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Price Dynamics and Speculators in Crude Oil Futures Market

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Abstract

This paper examines the behaviour of crude oil futures price and volatility, analyzes the relationship between speculative traders' positions and returns, and investigates whether speculative traders' position changes have a significant effect on crude oil price. It also studies how speculation factor influence crude oil returns and volatility, whether returns are related to risks, and whether financial crises increase volatility in crude oil futures markets. The empirical results from Granger causality reveal that return lead speculative position, which indicates that non-commercial or managed money traders are a class of positive feedback traders or trend followers; and also reveal that the position changes held by speculative traders will cause crude oil price movement. Based on the estimation results of GARCH(1,1) model we verify position changes of non-commercial or managed money traders can impact crude oil futures returns significantly, and indicate returns are not related to conditional variance. Moreover, during the financial crisis, crude oil futures return shows an extreme large volatility. These findings can help us better understand price discovery process in crude oil futures market, and is useful in risk management and financial engineering.

Keyword: crude oil futures; price dynamics; speculation; noncommercial positions; managed money positions; decision engineering

1. Introduction

In recent years, the importance of commodities, especially oil, as common investment alternatives to traditional markets has increased in recent years. This leads to more speculation in crude oil markets than before, and may make the mechanism of price determination a little different. We often notice articles in newspapers that discuss the effects of speculation activities, but few conduct quantitative analyses, or model the effects. For example, many comments in newspapers imply that speculative activities of funds in the energy market have recently pushed up the price of oil, making it deviate from levels determined by fundamentals, and have increased volatility. Extant literature has discussed the relationship between traders' positions and market prices, but these studies mainly focus on forecasting ability of traders and use Granger causality tests for analysis (Hartzmark, 1991; Leuthold et al., 1994; Buchanan et al., 2001; Wang, 2001, 2002; Sanders et al., 2004) [1-6]. Although researchers have examined the level and adequacy of speculation, flows of funds, and forecasting ability of traders, in futures markets, few have measured the magnitude of effects of traders' especially funds' trading activities, on crude oil futures markets and price volatility. This paper tries to investigate this very interesting question: what's the relationship of trading activities and price movements, and what are the effects of speculation on price volatility. In this paper, we discuss speculative traders' positions more thoroughly, and incorporate this factor into a model to measure the extent of its impact on crude oil futures returns and volatility. This study can reveal the speculative activities of funds in some degree.

Different theories explain different mechanisms of price determination. According to the classical economic theory, market fundamentals, especially supply and demand, should be the major factors that determine the price and drive its volatility. The efficient market hypothesis (EMH) says if financial markets are information efficient, then the price of traded assets reflects all known information and, therefore, is unbiased, in the sense that it reflects the collective beliefs of all investors about future prospects. The behavioural finance theory asserts that asset prices can change without changes in fundamentals. For example, volatility can be induced by anomalies and mass psychology (Deaton and Laroque, 1992, 1996[7, 8]; Chambers, 1996[9]; Shiller,

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2003[10]; etc). Our study can provide a supplement to these theories and make us understand price discovery process more thoroughly.

To measure the effect of trading activities on price volatility in futures markets is difficult since it is very difficult to track the activities of different traders. Fortunately, the Commodity Futures Trading Commission (CFTC) collects data on composition of open interest for all futures contracts, and releases the Commitments of Traders (COT) report to the public. We can analyze this report to get some information about activities of different traders. In the COT report, open interest is divided into reporting and non-reporting traders, wherein traders holding positions in excess of CFTC prescribed levels report their positions. Reporting traders are further categorized as commercials or non-commercials. Commercials are those associated with an underlying cash-related business, and are commonly considered to be hedgers. Non-commercials are not involved in an underlying cash business; they are referred to as speculators. Furthermore, the reported level of non-commercial activity is generally considered to be speculative activities of managed futures or commodity funds.

We notice that there are some limitations in the COT data. For example, we know nothing about the motives of non-reporting traders; these traders may be hedgers, speculators, or market makers. Furthermore, as Sanders et al. (2004)[6] has pointed out that the disaggregating of reporting traders into commercial and non-commercial market participants has potential sources of error. In particular, commercial traders may not always be hedgers, and hedgers may not always be hedging. True hedging positions are some subsets of commercial traders' positions. Total commercial positions are likely to reflect very diverse motives. This conclusion is consistent with findings of Ederington and Lee (2002)[11], who examined commercial traders in the heating oil market. To get over this problem in COT reports, some studies use non-public data to break down market participants into more groups, however these positions data is not available to the public. To obtain a true picture of speculators positions is very difficult. On the other hand, there are no obvious incentives for a trader to classify itself as a speculator, and it would seem particularly difficult for a CTA to describe itself as a commercial trader. Thus, reported non-commercial positions in the COT report most likely represent a relatively pure subset of total speculative positions, especially those held by managed funds. Therefore, we can still use non-commercial positions in the COT reports to get some information about speculation by managed funds indirectly.

To increases transparency, the CFTC began publishing a Disaggregated Commitments of Traders (DCOT) report on September 4, 2009, historical data for which are available back to June 13, 2006. The DCOT report separates reportable traders into four categories of traders: producer/merchant/processor/user, swap dealers, managed money, and other reportables. The CFTC removes swap dealers from commercial category and creates new "swap dealers" classification for reporting purposes. "Managed money" for the purpose of this report, is a registered commodity trading advisor (CTA), a registered commodity pool operator (CPO), or an unregistered fund identified by CFTC. These traders are engaged in managing and conducting organized futures trading on behalf of clients. Every other reportable trader that is not placed into one of the other three categories is placed into the "other reportables" category. The DCOT sets out open interest by long, short, and spreading for the three categories of traders—"swap dealers," "managed money," and "other reportables." For the "producer/merchant/processor/user" category, open interest is reported only by long or short positions. This paper makes use of both COT report and DCOT report to analyze the speculation activities.

2. Data and statistics

We use WTI (NYMEX) futures prices, rather than spot prices, as the study sample. Daily closing prices of the nearest contract of WTI futures (RCLC1 Cushing, Oklahoma, Crude Oil Future Contract 1) are from EIA. This price series is used as the crude oil futures price. Based on this price series, returns are calculated as the change of the logarithm of the daily closing price of crude oil futures, i.e. $R_t = \ln(P_t / P_{t-1})$. The descriptive statistics of price and returns are shown in Table 1. Also we report the autocorrelation and partial correlation of return and squared return in Table 1. The return series is a stationary series based on the augmented Dickey-Fuller (ADF) unit root test.

This paper makes use of both COT report and DCOT report to analyze the speculation activities. We use non-commercial positions in the COT report and managed money positions in the DCOT report to construct indicators to reflect speculative trading activities. The net long positions (*NL*) is defines as the long minus short position. And also we use the percent net long to capture the net long positions of speculative traders. The percent net long (*PNL*) position is calculated as long positions minus short positions, divided by the sum of all positions; the *PNL* for non-commercial positions, i.e. *NPNL* is:

$$NPNL_t = \frac{NCL_t - NCS_t}{NCL_t + NCS_t + 2\left(NCSP_t\right)} \tag{1}$$

where *NCL*, *NCS*, and *NCSP* are non-commercial long, short, and spread positions, respectively. De Roon et al. (2000)[12] calculated the *PNL* for reported commercials and referred to it as "hedging pressure", and Sanders et al. (2004)[6] used *PNL* of non-commercial positions in energy futures markets to determine if any relationships existed between trader positions and market prices. Here, we follow the literature and make use of *PNL* of non-commercial positions and *PNL* of managed money as the indicator to describe speculative trading activities.