

Impact of U.S. Tight Oil on NYMEX WTI Futures

A Report by Staff of the Market Intelligence Branch

Division of Market Oversight

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Executive Summary

The staff of the Market Intelligence Branch in the Division of Market Oversight (“DMO”) conducted research on activity in the New York Mercantile Exchange (“NYMEX”) Light Sweet Crude Oil futures contract (“WTI”) to determine what effect, if any, the growth of tight oil¹ in the United States had on usage of the contract. DMO staff analyzed trading volume and open interest across all listed expirations from January 3, 2003 to March 30, 2018 (“the study period”).

The research produced the following 4 main findings:

1. As a whole, volume and open interest in the contract remains robust;
2. At a more granular level, open interest in futures contracts for delivery five or more years into the future has declined;
3. Based on an examination of data available to the general public, data collected by the CFTC, and conversations with industry participants, the decline in open interest of NYMEX WTI contracts for delivery five or more years in the future has been primarily due to structural changes in physical crude oil caused by the growth of U.S. tight oil production; and
4. The overall price level for oil and developments in financial regulation may have had a secondary effect on open interest for NYMEX WTI contracts for delivery five or more years in the future.

¹ “Tight oil” is a term used by the oil and gas industry to describe what the public commonly refers to as “shale oil.” See the next section of this report for further information.

Background Information on Tight Oil

While the general public refers to “shale oil”, the oil and gas industry uses the term “tight oil.” Tight oil is defined as crude oil contained in rock formations of low permeability, most often tight sandstone or shale. The first tight oil fields developed in the U.S. were in shale rock formations, hence the oft-referenced term “shale oil.”

According to the U.S. Energy Information Agency, U.S. tight oil production was estimated at about 5.5 million barrels per day in March of 2018, which accounts for about 53 percent of total U.S. oil production (10.4 million barrels per day).² This is up from about nine percent in 2008, which is when the “shale boom” is generally considered to have started in the U. S.

Background Information on the NYMEX WTI Futures Contract

The primary crude oil futures contract in the U.S. trades on the NYMEX. Each contract is for 1,000 barrels of light, sweet crude oil. While the contract is often referred to as being for West Texas Intermediate crude, or “WTI”, other crudes can be delivered against the contract provided they meet specified quality standards.³

Prior to 2007, NYMEX listed oil futures contracts for consecutive delivery months for the first five years, and June and December contracts for the sixth year. In 2007, NYMEX expanded the contract at the request of market participants. At present, NYMEX lists contracts for delivery for nine years at a time: all consecutive months for the first six years, and June and December contracts in years seven through nine. While NYMEX offers multiple contract months in years four and beyond, traditionally, most of the open interest over that timeframe has been concentrated in the December contracts.

² U.S. Energy Information Agency, Petroleum and Other Liquids, Crude reserves and production, *Tight Oil Production Estimates by Play and Crude Oil Production*, available at <https://www.eia.gov/petroleum/data.php> (last visited Aug. 1, 2018).

³ For specifics on what constitutes a deliverable crude, see Chapter 200 of the NYMEX rulebook, available at <https://www.cmegroup.com/content/dam/cmegroup/rulebook/NYMEX/2/200.pdf>.

NYMEX WTI Futures Contract Trading Volume During the Study Period

DMO staff began the analysis by reviewing daily transaction volume in the NYMEX WTI contract, across all listed futures contract months.

Exhibit 1: Daily NYMEX WTI Futures Volume, All Months Combined

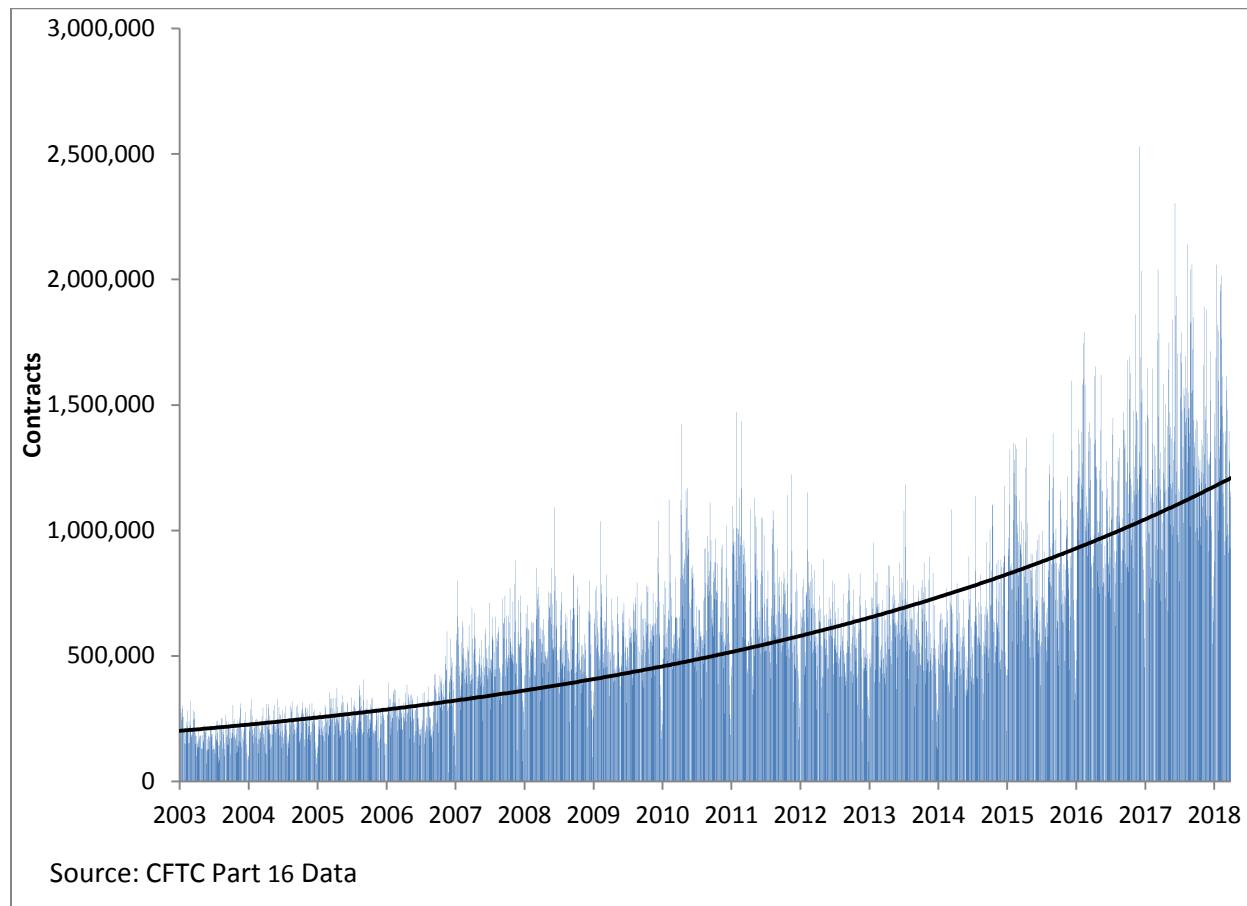


Exhibit 1 depicts the total number of NYMEX WTI contracts traded on each day during the study period. Because the total trade volume on any given day can vary, DMO staff plotted a trend line to highlight the general growth in trading volume during the study period. This finding is consistent with WTI's status as one of the world's benchmark grades of crude oil and the overall growth in commodity trading activity.

NYMEX WTI Futures Contract Open Interest During the Study Period

DMO staff reviewed the level of open interest in the contract, both in aggregate and by contract month, in order to determine if there had been any changes in contract usage during the study period. Unlike many other storable physical commodities, such as corn, wheat, or cattle, crude oil enjoys a longer production lifecycle and does not spoil; oil can be stored for years with no ill effects, and once an oil reservoir is tapped, production continues for years, barring mechanical or technical complications. As such, from the inception of the contract, the NYMEX WTI contract has had a healthy amount of open interest farther out the curve than most physical commodities.

Exhibit 2: Daily NYMEX WTI Futures Open Interest by Years to Expiration

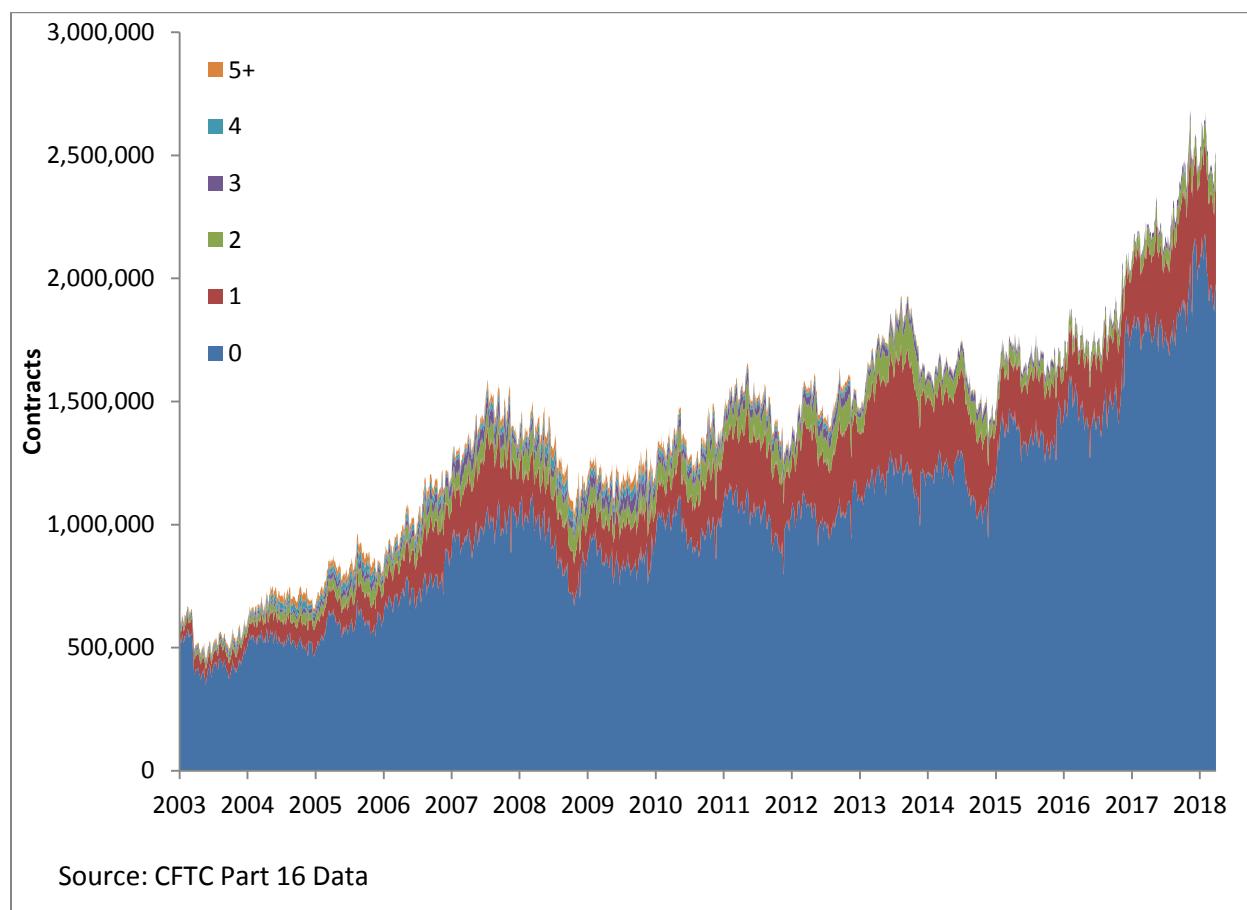


Exhibit 2 depicts the daily open interest in the NYMEX WTI contract by years to expiration. The blue area, which represents contracts set to expire within one calendar year both represents the largest share of open interest on each day, and is responsible for the majority of the growth in open interest during the study period. Contracts set to expire within 13 to 24 months from now, depicted by the red area, and those set to expire within 25 to 36 months, the green area above, also saw healthy usage during the period. However, note the orange section of the

graph, which represents contracts that expire five years or more from that day's date. In this chart, the orange area is clearly visible until 2010, and almost impossible to see by 2018.

A Closer Look at Open Interest Five Years Forward

Given the finding above, DMO staff examined more closely NYMEX WTI contract open interest five years into the future.

Exhibit 3: Daily NYMEX WTI Futures Open Interest, Five Years Forward

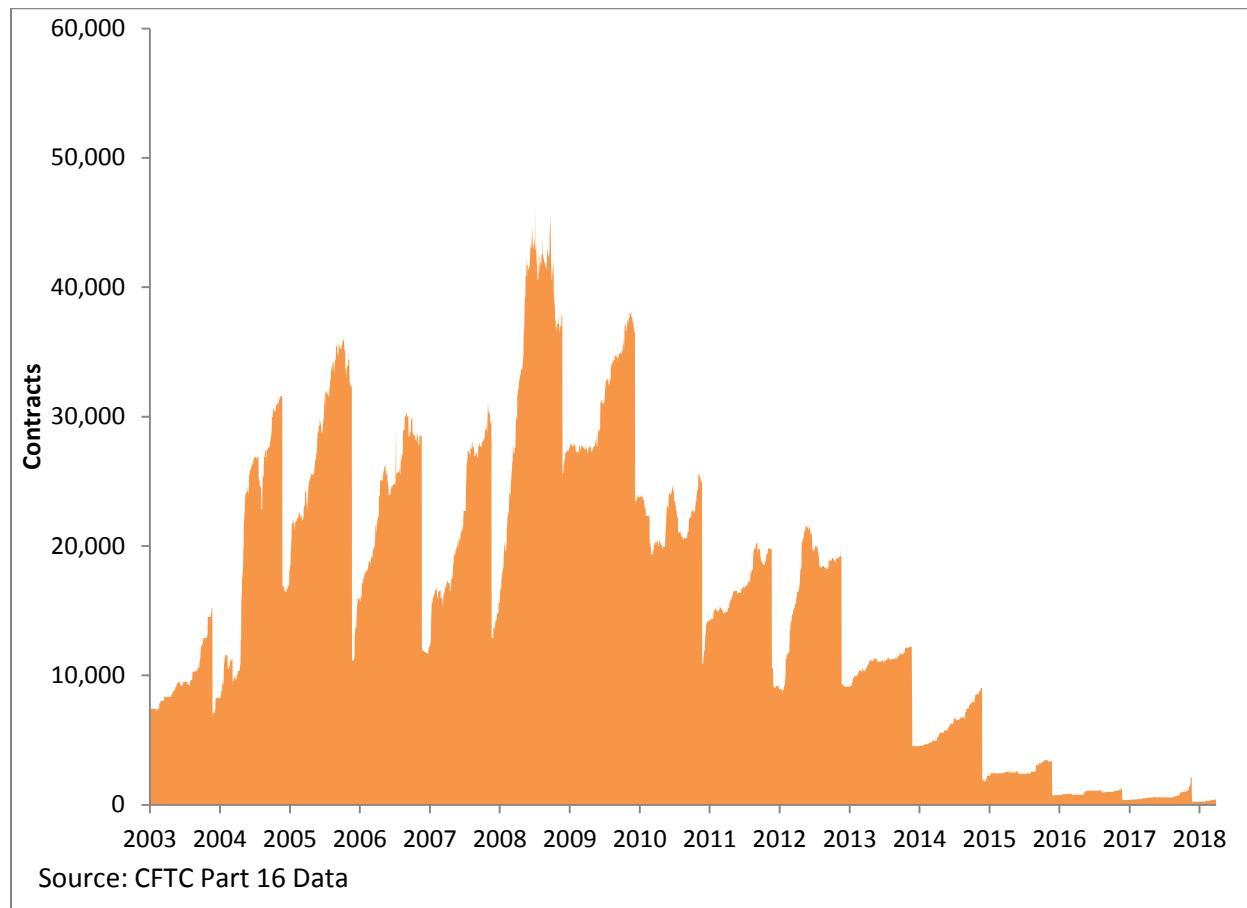


Exhibit 3 depicts the open interest in the NYMEX WTI contract for all contracts that expire five or more years into the future on each day of the study period. This chart shows a clear declining trend in the open interest held in these contracts. In 2008, open interest in these contracts peaked at 46,158 contracts, which represents about 46.2 million barrels of oil. As of March 29, 2018, there were only 481 open contracts for expirations five or more years into the future, representing about 481,000 barrels of oil.

The chart also shows a distinct annual pattern of gradually increasing open interest followed by a sharp decline. The reason for this cyclical pattern is simple: open interest in contracts builds over time, with the level of open interest in any given contract peaking as it approaches expiration. The bulk of the open interest for contracts five or more years forward is concentrated in December expirations. At the end of each year the nearby December contract

is dropped from this metric as it becomes set to expire in four years, rather than five, causing a significant portion of the open interest to roll out of the metric.

The Relationship Between NYMEX WTI Futures Contract Open Interest and Prices

After observing the behavior of five-year forward open interest in the NYMEX WTI contract, DMO staff reviewed the relationship between open interest and price to see if the drop in crude oil prices might help explain the decline in usage of contracts that far down the curve. At the time of this study, WTI was trading at around \$60 per barrel, the highest level in three years, but well below the \$140 per barrel level observed in late 2007/early 2008.

Exhibit 4: Five-Year Forward NYMEX WTI Open Interest v. WTI Futures Prices

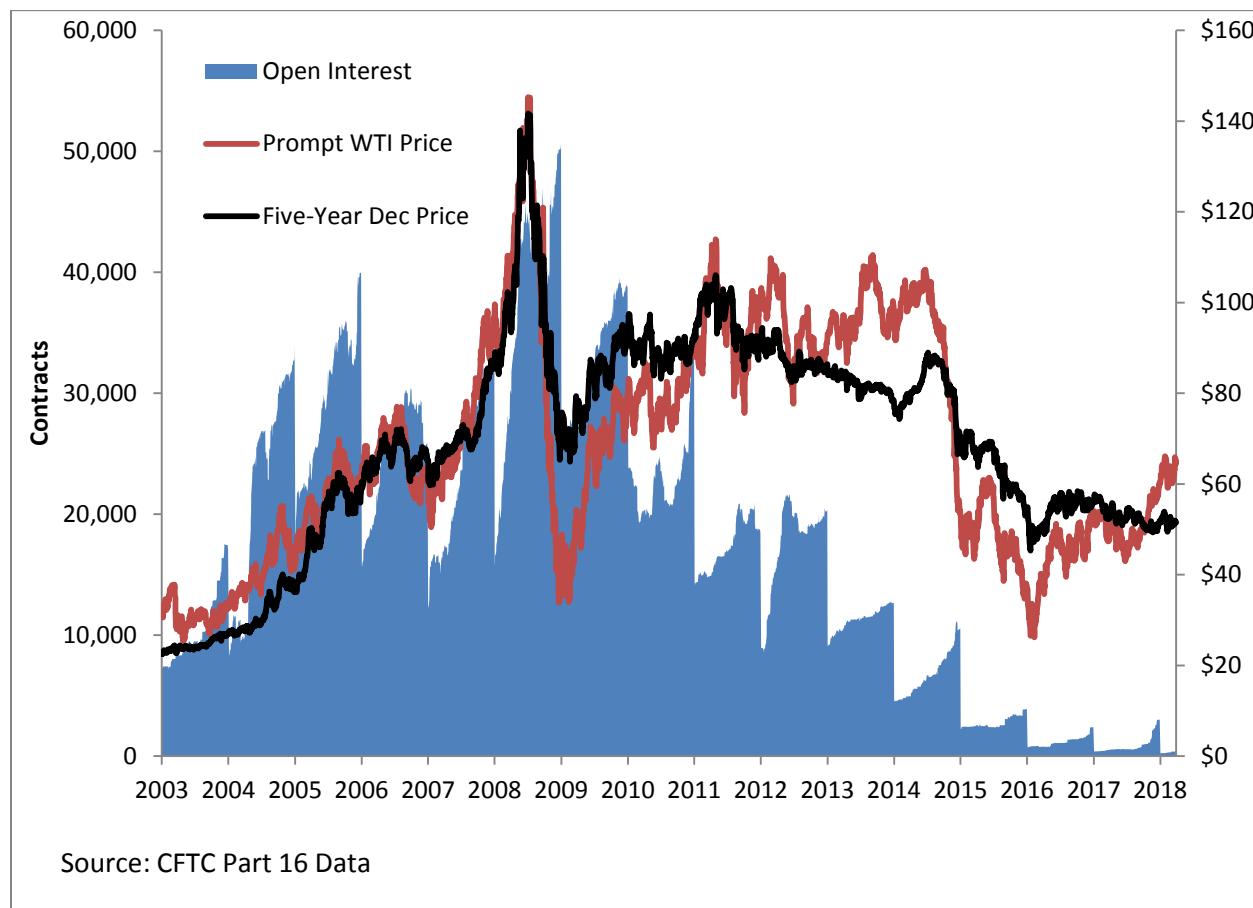


Exhibit 4 shows the daily open interest in NYMEX WTI contracts that expire five or more years into the future (blue area, left axis), along with both the daily settlement price of prompt-month WTI futures (red line, right axis) and the daily settlement price of WTI futures with a December delivery five years forward (black line, right axis). While prices had come down from the highs of late 2007/early 2008, the data suggests that the drop in prices may not necessarily be driving the decline in open positions in five-year forward contracts: at the end of the study period prompt prices were around \$65/barrel while the five year and beyond open interest was 397 contracts. In late 2014 the prices were at about the same level, but the open interest

peaked at over 10,000 contracts; in 2009 prices when prices were around \$65, open interest reached nearly 36,000 contracts.

In addition to the magnitude of prices, the chart also shows that the degree of contango (prompt price is less than deferred price) or backwardation (prompt price is greater than deferred price) does not have a meaningful impact on far-dated open interest levels.

The Relationship Between ICE Brent Futures Contract Open Interest and Prices

Given that WTI and Brent are considered the two global benchmark grades of crude oil, DMO staff compared the open interest of their respective futures contracts to determine if the patterns found in the NYMEX contract were unique to the WTI market or if the Brent market exhibited the same behavior. Brent crude oil futures trade on the Intercontinental Exchange's European futures exchange ("ICE"), and DMO staff collected publicly available data on Brent crude futures open interest and settlement prices to run a comparative analysis.

Exhibit 5: Five-Year Forward ICE Brent Open Interest v. Brent Futures Prices

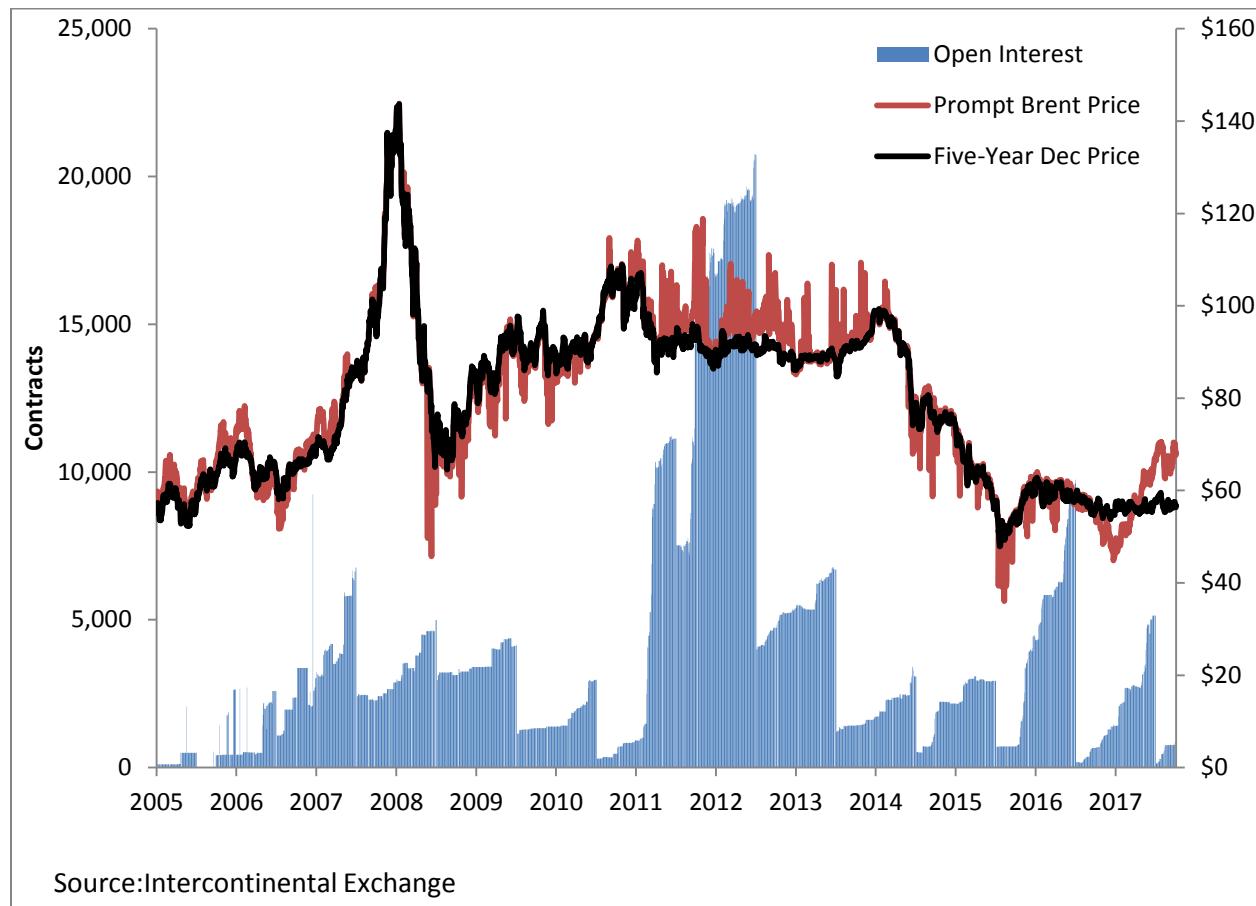


Exhibit 5 shows the daily open interest in ICE Brent contracts that expire five or more years into the future (blue area, left axis), along with both the daily settlement price of prompt-month Brent futures (red line, right axis) and the daily settlement price of Brent futures with a December delivery five years forward (black line, right axis); due to data availability and contract history, the Brent analysis starts in mid-2005. Much like the NYMEX WTI contract, five-year forward open interest in Brent exhibits the same general pattern of buildup during the calendar year and drop off as contracts become four-year forward expirations and are replaced in the series with less mature contracts. Comparing the Brent data to the NYMEX data shows

that unlike the NYMEX contract, participation in the Brent contract does not experience the same steady decline post-2010. While the magnitude of the peak in open interest changes from year to year, the ICE Brent contract still has between 3,000 and 7,000 open positions in five-year forward contracts outstanding at the end of each calendar year. This suggests that there may be some structural difference in the two physical oil markets that accounts for the different behavior we see in the two futures contract markets. The physical market for Brent oil is primarily driven by conventional oil field developments using more traditional oil rigs. Tight oil is a unique feature of the U.S. market, which suggests that the growth in tight oil production may have altered the way U.S. oil market participants use the WTI futures market.

Participation in the NYMEX WTI Market from a DCOT Perspective

Using data available to the Commission under Part 17 of the Commodity Exchange Act, DMO staff examined the behavior of market participants in the four trader classifications from the CFTC's Disaggregated Commitments of Traders (DCOT) report to identify trends in how the different trader types were using the contract.

Exhibit 6: Net Participation Position in Five-Year Forward NYMEX WTI Futures

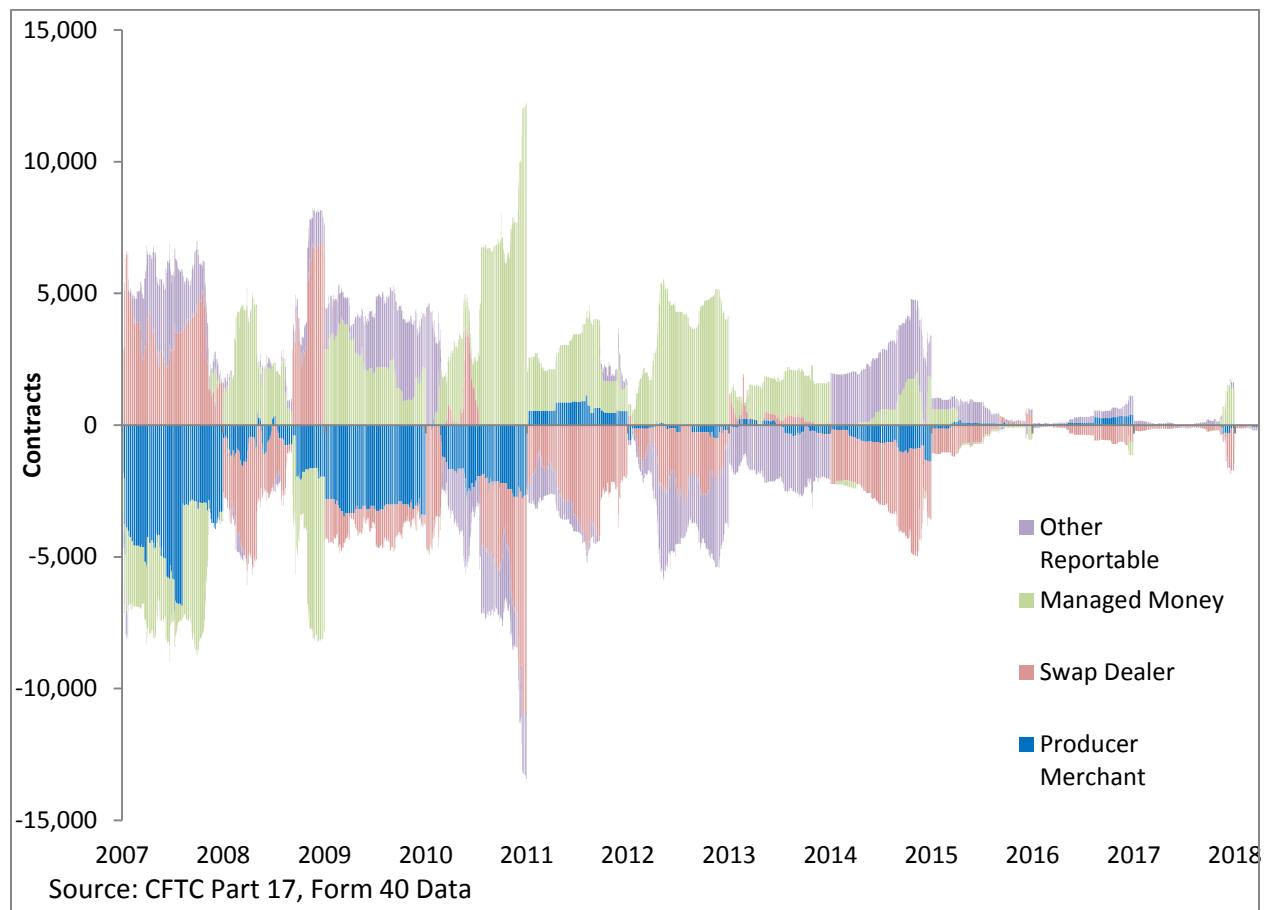


Exhibit 6 shows the daily net position in NYMEX WTI contracts with expirations five years from that day's date: Producer/Merchant/Processor/Users ("Producers") are represented by the blue area, Swap Dealers by the pink, Managed Money by the green, and Other Reportable traders by the purple. A positive net position indicates the group as a whole is net long WTI five years forward, while a negative net position indicates the group as a whole is net short WTI five years forward. While all four categories of traders are represented in the graph, the net positions of Producers were particularly noteworthy. The net exposure of that group was quite robust until 2011, after which the category largely stepped away from the market. Participation by the other three categories did not drop off until 2015 and, with the collapse of oil prices in late

2014/early 2015, overall market participation has been minimal. Any recent upticks in overall activity in the contract have been associated with the return of Producers to the market.

The non-Producer categories wound down their exposure to five-year forward WTI contracts during 2015, the first year that Producers stepped away from the market. While WTI prices saw an uptick in early 2016, Swap Dealers, Managed Money, and Other Reportable traders did not immediately rush back into the market.

In 2017, Producers again started establishing positions in the five-year term, although at levels significantly below historical norms. Contemporaneously, traders in other categories also entered the market. The CFTC will continue to monitor this development to see if present market behavior returns to historical norms.

This analysis strongly suggests that trading by Producers is a significant factor in determining overall market trading (and hence open interest) five years or more in the future.

Market Commentary from Producers

Having observed the behavior of traders in the Producer category, DMO staff reached out to several commercial participants in the crude oil space. These participants included firms involved exclusively in exploration and production of crude, marketing, and, in some cases, fully-integrated oil firms. The recurring theme from all participants was that the growth of tight oil fields in the producers' portfolio of production assets had dramatically altered their business models, which reduced their need to hedge physical market crude activity beyond three years into the future. They noted that for each individual tight oil well drilled, most of the oil was extracted within the first 18 to 24 months. Conventional oil wells, by comparison, produce oil over a much longer timeframe. Thus, as the percentage of oil-producing assets that come from tight oil fields increases, the less oil these firms have to sell three plus years from today. Without sufficient quantities of oil to sell, they do not need to use futures contracts that far down the curve.

Additionally, the participants whose business involved oil production stressed that they have greater operational flexibility with tight oil production than they do with conventional production: with tight oil wells they have the ability to turn production on and off in response to market prices, whereas with conventional developments they were essentially stuck with a constant stream of oil that had to be sold at market prices. Because of this lack of production flexibility, conventional production had to be hedged further out.

Firms involved in sourcing barrels of crude for clients told DMO staff that this degree of flexibility has introduced a degree of uncertainty into their ability to carry out sourcing agreements beyond three years. Merchants and marketers may have clients who may be interested in buying crude oil three plus years into the future, but the source oil is not necessarily available, making it riskier to enter into longer-dated contracts.

Market Commentary from Swap Dealers

Swap dealers told DMO staff that their reduced activity was due to a mix of client needs and changes in the regulatory landscape. Some swap dealers noted that they had fewer clients looking for exposure in the back end of the curve and, when a client did approach the dealer looking for such exposure, increased capital requirements had made the cost of trading long-term oil “a lot more expensive.” Even if the swap dealer has a favorable credit arrangement with their counterparty or client and the market risk of the trade is manageable from the firm’s perspective, the costs associated with holding and managing that position have caused some clients to balk at the cost of establishing a position further down the curve. Finally, some swap dealers mentioned that the short-term production cycles of shale and the lack of speculative interest in long-term WTI contracts has, in their mind, created some uncertainty about the long-term WTI price structure, which in turn has made pricing deals for clients more complicated.

Some swap dealers referred to a lack of activity at the back of the WTI futures curve. They pointed out that while the WTI futures market has a natural short over the long term, the firms who have physical oil to sell, no natural long exists; the long side of the back end of the WTI futures curve was built by entities taking a temporary position in the market, holding the long side of the position until someone who needed to purchase the oil came along. Some of this, in the opinions of market participants, was due to two things: a reluctance of market participants to engage in speculative trading on long-term contracts due to the price collapse in 2014/15, and restrictions on speculative trading put in place in the wake of the 2008 financial crisis. With the increase in U.S. crude oil production from tight oil fields and the rapid advances in extraction techniques, the idea that the peak levels of oil production has been reached is no longer as widely held as it once was, thus limiting the number of market participants who might be willing to purchase long-term crude futures in the hopes they will appreciate in value. While non-financial entities who are willing to take a speculative interest in crude markets remain free to do so, changes in financial regulations have been made to severely limit, if not outright prohibit, proprietary trading by financial institutions, which accounted for some of the liquidity on the back end of the oil futures curve prior to the shale boom.

Conclusions and Takeaways

As stated earlier in the report, this research set out to examine whether the rapid development of U.S. crude production from tight oil formations had any impact on the NYMEX WTI contract. DMO staff found a significant reduction in the usage of futures contracts for delivery five or more years in the future in the wake of the “shale boom,” primarily due to changes in the underlying physical market. The increasing amount of crude production from tight oil in the portfolios of oil-producing firms has left them with less oil to sell five or more years forward, reducing their need for long-dated futures contracts. DMO staff continues to monitor developments in tight oil production, both in the U.S. and around the globe, to keep abreast of how changes in the underlying physical market for crude oil might affect futures contracts under the CFTC’s jurisdiction.

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