
Crude Curves Navigate Tumultuous Year

Contango, backwardation and a 'black swan'.

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Sandy Fielden
Director, Oil and Products Research
+1 512 431-8044
sandy.fielden@morningstar.com

Data Sources for This Publication

EIA
CME Group

Fateful Day

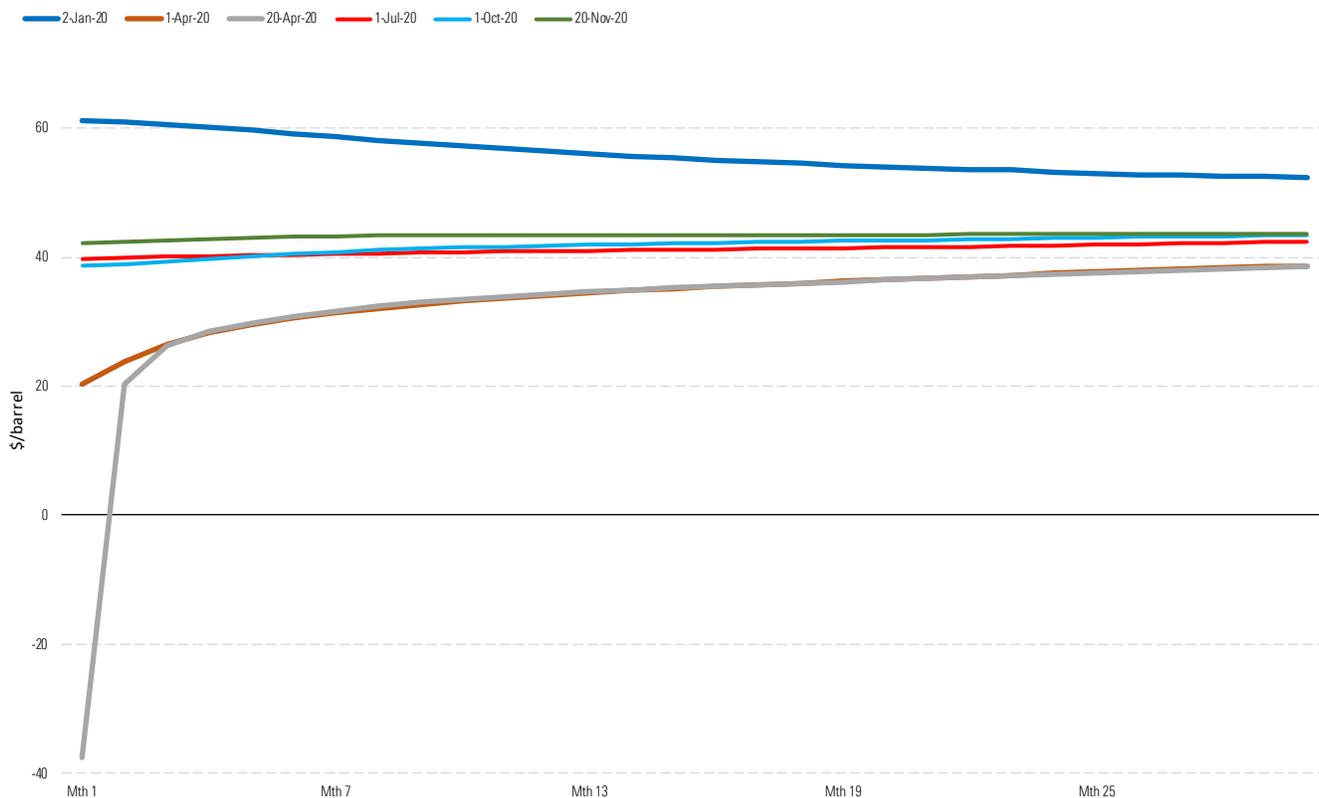
This analysis looks at how futures curves for CME Nymex West Texas Intermediate for Cushing delivery, the domestic benchmark, and Brent ICE London futures premiums to West Texas Intermediate, or WTI, evolved during this tumultuous year for the crude oil market. We chose curves on six days. Four days are the first business days respectively for the first-, second-, third- and fourth quarter. The fifth day is the fateful day when prompt delivery WTI futures settled at a negative price—April 20 and the last is from Friday, Nov. 20.

Our analysis uses end-of-day values extracted through Morningstar's Excel Add-In curve feature. We chose market close, rather than intraday values. Comparing curves traded on different exchanges and geographic locations introduces timing differences, such as when the market closes as well as different expiration dates for contracts. In this analysis we didn't adjust timing or dates to align expiration dates or market time-of-day closes, although Morningstar provides tools to do that if you wish.

We start with WTI Cushing curves and then look at Brent premiums to WTI.

New Year

The six WTI Cushing curves shown in Exhibit 1 are plotted against the same 30-month x-axis to facilitate comparison between relative delivery periods. The 30-month or 2.5-year period represents about 99% of daily trade volume and 95% of open interest for WTI even though the CME currently lists contracts out to the end of the decade (December 2030). On the first trading day of 2020 (Jan. 2, dark blue line) prompt WTI prices closed at \$61.18/barrel, near their high for the year so far, that occurred four days later on Jan. 6, at \$63.27/barrel. The Jan. 2 curve was backwardated over the 30-month period, meaning prices today are higher than in the future. In this case, prices for July 2022 delivery traded \$8.80/barrel lower than February 2020, reflecting tighter supply expectations for prompt deliveries following the December 2019 OPEC+ agreement to slightly increase production cuts. Fears of a future supply glut from record-breaking United States shale output and new production from countries like Norway, weighed on the back of the curve.

Exhibit 1 CME Nymex WTI Cushing Forward Curves 2020

Source: CME Group, Morningstar.

Second Quarter

After a quarter when the world woke up to the need to treat COVID-19 seriously, the second WTI curve on April 1 (orange line, Exhibit 1) had the opposite shape to the New Year market. By this time COVID-19 infections in the U.S. were rising and lockdowns to prevent the disease's spread had begun in earnest. The resulting travel freeze collapsed demand for transport fuels. In addition, a spat between OPEC+ leaders Russia and Saudi Arabia in late February led both countries to turn their back on restraint and open the taps, causing a glut of available crude. The April 1 front month printed \$20.31/barrel for May 2020 deliveries, less than one third of New Year levels, with the rest of the curve in a steep contango structure, \$18.40/barrel higher for October 2022 delivery at \$38.71/barrel. Contango is where prices today are lower than in the future. When that spread is wide enough it encourages traders to buy crude and store it at the same price as selling futures further out on the curve, to lock in a profit. The strategy is very profitable if you have finance to cover the trade and access to storage. This year the play was complicated by surplus crude production overwhelming available storage facilities as refineries slashed runs to balance the market.

Nosedive

On April 20 a lack of commercial storage at Cushing created an unprecedented market squeeze in the May delivery contract the day before it expired. The squeeze left a number of speculators with long May

contracts trying to sell or close out their futures positions to avoid taking physical delivery when no storage capacity was for sale. That day, the few owners of rights to Cushing storage that could buy out the stranded longs, held off until the price nosedived into negative territory below negative \$40/barrel, 20 minutes before the close. Prices recovered a little to settle at a historic negative \$37.63/barrel.

What turned out to be a momentous day on the CME had repercussions throughout the domestic crude market (see our April note [Crushing Cushing: Wider Impact of Negative Crude](#)). A number of naïve bystanders were also injured in the fray. Among them a Bank of China Index Fund that sold WTI futures to investors in the belief that rock-bottom crude prices could only go up. The fund invested in front month WTI futures and set up a mechanism to roll their positions the day before expiry, using trade-at-settle, or TAS, pricing, which locks the transaction at or near the closing price. This commonly used mechanism, which is supposed to avoid intraday volatility, left the investors on the hook to sell May contracts at negative \$37.63 and buy June at \$20.43/barrel for a net price of \$58.06/barrel on April 20. The result was a hefty margin call, leaving the fund's customers deep underwater until the bank subsequently agreed to absorb most of their losses.

Apart from the prompt two months, the forward curve that day (gray line, Exhibit 1) was not much different to the April 1 shape. The squeeze primarily affected prompt May delivery and weighed a little on June but left further-out delivery contracts unscathed. Nevertheless, that fateful negative May 2020 settlement price for April 20 is destined to haunt every historical chart axis and anchor one tail of every risk manager's distribution analysis for the foreseeable future.

Dull in Comparison

Compared with what came before, the remaining three WTI curves for July 1 (red line), October 1 (light blue line), and Nov. 20 (green line) are positively dull in comparison. Crude prices recovered from the April debacle to occupy a tight range of \$38-\$44/barrel between July 1 and Nov. 20 as consumer demand recovered most of the lost ground from coronavirus lockdowns except for air travel and other public transport. Today the curve remains in a slight contango of \$1.59/barrel as of Nov. 20. Prompt prices have picked up nearly \$3/barrel since October primarily as a result of positive news about vaccines that could end COVID-19 lockdowns. The flat curve shape today, compared with the first half of the year, indicates a wait-and-see mentality. We expect a bump in prices whenever wide-scale vaccinations begin.

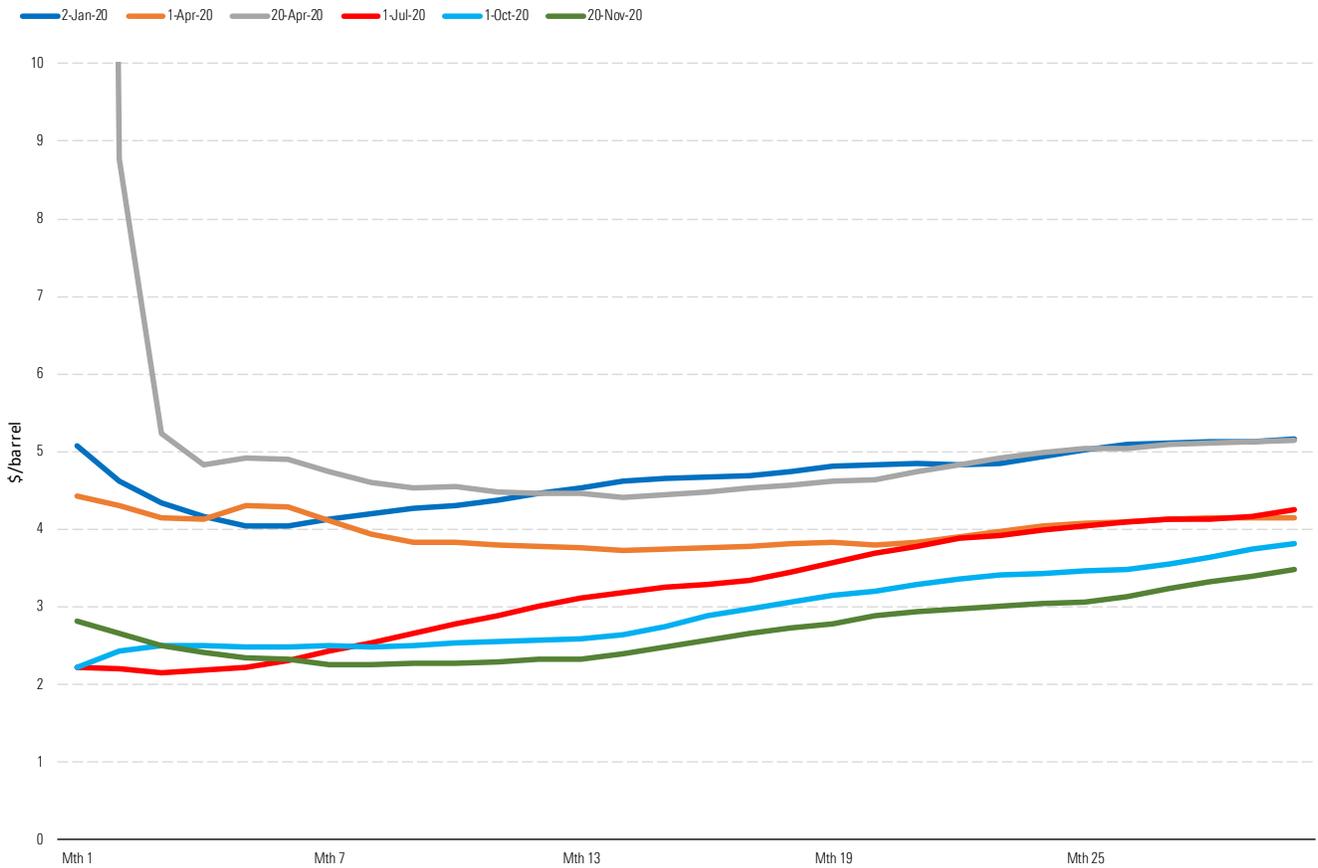
Brent Premium

The second set of curves we looked at for this analysis are ICE London Brent premiums to CME WTI at Cushing. These curves represent the financial market's perspective on the spread between U.S. and international crude values, despite Houston's growing importance for export pricing. Volume and open interest are growing in the CME Nymex Argus Trade Month WTI Houston contract, but it trades at a fraction of the volume and only at about 8% of the open interest that Cushing does.

Exhibit 2 shows Brent ICE premiums over WTI for the same 30-month horizon on the same curve dates that we used for our WTI analysis. As noted above, we didn't align the delivery months but stuck to the

simpler approach of comparing relative periods out into the future—first-month Brent with first-month WTI, second-month Brent with second-month WTI and so on.

Exhibit 2 ICE Brent Premium Over WTI Cushing Forward Curves 2020



Source: CME Group, Morningstar.

Although the two crudes are similar in quality, North Sea Brent has traded at a premium over WTI Cushing more or less continuously since August 2010. That’s when growth in domestic production reduced the need for U.S. refineries to import Brent, leaving WTI prices trading at a discount to the international market. This year prompt Brent did settle at \$0.16/barrel below WTI on May 29 in the aftermath of the Cushing meltdown, but it’s a rare phenomenon now that the U.S. is regularly exporting about 3 million barrels/day of crude that has to compete with Brent in overseas markets. On all of our six curve dates, Brent premiums to WTI were at least \$2/barrel.

As the year progressed, Brent premiums over WTI at the front of the curve almost halved from just over \$5/barrel on Jan. 2, to \$2.81/barrel on Nov. 20. That trend flew out of the window temporarily on April 20 when the Brent premium jumped to \$63.2/barrel due to the negative WTI settlement covered above (gray line, Exhibit 2). We cut off the axis scale at \$10/barrel in Exhibit 2 to avoid obscuring the detail on the other curves.

Cushing and Houston

A narrowing Brent premium at the front of the curve reflects two things. First, falling overall crude price levels during the year had the effect of shrinking differentials. Second, the value of WTI crude in Houston narrowed relative to Cushing, while staying level with Brent, and that caused the Brent premium to WTI Cushing to narrow.

This collapse in the spread between WTI at Houston and Cushing had two distinct phases. The first came after the pandemic caused lockdowns in March, destroying demand and leading to falling prices and a surplus of crude needing storage. In that environment Cushing was a more attractive destination as the country's largest storage hub, compared with sending crude to Houston for refining or export. Houston WTI prices that typically trade above Cushing, based on transport costs and export demand, instead traded at a discount during April. Where prompt month Houston WTI priced at a \$3.11/barrel premium to Cushing on Jan. 2, it traded at a \$3.65/barrel discount to Cushing on April 1, discouraging traders from shipping crude to the Gulf Coast. The lack of Houston refinery demand and a bleak export market left Brent trading \$8/barrel above WTI Houston in early April. In the absence of export demand, Gulf Coast traders launched tankers filled with crude into floating storage that could profit from the market contango by delivering to refiners later in the year.

The second phase of the narrowing Houston/Cushing WTI spread came after the April 20 Cushing meltdown. The advent of negative prices during that crisis, forced producers to rapidly shut wells to avoid the potential horror of having to pay shippers to take their crude. The resulting drop in production reduced pipeline flows to Houston from Cushing and the Permian Basin in West Texas. Lower flows as well as the opening of new pipeline capacity out of the Permian at the end of 2019 left shippers discounting tariffs for half-empty pipelines. Lower pipeline tariffs narrowed the Cushing/Houston spread to around \$0.70/barrel by October and November. A narrower Cushing/Houston spread allowed for a tighter Brent premium to WTI Cushing that traded in a range between \$2.20 and \$2.81/barrel between July and November. That Brent premium remained wide enough to encourage exports to Europe and Asia that have proven resilient this year in the face of demand destruction (see our October note [Resilient U.S. Crude Market Rebalances](#)).

Recovery

Looking at the back of the Brent premium curves, they all point to higher values the further out you look. That reflects market expectations Brent premiums will recover and increase over the period through 2023 as demand recovers worldwide. A wider Brent premium will encourage export growth at that time, with the proviso that falling domestic production may constrain available supplies in the interim. Historically, U.S. crude export growth since 2017 has been highly correlated to the Brent/WTI premium as well as OPEC+ production restraint. We caution that any breakdown in OPEC+ discipline will weigh on prices and translate into pressure on U.S. producers to reduce drilling.

Forward curves give analysts a lot to chew on during normal conditions. This year is anything but normal and has seen rapid changes from contango to backwardation as well as a "black swan" event on April 20. Although the traditional Brent/WTI Cushing relationship remains paramount in terms of market

depth and transparency, the influence of Houston and Gulf Coast exports is apparent and growing. While volatility at the front of the WTI curve on April 20 has been widely documented, the \$40/barrel range of prices seen outside that one event reflects a rapid adjustment to unprecedented circumstances. With a new Joe Biden administration touting a green agenda, we doubt crude curves have seen the last of rough seas. ■■

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For More Information

+1 800 546-9646 North America

+44 20 3194 1455 Europe

commoditydata-sales@morningstar.com



22 West Washington Street
Chicago, IL 60602 USA

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