on each side of those breaks separately suggests that from 2006 onwards prices moved from an old to a new, much weaker, long-term relationship. From November 2008 onwards, it appears that the long-term relationship has broken down altogether. Importantly, this suggests that the pressure on exporters of natural gas into the NW European market, to move away from oil-indexation and toward gas-indexation of long-term supply contracts, is mounting and was substantially elevated by the opening of the UK to global LNG trade. It is important to outline that from November 2008 onwards, Asian LNG markets were tight, and the average Japanese LNG import price continuously exceeded the AGIP. Given these relative prices, the break-up of the long-term relationship between UK NBP and AGIP is even more remarkable.

The results need to be interpreted with caution, as the low post-break sample size makes inference more difficult. However, it appears that a longer post-break sample would allow one to either (i) find consistent evidence against cointegration or (ii) find consistent evidence supporting the new, much weaker, cointegrating relationship. In either case, the tie between the UK NBP price and the AGIP appears to be significantly severed, the timing of which coincides with the opening of the UK natural gas market to global arbitrage.

Going forward, the analysis should be repeated as more data becomes available to help determine the cointegrating properties of the post-break model. In addition, including an LNG spot price marker into the analysis would help determine whether the global price of spot LNG cargoes has taken over from the AGIP in setting the UK NBP price during periods of peak UK natural gas demand.

Contact	pk304@cam.ac.uk
Publication	November, 2012
Financial Support	ESRC (3+1) Grant