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The behavior of crude oil spot and futures prices around OPEC and SPR announcements: An event study perspective

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ABSTRACT

This paper examines the informational efficiency of crude oil spot and futures markets with respect to OPEC conference and U.S. Strategic Petroleum Reserve (SPR) announcements. We employ the event study methodology to examine the abnormal returns in crude oil spot and futures markets around OPEC conference and SPR announcement dates between 1983 and 2008. Our findings regarding OPEC announcements indicate an asymmetry in that only OPEC production cut announcements yield a statistically significant impact with the impact diminishing for longer maturities. We also find that the persistence of returns following OPEC production cut announcements creates substantial excess returns to investors who take long positions on the day following the end of OPEC conferences. In the case of SPR announcements, we find that the government's use of this program initiates a short-run market reaction following the announcement date. Furthermore, our tests of cumulative abnormal returns suggest that the market reacts efficiently to SPR announcements providing support for the use of the strategic reserves as a tool to stabilize the oil market. Our findings have significant policy implications for investors and are useful in designing effective energy policy strategies.

1. Introduction

This paper uses the event study methodology to study the impact of two oil-related events on crude oil market activity. The first type of event is OPEC announcements regarding production quotas. Here, we look at three types of OPEC announcements: increase, no change, and decrease in aggregate quotas. The second type of event is U.S. Strategic Petroleum Reserve (SPR) announcements on crude oil purchases (releases) from (to) the market. In doing so, we contribute to the literature in several significant ways. First, we provide evidence from both spot and futures oil markets. Previous studies (summarized below) do not tend to cover both markets simultaneously. For the latter, we use up to 12-month maturities to examine whether these events affect more short- or long-end of the market. This is important for hedging and speculative strategies as informational efficiency of futures markets is shown to improve hedging performance. Second, unlike previous work, we perform sensitivity analysis by employing three different measures of abnormal (excess) returns estimated using the market model, the autoregressive conditional heteroskedaticity (ARCH) model, and the three-factor Fama-French model. Finally, we use a rich sample period running from1983 through 2008. This period covers important episodes in the crude oil market history and provides more robust results based on a larger number of events considered.

There are limited event study applications examining the impact of OPEC decisions on oil market activity. Draper (1984) investigates the impact of OPEC announcements on different maturities in the heating oil market using weekly returns. The results indicate significant differences in pre- and post average weekly returns for regularly scheduled meetings. Our paper is different from this study as we employ different normal performance models to measure abnormal returns and examine the behavior of cumulative abnormal return paths in order to test for persistence in excess returns. In addition,we focus on daily returns and crude oil market, while Draper (1984) calculates weekly returns and focuses on heating oil market.

Deaves and Krinsky (1992) examine the reaction of oil futures (crude and heating oil) to OPEC meetings during the period 1970–1990. They classify OPEC meeting outcomes into two categories (bad and good news) based on the sign of the abnormal returns on the day following the announcement. Using the ARCH methodology to model

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normal performance, they find statistically and economically significant excess returns following conferences that were associated with good news. Our paper is different from this study, as we utilize three different models to estimate normal performance and look at both spot and future returns for different maturities.

In a recent study on the effect of OPEC meetings on oil prices, Wirl and Kujundzic (2004) find a weak impact of OPEC announcements that is at best restricted to meetings that recommend price hikes. Guidi et al. (2006) use the event study methodology to examine the effects of OPEC production increases and decreases on stock returns in the US and UK, as well as on oil prices. They look at periods of conflict (i.e., Iraq war) and peace during 1986–2004 and find that OPEC production "cut" decisions have a much bigher impact on spot oil prices than decisions to "increase", indicating asymmetry. Our study is different from theirs in significant aspects. First, they focus on oil spot prices, while we also study futures prices. Second, they employ the market model in the event study, while we use different models to measure normal performance. In addition to "increases" or "decreases" in quotas, we also look at announcements of "no change in production quotas" as market participants may also react to "no news".

In a more recent study, Hyndman (2008) examines the effect of OPEC quota announcements during 1986–2002 on crude oil spot and two month futures prices as well as the prices of oil company stocks. He finds positive and significant abnormal returns following meetings when OPEC reduces the aggregate quota. His findings also yield significant and negative abnormal returns following announcements that indicate no change in quota levels. However, his study considers only one model, without any specification of the model, to measure normal performance and his data period ends in 2002 missing the recent bubble and subsequent crash in crude oil prices.

Another important aspect of our study is the inclusion of the events regarding U.S. SPR announcements. The SPR Program was established in 1977 following the oil embargo of 1973 in order to prevent the negative effects of a major petroleum supply interruption on economic activity by having sufficient petroleum reserves. The proponents of the program argue that the use of the reserves in case of significant negative oil shocks may act as an effective tool to stabilize the oil market in the U.S. and other parts of the world. However, others have argued that such stockpiling of oil by governments to deal with short term restrictions on supply imposed by both OPEC or non-OPEC nations may not be effective (e.g., Taylor and Van Doren, 2005) or that existing stocks are insufficient to significantly influence prices (Considine, 2006). By examining the impact of SPR announcements on both spot and future oil prices, we try to shed some light on this important current energy policy debate: Is the SPR Program an effective tool to stabilize the market?[1]

In the next section, we describe our dataset and the events. Section 3 explains the methology used. Empirical results are presented in Sections 4 and 5. The last section concludes the paper with policy implications for investors and policymakers.

2. Data and event descriptions

We examine daily spot and futures prices for light sweet crude oil over the period March 1983 through June 2008. We concentrate on crude oil contracts traded in the U.S. as the SPR Program was established with the goal of stabilizing the oil market in the U.S. Spot prices are measured by cash prices with the anticipation that cash prices will better reflect actual transactions. In order to examine the information content of OPEC and SPR announcements for different time horizons, we also compiled daily NYMEX light sweet crude oil futures settlement prices for a number of maturities into the future. More specifically, we examine the nearest contract as well as the third- and twelfth-closest contracts covering a range of maturities spanning up to one year into the future. Futures return series are constructed with contract rollover occurring about one week before maturity in most cases.

Table 1
Descriptive statistics.

Sample period (March 30, 1983–June 1, 2008) N = 6303				
	Spot	Future1	Future3	Future12
Mean	0.022%	0.044%	0.041%	0.051%
Std. Dev.	2.376%	2.056%	1.788%	1.389%
Maximum	−40.204%	−38.407%	−28.427%	−12.948%
Minimum	19.861%	12.353%	11.256%	7.976%
Skewness	−1.014	−1.260	−0.850	−0.424
Kurtosis	19.375	23.261	13.643	4.501
$\rho_{s,f}$		0.850	0.813	0.729

Note: $\rho_{s,f}$ is the correlation coefficient between spot and futures return series.

Table 1 presents several summary statistics for daily spot as well as futures returns for the different maturities mentioned earlier. As expected, we observe the highest volatility in the spot market with lower return volatility values as we move towards longer maturities. The highest volatility observed in the spot market is due to the fact that these prices reflect transactions for immediate delivery of the underlying asset and tend to be more sensitive to supply and demand changes in the market. This can also be seen in the extreme values observed in these return series with daily spot returns ranging between a lowest value of −40.2% and a highest value of 19.86%. High correlation values observed between spot and futures return series indicate the common risk factors underlying the oil market.

In this study, we explore the information content of OPEC announcements as well as SPR announcements. For this purpose, we examined meeting summaries from the Official Resolutions and Press Releases published by the OPEC Secretariat and compiled a list of official announcements on production decisions. OPEC meets twice a year on prescheduled dates for 'ordinary' conferences but they also call for 'extraordinary' conferences with short notice.[2] The ministerial meetings are held occasionally to resolve operational and monitoring problems in the organization; and sometimes they decide to change production levels. In our analysis, each official press release is considered an event. Having compiled a list of events, we then classified each OPEC announcement in terms of a production cut, hike and no change in production levels. As will be explained in the methodology section, several announcements had to be omitted from the analysis due to the specifics of the event study methodology. Overall, as reported in Table 2, a total of 63 OPEC meetings have been examined, of which 17 resulted in a production hike, 21 in a production cut, and 25 in no change in production levels. Similarly, U.S. government's announcements on the use of Strategic Petroleum Reserves are compiled from the Energy Information Administration's website.[3] During the period studied, 15 SPR related announcements have been made, of which 11 were announcements on the release of crude oil from the reserves to the market (SPR decrease) and 4 were on the purchase of crude oil from the market at market prices (SPR increase). Crude oil releases from the SPR have been either in the form of a sale or a loan to the market (mostly refineries) where purchases have been either in the form of a direct purchase from the market or payment by oil companies in return for federal leases. Whatever the

[1] Lien and Zang (2008), who provide an extensive survey of theoretical and empirical research on emerging derivatives markets, discuss the implications of several policy and regulation changes on the markets. For recent studies examining the energy policy issues in other countries, see Petri and Taube (2003), Kalyuzhnova (2005), and Ma et al. (2010).

[2] The number of unscheduled events is very small in our sample. We therefore do not distinguish between scheduled and unscheduled events in this paper.

[3] http://www.eia.doe.gov.