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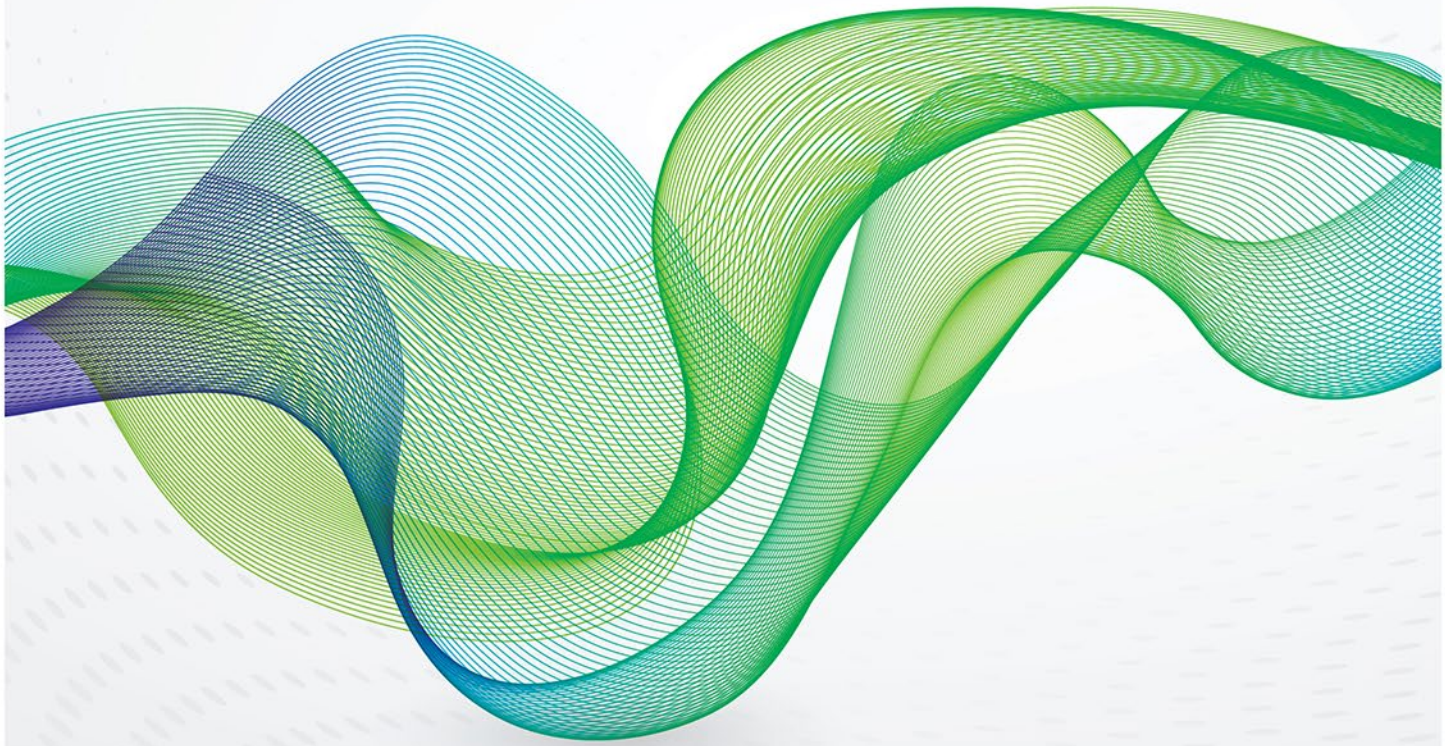
Crude Oil Pricing Optionality and Contracts for Difference



OXFORD ENERGY COMMENT

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Introduction

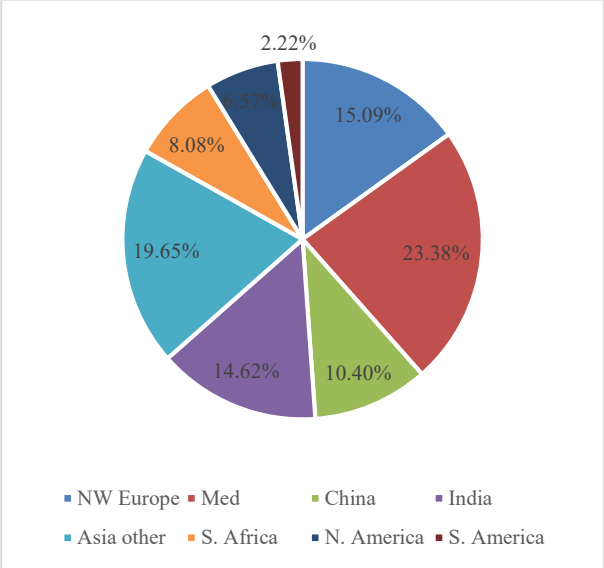
While exposing some of the fragilities in the current international oil pricing system and oil benchmarks,[1] the massive demand shock hitting the oil market also revealed the increasing sophistication and complexity of oil markets and the interconnectedness of the various layers surrounding the benchmarks.[2] Perhaps this was best illustrated in the Brent complex, when at the apex of the crisis in April 2020, the layer connecting the forward/ futures Brent to the Dated Brent, i.e. the Contracts for Difference (CFDs),[3] did most of the stretching, sending signals to market players about the stresses in the physical markets and storage facilities while the futures market was reflecting expectations of a faster demand recovery and a large supply response from producers [4] Furthermore, physical differentials relative to the benchmarks, as well as the differentials between benchmarks, played their part. Specifically, in an oversupplied market, producers have to adjust their differentials (also known as official selling prices or OSPs) to make their crude more attractive to refineries. But differentials between key benchmarks also need to adjust to give the incentive for traders to move crude from surplus to deficit areas.

The nature of the term contracts, the diversity of suppliers, the lack of destination restrictions, and current marketing practices, in addition to its high quality,[5] global acceptability, and popularity among refineries across the globe allow Nigerian crudes not only to play a key role as the swing barrels both to the East and the West of the Atlantic basin (see Figure 1), but also in the price formation process of key benchmarks such as Brent and Dubai. Also, its tradability on a spot basis implies that it is immediately impacted by changing market conditions, and thus the fast-changing quality differentials and shift in trade flows make Nigerian barrels (and WAF barrels in general) a good indicator of the health of oil market fundamentals. In a weak market, in order to find a new home in Asia the major centre of demand growth, Nigerian physical differentials such as Bonny Light to North Sea Dated (NSD) have to adjust lower, and the Brent-Dubai spread has to narrow (see Figure 2), to make Brent-priced crudes more attractive in Asia, compared to Dubai-priced crude exports from the Gulf. As demand recovers, physical differentials strengthen relatively fast, and so do the Brent-Dubai spreads to keep WAF crudes in the Atlantic basin. Despite the severity of the current demand shock, these mechanisms operated as expected, though the adjustment in differentials and benchmark spreads were very sharp.

For the various financial layers, such as CFDs, to perform their functions of risk management and price discovery efficiently, ensuring that these markets attract sufficient liquidity is of vital importance. Here again, Nigerian and WAF crudes play a key role in the Brent complex. One key feature in the marketing of these crudes is the pricing optionality, which adds to the attractiveness of term contracts, especially in volatile market conditions and when the market changes structure from backwardation to contango (or vice versa). The main objective of this Energy Comment is to explain why, and how, pricing options are used, their links to the CFDs and how, in the current environment of high volatility, pricing optionality can contribute to market liquidity as traders position themselves on the Forward Dated Brent curve to manage their risk. We use the pricing options offered by Nigerian National Petroleum Corporation (NNPC) as an example.

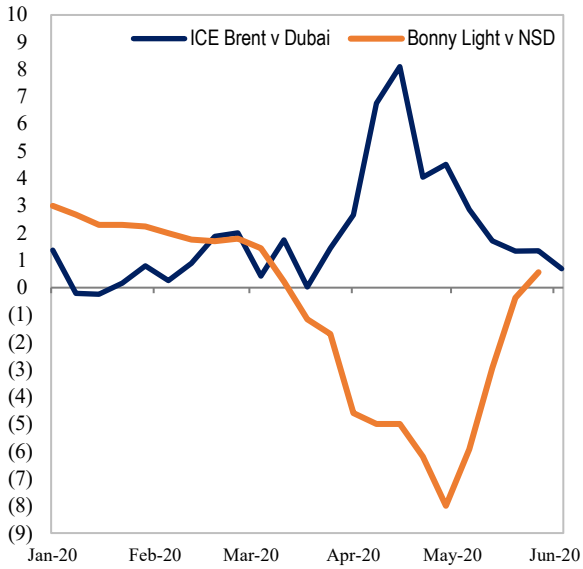
[1] Fattouh, B. and A. Imsirovic (2020), 'Oil Benchmarks Under Stress?' Oxford Energy Comment, Oxford: Oxford Institute for Energy Studies.
[2] See Fattouh, B. (2011), 'An Anatomy of the Crude Oil Pricing System', The Oxford Institute for Energy Studies Working Paper No 40. Oxford: Oxford Institute for Energy Studies.
[3] For details of the CFDs market, see Fattouh, B. and A. Imsirovic (2019), 'Contracts for Difference and the Evolution of the Brent Complex', Oxford Energy Comment, Oxford: Oxford Institute for Energy Studies.
[4] Fattouh, B. and A. Imsirovic (2020), 'Shocks and Differentials: How are the oil markets coping?' Oxford Energy Comment, Oxford: Oxford Institute for Energy Studies.
[5] There is always an exception (to confirm the rule): Ebok crude may be one, with 19.8 API, 0.4% S and a very high, 3% water content.

Figure 1: Nigerian Crude Export by Destination (Jan to May 2020)



Source: Authors, calculated from Clipper data

Figure 2: Key Differentials, $/B



Source: Argus

Pricing Options

Given that crude oil is not a homogenous commodity and given that it is not efficient or even possible to create liquid markets for the large variety of crudes, crude prices are often linked to a benchmark and adjusted for quality differentials. Despite the decline in the production volumes of the crudes underlying some of these benchmarks such as Brent and Dubai, these benchmarks have increased in sophistication and complexity and have developed a number of deep financial and over-the counter (OTC) layers which allow Price Reporting Agencies (PRAs) to assess prices and market participants to manage their risk. In crude sales contracts, these features of the crude pricing system are reflected in the pricing formula.[6] Specifically, for crude oil of variety *x*, the formula pricing is expressed as follows:

$$\mathbf{Px = PR \pm D}$$

Px is the price of crude x (expressed in $/Barrel)

PR is the benchmark crude or reference price (expressed in $/Barrel)

D is the value of the differential (expressed in $/Barrel)

While benchmarks and differentials have been analysed extensively in the literature, an important element of the pricing formula often ignored is the pricing option premium. Some sellers offer buyers pricing options for the benchmark component in the pricing formula in return for a premium or a fee which is added to the price of the barrel. Therefore, the standard pricing formula in a sales contract needs to be adjusted to include a third component:

$$\boldsymbol{Px = PR \pm D + Pricing\ Option\ Premium}$$

The central component of the pricing formula remains the benchmark. Sellers can choose different benchmarks depending on the destination of their crudes. For instance, Saudi Aramco uses a

[6] For more details, please see Fattouh, B. (2011), 'An Anatomy of the Crude Oil Pricing System', The Oxford Institute for Energy Studies Working Paper No 40. Oxford: Oxford Institute for Energy Studies.

combination of Dubai and Oman for pricing its crude exports to Asia; Brent for pricing its crude to Europe; and the Argus Sour Crude Index (ASCI) for pricing its crude to the US. West African producers such as Nigeria use Brent in their pricing formula. But such information is not sufficient to value a cargo, and the sales contract should specify which prices within the benchmark complex (futures Brent, Forward Brent or Dated Brent) are used and as assessed by which of the PRAs. For instance, in its exports to Asia, Saudi Aramco specifies the use of the combination of Oman futures prices as obtained by the Dubai Mercantile Exchange (DME) and Dubai prices as assessed by the PRA Platts.[7] Nigeria instead uses Dated Brent as assessed by Platts for all of its exports regardless of the destination.

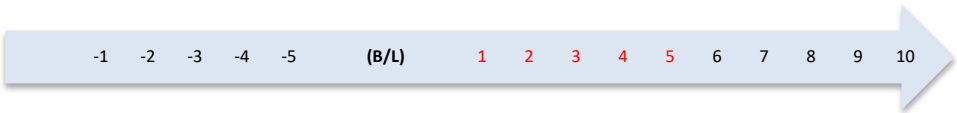
But such details are still not enough to find the value of a cargo sold or bought. A key element that affects the value of the cargo is the period over which the cargo is being priced. For instance, the seller and the buyer could agree that the cargo is valued on the basis of the average prices of the benchmark around the Bill of Lading (B/L), with the B/L date as day zero and 2 days before and after the B/L. If the B/L date is December 10 and the seller uses Dated Brent as the benchmark, then the value used in the pricing formula would be the average of the Dated Brent over the period December 8, 9, 10,11, and 12. Alternatively, the buyer and seller could agree that the pricing period should be around the delivery date rather than the loading date. For instance, if a cargo sold in January is expected to reach its destination on February 10 and the seller uses WTI as the underlying benchmark, the pricing period could be five days around February 10 in which case the value applied in the pricing formula would be the average of WTI prices on February 8, 9, 10, 11 and 12.

Many National Oil Companies (NOCs) don't offer flexibility in the pricing method, but this does not need to be the case, as the pricing formula is quite flexible, and some sellers such as most of the West African NOCs including Africa's largest, Nigeria's NNPC, offer buyers pricing options for the benchmark component (usually Dated Brent) in return for a premium or a fee which is added on top of the quality differential. This optionality has some advantages as it allows the seller to obtain a higher price for the barrel and increase the attractiveness of the sales contract, especially in an over supplied market. However, as argued later, the optionality affects the revenues accrued to the seller and if not priced properly, it can result in lost revenues to the seller.

The three widely used pricing options are prompt, deferred and advanced pricing:[8]

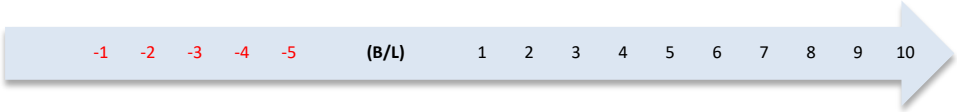
- Prompt pricing option: In this option, the pricing period is 5 consecutive published quotations after the Bill of Lading (B/L) with the B/L date as day zero (Figure 3). This is usually the default option.

Figure 3: Prompt pricing option (days over which the cargo is priced in red)



Advanced pricing option: In this option, the pricing period is 5 consecutive published quotations with the fifth day before the B/L as day one (Figure 4).

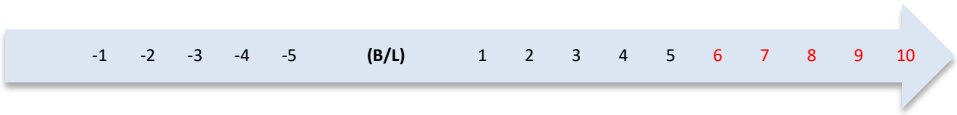
Figure 4: Advanced pricing option (days over which the cargo is priced in red)



[7] Fattouh, B. (2018), 'What Next for Asian Benchmarks?', Oxford Energy Comment, Oxford: Oxford Institute for Energy Studies.
[8] These are not the only options and there are some producers that offer the option of pricing over the entire month of loading. These will not be discussed here as they include elements of a 'look-back' option and require separate treatment.

- Deferred pricing option: In this option, the pricing period is 5 consecutive published quotations with the sixth quotation after the B/L as day one (Figure 5).

Figure 5: Deferred pricing option (days over which the cargo is priced in red)



These are the options offered by NNPC (other West African NOCs offer different options, including the monthly average of the loading date). These pricing options are usually communicated to the buyer at the same time as the quality differentials. For instance, for loading in January, these would be announced and communicated by early December. The seller usually requires the nomination of the preferred pricing option to be received by the buyer at least six working days prior to the first day of the scheduled loading window. The seller usually provides the buyer with the following information:

- The type of crude on sale;
- The valuation basis (the underlying benchmark used which is assumed to be Dated Brent);
- A premium or discount (depending on the quality of the crude);
- Pricing options premium including the default option.

Table 1 below provides an example for Nigeria's grades Bonny Light and QUA IBOE for loading in the month of November. It shows that the basis for valuation (Dated Brent), and that these crudes are trading at a premium (Plus). It also shows three pricing options: Prompt (which is the default option), advanced, and deferred pricing. Since the prompt is the default, the buyer does not need to pay a premium and the 58 cents per barrel for Bonny Light reflects only the quality differential. For the advanced and deferred pricing options, the wedge is higher and reflects the fact that the buyer pays a premium for exercising these pricing options. In the example below, the premium is set at US$ 0.07 dollars or 7 cents (63 minus 58). It is important to note that the premium is not adjusted often. For instance, despite the massive change in market conditions in recent months, the premium remained unchanged at 7 cents.

Table 1: Prices for Nigeria's Crude Grades (November 2019)

Crude Type	Valuation Basis	Plus/Minus	Pricing options		
			Prompt (Cents/b)	Advanced (Cents/b)	Deferred (Cents/b)
Bonny Light	Dated Brent	Plus	58	65	65
QUA IBOE Light	Dated Brent	Plus	63	70	70

Source: NNPC

While the seller obtains a higher price per barrel by charging the buyer an optionality fee for choosing the pricing window, as compared to the default option (which commands no such fee), allowing the buyers to select the dates over which a cargo is priced will result in a different value for the cargo sold/bought. Table 2 below provides an example using the price of Dated Brent over the month of January 2020 with the B/L assumed to be January 15. Based on this example, the advanced option yields the higher price, followed by the prompt option and then by the deferred option. The difference between the option with the maximum and minimum price is $6/barrel whereas the premium charged by the buyer is in cents/barrel. Assuming that the buyer selected the deferred pricing option, they would have more than covered the optionality fee.

Table 2: Actual values under different pricing options ($/barrel) with assumed B/L on 15 January

Date	Dated Brent ($/Barrel)
02-Jan-2020	65.14
03-Jan-2020	67.39
06-Jan-2020	69.96
07-Jan-2020	68.79
08-Jan-2020	67.51
09-Jan-2020	66.39
10-Jan-2020	66.43
13-Jan-2020	64.16
14-Jan-2020	64.54
15-Jan-2020	63.43
16-Jan-2020	64.35
17-Jan-2020	63.92
20-Jan-2020	64.42
21-Jan-2020	63.92
22-Jan-2020	62.30
23-Jan-2020	61.27
24-Jan-2020	59.83
27-Jan-2020	58.35
28-Jan-2020	59.28
29-Jan-2020	59.43
30-Jan-2020	57.77
31-Jan-2020	56.67
Prompt (Jan 16-22)	**63.78**
Advanced (Jan 8-14)	**65.80**
Deferred (Jan 23-29)	**59.63**

Source: Platts and Authors' own calculations.

It is important to stress that the gains of the various pricing options have been calculated after the prices have been realised (i.e. after the fact). Although exercising the deferred option would have yielded financial benefit to the buyer (buying a barrel at $59.63 for the default option compared to $63.78 for the deferred option), at the time of the decision, the buyer and the seller did not have the foresight about how prices would evolve. The market could have moved in a different direction, which would have made exercising these options unprofitable. However, very few serious physical players in the market would take such gambles. For any big risk takers, future markets offer a far easier, a more liquid, and a cheaper alternative.

Another issue concerns the loading date to which the option is linked. In reality, the B/L date may change, exposing the trader to pricing which is different to the CFD period that they hedged. While this may be very serious in case of a major change in the B/L date, causing a potentially large hedging loss to the trader, a change of the B/L by a day or two can usually be mitigated by minor adjustments in the CFD trades or simply leaving the existing ones as a 'proxy' hedge.

Hedging the risk

The key to understanding pricing options is that by having the optionality to select the pricing period, the buyer can hedge their risk and achieve a riskless profit by fully hedging their position. Specifically, by utilising the Forward Date Brent curve, and hedging their position using the CFD[9] market, the trader can still achieve a guaranteed profit. This explains, in large part, the attractiveness of this pricing option from a buyer's perspective.

This can be seen in the example in Table 3 below. In order to minimise confusing computation, we shall make some simplifying assumptions: Firstly, the trader is fully hedged in the futures markets, so the only thing that they are concerned about is the difference between the average Dated and the forward month (March Brent in our example) over the periods when they buy and sell the cargo. That is their profit, multiplied by one million barrels, which is the usual size for a Nigerian cargo. Secondly, we assume that the EFP[10] value, brokerage and other fees are zero. This is to simplify the argument without making a material difference to the bottom line.[11] Finally, for simplicity, we calculate cross-week CFD values using weighted averages, rather than extrapolating them.[12]

Table 3: Forward Dated Brent as of December 6, 2019

Date	CFD ($/B)	Forward Brent ($/B)	Forward Dated Brent ($/B)
December 9-13	1.75	66.98	68.73
December 16-20	1.4	66.98	68.38
December 23-27	1.01	66.98	67.99
December 30-January 3	1.57	68.2	69.77
January 6-10	1.13	68.2	69.33
January 13-17	0.68	68.2	68.88
January 20-24	0.29	68.2	68.49
January 27-31	-0.05	68.2	68.15
Prompt Forward Dated (Jan 16-22)	**0.446**		**68.646**
Advanced Forward Dated (Jan 08-14)	**0.950**		**69.15**
Deferred Forward Dated (Jan 23-29)	**0.086**		**68.286**

Source: Various Brokers' Reports; Authors' own calculations

[9] See Fattouh, B. and A. Imsirovic (2019), 'Contracts for Difference and the Evolution of the Brent Complex', Oxford Energy Comment, Oxford: Oxford Institute for Energy Studies.
[10] Exchange for Physical (EFP) is a trade where buyer and seller exchange futures contracts (in the same month) for a physical cargo.
[11] March EFP values fluctuated in December between 11 and 15 cents premiums. Brokerage fees are about a cent per barrel.
[12] For example, 16-22 January CFD consists of 2 last days of the 13-17 January and first three days of 20-24 January CFDs so we calculate the weighted average of the two. Extrapolation is more accurate as the non-linearity of the Dated curve implies that individual dates in the week have different values. We decided against the extrapolating, to avoid confusing the reader.

Assuming the B/L is January 15 and based on the Forward Dated Curve derived on December 6,[13] the price of the barrel using the various pricing options is calculated as follows: prompt ($68.646), advanced ($69.15), and deferred ($68.286) (see Table 3). Deferred pricing option gives the trader a buying price of Dated Brent $0.36/barrel (44.6–8.6 cents/barrel) cheaper than the 'prompt' or default option as the market is in backwardation in our example. Therefore, at that point in time (on December 6), the trader can select the deferred pricing option, hedge her cargo on the CFD market by buying January 23-29 week CFD, and selling January 16-22 week CFD, collecting $0.36/barrel (a different way to calculate the gain is by using the forward Dated Brent; the trader buys a cargo using the deferred option at $68.286 and selling it prompt at $68.646). When the pricing option cost of $0.07 is deducted, the profit is $0.29 cents or $290,000 for a normal cargo of Nigerian oil.

The trader can calculate the Forward Dated Curve every day up to the day when they need to notify the seller of the preferred pricing option, which is six working days before the first day of the laycan (in our example this is January 7). Once the option has been declared, it cannot be changed (bar some special, operational circumstances).

Now, let's assume that the trader is bullish and they decide to wait for a few days hoping for a steeper Forward Dated Curve and a more profitable outcome. We also assume that they re-visit the position on December 16. They are keen to take any profit before the holiday season kicks in and they get the following CFD curve (Table 4) from their favourite broker. They had a correct market view and the outcomes on various pricing options on December 16 are: Prompt ($68.77), advanced ($69.49), and deferred ($68.31). Since the Dated Brent market is even more backwardated than on December 6, they will again choose the deferred pricing option, giving an additional $0.1 profit ($0.57 - $0.11 = $0.46/barrel compared to $0.36/barrel on December 6). After having paid the $0.07/barrel for the pricing option, their profit is $0.39/ barrel and they achieve $390,000 for the whole cargo.

Table 4: Forward Dated Brent as of December 16, 2019

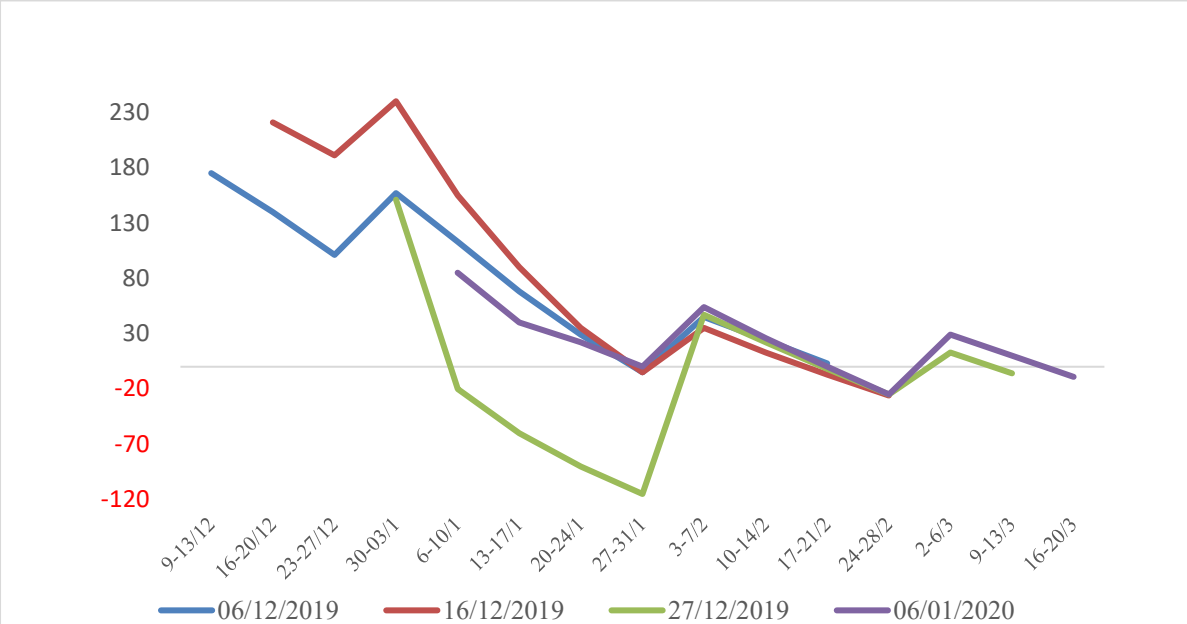
Date	CFD	Forward Brent	Forward Dated Brent
December 16-20	2.21	66.98	69.19
December 23-27	1.91	66.98	68.89
December 30-January 3	2.4	68.2	70.6
January 6-10	1.55	68.2	69.75
January 13-17	0.9	68.2	69.1
January 20-24	0.35	68.2	68.55
January 27-31	-0.05	68.2	68.15
Prompt Forward Dated (Jan 16- 22)	**0.57**		**68.77**
Advanced Forward Dated (Jan 08-14)	**1.29**		**69.49**
Deferred Forward Dated (Jan 23-29)	**0.11**		**68.31**

Source: Various Brokers' Reports; Authors' own calculations

In Figure 5 below, we show how the forward CFD curve has changed for selected dates in December 2019 during which our trader was making their decisions.

[13] These are real values. Sources are various broker indications at the time.

Figure 5: Changing CFD Curve Over December-January 2019 (cents/barrel)



Source: Various Brokers' Reports

If they do nothing and let the pricing option expire (possibly hoping for an even stronger market, though it never materialises), the default prompt pricing option applies. As the default pricing for Nigerian cargoes is the prompt (five days after Bill of Lading), they have no cost, but no profit (on the pricing part of the trade[14]) either.

Note that they may decide to take a risk, for instance by choosing deferred pricing, and not hedge their Dated Brent part of the exposure.[15] In this case, their outcome is as follows: Without hedging the Dated Brent (often referred to as CFD risk), they will lose $0.07/ barrel on pricing (their default selling price is the prompt -$0.75 against their purchase price of -$0.68) plus the cost of the option (-$0.07) giving them a total loss of $0.14 or a loss $140,000 for the whole cargo (see Table 5).

Table 5: Realised Dated Brent minus M1 (March)

Option	Date	CFD
Advanced	Jan 08-14	$0.44
Prompt	Jan 16-22	-$0.75
Deferred	Jan 23-29	-$0.68

Source: Various Brokers' Reports; Authors' own calculations

The demand shock, volatility and the CFD

In volatile times such as those witnessed in the second quarter of 2020, CFD structure can change quite dramatically. This exceptional increase in market volatility presents valuables opportunities for traders with pricing options to boost profits as the value of an option increases with volatility. We show this using an example with real market data. For simplicity, we shall only use CFD values and exclude absolute prices.

[14] Of course, she can profit if she sells the cargo at a higher quality premium than the OSP for that month.
[15] She is prudent to avoid absolute price risk, so she is still hedging her position with March Brent: selling March over the buying period and buying the March contract back over the period when she is selling the physical cargo.

Our trader is now in the pre-epidemic market of late February 2020. They have a cargo loading roughly around the mid of April and for further simplicity, we assume that the expected prompt pricing is April 14–17, advanced pricing is April 6–9 and deferred pricing is April 20–24. On February 28, as per Table 6 below, the Dated Brent curve is in backwardation. There is also an expectation of relatively little volatility as there is still much uncertainty about the full impact of the demand shock at the time. The trader decides to play safe and 'lock in' the deferred pricing option where they are buying the cargo, pricing over the April 20–24 week (it will be sold on the default, 'prompt' basis) and they sell the CFD roll (i.e. sells April 14–17 at June at -60 cents/barrel and buys April 20–24 week at June -70 cents/barrel, collecting 12 (-60 minus -72) cents/barrel. They are happy, given that their cost is only 7 cents/barrel and leaves the position to be fully hedged when the loading date approaches.

Table 6: Actual CFD Curves on February 28 and March 27, (in cents/barrel)

CFD Week	V Month	28-Feb	27-Mar	Pricing Options
March 30- April 3	June	-28	-545	
April 6-9	June	-46	**-479**	**Advanced**
April 14-17	June	**-60**	**-405**	**Prompt**
April 20-24	June	**-72**	-332	**Deferred**
April 27-May1	July	-78	-575	
May 4-7	July	-81	-510	
May 11-15	July	-83	-449	

Source: Various Brokers' Reports

Roughly a month later, the pandemic hits the oil markets hard, with prompt barrels struggling to sell. Dated Brent's response to the shock was strong and on March 27 the CFD curve moved into a deep contango (see Table 6). As a result, our trader clearly wants to change their pricing to the advanced option. Not only can they benefit from the advanced pricing (the week April 6–9) versus the default prompt (April 14–17), but they can also close their initial CFD hedge (the April 14–17 versus the April 20–24) which is now 73 cents/barrel 'in the money' (they sold that roll at +12 cents/barrel and bought it back at -73 cents/barrel making a profit of 85 cents/barrel in the process).

The sequence of their CFD trades is shown in Table 7. They close the initial CFD roll and make a profit of 85 cents/barrel and choose the advanced pricing option which they hedge by buying April 6–9 versus April 14–17 roll, where they collect a further 74 cents/barrel. The profit from the two trades, minus the 7 cent/barrel option cost, give them a 152 cents/barrel total profit (PNL) or $1.52 million for the one million barrels cargo. In short, volatility and a change in the market structure in particular, provides valuable benefits to the holder of such pricing options.

Table 7: Sequence of CFD trades and PNL

Steps	CFD Trades & PNL (cents/barrel)	Description of payoffs
1. Choose deferred		
And sells 14-17/20-24 roll	12	(sold -60, bought -72)
2. Changes to advanced		
Bought the 14-17/20-24 roll	-73	(bought -405, sold -332)
CFD profit	**85**	
3. Choose advanced pricing	74	(buying -479, selling -405)
Option Cost	-7	
Total PNL (cents/barrel)	**152 (67+ 85)**	

Source: Various Brokers' Reports

Conclusion

The oil demand shock revealed the key role that CFDs played in linking Dated Brent to forward and futures Brent and the importance of the various layers for risk management and price discovery. As discussed, using the CFDs market, traders can position themselves on the Forward Dated Brent curve and hedge their risk. If Forward Dated Brent is in contango, the trader can buy before the B/L date and sell the default or prompt pricing, five days after the B/L and fix a profit. In contrast, if the market is in backwardation, the trader can buy on a deferred pricing basis and sell on the default 'prompt' pricing, again making money in the process. As long as the profit from such positioning is higher than the pricing option fee charged by the seller, the trader can achieve a guaranteed profit. Thus, from a buyers' perspective, pricing options offer flexibility which is an attractive feature of the crude and sales term contract, especially in volatile markets and this in turn can contribute to the liquidity of CFDs.

In the extreme market conditions that we have witnessed in the second quarter of 2020, increased volatility amplified both risks and benefits of the pricing optionality. Intuitively, higher volatility increases the value of any pricing option. We have shown how the sudden shift in market conditions resulting from the demand shock enhanced the profits of our hypothetical trader, from the pricing option on a cargo of Nigerian crude oil, by more than tenfold. This was possible as the prudent trader hedged their position in a backwardated market and after the market shifted into contango, they not only took large profit on that hedge, but also made money on choosing the advanced pricing option. The market in that period carried high risks which could easily have wiped out our trader's profits and resulted in large losses. However, timing of trades is entirely in a trader's discretion and that is part and parcel of oil trading and can be positive or negative.

From a sellers' perspective, the optionality over the period in which the cargo is priced is an important component of the pricing formula as it determines the value of the cargo sold and the revenues accruing to the seller. While in principle it could provide an additional source of revenue, if not valued properly, it can result in a substantial amount of money being 'left on the table'. Periods of high volatility increase the value of such options, and since the option premium often remains unchanged, this raises the question of whether sellers value them correctly, and if not, the implications of mispricing on their revenues.