



Separated influence of crude oil prices on regional natural gas import prices



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HIGHLIGHTS

- Impacts of world economy and oil prices on regional natural gas prices are analysed
- North American natural gas prices are mainly affected by world economy
- Asian and European natural gas prices are mainly affected by oil prices
- The volatility of oil prices has a negative impact on regional natural gas prices
- The response of natural gas import prices to oil prices up and down shows asymmetry

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ABSTRACT

This paper analyses the impact of global economic activity and international crude oil prices on natural gas import prices in three major natural gas markets using the panel cointegration model. It also investigates the shock impacts of the volatility and the increase and decrease of oil prices on regional natural gas import prices. The results show that both global economic activity and international crude oil prices have significant long-term positive effects on regional natural gas import prices. The volatility of international crude oil prices has a negative impact on regional natural gas import prices. The shock impact is weak in North America, lags in Europe and is most significant in Asia, which is mainly determined by different regional policies for price formation. In addition, the response of natural gas import prices to increases and decreases in international crude oil prices shows an asymmetrical mechanism, of which the decrease impact is relatively stronger.

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1. Introduction

With the energy supply situation becoming tenser and climate change issues becoming increasingly severe, natural gas, as a type of the clean energy, has become an important component of national energy strategies for improving energy supply security and reducing carbon dioxide emissions. Especially, in recent years, the rise of the US shale gas revolution has caused widespread concerns in countries that produce and consume natural gas, which will likely drive the global energy market into the natural gas era in the future and have a profound impact on the global energy market and the natural gas trade pattern. At present, due to limitations in the types of transportation (pipelines and liquefied natural gas (LNG)), the global natural gas market has not been unified into an international market like the international crude oil market. Regionalization has become the most

prominent feature for the global natural gas market, which is mainly divided into three major distinct regional markets: the North American market, the European market and the Asian market. Therefore, great differences in both the market supply–demand situation and the pricing mechanisms in these three regional markets create a realistic need for more research.

Due to the substitution between oil and natural gas, natural gas prices were originally based on international crude oil prices worldwide; however, today, natural gas markets have developed at different levels in different regions. Henry Hub, the earliest natural gas trading centre, which was formed in the North American market, had transferred the natural gas pricing mechanism in the North American market to marketization. Lagging behind the USA for several decades, the UK broke the monopoly with the British Gas company and began to implement a pricing mechanism that was determined by market supply and demand, and the National Balancing Point (NBP) natural gas trading hub was formed in the UK in 1994. Then, with continental Europe gradually issuing open gas market regulations, two natural gas trading centres were formed: Zeebrugge Hub (1999) in Belgium and

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Title Transfer Facility (TTF, 2003) in The Netherlands. Although the current European gas spot prices and the long-term contract prices are mainly based on the international crude oil price, European gas pricing has gradually shifted to the market pricing mechanism (Asche et al., 2013). In Asia, due to the immature market mechanism and the lack of a natural gas trading centre, the long-term natural gas price contract is completely in accordance with international crude oil price, which results in the Asian natural gas prices being significantly higher than the North American natural gas prices.

Experts consider that the degree of deregulation in the global natural gas market is not high and natural gas pricing will be based on the oil index in the long term. As such, global economic activity and oil prices have become major factors that have an impact on the prices of regional natural gas imports. Because differences exist in the endowment of natural resources, the way in which natural gas is imported and the pricing mechanisms in the different regional markets, the role played by global economic activity and oil prices in the three regional natural gas markets is different. Therefore, identifying the different impacts that the global economic situation and oil prices have on the regional natural gas importing prices is important for natural gas importing countries to improve their natural gas supply security, develop reasonable strategies for natural gas import and reserve, and reduce the economic loss induced by the volatility of natural gas import prices.

A large number of studies have focused on the relationship between oil prices and natural gas prices and mainly analysed whether there was a separation between these two types of prices. Some studies found the long-term cointegration relationship between oil prices and natural gas prices (Villar and Joutz, 2006; Asche et al., 2006; Ates and Huang, 2011). Panagiotidis and Rutledge (2007) found that there was a cointegration relationship between oil prices and natural gas prices, while there was no separation phenomenon. Hartley et al. (2008) found that weather, natural gas storages, hurricanes and other seasonal factors had significant short-term impacts on the dynamic relationship between natural gas prices and oil prices. However, some recent studies showed that a separation between natural gas prices and oil prices had occurred (Ramberg and Parsons, 2012). Loungani and Matsumoto (2012) found that the separation between US natural gas prices and oil prices occurred as a result of the oversupply of natural gas due to increases in the natural gas production brought on by the US shale gas revolution. Erdos (2012) found that the existing long-term equilibrium relationship between US natural gas prices and oil prices disappeared after 2009. In addition, there have been few researches that focus on the relationship between natural gas prices and global economic activity. Kliesen (2006) analysed the impact of the price of natural gas on US economic activity, and the findings indicated that the rise of natural gas prices had no impact on the US economy. Arora and Lieskovsky (2012) found that changes in natural gas production had an impact on US economic activity.

As shown in the literature review, most of the studies focused on the relationship between crude oil prices and natural gas prices, in which only a single natural gas market was considered, such as the North American natural gas or European natural gas market. However, little research has investigated the different impacts that crude oil prices have on the different natural gas prices and taken into consideration of the regional features caused by the inconsistent pricing mechanisms. Therefore, this paper distinguishes the different impacts that global economic activity and oil prices have on three regional natural gas import prices from the importing countries' perspective. This paper makes the following two contributions: (1) it identified the impact that global economic activity and international crude oil prices had on natural gas import prices in different regions and (2) it

examined the shock response of natural gas prices to oil price volatility, increases and decreases to provide reference information for the countries' natural gas imports, reserves and investments.

The structure of this paper is as follows. Section 2 shows the description of the models. The data source and the discussion of the results are presented in Section 3. Finally, major conclusions are drawn in Section 4.

2. Methodology

2.1. The panel model for natural gas import price drivers

This paper examines the impact that global economic activity and international crude oil prices have on natural gas import prices in different regions. When we analyse the impact that international crude oil prices have on the different regional natural gas import prices, we take into account the regional characteristics and use different international crude oil prices, according to different regions. As such, we use West Texas Intermediate (WTI) crude oil spot prices for North America and use Brent crude oil spot prices for Europe and Asia. In this paper, Kilian index is chosen to analyse global economic activity. This paper constructs the panel models of the factors that impact the price of natural gas imports as follows:

$$\ln GASP_{it} = \alpha_{0i} + \alpha_{1i} \ln OILP_{it} + \alpha_{2i} KILIAN_t + \varepsilon_{it}, \quad (1)$$

where $GASP$ represents the monthly average import prices of natural gas. Based on the availability of data, this paper selected the following six kinds of major natural gas import prices as the subjects of this research: the Henry Hub spot price (HRYHB), the US pipeline natural gas import price (PipeUS), the LNG import price (LNGUS) in North America, the European pipeline natural gas import price (PipeEU), the LNG import price (LNGEU) in Europe and the Japanese LNG import price (LNGJP) in Asia. In addition, $OILP$ represents the international monthly crude oil spot price, $KILIAN$ represents the Kilian index and α_{0i} represents the individual panel fixed effects.

2.2. Modelling the impact of oil price volatility, increases and decreases

For an in-depth analysis of the impact that international crude oil prices have on natural gas import prices, this paper uses the vector autoregressive (VAR) model, impulse response functions and variance decomposition method to analyse the impact that volatility and the increases and decreases in international crude oil prices have on natural gas import prices.

The existing literatures found that increases and decreases in crude oil prices would usually have different effects (Mork, 1989; Hamilton and Herrera, 2004). Referring to Mork (1989), increases and decreases in international crude oil prices are represented by the positive and the negative return of crude oil prices, respectively, as follows:

$$ROILP_t = \ln(OILP_t/OILP_{t-1}) \quad (2)$$

$$ROILP_t^+ = \max(0, ROILP_t)$$

$$ROILP_t^- = \min(0, ROILP_t), \quad (3)$$

where $ROILP_t$ represents the monthly return of international crude oil prices, $OILP_t$ represents international crude oil prices and $ROILP_t^+$ and $ROILP_t^-$ denote the positive and negative monthly return of international crude oil prices, respectively.

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