

Negative WTI Crude Futures Prices Event Study

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1 Abstract

WTI Crude Oil futures and spot prices went below zero for the first time in history on Monday, April 20. Since the sweet crude dived below zero to explore a previously unknown territory, many articles have attempted to explain the possible reasons behind this phenomenon. In this short article we are going to summarize some of the most relevant reports and provide our own analysis.

2 Oil Markets Review Economic Background

The oil markets have been experiencing market turbulence for some time now. This market volatility is mostly a consequence of Covid-19, as the virus has had a severe impact on the world's economy. However, the oil markets also suffered from a disagreement within OPEC+ nations regarding production numbers, leading to increased production both in Russia and Saudi Arabia. The combination of these two factors have had a serious impact on the price of oil since the beginning of March.

Last week, following a devastating, weeks-long price war, Russia and Saudi Arabia agreed to cut crude production by 9.7 million barrels per day, to combat the demand shock caused by the coronavirus pandemic. However even with the proposed production cut, supply continued to substantially exceed demand.¹

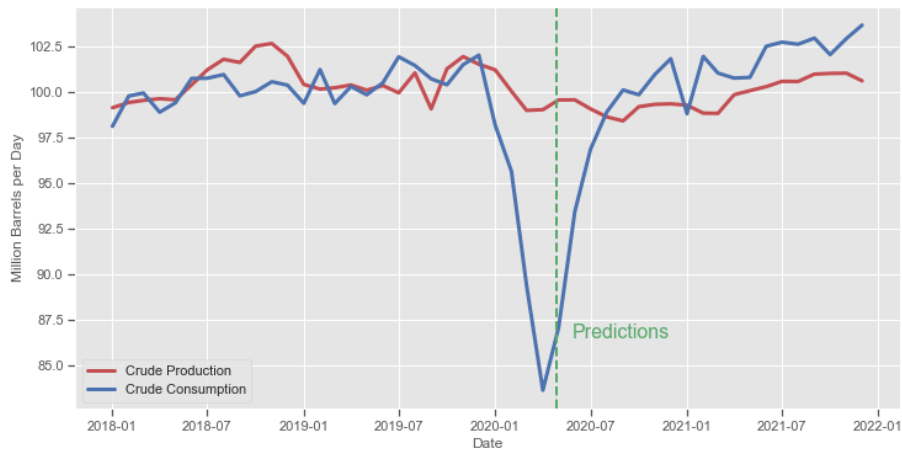


Figure 1: Global Crude Production and Consumption

¹Here's What Negative Oil Prices Really Mean

According to The International Energy Agency “There is no feasible agreement that could cut supply by enough to offset such near-term demand losses.”² Per the agency’s prediction, global oil production numbers will only marginally decrease while consumption rates are approximately fifteen percent lower than at the beginning of the year, as illustrated on Figure 1.

The number of drilling rigs in the United States and Canada have decreased from 1000 to less than 700 since early March, but some of these wells might stay closed even after the coronavirus is long gone. It is important to note that shutting down oil wells is not free and these wells can’t be easily turned on or off depending on the market conditions. If a smaller well with low pressure is shut off, it might not be possible to reopen it at all, and even for bigger wells there are tremendous closing costs to shut off the well. So even with low oil prices, some producers prefer to keep pumping crude in hopes of rising oil prices in the future.³

As demand falls and supply stays steady with only a slight decrease in production, relative to the diminishing demand, oil storage facilities around the globe, and in the United States, are filling up. One of the most often referenced storage facilities in the US is Cushing, OK. Cushing is the physical delivery location for many oil futures contracts including the one that went negative on Monday. Since futures settle at Cushing, the inventory levels at this location are a good indicator of supply and demand dynamic in the oil markets.

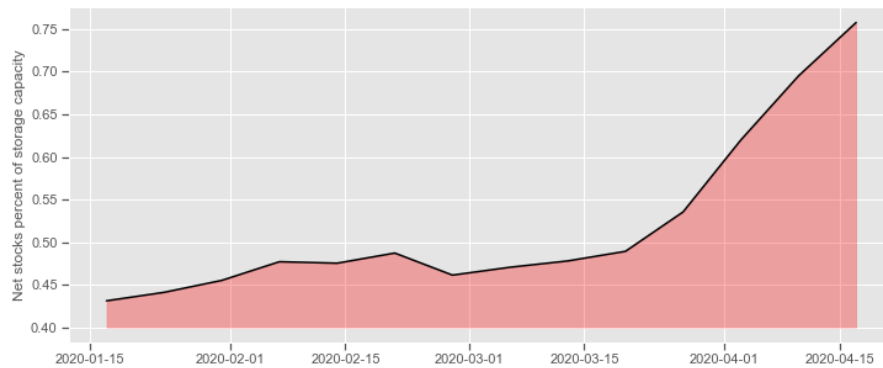


Figure 2: Cushing, OK Crude Stock as % of Capacity

As illustrated on Figure 2 there has been an ongoing stock build at Cushing, which now operates over 75% capacity. This large increase in inventory, in addition to the expected excess oil in the near future, is a bearish signal sending both spot and near future prices to the lowest they have ever been.

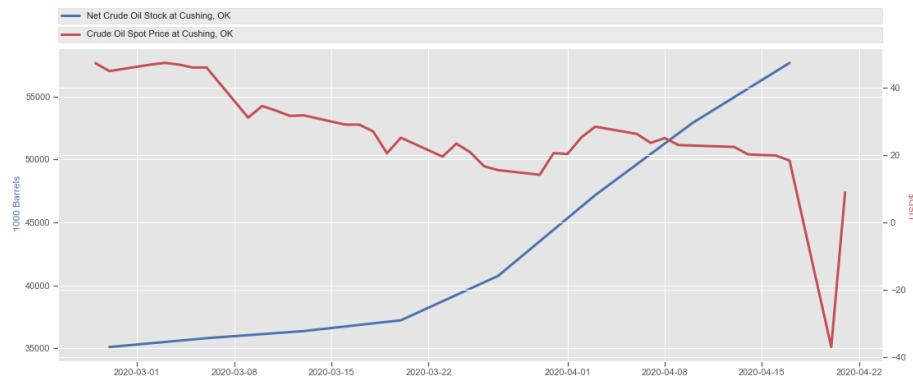


Figure 3: Cushing, OK Crude Stock & Spot Crude Price

²<https://www.iea.org/reports/oil-market-report-april-2020>

³<https://www.wsj.com/articles/we-pulled-the-plug-as-oil-prices-plunge-drillers-in-the-gulf-shut-off-wells-11587558182?ns=prod/accounts-wsj>

On Monday April 20th, the spot price of oil has reached negative 37.63 USD at Cushing, OK as seen on Figure 4. Simultaneously, the leading WTI 2020 May future sunk to negative 40.32USD at the low of the day.

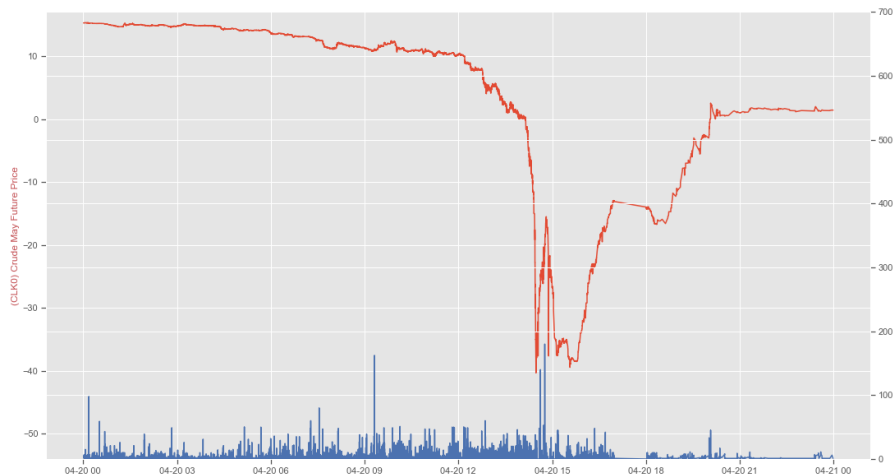


Figure 4: April 20 2020 CLK0 Price and Volume

3 CLK20 WTI Crude Oil Future

The future in question is the NYMEX WTI Light Sweet Crude Oil Future May 2020 (CLK20). This future family is the most liquid oil derivative traded according to the CME. Each contract is for 1000 barrel of oil, with physical settlement at Cushing, Oklahoma. This contract requires the short side to sell 1000 barrels of Crude Oil for the futures price at Cushing. On the other hand, it also requires the long side to take delivery of the oil for the predetermined price at Cushing. Delivery rules are further specified in the CME rule book, but in short delivery should take place on any calendar day of the delivery month, and not taking delivery is a breach of contract which carries serious legal consequences.^{4,5}

4 So Why Did Prices Go Negative?

Since the CL contracts are the most liquid oil instruments to trade, they attract large number of speculative investors as well as hedgers who don't have the infrastructure to store or transport oil. Both of these groups take positions in the oil futures market with the intension of closing out before expiry since neither of them is equipped to trade the actual commodity.

CLK20 was set to expire on Tuesday April 21, so speculators had to unwind their positions on Monday April 20 to avoid physical delivery. To illustrate the value associated with physical delivery, below on Figure 5 we plotted a time series of the prices of the CLK20 WTI Crude future and Brent Crude (COM0) future which has an option to be settled in cash and avoid physical delivery, and on Figure 6 we show the spread between the two-price series.

⁴https://www.cmegroup.com/trading/energy/crude-oil/light-sweet-crude_contractSpecs_futures.html

⁵<https://www.cmegroup.com/content/dam/cmegroup/rulebook/NYMEX/2/200.pdf>

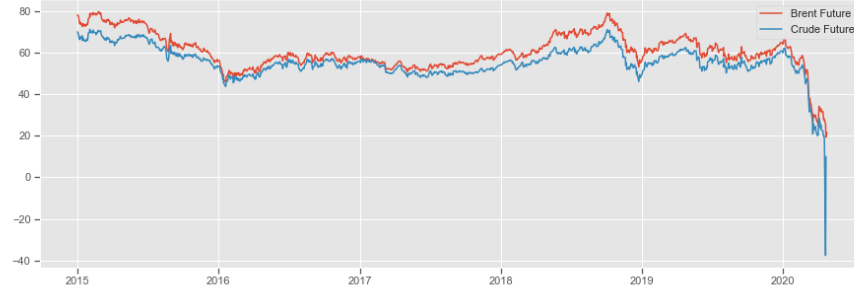


Figure 5: Brent and Crude Futures Contract Prices

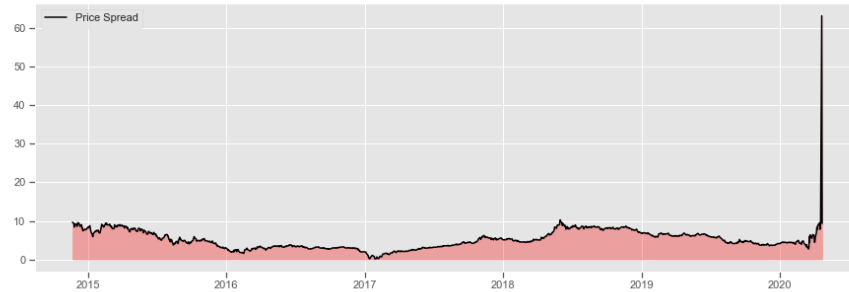


Figure 6: Spread Between Brent and Crude Futures

As we can observe on both graphs, the two contracts have been trading within close proximity of one another until this last Monday (April 20, 2020), when the price difference reached 63 USD. So, it is clear that the convenience cost for not having to take delivery was priced high by the market. It is important to note that while going to pure cash-settlement contracts may relieve potential extreme price distortion from delivery, it can cause problems for the hedgers who actually need the physical commodity at a specific location and time. Furthermore, the settlement price on cash contracts is a judgment with no guarantee either the buyer or the seller of the futures can actually trade the physical commodity at the futures price. However, since COM0 Brent contract has both physical and cash settlement options, the spread between the CLK20 and COM0 contracts is a reliable indicator that traders were willing to pay a lot to avoid the obligation of taking physical delivery.

Nonetheless, speculators exiting the market is certainly not an uncommon market event, and their exit on its own can't be the reason to sending WTI prices below 0. They are only one side of the coin, as these speculators try to unwind their positions to avoid delivery, they created large liquidity on the ask side of the tape pushing the price down. Under normal market conditions, at some discount the natural users of oil would buy these contracts from the speculators providing liquidity on the buy side of the tape. Since the hedgers have the infrastructure to handle and store the commodity, if the spot, near and further dated futures prices are not in equilibrium, they can buy the oil (at spot or leading future prices) and sell it at a later date via a further dated futures contract. Therefore, under normal market conditions this arbitrage opportunity would allow speculators to liquidate their positions at some discount. However, as storage facilities are already operating near capacity the cash and carry trade is more costly to implement and liquidity is impaired.

Given this impaired liquidity, speculators are forced to sell oil at negative prices, essentially paying someone for taking the oil off their hand. We can interpret this as the asset (oil delivered in May) became a liability. This paradox of negative price can occur because there is no free disposal of the asset. Much like toxic waste or even garbage, we have to pay to have someone take these materials away. Similarly, the speculators cannot just dump the crude in a lake, ocean so they rather pay 40 dollars per barrel to someone just to take the oil off their hands.

5 References

Referenced Articles

1. "Here's What Negative Oil Prices Really Mean" Forbes, April 21, 2020, Sarah Hansen
2. IEA Oil Market Report April 2020
<https://www.iea.org/reports/oil-market-report-april-2020>
3. "As Oil Prices Plunge, Drillers in the Gulf of Mexico Shut Off Wells" The Wall Street Journal, April 22 2020, Collin Eaton
<https://www.wsj.com/articles/we-pulled-the-plug-as-oil-prices-plunge-drillers-in-the-gulf-shut-off-wells-prod/accounts-wsj>
4. CME Crude Oil Futures Contract Specs
https://www.cmegroup.com/trading/energy/crude-oil/light-sweet-crude_contractSpecs_futures.html
5. NYMEX Rulebook Chapter 200 Light Sweet Crude Oil Futures
<https://www.cmegroup.com/content/dam/cmegroup/rulebook/NYMEX/2/200.pdf>

Graph Data Sources

1. EIA "Short-Term Energy Outlook" April 7, 2020
https://www.eia.gov/outlooks/steo/report/global_oil.php
2. EIA "Petroleum Other Liquids" https://www.eia.gov/dnav/pet/pet_stoc_wstk_dcu_nus_w.htm
3. EIA "Petroleum Other Liquids"
4. CLK0 Price Data
5. CLK0 and COM0 Price Data
6. CLK0 and COM0 Price Data