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Market fundamentals, competition and natural-gas prices

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HIGHLIGHTS

- We analyse the development of the day-ahead spot price at TTF over 2011–2014.
- The oil price had a small impact on the gas price, while the coal price had no effect.
- Changes in the concentration on the supply side did not affect the gas prices.
- The gas prices are predominantly determined by weather and storage availability.
- Policies to integrate gas markets foster gas-to-gas competition.

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ABSTRACT

After the liberalisation of the gas industry, trading hubs have emerged in Europe. Although these hubs appear to be liquid market places fostering gas-to-gas competition, the efficiency of the gas market remains a topic of interest as a fair share of gas is still traded through long-term contracts with prices linked to the oil price while the number of gas suppliers to the European market is limited. In order to assess the efficiency of the gas market, we analyse the day-ahead spot price at the Dutch gas hub over the period 2011–2014. We find that the oil price had a small positive impact on the gas price. Changes in the concentration on the supply side did not affect the movement in gas prices. The availability of gas in storages and the outside temperature negatively influenced the gas price. We also find that the gas price was related to the production of wind electricity. Overall, we conclude that the day-ahead gas prices are predominantly determined by gas-market fundamentals. Policies to further integrate gas markets within Europe may extend this gas-to-gas competition to a larger region.

1. Introduction

The institutions of the European gas market have changed considerably in the last decade. Trading at gas hubs such as the National Balancing Point (NBP) in the United Kingdom and the Title Transfer Facility (TTF) in The Netherlands have gained rapid importance (Heather, 2012). Parallel to this development, the convention of explicitly linking the gas price to the oil price has lost importance. Because oil and gas were substitutes in many processes, oil indexation became the leading pricing mechanism for gas in the 20th and early 21st century in Europe. Since the gas market has changed significantly in recent years, however, gas-to-gas competition seems to have become the dominant price mechanism (IGU, 2014). Moreover, recent evidence shows that national gas markets in North-west Europe are increasingly integrated with each other, resulting in a North-west European market covering countries as the UK, France, The Netherlands, Belgium, Germany, Denmark, Italy and Austria (Growitsch et al., 2012; Kuper and Mulder, 2014; Neumann and Cullmann, 2012; Petrovich, 2013; Timera Energy, 2013).

Nevertheless, there are still concerns regarding the intensity of competition within the European gas market as the dispersion of reserves is concentrated while the number of suppliers is limited. If firms are able to exert market power, above-competitive gas prices may result which reduces consumer welfare. Furthermore, the gas market faces periodical shocks in both supply and demand, which distort the gas prices. For example, the extremely cold weather throughout Europe in February 2012 led to a (perceived) tightness of the market supply. In addition, the Fukushima disaster and the consequent nuclear shutdown in Japan led to a substantial increase in Asian demand for LNG.

A number of different approaches to understand the factors behind gas prices have been used in the recent literature. Several

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authors have established long run co-integrating relationships between gas and oil prices (e.g. Asche et al., 2006; Regnard and Zakoïan, 2011, for the European gas market and Erdős, 2012; Villar and Joutz, 2006, for the US gas market). Some papers have emphasised the role of other supply and demand fundamentals, in particular for the short-run price development because energy commodities differ in fuel density and accordingly in production, transportation and environmental cost (Smith, 2004; Mu, 2007; Brown and Yücel, 2008). Ramberg and Parsons (2012) show that the vector error-correction models typically applied in the co-integration framework do not perform very well in explaining short run gas price development. In another fashion, Nick and Thoenes (2014) investigated the effect of market shocks in a structural vector autoregressive (SVAR) model and found that temperature, storage and supply shocks lead to relatively short lasting effects on the gas price whereas oil and coal price shocks result in more persistent effects on the gas price.

With the strongly reduced share of explicit oil indexation and the reduced options for short run gas–oil substitution in North-west Europe (Stern, 2007, 2009), the supply and demand fundamentals might have become more important for the development of the gas price at liberalised hubs. This is the reason that we estimate a reduced form model of the gas price which enables us to assess the impact of the key fundamental factors on the short term movements of the gas price.

The main question addressed in this paper is: what drives natural gas prices at liberalised European gas markets? More specific, to what extent is the gas price tied to oil and/or coal and what is the effect of other supply and demand fundamentals? This paper contributes to the literature by providing a comprehensive empirical analysis, facilitated by the collection of data for a broad set of gas-market variables. Moreover, while other papers have largely focussed on a single national market, we include a number of variables related to the North-west European market for natural gas. We define the North-west European gas market as the markets in Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands and the UK. The gas networks in these countries are closely connected. In addition, gas is being exported from the Netherlands to each of these markets, which fosters the integration of the markets. As a result, changes in fundamental factors affecting supply or demand in these countries may also affect the gas price at the TTF.

This paper analyses the development of spot market gas prices at the TTF hub over the period 2011–2014 by assessing the contribution of a number of supply and demand fundamentals. We focus at the TTF since it is viewed as a suitable reference hub which is the most liquid and mature trading hub in continental Europe (Heather, 2012). The annual volume delivered at TTF is about 40 bcm while the total gas consumption in the Netherlands is about 45 bcm, which indicates that the TTF is important for the Dutch gas market (GTS, 2012). Moreover, the TTF appears to be strongly integrated with gas hubs in neighbouring markets such as the NCG in Germany (ACM, 2014; Kuper and Mulder, 2014). As a result, the prices on TTF and the other hubs show almost the identical pattern. The day-ahead price is appropriate because it refers to one of the most liquid traded products, which makes that the price of this product is strongly related to the underlying factors (Heather, 2010). The liquidity of the day-ahead products follows from the depth of this market, which is significantly higher than for the other products (ACM, 2014).[1] Hence, in the short run, fundamental supply and demand factors are especially important for the development of the day-ahead price. The fundamentals include the outside temperature, the macroeconomic development, the price of substitute fuels, the concentration in physical terms on the supply side to the European market, the expected level in global gas reserves and the development in renewable energy. While assessing the impact of these factors, we control for a number of incidental events such as the inability of Gazprom to meet unexpected demand and the Fukushima disaster.

We find no evidence of a strong tie between the spot prices of natural gas, crude oil and coal over 2011–2014. The development of the gas price is mainly determined by own fundamentals. Though, a short-run link between the three energy commodities is present via arbitraging between oil indexed gas and hub gas as well as via fuel competition in the power market. Despite being a fairly concentrated market, the changes in the daily gas price do not depend on the changes in the structure on the supply side. Overall, we conclude that the day-ahead gas prices are predominantly determined by gas-market fundamentals.

The remaining of this paper is organised as follows. Section 2 describes the method of research which includes a description of the variables which are used to measure the fundamentals behind the gas price. This section also presents the data which is used to estimate the model. Section 3 presents and discusses the results. The conclusions and policy recommendations are given in Section 4.

2. Method and data

We estimate a reduced-form model of the gas price. This model is based on the idea that the gas price is a function of shifts in the demand and the supply curves. To determine the effect of supply and demand factors on the gas price the equation $P^{TTF}=\phi(\boldsymbol{X}, \boldsymbol{Y})$ is estimated, where $\boldsymbol{X}$ and $\boldsymbol{Y}$ contain the demand and supply variables and P^{TTF} reflects equilibrium gas prices on both the supply and demand schedules, i.e. the points of intersection of both curves. In this section we elaborate on the key factors affecting the demand and supply curves behind the TTF price. The dataset for the quantitative analysis comprises data from 4/1/2011–30/12/2014. It consists of daily observations except for the macroeconomic indicator which is available on a monthly frequency. The dataset does not include prices for weekends limiting the analysis to weekdays only. Table 1 gives an overview of all variables, how they are measured and the data sources. See Fig. 1 for the day-ahead gas price

2.1. Price of oil

A factor which may affect both the demand and the supply of gas is the price of oil. The price of oil is relevant because of substitution properties of gas and oil (Villar and Joutz, 2006). Substitution is primarily relevant in the electricity generation and the heavy industry. If the price of oil rises, burning gas becomes relatively cheaper, increasing the demand for gas which results in an upward pressure on the gas price. However, Stern (2007, 2009) argues that short-run fuel switching is hardly relevant anymore in West Europe because oil has virtually disappeared in most stationary energy sectors, maintenance of dual-fuel burners is expensive, tight environmental standards as well as the inefficiency of using oil in new gas burning technologies.

In addition to the apparent lack of short-run substitutability there are several other reasons why oil and gas should have distinct price dynamics (Smith, 2004). The transportation costs differ and there are differences in the costs of production, processing, storage and environment. Moreover, the differences in characteristics have led gas and oil prices to be determined in different geographical market places, as noted by Ramberg and Parsons

[1] The depth of a market is measured by the number of additional lots of 30 MW traders could sell or buy without influencing the price (ACM, 2014).

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