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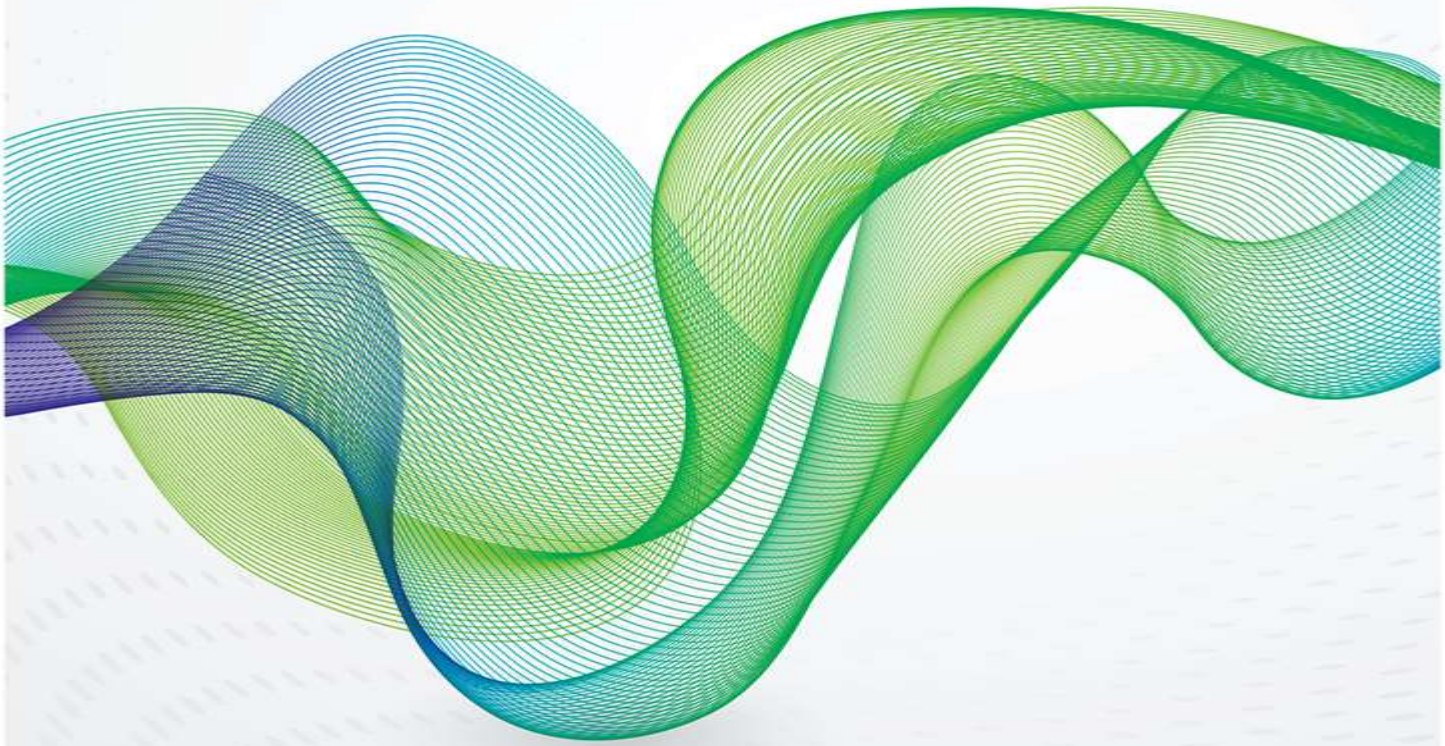
Shocks and Differentials: How are oil markets coping?



OXFORD ENERGY COMMENT

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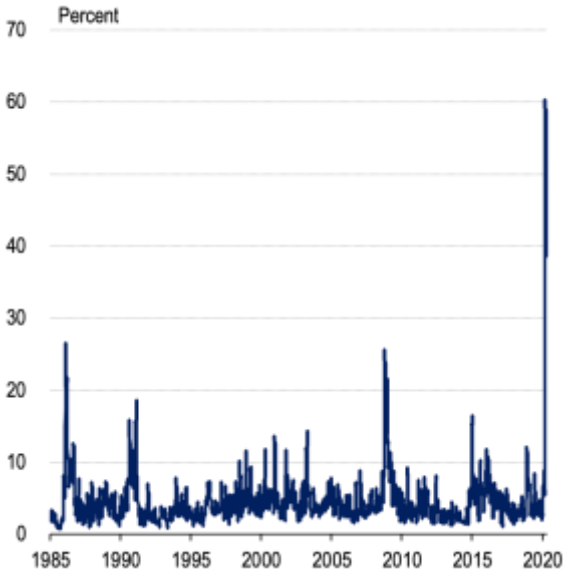
A combination of unprecedented demand and supply shocks are testing the oil market and its physical infrastructure to the limits. While the sharp fall in the futures price of benchmarks such as Brent and WTI over the last few weeks reflects the severity of the crisis, the recent movements in price levels and their volatility capture only part of the picture and do not fully reveal the extent of the large imbalances building in the system. To capture these imbalances, it is important to look at the evolution of some of the key differentials and spreads; as in the extreme market conditions that we are currently witnessing, it is the differentials which do most of the adjustment to reflect the underlying changes in the physical market and the shift in trade flows. Although price levels have exhibited extreme movement and high volatility in recent weeks (see Figure 1 and Figure 2), movements in price differentials and spreads have been even more acute, breaking most records set in previous cycles. In fact, one could argue that currently there is a disconnect between the futures prices and the physical differentials which is pointing towards a more distressed market.

Figure 1: NYMEX WTI

Source: EIA, OIES.

Figure 2: Implied volatility (Jan 85 – Apr 20)



Source: OIES.

One such differential is the time spreads. In a matter of days, the market shifted from backwardation to deep contango (Figure 3) with time spreads reaching levels unseen since the height of the 2008 global financial crisis. Even assuming no change in supply dynamics, the massive contraction in demand would have given rise to the need to store the additional crude arriving into the market. With the dissolution of the OPEC^{+} meeting and producers maximizing their exports, the pressure for storage only intensified. In effect, by increasing production in the face of demand contraction, producers are shifting stocks from underground to overground and the time structure has to adjust to give traders the incentive to store the excess crude overground. As storage becomes more expensive, and traders start resorting to floating storage, the contango has to deepen to reflect the increase in the storage cost. Given the massive current imbalance, there are serious concerns that the world may be running out of storage which will continue to put severe pressure on front prices, deepening the contango, in turn giving the incentive for the contango players to store crude and sell it forward through futures contracts. This will eventually cause the entire curve to continue to shift downward as seen in Figure 4.

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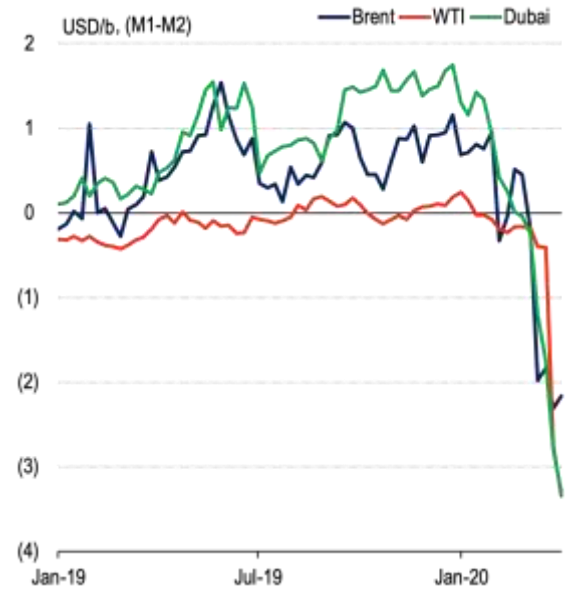
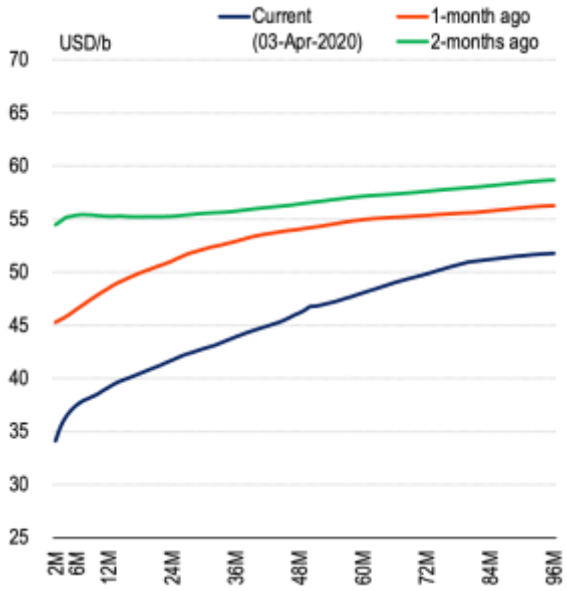
Figure 3: Time spreads



Source: Argus, OIES.

Figure 4: Forward curves



Source: ICE, OIES.

Normally, this shift happens in several stages: The immediate impact of a sharp fall in demand is first seen in the prompt physical markets.[1] As oil demand is derived from petroleum products, weaker product demand squeezes refinery margins. Depending on the quality, crude differentials are first to take a hit from the fall in demand. This can be seen in Figure 5 which shows the evolution of grade differentials in the last few weeks. All of these grades moved into negative territory in a very short period of time.[2] For instance, CPC Blend is naphtha and jet rich oil and given these two products have been particularly hard hit by government measures to stop the Covid-19 pandemic ('lockdown', quarantines and travel bans), its value has fallen sharply.[3] The grade differential collapsed by over $8/b in just one month, and at one stage, this high quality crude oil approached the absolute price of $10/b.[4]

Prompt or physical BFOET[5] ('Brent') is not immune to the demand fall and Figure 6 below illustrates the even more drastic fall in Dated values compared to Brent 'cash' cargoes.[6] Dated Brent derivatives are traded forward (usually through OTC brokers) on a weekly basis (Figure 4 reports CFD values for the weeks 6-4 April, 14-17 April and so on until 11-15 May). Since the beginning of March, those values have fallen about tenfold: for example, the week 27 April–1 May (in yellow) fell from - $0.67/b on 2 March to -$7.26/b on 3 April, 2020. This is a very significant move, adding to the pain of the seller, on top of the fall in the quality differential. In other words, in one month, between early March and early April, the value of a CPC Blend cargo, pricing over the last week of April (27 Apr–1 May) would have fallen due to the change in the quality premium (from Dated-2.10 to Dated-10.00) and the change in Dated itself (which fell by $6.59 as per above) to give a total loss of value to the upstream producer of $14.49/b, before any fall in the futures price.

[1] See B. Fattouh and A. Imsirovic (2019), 'Contracts for Difference and the Evolution of the Brent Complex' OIES, June 2019. Access: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/06/Contracts-for-Difference-and-the-Evolution-of-the-Brent-Complex.pdf

[2] In previous months, CPC Blend was trading close to Dated Brent.

[3] Reuters News, ASIAN JET FUEL REFINING MARGINS JET (SGCKMc1) DROP TO A RECORD LOW OF MINUS $3.35/BBL TO DUBAI CRUDE - REFINITIV - April 3, 2020

[4] ICE Brent minus Dated discount minus quality discount. At the time of finishing this paper, the quality differential has fallen further to Brent Dated minus $10.00 (Source: Argus).

[5] BFOET or 'Brent basket' gets the name from grades comprising it for assessment purposes: Brent, Forties, Oseberg, Ekofisk and Troll.

[6] These are Brent cargoes traded forward for loading, without loading dates (only loading month).

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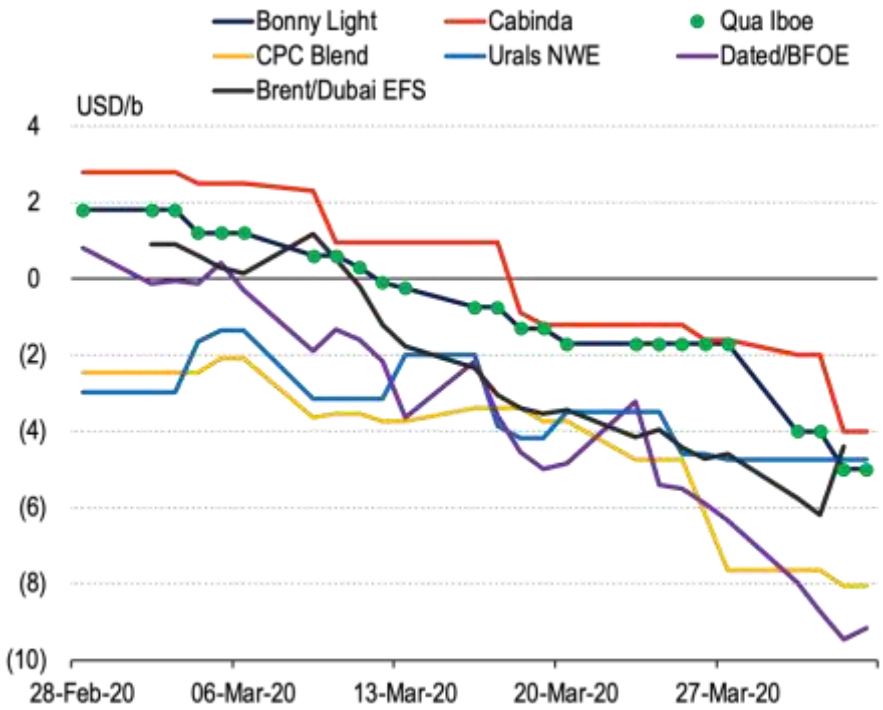
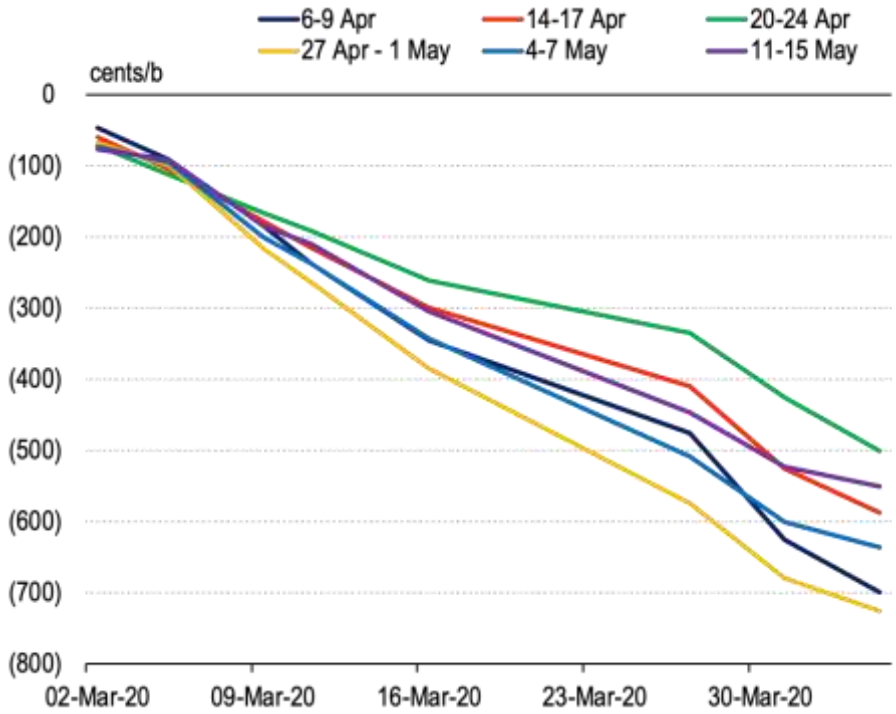
Figure 5: Oil grade differentials



Source: Argus, OIES.

Figure 6: Collapse of the CFD curve



Source: Authors' estimations using various broker data.

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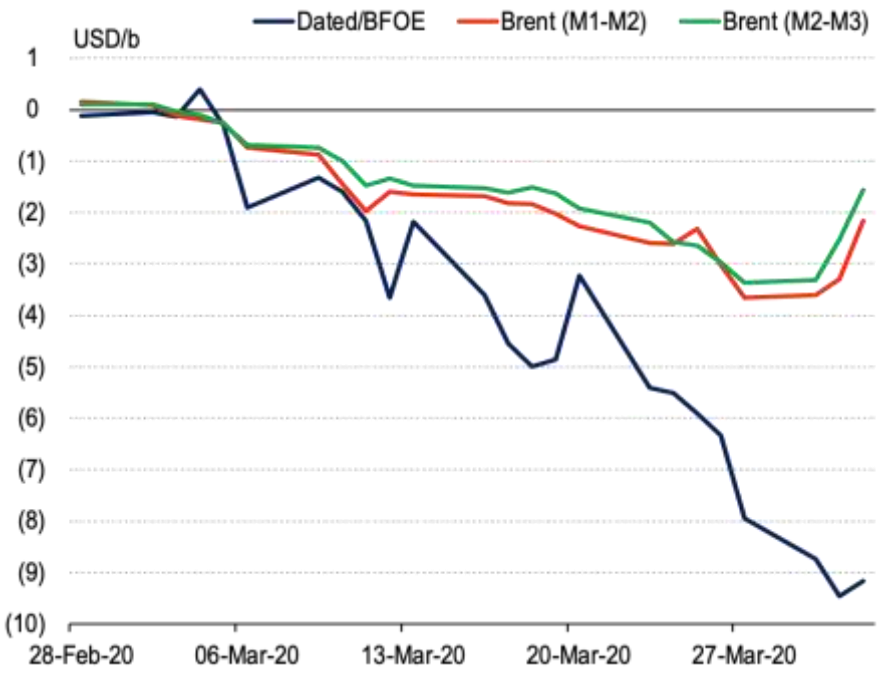
As the value of physical or Dated Brent falls, so does the value of 'cash' or forward Brent (and therefore futures Brent, linked with forward Brent through the EFP). Figure 7 shows how the Brent spreads fell over the course of March 2020, following the collapse of the price of Dated Brent.[7] Seeing a flood of physical crude in the market, traders can anticipate this relationship and sell time spreads in very liquid futures markets even before the physical cargoes depreciate in value.

Figure 7: Brent price structure



Source: Argus, OIES.

The collapse in differentials is not only confined to the Brent benchmark. Dubai benchmark is subject to the same forces. Figure 8 below depicts values of physical Dubai (normally seen as equivalent to the M1-M3 Dubai spread), Oman ESPO blend and the Brent-Dubai EFS which normally trades in positive numbers of $2-$4 while, in this crisis, has turned negative. Asian grades of oil, pricing off Dubai, usually use average of the month of loading pricing. This will make Dubai-related crudes such as those exported from the Middle East to Asia, including Saudi grades, relatively more expensive than Brent and WTI-related crude.[8] In a direct clash for market share, in the key Asian market, the shift to contango and EFS turning negative will make Dubai-related Saudi grades less competitive than imported Russian (Urals) and US (Mars) oil in Asia[9]. In fact, Russian Urals are already finding a home in China where demand is showing signs of a slight recovery.[10] This will force Middle Eastern sellers to Asia to compensate by aggressively dropping the official selling prices (OSPs).

[7] Reuters, 'UPDATE 1-Benchmark Brent's record $10 discount gives oil market reality check', Reuters News April 2, 2020
[8] Dubai swap is assessed based on two months forward cash Dubai. For example, during the month of April, relevant trades are for the June loading crude in the Dubai basket. So, Dubai swap will reflect oil loading two months forward which, in contango is more expensive than Dated Brent which reflect prompt oil. Also, this can explain the unusual reversal in the Brent-Dubai EFS value: It is normally traded in positive numbers of $2-$4 while, in this crisis, it has turned negative.
[9] For instance, PLATTS reports that '… Russia remained the top supplier to China's independent refineries, with 2.4 million mt of crude arriving in March, up 47.5% on the month... The imports of Urals crudes from Russia saw a big jump of 95.7% on the month in March, to 994,000 mt... ZPC, Hongrun, Hebei Xinhai Petrochemical each took one cargo of about 280,000 mt of Urals, while ChemChina took half of a VLCC last month...'
[10] As Russian Urals volumes are getting squeezed out of Europe as result of contraction in demand and higher availability of supplies from Gulf exporters, the discounts on Urals have deepened and the relative price of Brent (on the basis of which Urals is priced) to Dubai (the basis of which crude exports from the Gulf to Asia are priced) has turned negative making Urals more attractive for China's refineries. But as US refineries cut runs and competitively priced US sour crudes such as Mars start heading to China, the discounts on Urals may have to deepen further for it remain competitive.

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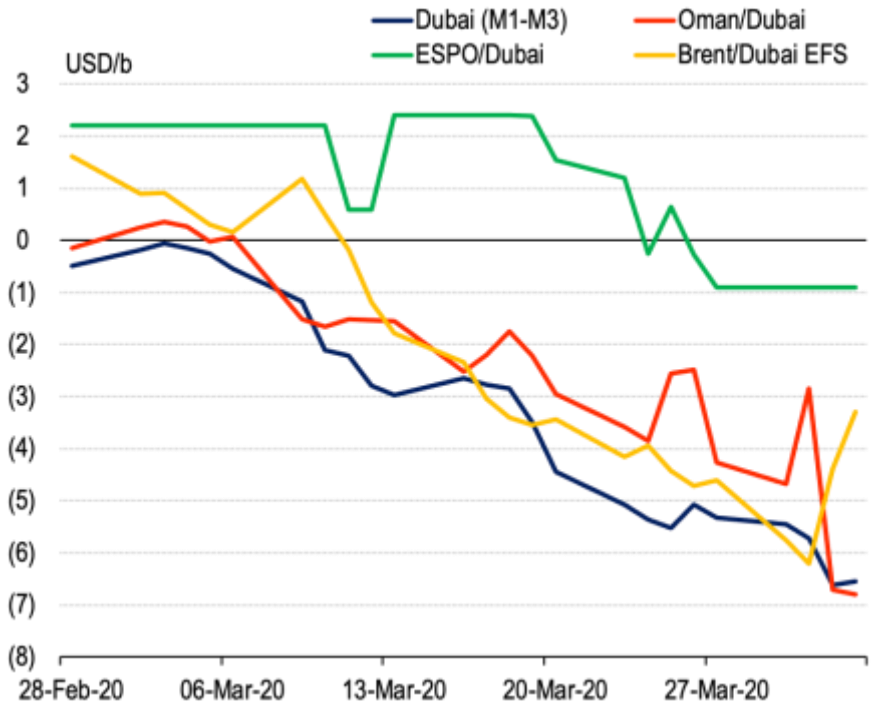
Figure 8: Dubai, Oman, EFS and ESPO values



Source: Argus, OIES.

Another interesting feature of the Dubai benchmark in this crisis is that Murban has frequently been setting the price for Dubai. Murban is high quality light sour crude, and until recently it traded at a minimum of a couple of dollars above Dubai due to its high naphtha content. In fact, when Murban was first introduced into the Dubai basket in 2016, it was seen as a safety valve that would be used only in case of a severe squeeze on the benchmark. But as gasoline and jet have become the main casualties of the demand collapse, naphtha has been so weak as to make Murban even less valuable than the Qatari heavy and high sulphur Al Shaheen, thus setting the price of the Dubai benchmark.

These dynamics are having spillover effects on other markets. The increase in exports and the resort to floating storage have resulted in a sharp increase in tanker rates. Figure 9 below illustrates an inverse relationship between the freight rates and the 'contango' price structure. As the prompt physical oil becomes cheaper and difficult to find a buyer for, the contango widens. The extent of this contango depends on the cost of storage. Once the cheaper shore tanks (ideally in delivered location) are filled, more expensive storage may be considered. Such storage tanks are in locations that may require 'double freight' (such as Saldana bay in South Africa) and hence a higher cost. More expensive yet is to use ships to store crude oil. To make it work, the contango has to be sufficiently wide to pay for the daily rate of a ship (usually a very large crude carrier or VLCC). However, as demand for such shipping increases so does the rate at which ships are chartered. This puts a further pressure on the unsold physical barrels and widens the contango. Hence the negative relationship between contango and freight rates. At the time of writing, the daily rate for a VLCC used for storage (no steaming) is about $210,000 per day. This is over $0.10/b per day and over $3/b per month. It is no coincidence that spreads (see Figure 5) normally find, at least temporarily, support around that level.

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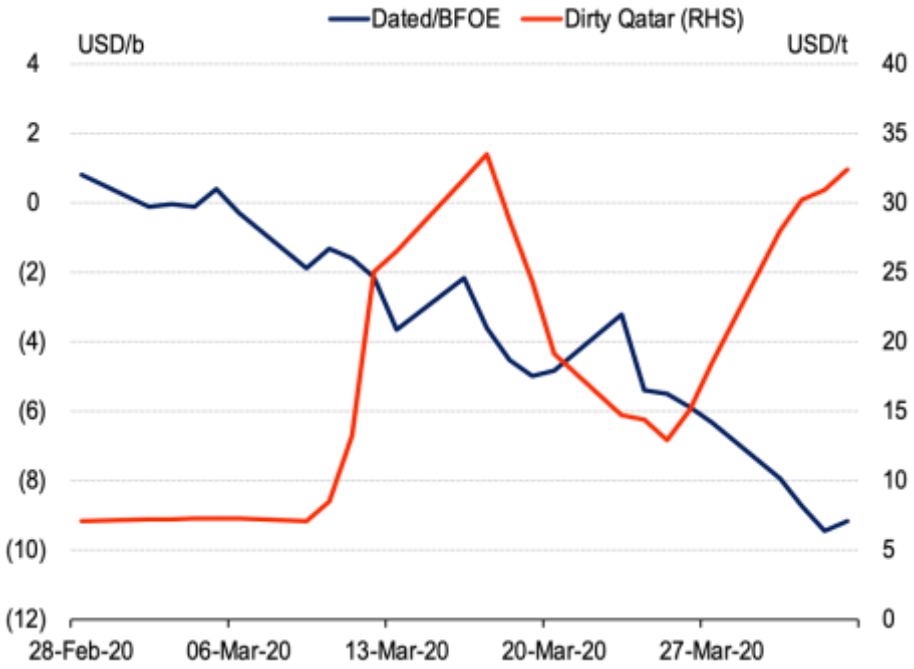
Figure 9: Contango and freight rates



Source: Argus, OIES.

As storage fills up it needs to be hedged by selling forward futures for the length of the intended storage. This selling exerts pressure on the back end of the price curve, gradually bringing it in line with the overall fundamentals. Oil in commercial storage adds to potential future supply influencing the overall balances and price. Some of the inland storage may fill up so quickly that rail cars and pipelines may be considered. Alternative to expensive storage is shutting down production, which may damage the oil well and carry a very large cost. For this reason, producers may even consider a negative price – to pay the buyer to take the oil in order to avoid a shutdown. Indeed, some inland locations in the shale regions of the US have recently witnessed negative bids.[11]

Finally, if the weakness of contango persists to the point that all the storage (including shipping) is full, the extent of a price fall of prompt crude oil becomes unlimited (the 'bottom falls out of the market'). This is 'super-contango'. While we have mentioned possible negative prices for some isolated regional and inland grades of oil, the emergence of super-contango can, in theory, mean negative prices even for seaborn oil. It is not a coincidence that ExxonMobil recently introduced a price clause in their sales contracts ruling out negative prices.[12]

The fastest route to resolve these physical imbalances is for producers to keep oil underground by restricting supplies. This is the key role that OPEC has historically played with some success. However, the dissolution of the OPEC$^+$ agreement in March 2020 means that this adjustment mechanism can't be relied on, at least not in the immediate future, and OPEC$^+$ producers by maximizing their production have, in fact, amplified the physical imbalance. In the absence of the OPEC$^+$ adjustment mechanism, the oil price and differentials have to do the heavy lifting and send the signal to producers to keep the unwanted oil underground. In the current context of extensive lockdowns across the globe global oil demand and refinery runs will do little to contribute, and most of the adjustment has to come from the supply side. Unlike the 'OPEC$^+$ adjustment' mechanism where the low-cost producers restrict supplies, in the current context it will fall on the higher cost and less financially viable producers to keep their oil underground. And unlike the OPEC adjustment mechanism, this process will take time as the cost of

[11] Bloomberg: 'Negative Oil Prices? They're Already Here', 2 April 2020
[12] Reuters Business News: 'As oil sinks, some companies float idea of 'zero clause' in trades', April 3 2020.

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shut in is high and the chain of events is long, from refinery cuts, to limits on land and floating storage, to pipelines being filled, all the way to shutting down production at the well head. Once production is shut in, it is possible that some of it would never come back, and thus, while all the recent focus has been on how the coronavirus may result in some demand being permanently destroyed, some supply destruction is now also a real possibility.

Last week President Trump while advocating 'free market' principles in correcting the market imbalance, also called on Russia and Saudi Arabia to reach an agreement to restrict their supplies and in case they don't, implicitly threatened to impose tariffs on crude imported from those countries. He also kept raising expectations by indicating that a deal is imminent and Russia and Saudi Arabia 'will be cutting back approximately 10 Million Barrels, and maybe substantially more' which was followed by another comment only a few minutes later that this 'could be as high as 15 Million Barrels'. In response to President Trump's tweets, futures Brent and WTI rallied, at a time when most of the physical prices and differentials are pointing in the opposite direction. In addition to the massive volatility that such tweets create, raising expectations will only increase the extent of dislocations and the disconnect between paper and physical markets, which means that differentials and spreads have to do even more stretching to send the correct signals to the physical players and operators and to allocate crude and products through the globe in the face of the most severe demand shock. These disconnections however are not sustainable and the alignment between physical and paper markets will eventually happen. Trump's tweets risk making such an alignment abrupt and severe, introducing unnecessary volatility and extreme price movements, especially if the proposed producers' meeting later this week fails to deliver an agreement on an output cut. The oil market is not broken; it is still functioning well, and this is despite some misguided interventions.

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