

Executive Summary

«Modeling UK Natural Gas Prices when Gas Prices Periodically Decouple from the Oil Price»

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Crude oil and natural gas are central carriers of energy. The states of these markets are important to most economies, and knowledge about relative prices are important for evaluating effects of market deregulations, for determining the relevance of oil indexation in gas contracts, for company decisions regarding investments in oil or gas projects, and for investments in energy-asset portfolios.

Since oil and natural gas are fundamentally valued for the same thing, energy, it is reasonable to believe their prices reflect a degree of common pricing. Relative prices should not differ by too much over too long time. Econometric tools, such as co-integration analysis, can be used to evaluate what an unreasonable price difference is, and how fast markets operate to close differences in relative prices to retain a long-run equilibrium price. Less formal rules of thumb also exist. One common rule states that one barrel of crude oil should be, on average, ten times the price of one MMBtu of natural gas.

Despite both oil and natural gas both being carriers of energy, their use and handle as energy commodities differ. Globally, the markets for natural gas remain fragmented, reflecting difficulties in transporting and handling natural gas as well as regional differences in gas trading. Gas in Europe has historically been traded using long-term contracts indexed to, amongst others, the price of oil. In recent years, the relative importance of long-term contracts has diminished as hub trading has become more prevalent. The UK National Balancing Point (NBP) virtual gas hub is currently the most liquid European gas hub. Increased gas-to-gas competition means gas is valued as a commodity in and of itself, and prices should reflect differences in use from crude oil. In the UK, for instance, gas is used for heating and as input into electricity generation.

Periods of gas-specific pricing leads to periodic decoupling of natural gas from oil prices. Assuming oil at all times influences natural gas prices will only reflect an average over the different relationships between natural gas and oil. For instance, peak-load pricing of natural gas due to seasonal demand factors and constrained gas infrastructure leads to periods where natural gas prices substantially deviates from the oil prices.

Motivated by periodic decoupling, we propose an alternative econometric model to determine the relative value of oil to natural gas in the UK. The model allows the pricing of natural gas to move between states of being oil-driven and gas-specific. We demonstrate that this approach leads to

unbiased estimates of cointegration relationships, adjustments, as well as equilibrium relative values when markets are periodically decoupled.

Estimating the model on UK natural gas (NBP) and Brent oil prices, we find that markets have been integrated for the majority of the sample (1997-2014). When they are integrated, the law of one price holds. This is contrary to results suggested by a linear error correction estimator, which rejects the law of one price over the whole sample. Gas prices adjust more strongly to oil prices when they are integrated than what is suggested by the linear estimator. When gas prices decouple they follow a random walk with positive drift. They tend to increase relative to oil prices and become more volatile. This is mostly linked to the winter pricing of gas. The probability of gas-specific pricing increases substantially during the fall and winter. We also find evidence of decoupling during the early ramp up in oil prices starting in 2006. We do find that market integration has become stronger in recent years (from around 2010/11 to now), coinciding with a period of stable oil and weaker seasonal pricing of gas.

By accounting for periods where price movements do not indicate any common pricing, we can derive a more refined measure of the relative price of oil to natural gas in the UK. Using the sample mean of relative values, one barrel of oil has on average traded at 9.2 times the price of one MMBtu of natural gas. Using only periods when evidence favours integration and proportional price movements, we find that one barrel of oil is, on average, 10 times the value of one MMBtu of natural gas, confirming the 10-1 rule-of-thumb. What relative value to use in practice depends on its purpose. For pricing natural gas in oil indexed contracts, the total sample average is suitable. However, for using relative prices to predict relative price developments, we need also specify if markets are integrated or decoupled. When integrated, the correct relative value to use is the 10-1 rule. This is only economically meaningful and relevant when applied to periods where oil actually influences natural gas prices. Applying the 10-1 rule unconditionally, one would undervalue natural gas on average.