THE STRUCTURE OF THE OIL/GAS PRICE RELATIONSHIP

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Overview

It is well documented that oil(Brent) and natural gas markets in Europe are well integrated, with the Law of One Price holding and oil being an exogenous driver accounting for the long-run trend in natural gas prices (Asche, Osmundsen and Sandsmark, 2006; Asche, Osmundsen and Tveterås, 2002; Panagiotidis and Rutledge, 2007). In the long-run equilibrium oil is priced at approximately twice the value of natural gas. However, relative long periods exist where natural gas moves almost independently of oil, such that relative prices appear to diverge. This is linked to several factors, where the interaction between capacity restrictions on natural gas supply and seasonal demand appear to be a specifically important factor. In addition changes in competitive patterns, such as natural gas being increasingly used for electricity generation, and the potential effect of developments in liquefied natural gas (LNG) and shale gas supply will likely affect the relative value of oil and natural gas. To arrive at a more detailed measure of the relative value of oil and natural gas it is necessary to account for periods where natural gas prices appear to diverge from oil prices. These periods are associated with regimes where natural gas is not priced relative to oil, and where natural gas is allowed idiosyncratic movements relative to oil. In this paper we seek to isolate these periods by using temperature as a proxy for natural gas demand. To achieve this we utilize non-linear time series models (regime switching models) which has previously been successfully applied to model electricity prices (Mount et.al 2006; Kanamura and Ohasi 2007; Geman and Roncoroni 2006). We suggest that such methods can also be applied to other energy markets, such as oil and natural gas, to gain a more detailed insight into energy price dynamics.

Method

Since oil and natural gas markets are integrated in Europe, with the Law of One Price holding and oil accounting for the long-run stochastic trend in natural gas, the relative price of oil and natural gas can be treated as a stationary variable. Furthermore, this series can be interpreted as the short-run fluctuations in natural gas prices. We model this series using a two-state regime shifting model. The purpose of this is to isolate divergent and non-divergent pricing regimes in relative prices, relevant to the relative value of oil and natural gas. To assist in identifying pricing regimes we use temperature, a proxy for demand, as an exogenous driver affecting the likelihood of changing regimes.

Results

We use the front month Brent futures price as a measure of oil price and the front month ICE natural gas futures price as a measure of natural gas prices.

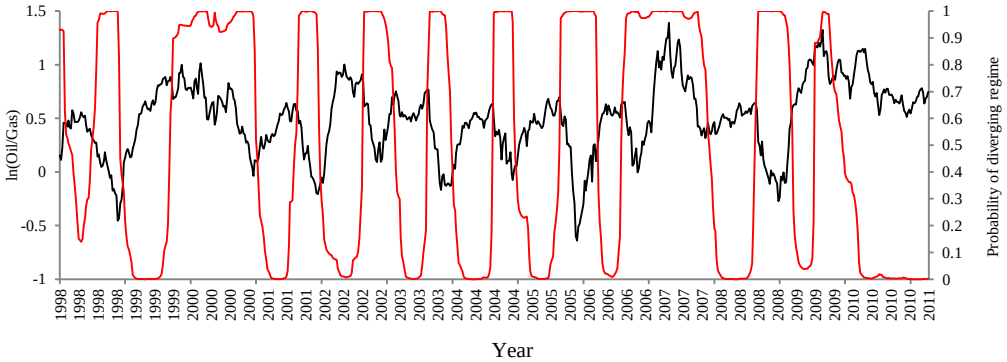

Figure 1. The relative price of oil and natural gas (left axis) and the probability of existing in a regime where gas price diverges from oil.

The data is measured weekly from 1997 to the spring of 2011. These measures are consistent with the measures used in previous empirical analysis. Our estimation successfully isolates two regimes associated with reverting and diverging (unit-root) price dynamics (See figure 1). Furthermore, temperature significantly affects the likelihood of changing pricing regimes. Specifically, when temperatures decline, demand for natural gas increases, and the likelihood of changing to a divergent pricing regime increases. When temperatures start increasing, natural gas is likely to start reverting back towards oil. Our research highlights the importance of accounting for the time-varying nature of oil/natural gas price dynamics. This is especially important when assessing the relative value of oil and natural gas. Such changing dynamics are likely to become even more important as LNG and shale gas supplies starts significantly affecting the European energy market.

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