



Jump spillovers in energy futures markets: Implications for diversification benefits

Qingfu Liu ^{a,1}, Anthony H. Tu ^{b,*}

^a Institute for Financial Studies, Fudan University, China

^b New Huadu Business School, Minjiang University, China

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ABSTRACT

In this paper, we investigate jump spillover effects of five energy (petroleum) futures and their implications for diversification benefits. In order to identify the latent historical jumps for each of these energy futures, we use a Bayesian MCMC approach to estimate a jump-diffusion model for each. We examine the simultaneous jump intensities of pairs of energy futures and the probabilities that jumps in crude oil (and natural gas) cause jumps or usually large returns in other energy futures. In all cases, we find significant evidence that the diffusion-jump process is a better characterization for energy futures prices. We further find that jump spillovers significantly reduce the diversification benefits of an energy futures portfolio in a tranquil (rather than crisis) period.

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1. Introduction

There is strong evidence that jumps (price spikes) play an important role in the continuous diffusion process of asset price. Such models, which allow for the presence of jumps, are often referred to as event risk models. A number of recent theoretical studies analyze the impact of event risk on strategic asset allocation (Liu et al. (2003), Wu (2003)), on option pricing and its ability to explain the observed volatility smiles (Pan (2002), Eraker et al. (2003)), on calculations of risk measures such as value-at-risk (VaR) (Duffie and Pan (2001), and Gibson (2001)). Recently, Asgharian and Bengtsson (2006) employed such an event risk model to study jump spillover effects between a number of country equity indexes. They use a Bayesian approach to estimate a jump-diffusion model on each index and find significant evidence of jump spillover.

The recent dramatic spikes in energy prices (in particular oil) that peaked in the summer of 2008 (see Fig. 1) have greatly emphasized the importance of understanding and managing risk in these markets. Askari and Krichene (2008) show that oil price dynamics during

2002–2006 have been characterized by high volatility, high intensity jumps, and strong upward drift. Market expectations, extracted from call and put option prices, indicated no change in underlying fundamentals in the short term. But markets expect oil prices to remain volatile and jumpy, and with higher probabilities of rising, rather than falling, above the expected mean. Observers of energy futures markets (crude oil, natural gas, heating oil, gasoline and fuel oil) have long noted that energy futures prices are very volatile and often exhibit jumps following important news. The main purpose of this paper is to estimate an event risk model for the above five energy (petroleum) futures contracts in order to identify the latent historical jump times of each energy futures, which we then use to quantify the degree of jump spillover between the different futures contracts.

As we know, heating oil, gasoline and fuel oil are all refined products of crude oil, and natural gas is a close substitute for crude oil in many industrial processes. Past studies have established the existence of long-run price cointegrations between crude oil and its refined products (Girma and Paulson (1999); Gjøberg and Johnsen (1999); Asche et al. (2003)). Furthermore, a cointegrating relationship between crude oil and natural gas has also been found. In contrast to the prediction of the natural gas market liberalization theory, Panagiotidis and Rutledge (2007) found that the cointegrating relationship between UK wholesale natural gas prices and the Brent oil price continued to exist during the period of 1996–2003, although oil and natural gas prices had been “decoupled” since 1994. Although the integration of energy (petroleum) markets has been widely investigated, the jump spillover (or event risk)

* Corresponding author at: New Huadu Business School, Minjiang University, No. 1 Wenxian Rd, Campus city of Fuzhou, China. Tel.: +86 591 83761823; fax: +86 591 83761823.

E-mail addresses: liuqf@fudan.edu.cn (Q. Liu), atu1106@yahoo.com.tw (A.H. Tu).

¹ Institute for Financial Studies, Fudan University, No.220 Handan Road, Shanghai 200433, China.

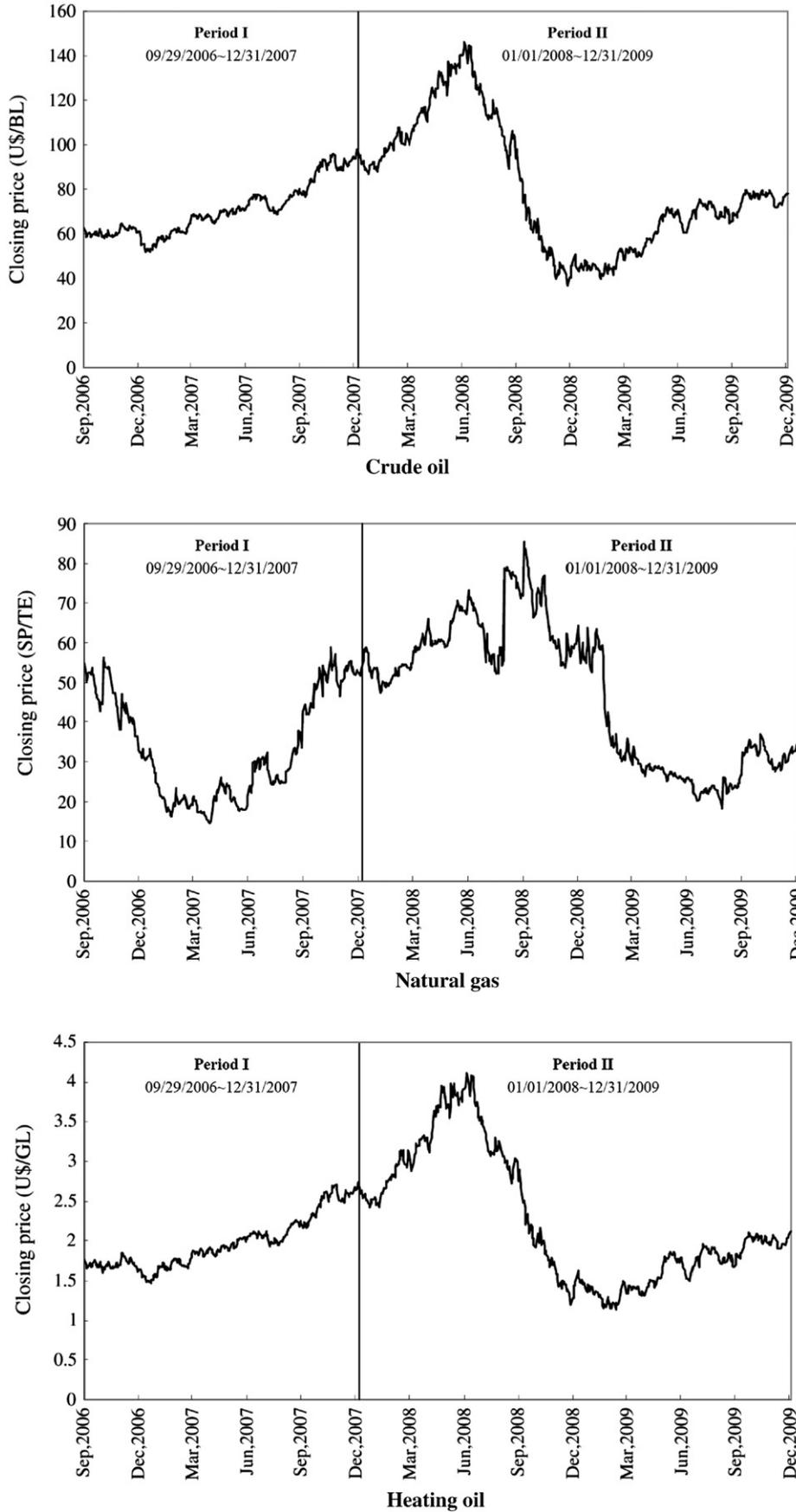


Fig. 1. The prices of five energy futures.

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