Oil Futures Markets –

With the CFTC Publication of a Disaggregated Commitments of Traders Report are we in a position to better assess whether specific categories of Oil Futures Market Participants did cause the Oil Price moves we witnessed in recent years?

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Abstract

The Commodity Futures Trading Commission (CFTC) began publishing a Disaggregated Commitments of Traders report on September 4, 2009. The CFTC is endeavoring to increase the transparency of its past Commitments of Traders reports by enlarging the breakdown of traders into four categories – "Producer / Merchant / Processor / User", "Swap Dealers", "Managed Money" and "Other Reportables" – vs. the original two – "Commercial" and "Non-Commercial". As indicated by the CFTC in its explanatory note on the new data, "This initiative for providing new market transparency arises from the recommendation to disaggregate the existing "commercial" category in the Commission's September 2008 Staff Report on Commodity Swap Dealers & Index Traders". Three years of weekly historical data for the new Disaggregated Commitment of Traders report were subsequently released by the Commission staff.

This paper examines whether releasing such data brought more clarity to the debate prevailing worldwide on the possible contribution by each category of market participant to the formation of the price of oil.

We found that Open Interest in NYMEX Oil Futures and Options contracts was concentrated in the hands of the physical market players - on the sell side - and in those of Managed Money operators - on the buy side - throughout the period under review. Furthermore changes in Open Interest of either category caused changes in price levels, according to Granger tests applied to available time series (with a 5% level of significance). This result contradicts previous publications asserting there is no causal relationship between the behavior of groups of traders and oil price formation.

Given the still limited scope of the weekly data made available to describe the behavior of a market trading electronically, both in real time and daily, our conclusions at this stage must remain conservative. While appreciating the real effort made by the CFTC staff in adapting its weekly report, we believe that additional data already available to market authorities should be released if the CFTC truly wishes to facilitate further statistical analysis on the behavior of oil Futures markets. In this respect, we would be grateful to both the CFTC and the FSA if they could agree to promptly make publicly available, on a routine basis (even with a time lag), all the available aggregate daily data pertaining to the activities of the key groups of market participants in the trading of oil futures or options contracts listed in their jurisdiction on market places like NYMEX or ICE Europe.

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The continuous rise in crude oil prices which peaked during the summer of 2008 – just a few US dollars short of 150 $ - provoked a very lively debate between market professionals, policy makers and market regulators (not the least of which, was the US CFTC) about the role played by speculators in oil price formation.

Over that period, observations from futures market participants, based on anecdotal evidence of market activity, highlighted the steady increase in the volume and positions of non-commercial players (investment funds, money managers, and others). The same observers felt that their observations were comforted by past CFTC data showing a steady increase in the participation of non commercial players in the trading of oil futures contracts listed on the NYMEX. Hence, there was a natural temptation for analysts to publish all kinds of opinionated statements aiming at addressing the question of a possible causal relationship between "speculative" trading activities and oil prices.

So far, one of the most authoritative studies on this issue has been the report released in July 2008 by the CFTC[1]. This *Interagency Task Force Interim Report on Crude Oil* used the CFTC privileged access to statistical data pertaining to oil futures trading on the NYMEX/CME platforms to study whether fundamental developments taking place in the underlying physical markets or peculiar trading activities developed by specific market participants trading NYMEX futures contracts, would best account for crude oil prices behavior from January 2003 till June 2008. To the disbelief of many empirical observers not having access to the same CFTC data, the CFTC analysts concluded in their report that the increase in oil prices during that period mainly reflected fundamental supply and demand factors.

In establishing that the behavior of these market participants was not a key driver of oil price formation the CFTC analysts applied a statistical methodology - the *Granger test*, which we will describe later – to a specific set of data.

As indicated by the CFTC on its web page "The Commitments of Traders (COT) reports provide a breakdown of each Tuesday's open interest for market reports in which 20 or more traders hold positions equal to or above the reporting levels established by the CFTC." Prior to September 2009, the CFTC data from the Commitments of Traders Report were only partly known to the general public via the CFTC's weekly *Commitments of Traders report*. Until September 2009, this report broke down the overall open interest in NYMEX oil futures contracts held by market participants into three categories: the positions held by "*Commercial*" traders – those who use futures contracts to hedge, the positions held by "*Non Commercial*" traders – those who do not hedge but "speculate" instead, and the non-reported positions (i.e. total Open Interest net of the other two categories and including the entities falling below the criteria imposing COT reporting to the CFTC).

It is worth noting that the CFTC has published the COT Report since 1962 (http://www.cftc.gov/marketreports/commitmentsoftraders/cot_about.html), and that this report has been published for almost a decade in its previous weekly format for all commodity markets. The breakdown between Commercial and Non-Commercial traders was implemented in 1982 (as indicated in the Commission's September 2008 Staff Report on Commodity Swap Dealers & Index Traders) and were felt to fairly accurate reflect the

[1] CFTC 2008 *Interim Report on Crude Oil* Interagency Task Force on Commodity Markets
http://www.cftc.gov/ucm/groups/public/@newsroom/documents/file/itfinterimreportoncrudeoil0708.pdf

breakdown of roles in the futures markets at that time (hedging vs. speculation). As indicated in the report, the derivatives markets and trading patterns have changed massively over the past two decades. Access to the detailed daily data remains exclusively limited to the CFTC for its own regulatory use. Hence, non-CFTC studies can not undertake more in depth statistical studies of trading behavior in relation to oil prices..

Given the CFTC analysts' exclusive access to this privileged information, to date no one in the academic world has been in a position to reproduce their 2008 study in the same conditions. As a result, the CFTC's report has been considered either as authoritative – because of the status of the CFTC – or as "surprising" as such results could neither be validated nor challenged by independent researchers. The authoritative character of the study partly reflects the status of the CFTC. However, without independent research using the same data (i.e. researchers not themselves involved with the CFTC), the academic authority of the paper remains in question.

Whatever the merits of this study, it has failed to resolve the continuing debate on the causes of the level of oil price volatility observed in 2008 and again in 2009. That is, after oil prices peaked at nearly 150 $/b in summer 2008 and subsequently collapsed falling to 35 $/b early in 2009, they have since risen more than two-fold in six months time to trade between 75$/b and 80 $/b in autumn 2009.

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Data

In this context, in August 2009, the CFTC decided to follow its own recommendation from its September 2008 Staff Report on Commodity Swap Dealers & Index Traders, and for the first time it has released a *Disaggregated Commitment of Traders report.* The report provides the same set of weekly data as the previous CFTC weekly report, but reallocates the open interest of the participants amongst more specific categories.

One of the main changes in the CFTC reporting methodology is that the former *"Commercial"* category [aggregating operators hedging physical oil exposure together with financial institutions hedging over the counter financial transactions such as oil derivatives] has now been split between *"Producers/Merchants/Processors/Users"* – likely to mainly regroup physical oil markets participants - and *"Swap Dealers"* – likely to be financial institutions. In addition, the *"Non-Commercial"* category has also been split into two categories: *"Money Managers"* (hedge funds, pension funds, Commodity Trading Advisers…) and *"Other Reportable"*.

The publication *Petromatrix*[2] has noted some inconsistencies in the data related to the "*Other reportable*" category, for which the CFTC did not provide a clear definition. For our own analyses, we will follow *Petromatrix's* approach which remerges the *"Other Reportable"* and *"Money Managers"* categories into one single *"Large Investors"* category.

While we are grateful to the CFTC for this first step towards more transparency in how oil futures contracts are traded, we still believe that several additional steps are required should the Regulators wish to enable academics to undertake more serious analysis of the topic.

For example, one should have in mind that for one same underlying oil commodities – say, the light sweet crude oil contract best known as the *NYMEX WTI contract* – NYMEX

[2] Petromatrix - September 8th 2009 - Weekly CFTC / Market Analysis – contact: info@petromatrix.com

offers the possibility to trade it either as a contract settling via a physical delivery [3] or as a contract to be cash settled only.

Regrettably, while the CFTC's new *Disaggregated Commitment of Traders report* provides detailed information for NYMEX contracts with a physical delivery settlement, the data relative to corresponding NYMEX cash-settled contracts are still published only for the two broader *"Commercial"* and *"Non-Commercial"* categories. As a result it is still impossible to fully evaluate the respective roles of *"Large Investors"* *"Producers/Merchants"* and *"Swap Dealers"* in oil price formation and the impact of trading different NYMEX contractual formats of a same commodity.

Assuming this difficulty may be overcome in the near future, some other methodological issues still have to be addressed.

First of all, similar historical sets of data should also be made available to the public for those futures contracts traded on ICE Futures Europe, which mirror NYMEX oil futures contracts. At this stage, the depth of the data published for ICE futures contracts mirroring NYMEX contracts does not match that available for NYMEX futures contracts and is not sufficient to allow for detailed statistical analysis.

Secondly, and more significantly, a thorough academic analysis can not be undertaken without an increase in the frequency of the data published in the *Disaggregated Commitment of Traders report.* Only weekly data have been made available so far, while daily data would be much preferred and would facilitate more precise statistical analyses, such as causation studies.

The third issue relates to the kind of daily data to be made available to the public. Open Interest and prices do not suffice any more to fully appreciate the drivers behind market dynamics: daily volumes traded in each traders category must also be taken into account. Even if over time academic work on the behavior of futures market prices consistently refers to open interest and price, in today's environment where *momentum trading* and *algorithmic trading* take an ever more significant role in the futures market real time transaction process, one would reasonably argue that a static indicator such as *Open Interest* may no longer be the best one to use when aiming to measure the influence of each trader category on the development of prices on a specific Exchange.

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[3] Crude Oil qualities deliverable in Cushing – Oklahoma - against NYMEX Light Sweet Crude Futures contract

Domestic Crudes, (Deliverable at Par): West Texas Intermediate - Low Sweet Mix (Scurry Snyder) - New Mexican Sweet - North Texas Sweet - Oklahoma Sweet - South Texas Sweet

We had estimates a few years ago of deliverable domestic crude oil into the NYMEX contract of roughly 600 kbd and falling. However, PADD 2 production has actually risen slightly since then. The make-up comes mainly from the Southwest which has also been rising very slightly in recent years. So we would estimate that we are still around 600 kbd of domestic crude of "WTI quality" (light sweet) that can be delivered into the contract. In addition, there are a few foreign crude oils that can be delivered into the contract:

U.K.: Brent Blend (for which seller shall be paid a 30 cent per barrel discount below the last settlement price) - Norway: Oseberg Blend (for which seller shall be paid a 55 cent per barrel discount below the last settlement price) - Nigeria: Bonny Light (for which seller shall be paid a 15 cent per barrel premium above the last settlement price) ; Qua Iboe (for which seller shall be paid a 15 cent per barrel premium above the last settlement price) - Colombia: Cusiana (for which seller shall be paid 15 cent per barrel premium above the last settlement price).

Given the prevailing suspicion of concentration of oil futures and options trading activity in the hands of a limited number of Swap Dealers – especially as they behave in the OTC derivatives market as *market makers* in the price of any oil futures contract listed on NYMEX or ICE Europe – Regulators would greatly improve the market transparency by releasing information on daily volumes traded on each Exchange by specific groups of market participants.

Last but not least, given the very physical nature of the oil market and the need for the US economy to import oil, one should take note as well that *WTI* – despite potentially being a relevant domestic benchmark for low sulfur north American crude oil – is not the only price indicator used by US oil refiners when having to acquire imported crude oil cargoes. As a matter of fact most physical crude oil cargoes traded in the Atlantic basin and likely to be imported by a US refiner derive their prices from another oil price benchmark – the BFOE pricing mechanism generally referred to as Brent blend crude oil – which is based on North Sea crude production and serves as well as the underlying for the specific crude futures contract tradable on ICE Europe. Hence having access to ICE Europe historical data for its Brent Crude and European Gasoil futures contracts are also necessary to get a full picture of oil price formation mechanisms likely to impact the US markets. This data is not currently published. Accordingly, it would be helpful if the CFTC asked the relevant British Authorities to arrange for ICE Europe to prepare to make available to the general public (as soon as possible) the same set of data that NYMEX provides to the CFTC, via its own regulatory authority - the FSA.

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Despite the aforementioned limitations of the available set of historical data, we have undertaken a study of the possible causal links which may have developed over time between the variations of prices and the variations of the positions held by various groups of NYMEX oil futures market participants. We will begin by first introducing the *Working's Speculative Index* to highlight the role of speculators and hedgers in the price formation process. Then we will apply the *Granger methodology* to the data available and assess whether causal relations can be traced among the different trader categories.

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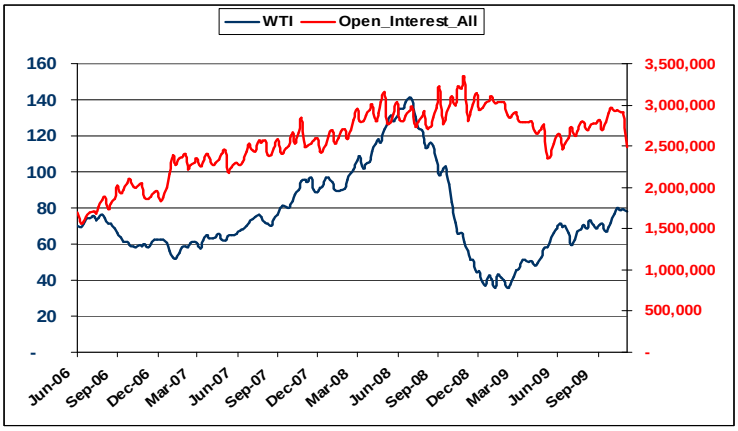
Since the beginning of this century we have witnessed an overall increase in the trading activity in oil futures markets. For example, as shown in Graph 1 hereunder, in the case of NYMEX WTI futures, Open Interest grew on average from 1 750 000 contracts in 2006 to around 2 800 000 contracts in 2009.

Graph 1 : NYMEX WTI open interest



Given the size of each contract (1 contract = 1,000 barrel) and a world oil consumption estimated at approximately 85,000,000 barrels per day, the vested interest of market participants remaining exposed overnight to fluctuations in oil prices represent close to 33 days of oil consumption worldwide. By contrast, the physical flows of oil produced in the Cushing area – where NYMEX WTI contract can be physically delivered – are estimated to be around 600,000 barrels per day. As a result it would appear that the average open interest held in 2009 by the NYMEX trading community represents close to 13 years of production in the local market for underlying the WTI contract.

Given the average size of the positions held on NYMEX by the trading community, its is worth looking at the distribution of NYMEX WTI Open Interest among the various groups of market participants identified in CFTC reports.

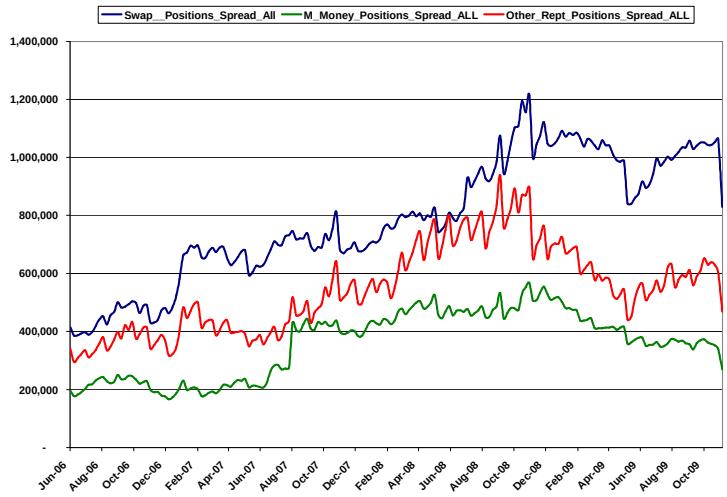
Table 1:

	Total Open Interest	Hedgers		Swap Dealers			Large Investors			Non Reported	
		Long %	Short %	Long %	Short %	Spread %	Long %	Short %	Spread %	Long %	Short %
2006	1,856,385	23.3	28.0	7.9	6.0	24.2	9.9	6.5	30.9	3.8	4.4
2007	2,407,847	20.8	26.6	7.5	5.3	28.3	9.3	5.3	30.7	3.5	3.7
2008	2,887,494	10.4	14.4	6.2	5.4	31.0	8.2	4.7	41.4	2.8	3.1
2009	2,773,687	10.4	16.5	6.7	4.8	36.0	7.9	3.9	35.2	3.5	3.3

In 2007, of the average 2 407 847 contracts held open at close of business, 20.8% (*26.6%)* of all long *(short)* positions were held by *"Producers and Merchants"* traders, 7.5% (*5.3%*) were held by *"Swap Dealers"*, 9.3% (*5.3%*) were held by *"Large Investors"*, with the remaining split between *"Swap Dealers"* for 28.3% and *"Large Investors"* for 30.7% holding time spread positions (i.e. a contract purchased for delivery in on month and a contract sold for delivery in another month).

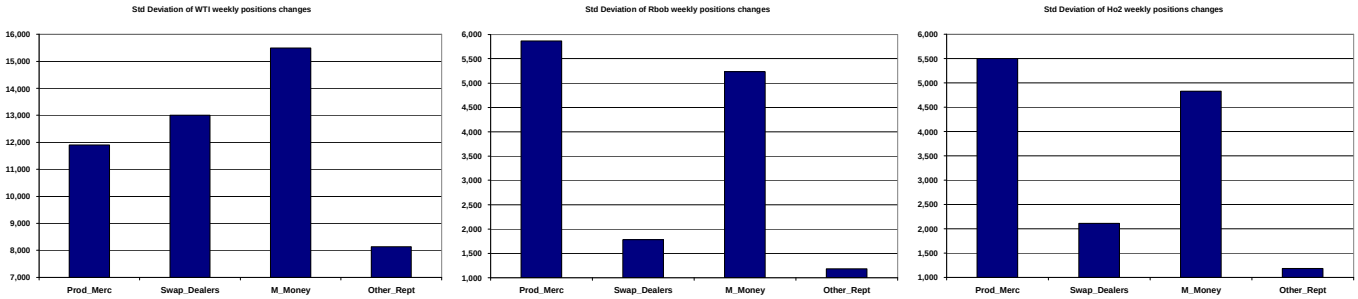
As shown in Graph 2, the spread positions held by traders have grown constantly over the sample period:

Graph 2: Open Interest held as time spreads



We also note in Graph 3 that *"Large Investors"* positions are more volatile than *"Producers and Merchants"* and *"Swap Dealers"* when trading WTI, while being second only to *"Producers and Merchants"* when trading RBOB (gasoline) and HO2 (heating oil). Surprisingly the *"Swap Dealers"* seem to have a much less volatile activity in the refined product markets supposedly used to price oil consumers hedging requirements.

Graph 3 : Standard Deviation of Open Interest Changes – by category and underlying.



Finally, by reallocating each time spread position between a Long position and a Short position while regrouping into a single "*Hedgers*" category the positions held both by the *"Producers and Merchants"* and the *"Swap Dealers",* it becomes possible to reconstitute the share of net long / net short positions held by groups equivalent to the *"Commercial"* and *"Non Commercial"* categories prevailing in the former CFTC reports:

Table 2: Hedgers versus Large Investors

	Total Open Interest	Hedgers		Large Investors		Non Reported	
		Long %	Short %	Long %	Short %	Long %	Short %
2006	1,856,385	55.4	58.2	40.7	37.4	3.8	4.4
2007	2,407,847	56.5	60.2	40.0	36.0	3.5	3.7
2008	2,887,494	47.6	50.8	49.6	46.1	2.8	3.1
2009	2,773,687	53.0	58.0	43.0	39.0	4.0	3.0

In 2008 the *"Large Investors"* significantly raised their shares of Open Interest while *"Hedgers"* reduced theirs.

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To go one step further in the analysis of this data we introduce the *Working's Speculative Index*

Working's Speculative Index

Working[4] developed a *Speculative Index* for the agricultural futures markets. We will apply his concept to oil futures markets.

Working's main hypothesis is that futures markets are used primarily for hedging and that speculation can only be judged "excessive" relative to the level of hedging activity in the market. Peck (1979) gives a summary of *Working*'s arguments:

> *"Taken together, these analyses reaffirm the fundamental importance of hedging to futures markets and dependence of total activity upon hedging needs.*
> *The results also lend support to the Working definition of an appropriate measure of hedger demands upon a market. Net hedging is not the most useful view of the demands commercial users make on a market.*
> *Speculation is needed to offset both long hedging and short hedging. Only coincidentally are long and short hedgers sufficiently alike in date and amount to be offsetting, although increased balance increases the probability of such correspondence and differences in seasonal needs between long and short hedgers decreases this probability.*
> *The appropriate measure of minimum required speculation must at least begin with total hedging demand."*

The purpose of *Working's speculative index* is to measure the extent of excessive speculation prevailing in a given futures market. It is defined as follows:

T = 1 + SS / (HL + HS) if HS > HL
T = 1 + SL / (HL + HS) if HL > HS

Where

SS is Speculator (here, *"Large Investors"*) Short positions,
SL is Speculator Long positions,
HS is Hedger (here *"Producers and Merchants"* + "*Swap Dealers*") Short positions
and HL is Hedger Long.

To illustrate what T as *speculative index* may mean, we can consider the most simple case where HL=0, i.e. a market in which *"Hedgers"* are short only.

We then have T=1 + SS/HS.

According to the definition of the "Open Interest", HL + SL = HS + SS must hold if all positions are counted in *"Hedgers"* or in *"Speculators"*. So when HL=0, SL=HS+SS; and this is equivalent to say that 1+SS/HS = SL/HS. Which means that when Speculators Long positions equal Hedgers Short positions, then T=1.

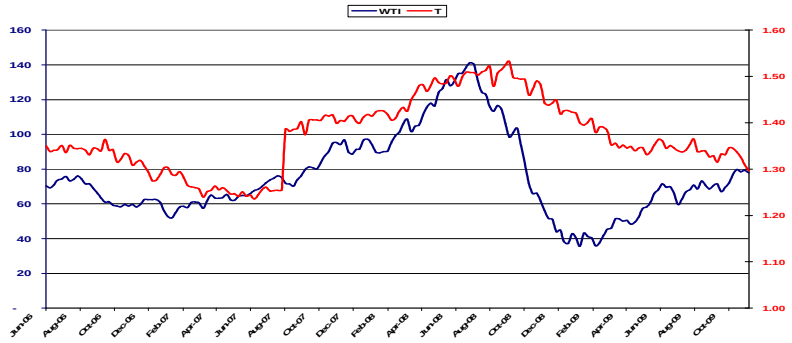
[4] Working, Holbrook, 1960 - *Speculation in hedging markets,* Stanford University Food Research Institute Studies 1.

Now, if Hedgers Long = 0, Hedgers Short = 100, Speculators Long = 110 and Speculators Short = 10, then T=10%: there is a 10% excess of speculation.

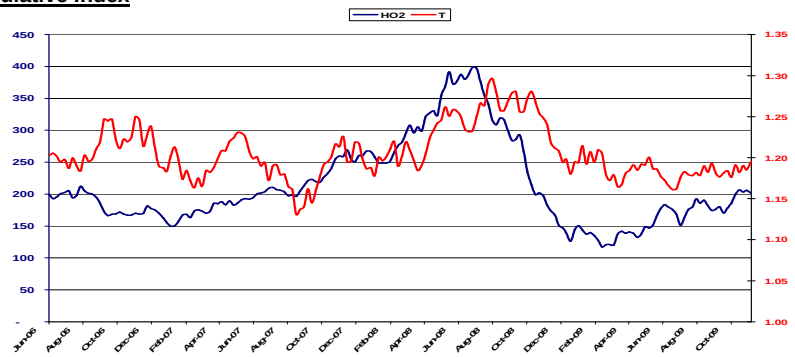
In order to apply this calculation to our set of data, we had to deal with the *"Non Reported"* portion of Open Interest; we followed in that respect the advice of Sanders et al[5] and allocated the *"Non Reported"* positions to "*Hedgers"* and *"Large Speculators"* according to their respective share of the overall reported positions.

We obtain the following graphs for WTI, HO2 and RBOB contracts:

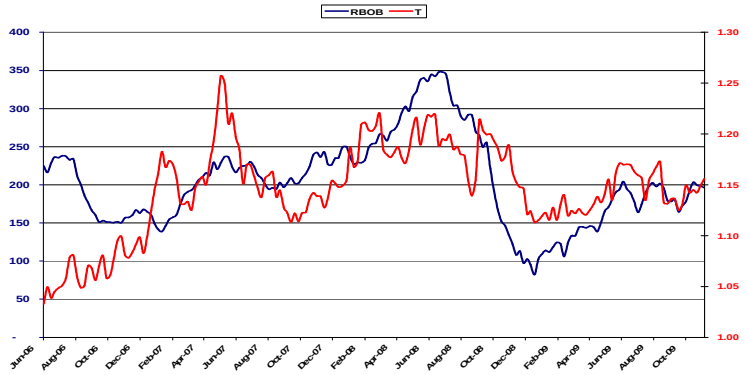
Graph 4 : WTI Speculative Index



Graph 5 : HO2 Speculative Index



Graph 6: RBOB Speculative Index



[5] Dwight R.Sanders, Scott H. Irwin, Robert P.Merrin - *The Adequacy of Speculation in Agricultural Futures Markets: Too Much of a Good Thing?* - Department of Agricultural and Consumer Economics - University of Illinois at Urbana-Champaign

WTI prices and corresponding *Working's speculative index* seem to follow the same trends. The correlation between the two variables is positive (63%).Nevertheless the weekly changes are poorly correlated. Similarly, we observe positive correlations for both HO2 and RBOB (respectively 52% and 45%).

Our first results are modest.

At least we can say that there is a non negligible correlation between the level of oil prices and the level of *excessive speculation* - [as defined by Working - prevailing on NYMEX during the period under review.

However we still have at this stage to refrain from being assertive about the role of "speculation" in oil futures price formation, for methodological reasons.

> Working's hypothesis that there is a clear-cut distinction between hedgers and speculators amongst market participants is quite determinant in his proposed definition of an *"excessive speculation"* concept. It would imply, for example, that the *"Producers, Merchants"* group of NYMEX participants do trade oil futures contract only to hedge a physical exposure. Needless to say it is not the case as can be illustrated by the need felt by CFTC to introduce in its terminology the concept of "Major Swap Participant" being neither a pure physical hedger nor a pure "swap dealer". Likewise, when we aggregate the *"Swap Dealers"* activity into our *"Hedgers"* category, we do assume – by Working's standards – that no Swap Dealer does trade NYMEX futures contract for profit…
>
> The lack of empirical evidence that various categories of NYMEX participants do distinguish between hedging and for-profit-trading activities – see for example the literature on so called *"dynamic hedging"* … - prevents the implementation of any systematic reporting aiming at separating the daily open interest carried by each market participant into one "for hedging" and one "for speculation" positions. As a result we tend to consider that our "macro grouping" approach remains the least worst solution when attempting to apply the Working's Speculative Index to oil futures markets.
>
> As a side note we need also to mention that open positions on time spreads are only made available to the public for our *"Large Investor"* category, for CFTC *"Swap Dealers"* category. We wonder why such information – if considered pertinent for those categories – should not also be published for *"Producers & Merchants"* and *"Non Reported"* trades, and whether this inconsistency in the data provided so far by the CFTC may have introduced a bias in our analysis.

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To overcome such limitations of *Working's Speculative Index*, a more detailed study of the DCOT data is required. We will then first calculate the net positions of the different traders' categories and look for possible correlations between such net positions before moving to the application of Granger causality tests to our limited set of data.

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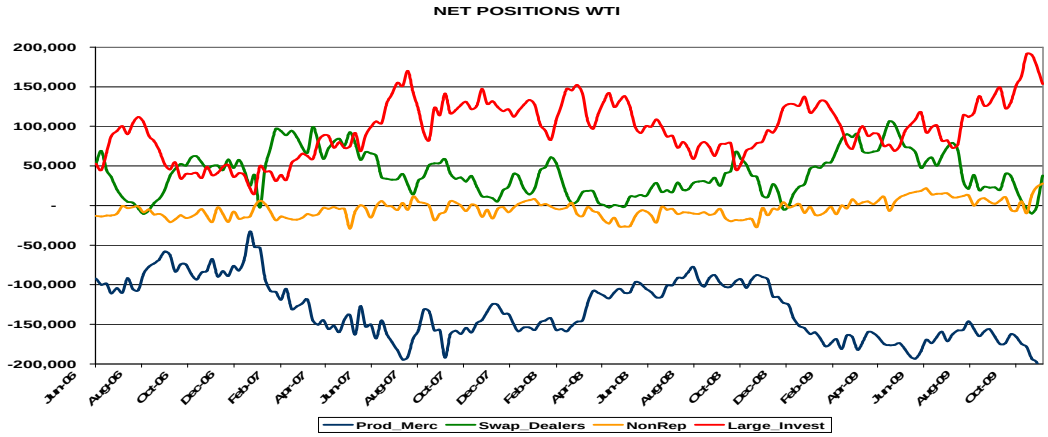
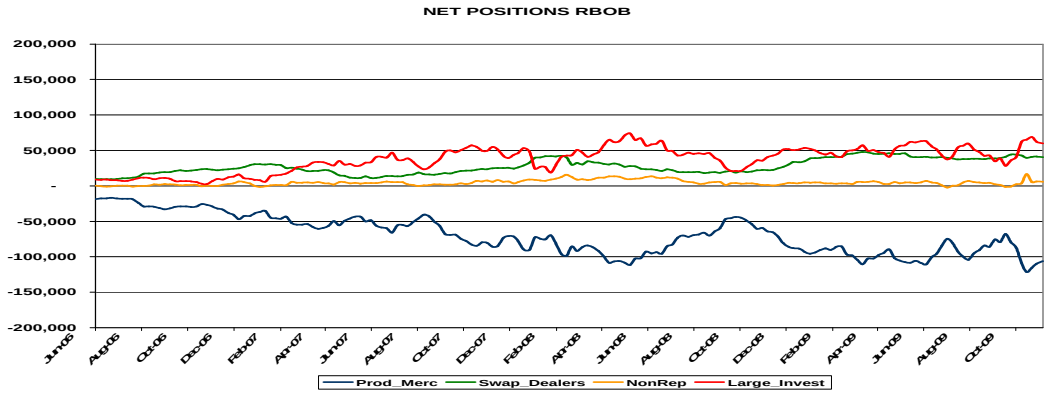
Correlations

Graphing the net positions of various traders categories on WTI, RBOB and HO2 futures markets provides a good illustration of their differences in behavior

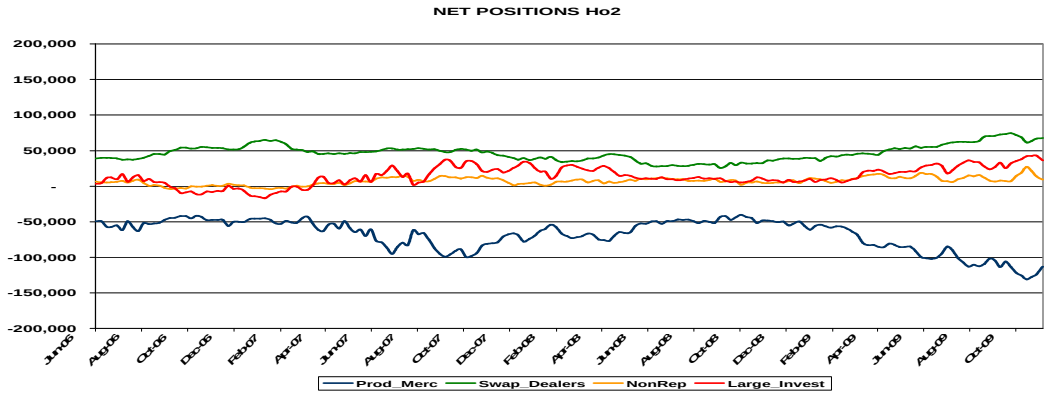
Graph 7: Net positions on NYMEX crude oil futures contracts



Graph 8 : Net positions on NYMEX gasoline futures contract



Graph 9: Net positions on NYMEX heating oil futures contract



A first striking feature of the oil futures complex over that period of time is that the distribution of net long / net short positions amongst the different categories of market participants is the same for crude oil, gasoline and heating oil futures contracts.

"Swap Dealers" and *"Large Investors"* have been holding structural net long positions while the short side remained the quasi exclusivity of *"Producers & Merchants"* (if we were to ignore the *"non reported"* category)

Besides we observe that

- Similar patterns developed in three oil futures market segments
- *"Producers & Merchants"* and *"Large Investors"* net positions followed symmetrical trends.
- *"Large Investors"* were holding the more significant long positions on crude oil and gasoline futures markets, while *"Swap Dealers"* have been the dominant long category in the heating oil futures market.

Moving from an illustrative approach to a quantitative approach of possible correlations between market participant behaviors and prices of the commodities they trade requires working not directly with price levels and net positions time series, as such variables are not stationary, but rather on corresponding weekly changes. (Unfortunately no daily data are available …!).

Matrix of correlations which are presented in the three tables below confirm the strong interaction between "*Producers & Merchants"* and *"Large Investors"* given the high negative correlations between changes in their respective net positions (- 49% on crude oil; - 88% on heating oil; - 90 % on gasoline).

Table 3: Prices and Net positions - Correlations in NYMEX crude oil contract

	D_WTI	*D_Prod_Merc*	*D_Swap_Dealers*	*D_Large_Invest*	*D_NonRep*
D_WTI	100%				
D_Prod_Merc	-6%	100%			
D_Swap_Dealers	-17%	-35%	100%		
D_Large_Invest	25%	-49%	-47%	100%	
D_NonRep	-8%	-6%	-28%	-25%	100%

Table 4: Prices and Net positions - Correlations in NYMEX gasoline contract

	D_RBOB	*D_Prod_Merc*	*D_Swap_Dealers*	*D_Large_Invest*	*D_NonRep*
D_RBOB	100%				
D_Prod_Merc	-43%	100%			
D_Swap_Dealers	-13%	-12%	100%		
D_Large_Invest	41%	-90%	-18%	100%	
D_NonRep	30%	-48%	-6%	18%	100%

Table 5: Prices and Net positions - Correlations in NYMEX heating oil contract

	D_HO2	*D_Prod_Merc*	*D_Swap_Dealers*	*D_Large_Invest*	*D_NonRep*
D_HO2	100%				
D_Prod_Merc	-37%	100%			
D_Swap_Dealers	-18%	1%	100%		
D_Large_Invest	34%	-88%	-28%	100%	
D_NonRep	36%	-60%	-36%	36%	100%

It is also worth noting that despite the *"Swap Dealers"* dominance in the net long positions held by heating oil market participants that we mentioned before, and the structural net short positions held in that market by *"Producers & Merchants"* there is no obvious correlation between *"Swap Dealers"* and *"Producers & Merchants"* changes in net positions in the heating oil market.

In fact *"Swap Dealers"* most significant interactions with other market participants seems to have taken place in the crude oil futures markets where we observe a negative corre-

lation between their changes in net positions and both *"Large Speculators"* (- 49%) and *"Producers & Merchants"* (- 28%) own changes in net positions.

We can observe as well that correlations between price and position changes (1st column in each matrix) do follow a similar pattern in each of the three futures markets characterized by both

- a positive correlation between price and *"Large Investors"* net position changes (crude oil: 25%; gasoline: 41%; heating oil 34%), and
- a negative correlation between weekly price and position changes for our other two relevant categories ("*Producers & Merchants"* crude oil: -6%; gasoline: -43%; heating oil: - 37% - *"Swap Dealers"* crude oil: -17%; gasoline: -13% ; heating oil: -18%).

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Even if highlighting that prices changes and market participants behavior are not independent variables in NYMEX oil futures contracts, Speculative Indices and Correlations Matrix cannot give us any information about any possible causality between these variables. This specific matter is addressed hereunder using *Granger causality tests*.

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GRANGER

Granger introduced a characterization of causality between two variables which we can summarize as follows:

> *A time series X is said to Granger-cause another time series Y when it can be demonstrated, using lagged values of X and lagged values of Y being also know, that those X values provide statistically significant information about future values of Y.*

The test works by first doing a regression of Δ*Y* on lagged values of Δ*Y* (Note: a decision has to be made of the number of lags to be used in the regression, in the present study, we selected one lag corresponding to one week):

$$Y_t = d + \sum_{i=1}^{n} \alpha_i Y_{t-i} + \omega_t \qquad \text{"Constrained Model"}$$

Subsequent regressions for lagged levels of Δ*X* are performed:

$$Y_t = c + \sum_{i=1}^{n} \lambda_i Y_{t-i} + \sum_{j=1}^{n} \mu_j X_{t-j} + \varepsilon_t \qquad \text{"Unconstrained Model"}$$

If the Unconstrained Model has a better explanatory power – as measured by comparing the variance of the residues - than the Constrained Model then Y is said to be Granger-caused by X.

The most common criticism addressed to the Granger methodology is that Granger causality can tell us whether the occurrence of an event can help predict the occurrence of another one, only if both events occur in sequential order. As a result Granger characterization of causality may not account for possible interactions between variables which

may result from indirect links existing between them: for example if both positions and prices were to be influenced by a common third non-modeled variable – say for example the Fed overnight interest rate level …- then the Granger-test applied to prices and positions may not detect a causality relation between them.

With these restrictions in mind, we did apply Granger tests to weekly price and position changes reported by CFTC between June 2006 and November 2009 in crude oil, heating oil and gasoline futures and options contracts traded on NYMEX.

Our results are the followings:

Table 6: Causality indicators between price and position changes in NYMEX oil futures contracts

WTI	Prod.&Merc.	Swap Dealers	L. Invest.	Non Rept.
dPrice -> dPos	22%	9%	46%	6%
dPos -> dPrice	**1.5%**	53%	**1.7%**	15%

RBOB	Prod.&Merc.	Swap Dealers	L. Invest.	Non Rept.
dPrice -> dPos	13.1%	17.0%	21.0%	**0.5%**
dPos -> dPrice	62.0%	7.4%	12.0%	39.0%

HO2	Prod.&Merc.	Swap Dealers	L. Invest.	Non Rept.
dPrice -> dPos	53%	**1.3%**	54%	**4%**
dPos -> dPrice	41%	51%	43%	30%

Table of p-values:

> *A p-value corresponds to the probability of being wrong when rejecting the "null hypothesis". In the table above, the "null hypothesis" is the hypothesis that there is no causality relation. In our framework, rejecting the "null hypothesis" would mean to accept the causality relation.*
>
> *For example, there are 46% chances to be wrong when assuming that changes in WTI prices will cause Large Investors to change their net position in that market.*
>
> *To consider that a causality hypothesis is relevant, the corresponding p-value has to be below the usual level of significance - 5% - used as a common reference in most academic studies.*

In the crude oil market, the hypothesis that a group of Market Participants may change its net position because of a preceding price move appears not to be relevant (the lowest p-plus value being 6% for *"Non Reported" traders*).

In the heating oil market, the price moves seem to influence position changes for *"Swap Dealers"* and *"Non Reported"* traders. In the gasoline market, this phenomenon is only observable for *"Non Reported"* traders.

Changes in groups net open positions failed to cause changes in prices in both heating oil and gasoline markets.

The crude oil futures contract is where we get the most significant result: with p-plus values of respectively 1.7% and 1.5% *"Large Investors"* and *"Producers & Merchants" weekly changes* in net positions appear to have caused *weekly changes* in NYMEX crude oil futures prices. This finding is corroborated by the empirical evidence that *"Producers & Merchants"* and *"Large Investors"* are the leading traders respectively on the long side and on the short side (cf Graph 7).

Even if consistent with our empirical findings, this quantitative result came to us as a surprise as, at first sight, it contradicts the conclusions of at least two previous studies on this issue.

In the "Interagency Task Force Interim Report on Crude Oil" published by the CFTC in 2008, the authors concluded that the sharp increase in prices observed in 2008 was not explained by the *daily changes* in positions of the different trader categories. And contrary to our own findings they concluded that in the crude oil futures contract, *daily price changes* lead *daily changes* in net positions.

Figure 16 Granger Causality Tests relating Daily Position Changes to Price Changes in the NYMEX WTI Crude Oil Futures Contract from January 2000 to June 2008

Trader Classification		Hypothesized Direction of Causality					
		Price Changes lead Position Changes			**Position Changes lead Price Changes**		
		Direction	Significant?	P Value	Direction	Significant?	P Value
All Commercials (includes Manufacturers, Commercial Dealers, Producers, Other Commercial Traders, and Swap Dealers)		+	**Yes**	**0.028**	.	*No*	*0.896*
	Manufacturers	+	**Yes**	**0.048**	.	*No*	*0.191*
	Commercial Dealers	+	**Yes**	**0.040**	.	*No*	*0.908*
	Producers	+	**Yes**	**0.032**	.	*No*	*0.449*
	Other Commercial Traders	.	*No*	*0.918*	.	*No*	*0.391*
	Swap Dealer	.	*No*	**0.114**	.	*No*	*0.832*
All Non-Commercials (includes Hedge Funds, Floor Brokers & Traders)		.	*No*	*0.062*	.	*No*	*0.764*
	Hedge Funds	-	**Yes**	**0.003**	.	*No*	*0.585*
	Floor Brokers & Traders	.	*No*	*0.741*	.	*No*	*0.494*
All Non-Commercials combined with Swap Dealers		.	*No*	0.062	.	*No*	*0.947*

Source: Commodity Futures Trading Commission

J. Harris and *B. Buyuksahin*[6] – also in a CFTC context – used daily data from 2000 to 2008 with different groupings (not the same as the new disaggregated report published by CFTC). They analyzed causality relations for *Non Commercials*, *Commercials* and the fusion of *Non Commercials* and *Swap Dealers.* Then they did the same analysis for more fragmented groups, for example they have split the *Commercials* between

[6] J. Harris, B. Büyüksahin, 2009. *The role of speculation in the crude oil futures market.*

Dealer/Merchants, *Manufacturers*, *Producers*, *Other* and *Swap Dealers*. This classification is more detailed than that available in the CFTC report. We will focus here on their results for *Commercials*, *Non Commercials* and *Non Commercials +Swap Dealers* as these categories are similar to our grouping.

Their results are the followings:

Table 6a: Granger Causality Tests: Price and Position Change (Nearby)

	Non-Commercials (Futures Only)				Non-Commercials (Futures and Options)			
Day Change	ΔPrice→ΔPosition		ΔPosition→ΔPrice		ΔPrice→ΔPosition		ΔPosition→ΔPrice	
1	**0.000**	**(0.001)**	0.466	(0.227)	**0.000**	**(0.000)**	0.805	(0.376)
2	0.083	(0.670)	0.363	(0.185)	**0.001**	(0.046)	0.645	(0.246)
3	0.693	(0.952)	0.593	(0.172)	0.062	(0.208)	0.163	(0.372)
4	0.164	(0.080)	0.342	(0.187)	0.858	(0.941)	0.101	(0.394)
5	0.270	(0.137)	0.139	(0.254)	0.527	(0.615)	0.040	(0.496)
	Commercials (Futures Only)				Commercials (Futures and Options)			
Day Change	ΔPrice→ΔPosition		ΔPosition→ΔPrice		ΔPrice→ΔPosition		ΔPosition→ΔPrice	
1	**0.000**	**(0.002)**	0.873	(0.358)	**0.000**	**(0.000)**	0.643	(0.452)
2	0.077	(0.927)	0.398	(0.259)	**0.001**	(0.022)	0.645	(0.287)
3	0.785	(0.552)	0.429	(0.360)	0.104	(0.315)	0.342	(0.476)
4	0.161	(0.027)	0.097	(0.406)	0.642	(0.953)	0.057	(0.598)
5	0.140	(0.067)	0.043	(0.481)	0.659	(0.723)	0.027	(0.649)
	Non-Commercials and Swap Dealers (Futures Only)				Non-Commercials and Swap Dealers (Futures and Options)			
Day Change	ΔPrice→ΔPosition		ΔPosition→ΔPrice		ΔPrice→ΔPosition		ΔPosition→ΔPrice	
1	**0.000**	(0.019)	0.983	(0.552)	**0.000**	**(0.000)**	0.313	(0.376)
2	**0.000**	(0.054)	0.946	(0.348)	**0.000**	(0.005)	0.973	(0.171)
3	**0.002**	(0.263)	0.209	(0.425)	**0.000**	(0.053)	0.153	(0.378)
4	0.031	(0.837)	0.417	(0.497)	**0.000**	(0.341)	0.376	(0.432)
5	0.008	(0.530)	0.293	(0.440)	**0.000**	(0.109)	0.305	(0.377)

Table 6a presents the Granger causality results for price and net position changes. It also shows the Granger-causality results for price change and the level of net position in parenthesis. Bolded probabilities indicate the rejection of Granger non-causality at 1 percent level of significance.

Looking into the details of their p-value table, it appears first that *J. Harris* and *B. Buyuksahin* elected to refer to a level of significance of 1% to articulate their conclusion. As a result they focused on the causation of daily position changes by daily price changes be it for the *Commercial* or the *Non commercial* categories of market participants.

We can notice as well that there is an asymmetry in the causality indicators they calculated, from Prices to Positions and from Positions to Prices. It seems in fact that the influence of prices over traders positions reduces as the number of lags is increased, while at the same time the influence of traders positions over prices do increase, until getting a significance indicator below 5% with a 5 day lag 5 (an imperfect proxy for our own weekly data constraint).

One could therefore wonder if increasing the lag beyond 5 days may have brought their indicator below the 1% significance level they chose.
Their results are in fact not so divergent from ours when considering the 5 days lag with a 5% p-value: they find no causality from prices to positions and causality from positions to prices for both *Commercials* and *Non Commercials* as we do for our *"Large Investors"* (equivalent to *"Non Commercials"*) and *"Producers and Merchants"* categories.

But contrary to our own results presented in table 7 below, when grouping "*Non Commercial"* together with *"Swap Dealers"* in a category that would represent all financial

market participants, they find no causality from positions to prices whatever the number of lags they chose.

Table 7: Causality for aggregated positions

WTI	Producers & Merchants	Large Investors + Swap Dealers
dPrice -> dPos	22%	**2.9%**
dPos -> dPrice	**1.5%**	**0.3%**

RBOB	Producers & Merchants	Large Investors + Swap Dealers
dPrice -> dPos	13.1%	11.7%
dPos -> dPrice	62.0%	37.9%

HO2	Producers & Merchants	Large Investors + Swap Dealers
dPrice -> dPos	53%	7.0%
dPos -> dPrice	41%	64.5%

With this grouping we observed no objective causality in the gasoline and heating oil markets.

In the crude oil market, we do observe causality from positions to prices with a significance level of 0.3% for the Financial Institutions (*Large Investors + Swap Dealers)* where they find a very high p-value (30%) when testing the same hypothesis on daily data with a five day lag.

Part of that critical divergence in results may well be explained both by the difference in the periods of reference used in the two studies, and by our use of weekly data instead of daily data (unavailable…).

This last study confirms two of our previous findings:

- There is no significant causality relationship between weekly position changes and weekly price changes in the gasoline and heating oil futures and options contracts with physical delivery resolution, listed by NYMEX.
- Physical and financial traders weekly position changes do cause weekly price changes in the crude oil futures and options contracts with physical resolution, listed by NYMEX.

The grouping of our *Large Investors* and *Swap Dealers* categories into a single financial trader category brought a new (for us) result - confirming *J. Harris* and *B. Buyuksahin* for that category only, and for crude oil only -:

- Weekly price changes (proxy for 5 days lag) in WTI futures prices did cause (with a 2.9% significance level, i.e. not below 1% …) weekly changes in their net positions by the financial traders.

It is our opinion that proper explanations for this price to position relationship can be found in *Index Investing and the Financialization of Commodities*, a study published by *Ke Tang* and *Wei Xiong* in September 2009.

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Our own conclusion will remain conservative, given the limitations of the CFTC data we have used:

- We consider the results of this study to be strong enough to assert that there is no statistical evidence of an absence of causation of price changes due to changes in behavior of some market participants.
- But we do consider, as well, that a much wider set of daily data is required – including daily volumes by trader category – to perform a more thorough statistical analysis in order to better understand what causes what in oil futures markets.

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