CRUDE OIL FUTURES TRADERS: WHO IS WATCHING WHOM?

DAMIR TOKIC
ESC Rennes International School of Business, France

ABSTRACT
We test for the pair-wise Granger type causality between the net long positions of crude oil futures traders, as categorized by the CTFC. Our results leads us to conclude that: 1) the Swap Dealer category behaves as a speculator because it monitors (or causes) the changes in the net long positions of all other traders and trades accordingly; 2) the Producer/Merchant group behaves as a hedger because it makes the trading decisions without the influence of other traders, 3) the Money Manager group behaves as an investor because it's always net long crude oil futures and makes the trading decisions without the influence of other traders, and 4) the Other Reportable and Nonreportable groups, which represent retail traders and smaller accounts, act mostly as noise traders. Thus, this study provides some support for the increased regulation of Swap Dealers under the Dodd-Frank Act and the Volcker rules.

Keywords
Speculation, Oil, Swap Dealer

Corresponding Author:
Damir Tokic, ESC Rennes International School of Business, 2 rue Robert d'Arbrissel CS 76522, 35065 RENNES CEDEX FRANCE
Email: tokicd@macrotheme.com

INTRODUCTION

Masters (2008) argues that commodity markets, especially the oil market, are suffering from excessive speculation. More institutional investors (such as pension funds that have been advocating portfolio allocations of between 5% and 12% to commodity indices) want to invest in commodity indexes. Further, the Wall Street has been promoting the commodity exchange traded funds to retail investors. As a result, the money inflows to commodity futures market have increased dramatically since the mid 2000's, which is evident from the dramatic increase in the open interest, especially in the crude oil futures. Masters (2008) points to the high and positive correlation between the rising oil prices and the rising open interest in crude oil futures as the evidence that index investors directly caused the 2008 oil bubble. Thus, Masters (2008) urged the U.S. Congress to take action against the Swap Dealers and the index investors. The U.S. Congress acted relatively swiftly, which eventually led to the increased regulation of Swap Dealers under the Dodd-Frank Act and the Volcker rules in 2010/11.

However, the academic literature rightly argues that the high correlation between the open interest and the crude oil futures prices does not imply the causation. Further, the literature mostly finds that speculation in general played only a minor role during the 2008 oil bubble. Most academic studies look for the evidence of positive feedback trading by index investors (whether that the index investors were buying the crude oil futures as prices were rising, irrespective of fundamentals). Irwin and Sanders (2010) analyze the causality between the positions of Swap Dealers and the crude oil futures prices and find that index funds did not cause the 2008 oil bubble, or the other commodity futures price bubbles. Other studies seem to agree: Hamilton (2009) doubts that speculation could have caused the oil bubble in 2008; Kaufmann and Ullman (2009) and Kaufmann (2011) conclude that both, changes in fundamentals and speculation, explain the oil price spike in 2008; Cifarelli and Paladino (2010) find that speculation played a role in crude oil market in 2008, although they caution that they had difficulties in their modelling and interpretation of their results; Kesicky (2010) finds that the impact of speculators during the 2008 oil bubble was small and short term relative to fundamental trends in supply and demand for physical crude oil. Till (2009) finds that speculative positions in the exchange traded oil derivatives have not been excessive in 2008.

In this study, we take a different approach to evaluating the role of speculation in crude oil futures market. Rather than testing for the positive feedback trading (or the causality between the trader's positions and the crude oil futures prices), we test for the pair-wise Granger type causality between the net long positions of crude oil traders and look for the evidence of intentional herding possibly for information-gathering purposes. Specifically, we try to determine whether the crude oil futures traders change their net long positions based on the lagged changes of positions of other crude oil futures traders.

Our results show that the controversial Swap Dealer category changes its' net long positions based on the lagged changes in the net long positions of the Producer/Merchant category, the Money Manger category, and the Other reportable category of crude oil futures traders. Thus, the implication is that the Swap Dealer category possibly monitors the net long positions of other market participants to speculate on privileged information, and trades accordingly. Further,

our results also show that the noise traders' net long positions (Nonreportable and Other reportable categories) were caused by the lagged changes in the Swap Dealer's net long positions, which could be an indication of rational speculation by Swap Dealers, as defined by Delong et al. (1990). Thus, this study provides some support for the increased regulation of Swap Dealers under the Dodd-Frank Act and the Volcker rules. The results also confirm that: 1) the Producer/Merchant group behaves as a hedger because it makes the trading decisions without the influence of other traders 2) the Money Manager group behaves as an investor because it's always net long crude oil futures and makes the trading decisions without the influence of other traders, and 3) the Other Reportable and Nonreportable groups, which represent retail traders and smaller accounts, act mostly as noise traders.

THEORETICAL BACKGROUND

There is a wide body of literature that tries to explain why trades occur and how market participants behave. Generally, the literature separates the market participants into different categories and models the behavior of each group of traders accordingly. For example, the literature on market efficiency suggests that the interaction between noise traders (that randomly push prices away from their fundamental values) and arbitragers (that trade against these noise traders) rules out the existence of significant and persistent asset price bubbles (Fama, 1965). On the other hand, studies that argue against the efficient market hypothesis (EMH) suggest that there are potentially significant barriers to arbitrage, and thus arbitragers are reluctant to trade against the noise traders (see for example Abreu and Brunnermeir , 2002). Delong, Shleifer, Summers, and Waldmann (1990) take the argument even further by suggesting that: 1) the noise traders don't trade randomly, they are trend followers also knows as the positive feedback traders; and 2) since there are significant limits to arbitrage given the predictable behaviour of the positive feedback traders, some rational arbitragers turn into rational speculators and manipulate (destabilize) the market by triggering the positive feedback trading – they buy an asset to create the pattern on rising prices which causes even more buying the positive feedback traders. Thus, Delong et al. (1990) argue that because of the rational speculation and the positive feedback trading, asset prices can remain significantly and persistently different from their fundamental values, which is the key argument against the market efficiency. Delong et al. (1990) also formalize the existence of the passive investor, which passively invests based on the perceived difference between the asset's long-term fundamental value and its' current market value.

The key implications about the behaviour of different market participants are as follows: 1) the passive investor observes the asset's current market price and compares it to its' estimated fundamental value; 2) the positive feedback traders observe only the historical price patterns; 3) the rational arbitrager observes the activity of noise traders, as well as the difference between the assets' fundamental value and its' current market value; and 4) the rational speculator anticipates the expected trading activity of the positive feedback traders.

The empirical literature on bubbles, speculation and traders' positions has been generally testing for the evidence of the positive feedback trading by analyzing the relationship between the traders' positions and the price/volatility of an underlying

asset (see for example OEDC, 2010; Wang, 2003; and Sanders, Boris, Manfredo, 2004). Some studies also examine the overreaction/underreaction hypothesis, which deals with how traders react to a new information and price an asset relative to its' fundamental value (see for example Jagadeesh, Titman, 2003). However, the empirical studies have completely ignored the conditional trading demands or the lead/lag causality among traders' positions. Yet, the theory suggests that the rational speculator trades (behaves) conditional to the expected trading activity (behaviour) of the positive feedback traders, and the rational arbitrager trades (behaves) conditionally to the activity of noise traders.

In this study, we combine the theoretical propositions and empirical evidence on conditional trading demands and specifically test for the Granger type causality among traders' positions in the crude oil futures market. We are interested to determine whether the crude oil futures traders change their positions based on the lagged changes in the positions of other crude oil futures traders. Thus, we formalize the conditional trading demands of the different market participants in following equations:

$$D_{RS} = \alpha((P_{t+1}|(\beta(P_{t-1} - P_{t-2})) - P_t) \quad (1)$$

D_{RS} is the trading demand by the rational arbitrageur, P_{t+1} is the price in the next period, the term $(P_{t+1}|(\beta(P_{t-1} - P_{t-2})) - P_t)$ is the price in the next period, given the trading demand of positive feedback traders with the coefficient of responsiveness to historical prices β and the price trend $(P_{t-1} - P_{t-2})$, P_t is the current market price, α is the inverse of risk aversion coefficient.

Equation (1) suggests that the rational speculator trades based on the expected future price, conditional to the historical price pattern, and how positive feedback traders react to the historical price pattern. Thus, the rational speculator likely monitors the lagged positions of the positive feedback traders to evaluate the magnitude of the β coeficient.

$$D_{RA} = \alpha(P_F - P_t|\varepsilon_t) \quad (2)$$

D_{RA} is the trading demand by the rational arbitrageur, P_F is the stock's fundamental or intrinsic value, and $P_t|\varepsilon_t$ is the stock's current market value given the noise trader effect. P_t is the current market price, α is the inverse of risk aversion coefficient.

Equation (2) suggests that the rational arbitrager trades conditional to the extent to which the current prices are influenced by the noise trading activity. Thus, the rational arbitrager is likely to monitor the lagged positions of small traders (assuming that small traders are noise traders) to detect any unusual lagged activity, as an aid to an otherwise fundamental approach to valuation.

$$D_{Out} = \alpha(P_{t+1}|D_{Ins} - P_t) \quad (3)$$

D_{out} is the trading demand of an outsider, and $P_{t+1}|D_{Ins}$ is the price in the next period given the demand of insiders with private information. P_t is the current market price, α is the inverse of risk aversion coefficient.

Equation (3) generalizes all possible reasons for rational intentional herding behavior and suggests that some traders are likely to monitor the lagged positions of those traders expected to possess the informational advantage (due to any reason), solely for information-gathering purposes.

The theory, as we explained, classifies traders based on their trading demands. On the other hand, the U.S. Commodity Futures Trading Commission (CFTC) classifies traders into the different categories based on their trading needs (hedging/speculation/swaps) and size (large/small). By using the CFTC classification of traders, Tokic (2011) attempts to theoretically explain the 2008 oil bubble by modeling the expected trading demands of the crude oil futures traders, and suggests that: 1) the CFTC-defined commercial crude oil producers and consumers should act as arbitragers, given their expert knowledge of the energy market supply/demand fundamentals; and 2) however, the passive institutional investors in the crude oil futures that use their expert knowledge of macroeconomic variables to diversify/hedge their portfolios can potentially (unintentionally) destabilize the arbitrager's demand and the efficient pricing of crude oil. In support to his arguments, Tokic (2011) finds that the CFTC-defined commercial traders engaged in the positive feedback trading leading to the top of the 2008 oil bubble by engaging in short covering and further explains that the commercial players in the crude oil futures market perhaps ignored their private information (supply/demand fundamentals) and engaged in intentional herding by removing their short hedged positions (likely due to the uncertainly of pricing crude oil based on macroeconomic fundamentals caused by the financial crisis). The key implication from Tokic (2011) is that the crude oil futures traders perhaps monitor each other's lagged positions and trade accordingly, which provided the motivation to further explore the issue of causality among traders' positions in this study.

DATA

The source of our data is the Disaggregated Commitments of Traders Report, or the DCOT report, published by the US Commodity Futures Trading Commission (CFTC) on weekly basis. Each Friday the report provides a breakdown of Tuesday's open interests and positions by group of traders. Numerous studies have used the CFTC data to test the various aspects of speculation in commodity futures markets (Roon, Nijman, and Veld, 2000; Wang, 2003; Sanders and Irwin, 2011; Stoll and Whaley, 2011; Sanders and Irwin, 2010; Chatrath, Lian, and Song, 1997; Wang, 2001; Wang, 2002; Weiner, 2002; Yung and Liu, 2009; Moulton, 2005; Sanders, Boris, and Manfredo, 2004; and Till, 2009; and Klitgaard and Weir 2004; Irwin and Sanders, 2010; United Nations, 2011).

The CFTC separates traders into the different categories based on trader responses on the CFTC Form 40: Producer/Merchant/Processor/User, Swap Dealers, Managed Money, Other Reportables and Non Reportables. These are the CFTC definitions of each trader category:

> 1) "producer/merchant/processor/user" is an entity that predominantly engages in the production, processing, packing or handling of a physical commodity and uses the futures markets to manage or hedge risks associated with those activities;

2) "Swap Dealer" is an entity that deals primarily in swaps for a commodity and uses the futures markets to manage or hedge the risk associated with those swaps transactions. The Swap Dealer's counterparties may be speculative traders, like hedge funds, or traditional commercial clients that are managing risk arising from their dealings in the physical commodities; and

3) "money manager," for the purpose of the DCOT 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. Nonreportable traders' positions are derived by subtracting the total long "Reportable Positions" and the total short "Reportable Positions" from the total open interest and generally represent small retail traders.

The Commodity Futures Trading Commission has been publishing the legacy Commitments of Traders (COT) report since 1986, grouping traders simply as commercial and non-commercial. However, in order to provide for increased transparency of the exchange traded futures and options markets post the 2008 oil bubble, the CFTC staff worked on a proposal to enhance and improve the legacy COT report by including more delineated trader classification categories. Thus, the CFTC began publishing the Disaggregated Commitments of Traders (DCOT) report on September 4, 2009 disaggregating the existing "commercial" category to remove Swap Dealer from Commercial Category and to create new Swap Dealer classification for reporting purposes.

The DCOT report includes the historical data since June 13, 2006. However, the CFTC notes that it does not maintain a history of large-trader classifications, so, recent classifications had to be used to classify the historical positions of each reportable trader. A reader should note that this approach diminishes the data's accuracy as it goes further back in time.

We used the combined futures and options data for NYMEX crude oil futures from the DCOT Report with the time frame from June 13th, 2006 to December 28th 2009. The DCOT report includes the open interest in crude oil futures, the total long positions, and the total short positions (among other variables) for the each group of traders. We compute the net long positions by simply deducting the total net short positions from the total net long positions. Table 1 presents the descriptive statistics.

As we can see from Table 1, the mean statistics (for the positions) shows that the money manager group, on average, held close to 65% of all net long positions, while the producer merchant group held 100% of all net short positions. Other traders were all, on average, net long crude oil futures during our data time frame. This is consistent with the classification of the producer merchant group as a hedger/ arbitrager (as in Tokic, 2011). The money manager group held the majority of the net long positions, suggesting that the professional traders (CTAs and CPOs) were overwhelmingly long crude oil futures, even as the 2008 bubble popped, which indicates that these traders (as a group) really behaved as a long-only investors. Exhibit 1 shows the actual positions held by each group of traders.

Table 1. Descriptive statistics (net long positions by trader category)

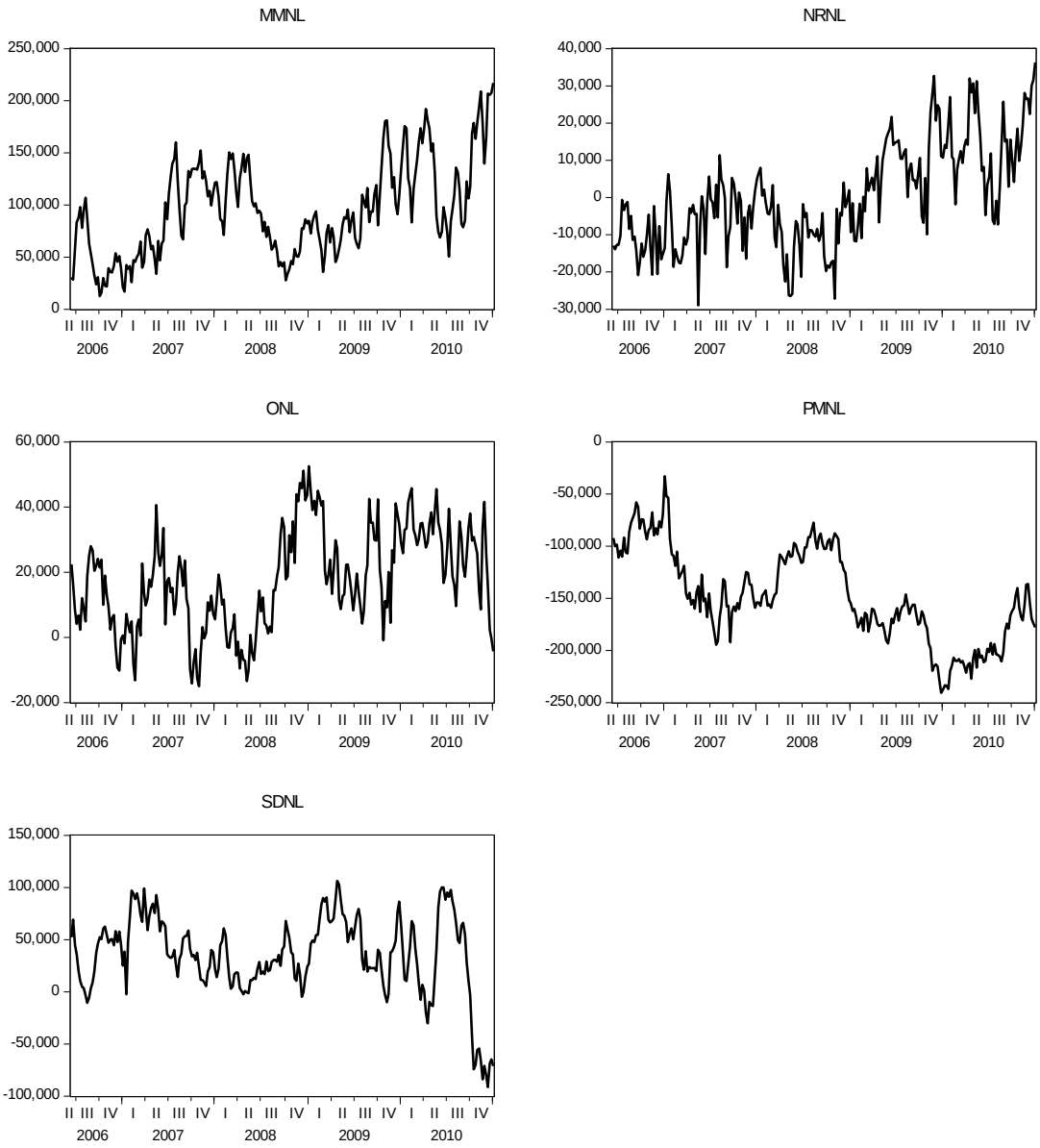
	MMNL	NRNL	ONL	PMNL	SDNL
Mean	95084.02	255.2343	17805.56	-148042.4	34897.38
Median	87583.00	-1525.000	18223.00	-155822.0	37188.00
Maximum	217046.0	36292.00	52579.00	-33011.00	106176.0
Minimum	12710.00	-28931.00	-14999.00	-240744.0	-91292.00
Std. Dev.	45233.92	13570.69	15311.22	44547.87	38284.27
Skewness	0.468990	0.401328	0.028952	0.117515	-0.789346
Kurtosis	2.571720	2.658001	2.251564	2.246210	4.105577
Jarque-Bera	10.58800	7.580489	5.611621	6.208414	36.99091
Probability	0.005022	0.022590	0.060458	0.044860	0.000000
Sum	22725080	61001.00	4255529.	-35382130	8340474.
SumSq.Dev.	4.87E+11	4.38E+10	5.58E+10	4.72E+11	3.49E+11
Observations	239	239	239	239	239

Notes: MMNL: net long positions for the money manager group, NRNL: net long positions for the non reportable group, ONL: net long positions for the other group, PMNL: net long positions for the producer merchant group, SDNL net long positions for the Swap Dealer group.

Exhibit 1 confirms that: 1) the producer merchant group remained net short the crude oil futures during the entire period, 2) the money manager group remained net long the crude oil futures during the entire period, and 3) the Swap Dealer group, as well as the other reportable and non reportable groups, were occasionally net short the crude oil futures, although their positions were mostly net long. It is interesting to note that the Swap Dealer category occasionally held a net short position in 2006, 2009, and 2010, which suggests that the Swap Dealer group was not a long-only passive investor, rather it possibly behaved as a trader taking the both directions (long and short), unlike the money manager group.

It is important to point out that the sum of all net long positions must be equal to zero. One can simply add all the means from Table 1 and get zero. Since the futures markets are a zero-sum game, each long positions must be offset by a short position – for each buyer there has to be a seller. Thus, the implication is that the traders' positions must be negatively correlated. Table 2 shows the correlations of traders' positions illustrated in Exhibit 1.

As we can see from Table 2, cross-correlations among traders' positions are generally negative and very high. For example, the correlation between the MMNL and SDNL is -0.67 and the correlation between PMNL and MMNL is -0.57. The money manager group MMNL is positively and highly correlated only with the non reportable group NRNL and negatively correlated with the rest, the producer/merchant group is negatively correlated with all other groups, while the Swap Dealer group shows negative correlations with all the groups except the other reportable group ONL.



Notes: MMNL: net long positions for the money manager group, NRNL: net long positions for the non reportable group, ONL: net long positions for the other group, PMNL: net long positions for the producer merchant group, SDNL net long positions for the Swap Dealer group.

Exhibit 1. Net long positions by category of traders.

Table 2. Cross-correlations among traders' positions.

	MMNL	NRNL	ONL	PMNL	SDNL
MMNL	1.000000	0.515175	-0.089603	-0.566321	-0.669329
NRNL		1.000000	0.306491	-0.673648	-0.301880
ONL			1.000000	-0.382945	0.042887
PMNL				1.000000	-0.102541
SDNL					1.000000

Notes: MMNL: net long positions for the money manager group, NRNL: net long positions for the non reportable group, ONL: net long positions for the other group, PMNL: net long positions for the producer merchant group, SDNL net long positions for the Swap Dealer group.

We expected the cross correlations among traders' positions to be generally high and negative due to the zero-sum feature of the futures market. However, as previously explained, in this study we are interested to see if there is any causality among traders' lagged positions, which is further discussed in the next section.

METHODOLOGY

Our main proposition is that crude oil futures traders possibly monitor each other's lagged positions and trade accordingly. We test our proposition using the pair-wise bidirectional Granger causality test (Granger, 1969). In essence, we run bivariate regressions of the form (equation 4):

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots \alpha_i y_{t-i} + \beta_1 x_{t-1} + \cdots + \beta_i x_{t-i} + \varepsilon_t \quad (4)$$
$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \cdots \alpha_i x_{t-i} + \beta_1 y_{t-1} + \cdots + \beta_i y_{t-i} + u_t \quad .$$

for all possible pairs of (x,y) series in the group, in our case all possible pairs of traders. The reported F-statistics are the Wald statistics for the joint hypothesis:

$$\beta_1 = \beta_2 = \cdots = \beta_i = 0 \quad (5)$$

for each equation. The null hypothesis is that x does not Granger-cause y in the first regression and that y does not Granger-cause x in the second regression.

In our case, we test whether the net long position of trader "x" cause the net long position of trader "y" by evaluating how much of the current net long positions of trader "y" can be explained by past net long positions of "y" and then whether adding lagged values of net long positions of trader "x" can improve the explanation. "x" is said to Granger-cause "y" if "x" helps the prediction of "y" (or if the coefficients of "x's" are statistically significant).

Equation (4) requires us to select the number of lags to use in the test regressions. In general, it is better to include more lags in terms of relevance of all past information. We decided to report our results using various (1 lag, 2 lag, 3 lag, 4 lag, 8 lag and 12 lag) lag specifications. Our data time frame is 1 week, thus, we observe information based on the most recent week, up to 3 months in the past.

The pair-wise Granger causality test requires all variables to be stationary, or time independent and mean reverting. We run the Augmented Dickey-Fuller test (equation 6) to determine if all of our variables are stationary:

$$\Delta y_t = \ a_0 + a_2 t + \gamma y_{t-1} + \sum_{i=2}^{p} \beta_i \, \Delta y_{t-1+i} + \epsilon_t \quad (6)$$

The Augmented Dickey-Fuller test is repeated for variables non-stationary in levels, transformed into first differences.

RESULTS

We first test each variable in levels for stationarity. Table 3 presents the results of the Augmented Dickey-Fuller test. All variables are level stationary, except the net long positions of money managers (MMNL) and producer/merchants (PMNL). We repeat the Augmented Dickey-Fuller test in first differences and confirm that all variables are first difference stationary.

Table 3. The results of the Augmented Dickey-Fuller test for stationarity.

	Level	First difference
MMNL	-2.57 (0.1002)	-13.99 (0.0000)***
NRNL	-3.03 (0.0327)**	-20.94 (0.0000)***
ONL	-4.16 (0.0009)***	-11.82 (0.0000)***
PMNL	-2.12 (0.2358	-17.05 (0.0000)***
SDNL	-3.14 (0.0249)**	-12.44 (0.0000)***

Notes: MMNL: net long positions for the money manager group, NRNL: net long positions for the non reportable group, ONL: net long positions for the other group, PMNL: net long positions for the producer merchant group, SDNL net long positions for the Swap Dealer group.

Table 4. The results of the pair-wise bidirectional Granger causality test for each pair of traders.

	1 lag	2 lags	3 lags	4 lags	8 lags	12 lags
Null Hypothesis:	F-Stat	F-Stat	F-Stat	F-Stat	F-Stat	F-Stat
ONL does not Granger Cause NRNL	0.95692	0.09922	0.76421	0.41052	1.9376*	1.54878
NRNL does not Granger Cause ONL	6.636**	7.88***	5.23***	3.92***	2.443**	2.105**
SDNL does not Granger Cause NRNL	4.010**	6.58***	5.02***	3.79***	2.4815*	1.852**
NRNL does not Granger Cause SDNL	2.31929	1.92747	2.1342*	2.1737*	1.67876	1.38486
RMMNL does not Granger Cause NRNL	17.5***	10.5***	7.88***	6.94***	4.70***	3.61***
NRNL does not Granger Cause RMMNL	0.3246	1.15580	0.94929	1.28464	1.08446	1.03353
RPMNL does not Granger Cause NRNL	1.5357	1.45783	2.2876*	1.77437	1.60090	1.38202
NRNL does not Granger Cause RPMNL	0.6612	1.88106	1.99538	1.45279	1.16884	0.95126
SDNL does not Granger Cause ONL	1.3672	4.679**	4.45***	2.587**	1.9209*	2.012**
ONL does not Granger Cause SDNL	6.91***	10.6***	7.48***	5.73***	3.03***	1.886**
RMMNL does not Granger Cause ONL	2.5607	1.68836	2.05408	0.59637	0.81817	1.6662*
ONL does not Granger Cause RMMNL	1.2411	1.85203	2.3655*	1.67862	1.18939	0.79814
RPMNL does not Granger Cause ONL	0.4446	0.70435	0.67419	0.40555	0.58676	0.56351
ONL does not Granger Cause RPMNL	1.1762	0.69712	2.2644*	1.92540	1.53506	1.27835
RMMNL does not Granger Cause SDNL	50.5***	16.4***	11.3***	8.87***	4.14***	2.68***
SDNL does not Granger Cause RMMNL	5.948**	2.636**	1.46908	0.96133	0.89587	1.0569
RPMNL does not Granger Cause SDNL	2.758*	6.82***	5.165***	3.787***	1.944***	1.7068*
SDNL does not Granger Cause RPMNL	0.08432	0.50700	1.24004	1.42714	1.61958	1.08170
RPMNL does not Granger CauseRMMNL	1.46090	0.92972	0.43656	0.38456	0.31073	0.54943
RMMNL does not Granger CauseRPMNL	0.03387	0.67676	0.99587	1.32422	1.15192	0.79432

Table 4 Notes: RMMNL: net long positions for the money manager group (first difference), NRNL: net long positions for the non reportable group, ONL: net long positions for the other group, RPMNL: net long positions for the producer merchant group (first difference), SDNL net long positions for the Swap Dealer group.

Next, we performed the pair-wise bidirectional Granger causality test for each pair of traders using the stationary time series for each. We performed the Granger causality test using the different lags and report the results with various lag length specifications: 1, 2, 3, 4, 8, and 12 lags. Table 4 presents the results.

Granger causality between Nonreportable traders and Other reportable traders

We reject the null hypothesis that the net long positions of nonreportable traders do not Granger-cause the net long positions of other reportable traders at all lag lengths. Thus, the other reportable crude oil traders do monitor the positions of the non reportable crude oil traders, which are assumed to be the small retail traders - the Granger causality runs one-way from NRNL to ONL. This relationship is significant from very short lag lengths (1 week) up to very long lag length (3 months). We find weak bidirectional Granger causality only at 8 lags specification (2 months). For the rest of the time, we fail to reject the hypothesis that the net long positions of other reportable traders do not Granger cause the net long positions of nonreportable traders.

Granger causality between the Swap Dealer group and Nonreportable traders

We reject the null hypothesis that the net long positions of the Swap Dealer group do not Granger-cause the net long positions of nonreportable traders at all lag lengths. Thus, the nonreportable crude oil traders monitor the positions of the Swap Dealer group - the Granger causality runs one-way from SDNL to NRNL. This relationship is significant from very short lag lengths (1 week) up to very long lag length (3 months). We find weak bidirectional Granger causality only at 4 lags specification (1 month). For the rest of the time, we fail to reject the hypothesis that the net long positions of nonreportable traders do not Granger cause the net long positions of the Swap Dealer group.

Granger causality between the Money Manager group and nonreportable traders

We reject the null hypothesis that the net long positions of the Money Manager group do not Granger-cause the net long positions of nonreportable traders at all lag lengths. Thus, the nonreportable crude oil traders monitor the positions of the Money Manager group - the Granger causality runs one-way from RMMNL to NRNL. This relationship is significant from very short lag lengths (1 week) up to very long lag length (3 months). We fail to reject the hypothesis that the net long positions of nonreportable traders do not Granger cause the net long positions of the Money Manager group.

Granger causality between the Producer/Merchant group and nonreportable traders

We fail to reject the hypothesis that the net long positions of the Producer/Merchant group do not Granger cause the net long positions of nonreportable group, and we fail to reject the hypothesis that the net long positions of the nonreportable group do not Granger cause the net long positions of Producer/Merchant group. Thus, we find no Granger-type causality between these two groups of trades – they don't monitor each other's positions and trade accordingly.

Granger causality between the Swap Dealer group and Other reportable traders

We reject the null hypothesis that the net long positions of other reportable traders do not Granger-cause the net long positions of the Swap Dealer group at all lag lengths. Thus, the Swap Dealer group monitors the positions of other reportable traders and trades accordingly. This relationship is significant at very short lag lengths (1 week) up to very long lag length (3 months). We also reject the null hypothesis that the net long positions of the Swap Dealer group do not Granger-cause the net long positions of other reportable traders at all lag lengths, except at 1 week leg length specification. Thus, other reportable also monitors the positions of the Swap Dealer groups, except at the very short lag lengths. The Granger causality runs bi-directional from SDNL to ONL and from ONL to SDNL.

Granger causality between the Money Manager group and Other reportable traders

We fail to reject the hypothesis that the net long positions of the Money Manager group do not Granger cause the net long positions of other reportable traders and we fail to reject the hypothesis that the net long positions of the other reportable traders do not Granger cause the net long positions of the Money Manager group. Thus, we find no Granger-type causality between these two groups of trades – they don't monitor each other's positions and trade accordingly.

Granger causality between the Producer/Merchant group and Other reportable traders

We fail to reject the hypothesis that the net long positions of the Producer/Merchant group do not Granger cause the net long positions of other reportable traders, and we fail to reject the hypothesis that the net long positions of the other reportable traders do not Granger cause the net long positions of the Producer/Merchant group. Thus, we also find no Granger-type causality between these two groups of trades – they don't monitor each other's positions and trade accordingly.

Granger causality between the Money Manager group and the Swap Dealer group

We reject the null hypothesis that the net long positions of the Money Manager group do not Granger-cause the net long positions of the Swap Dealer group at all lag lengths. Thus, the Swap Dealer group monitors the positions of the Money Manager group and trades accordingly. This relationship is significant at very short

lag lengths (1 week) up to very long lag length (3 months). We also reject the null hypothesis that the net long positions of the Swap Dealer group do not Granger-cause the net long positions of the Money Manager group, but only at very short lag lengths 1 and 2 weeks. Thus, the Granger causality runs bi-directional from SDNL to RMMNL and from RMMNL to SDNL at very short lag lengths. We fail to reject the hypothesis that the net long positions of the Swap Dealer group do not Granger-cause the net long positions of the Money Manager group at 3, 4, 8, and 12 week lag lengths. Thus, the Granger causality runs one-way from RMMNL to SDNL at mid and longer lag lengths.

Granger causality between the Producer/Merchant group and the Swap Dealer group

We reject the null hypothesis that the net long positions of the Producer/Merchant group do not Granger-cause the net long positions of the Swap Dealer group at all lag lengths. Thus, the Swap Dealer group of crude oil traders monitors the positions of the Producer/Merchant group - the Granger causality runs one-way from RPMNL to SDNL. This relationship is significant from very short lag lengths (1 week) up to very long lag length (3 months). We fail to reject the hypothesis that the net long positions of Swap Dealer group do not Granger cause the net long positions of the Producer/Merchant group at all lag lengths.

Granger causality between the Producer/Merchant group and the Money Manager group.

We fail to reject the hypothesis that the net long positions of the Producer/Merchant group do not Granger cause the net long positions of the Money Manager group, and we fail to reject the hypothesis that the net long positions of the Money Manager group traders do not Granger cause the net long positions of the Producer/Merchant group. Thus, we find no Granger-type causality between these two groups of trades – they don't monitor each other's positions and trade accordingly.

DISCUSSION

Next, we analyze our results by the each category of traders. For each group, we try to determine the implications of the pair-wise Granger causality and discuss the practical implications (see Table 5).

The Producer/Merchant group analysis

The members of the Producer/Merchant group are commercial entities that have superior information about the supply/demand fundamentals (see Tokic, 2011). Thus, any other group of traders that monitors the lagged changes in the net long positions of the Produce/Merchant group for trading purposes is likely engaged in intentional herding due the fundamental information-gathering purposes. The changes in the lagged net long positions of the Producer/Merchant group only Granger-cause the changes the net long positions of the Swap Dealer group. The implication is that the Swap Dealer group monitors the lagged changes of the Producer/Merchant group and trades accordingly.

On the other hand, none of the other traders Granger-cause the changes in the net long positions of the Producer/Merchant group. The implication is that the Producer/Merchant group does not make its' trading decision based on the lagged changes in the net long positions of other categories of crude oil traders. This finding is consistent with the classification of the Producer/Merchant group as a hedger/arbitrager – they hedge their physical crude oil positions, regardless of activity of other traders in crude oil futures market, and naturally arbitrage extreme movements in crude oil prices (Tokic, 2011). Notice, the Producer/Merchant category does not act as a rational arbitrager in equation (2) as defined by Delong et al. (1990), they do not monitor the lagged positions of noise traders.

The Money Manager group analysis

The members of the Money Manager group include large hedge funds and other financial institutions that have "sophisticated" research departments and "deep pockets" to collect the macroeconomic/geopolitical/statistical/algorithmic information for trading purposes. Thus, any group of traders that monitors the lagged positions of the Money Manager groups is likely engaged in intentional herding for information-gathering reasons. The changes in the net long positions of the Money Manger group Granger-cause the changes the net long positions of the Swap Dealer group and the nonreportable traders. The implication is that the Swap Dealer group and the small traders (nonreportables) monitoring the positions of the Money Manager group for various macro/technical information-gathering purposes, and make their trading decisions accordingly.

On the other hand, none of the other traders Granger-cause the changes in the net long positions of the Money Manager group at all lag specifications. Only the changes in the net long positions of the Swap Dealer group at very short lag lengths Granger-cause the changes in the net long positions of the Money Manager group. The implication is that the Money Manager group does not make its' trading decision based on the lagged changes in the net long positions of any other category of crude oil traders, except they perhaps monitor the 1 and 2 week history of changes in the net positions of the Swap Dealer group, likely for information-gathering purposes on the recent behavior of index funds. These finding are consistent with the classification of the Money Manger group as an investor in crude oil futures. It is also important to remember that the Money Manager group held almost 65% of all net long positions on average and remained net long crude oil futures during the entire period, pre and post the 2008 oil bubble burst.

The Swap Dealer group analysis

The Swap Dealer group is the controversial group specifically targeted by Dodd-Frank Act and the Volcker rules, as urged by Masters (2008). The members of the Swap Dealer group include index investors and sponsors of the commodity exchange traded funds, that supposedly only "hedge" in crude oil futures market. The CTFC specifically created the DCOT report to monitor the positions of Swap Dealers.

Our results show that the changes in the net long positions of the Producer/Merchant group, the Money Manager group, and the other reportable group of traders, all Granger-cause the changes in the net long positions of the Swap Dealer group. These findings indicate that the Swap Dealer group monitors

the positions of all (except the nonreportable) other groups of crude oil futures traders and trades accordingly. The Swap Dealer group likely seeks the fundamental information from the Producer/Manger group, the macro/technical information from the Money Manger group, and possibly monitors the positive feedback trading of smaller traders. The implication is that the Swap Dealer group speculates on different (or all possible) information to trade the crude oil futures. This finding is consistent with classification of the Swap Dealer as a speculator, in equation (3).

Interestingly, smaller traders responded to lagged changes in the net long positions of the Swap Dealer group. The lagged changes in the net long positions of the Swap Dealer group Granger-cause the changes in the net long positions of both, other reportable traders and nonreportable traders. The implications is that, assuming both of these groups of smaller traders are noise traders (which we confirm in the next section), the Swap Dealer group actually acts as a rational speculator (equation 1) by triggering the position changes by noise traders.

The Other reportable and Non reportable traders analysis

The other reportable and non reportable traders represent smaller accounts and retail traders. As we previously discussed, the lagged net long positions of Swap Dealer group Granger-causes the net long positions of both of these groups. The possible implication is that other reportable and non reportable traders respond to the destabilizing activities of the Swap Dealers. Thus, we can argue the other reportable traders and the nonreportable traders can be classified as noise traders. Further, the nonreportable traders seem to influence the other reportable traders, which could be another indication of trading based on the noisy signal.

Table 5. Summary of the pair-wise Granger-causality analysis.

Trader category	Granger cause	Granger caused by	Classification
Producer/Merchant	Swap Dealer		Hedger/Arbitrager
Money Manager	Non reportable Swap Dealer	Swap Dealer (only at short lags)	Investor
Swap Dealer	Non reportable Other reportable	Producer/Merchant Money Manger Other reportable	Speculator Rational speculator
Other reportable	Swap Dealer	Non reportable Swap Dealer	Noise trader
Non reportable	Other reportable	Swap Dealer Money Manager	Noise trader

CONCLUSIONS

In this study we find that: 1) the controversial Swap Dealer category behaves as a speculator in crude oil futures market; 2) the Producer/Merchant group behaves as a hedger/arbitrager in crude oil futures markets, 2) the Money Manager group acts as an investor in crude oil futures, and 3) the Other Reportable and Nonreportable groups can be classified as noise traders.

The Volker rules, a major provision in the Dodd-Frank Act, aim to prevent financial institutions to engage in proprietary trading in their own accounts. The rationale is that financial institutions use their knowledge of their clients' positions (hedgers, retail investors, other institutional investor) and trade against those positions to realize speculative profits. This study provides some support for the Dodd-Frank act and the Volcker rules by finding that (in crude oil futures market) the Swap Dealer monitors the lagged positions of other traders and trades accordingly, as well as Granger-causes the changes in positions of noise traders.

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