

# Risk premium in the UK natural gas forward market

Ingrid Hobæk Haff\*, Ola Lindqvist, Anders Løland

*Norwegian Computing Center, Gaustadalleen 23, NO-0373 Oslo, Norway*

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## Abstract

This report investigates the UK natural gas market, and tests whether it is a fair-game efficient forward market, using forward contracts ranging from one to five months time to delivery. The forward and spot price series are separately non-stationary, but cointegrated. Furthermore, the forward prices are biased predictors of both the future spot and the 1-month-ahead forward price. The risk premium on the forward prices is positive, as opposed to the US gas market, where the risk premium was found to be negative in similar work. Moreover, the analysis reveals that the storage model is an incomplete model for the relationship between the spot and forward prices. However, storage has a clear effect on this relationship, an effect that appears to be non-linear. © 2008 Elsevier B.V. All rights reserved.

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## 1. Introduction

A common hypothesis is that forward prices are unbiased predictors for future spot prices (Williams, 1996, 2001). There are arguments for both upward and downward bias, called a risk premium (whether upward or downward). Such a risk premium in the forward market affects the costs and benefits of hedging activities.

Energy prices have increased dramatically during the last couple of years. The European gas markets have been no exceptions. As the forward market for gas delivered on the National Balancing Point (NBP) in the UK increased sharply during the winter 2005/2006, market players asked themselves more than ever whether to expect future spot prices at the same high levels. The

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\* Corresponding author.

E-mail address: [ingrid@nr.no](mailto:ingrid@nr.no) (I. Hobæk Haff).

NBP is a notional point in the UK Transmission System (NTS) used as a delivery point for gas which is traded “entry paid”, i.e. already in the NTS, rather than at the beach.<sup>1</sup> For accounting and balancing purposes all gas is said to flow through this point. The market is relatively young compared to other energy markets such as the oil market, and literature on the European gas markets is scarce (see however Panagiotidis and Rutledge (2007)). The US gas market for gas traded at the Henry Hub has a longer history and has been examined more thoroughly in the literature (see for instance Walls (1995), Buchanan et al. (2001), Movassagh and Modjtahedi (2005), Modjtahedi and Movassagh (2005) and Wei and Zhu (2006)).

The physical conditions for the UK gas market are constantly changing. The domestic production in the UK is declining and the dependence on imported gas increases. Bottlenecks in the transport capacity to the UK from abroad drove up prices sharply during the winter 2005/2006. There is a large gas field in development on the Norwegian shelf with a direct link to the UK market. In addition, the Interconnector, a large pipeline connecting the UK and continental Europe gas markets, has recently been expanded. This is expected to improve the current physical situation.

Intuitively, the net position of a producing market player should be short, whereas the net position of a consuming player should be long, aiming to secure the price of gas delivered at a future time. If the producers are the most compelled to hedge, they have to sell forward gas cheaper than the expected value of future spot prices (Keynes, 1930; Hicks, 1939). Hence, the net position is short and the price of forward contracts will decrease. If, on the other hand, consumers are constrained to secure future prices, the opposite will occur, pushing forward prices above expected future spot prices (Duffie, 1989; Longstaff and Wang, 2004).

However, many of the large producing players choose to be exposed to energy spot prices. According to Haushalter et al. (2002), the sample mean and median fraction of production hedged by 68 oil and gas producers (data from 1992–1994) was 8.4% and 0%, respectively, meaning that fewer than 50% hedge their production. Lookman (2005) reports a sample median of 23% based on data from 1999–2000. This is confirmed by market players, who state that the stakeholders of such companies prefer to be exposed to the fluctuating energy spot prices. Hence, the companies do not hedge much of their production in the forward market. In addition to the trade of physical gas, there are hedge funds and speculators in the market, taking advantage of any observed risk premium (positive or negative).

The forward market is important not only for trading and hedging purposes. Many economic players make production, storage and consumption decisions by studying the forward curve. In many of these cases the forward contracts are never bought or sold to secure values, but only used as a prediction for future values of the spot price. Thus, predicting the spot price is a problem of great interest for many.

Since natural gas is a storable commodity, inventory may also affect the difference between forward and spot prices. That is addressed by the theory of storage (Fama and French, 1987), according to which this price difference depends linearly on the interest rate, marginal cost of storage and convenience yield. The latter two are, in turn, functions of the inventory. Naturally, the difference between forward and spot prices may be influenced by inventory even if the theory of storage does not apply to the natural gas market. In particular, this difference may be depending on other factors as well as storage. Moreover, the relationship could be non-linear.

The main contribution of this paper is to explore the relatively young UK natural gas market. This market has previously been explored by Cartea and Williams (2007). They investigate the effect of deviations from expected seasonal storage levels on spot and forward prices. They also

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<sup>1</sup> Imported gas delivered to the UK is said to be delivered at the beach. From this delivery period, the gas is put into the NTS, which introduces an entry fee. The gas traded at NBP is already in the NTS, i.e. the entry fee is already paid for.

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