Global Energy Weekly

Products quarantined 'til further notice

13 March 2020

Commodities
Global

Global Commodity Research
BofAS

Warren Russell, CFA
Commodity Strategist
BofAS
+1 646 855 5211
warren.russell@bofa.com

Peter Helles
Commodity Strategist
MLI (UK)
+44 20 7996 8154
peter.helles@bofa.com

Francisco Blanch
Commodity & Deriv Strategist
BofAS
+1 646 855 6212
francisco.blanch@bofa.com

Clifton White
Commodity Strategist
BofAS
+1 713 247 6136
clifton.white@bofa.com

Michael Widmer
Commodity Strategist
MLI (UK)
+44 20 7996 0694
michael.widmer@bofa.com

Product demand is collapsing as refining capacity rises…

In light of recent global economic headwinds and coronavirus quarantine measures that are weighing on demand, we revise our global crack forecasts lower. Signs of demand weakness are everywhere and new measures are announced daily that will likely lead to a petroleum product demand contraction this year. Yet at the same time, global refining capacity is expanding at an accelerating rate. Thus the market will likely be oversupplied until demand can regain its footing. Also, it may take some time to for consumers to return to normal consumption patterns once coronavirus fears fade. The global economy seems to be fast approaching recession territory which could further delay the return of gasoline consumption and hamper industrial activity. In the meantime, any energy intensive fiscal stimulus could help reinvigorate demand.

…casting a pall on 1H20 cracks, but we see 2H20 upside

Refined product cracks experienced nearly unprecedented moves this week as the market digested news of how COVID-19 is affecting the economy. A majority of the EBOB-Brent crack forward curve is negative now. We see potential for more downside near term as the market struggles to balance inventories, but we see upside in 2H20. Diesel cracks declined early in 2020 but have held up better recently, acting as a linchpin for refining margins globally. We see more near-term pain for diesel too but restocking and a return to more normal trade should lift diesel cracks into year-end. HSFO-Brent cracks surged higher this year as other products buckled. This trend could continue near-term but HSFO cracks should fall as RBOB and diesel rebound. After all, OPEC+ sour volumes are set to rise. VLSFO and LSFO cracks should rebound in 2H as trade recovers.

OPEC price war distorting margins, pressuring US refiners

Saudi Arabia's decision to undercut other producers is distorting margins and signaling refiners to run harder even though refined product demand is in the dumps. Ultimately, it will catch up to the market, shifting the glut downstream from crude oil into the product markets. We expect this is already underway and will become more apparent in 2Q as refiners return from maintenance. As Saudi, the UAE, and Russia add more oil than the market needs, we expect the oil futures market to move into supercontango as oil prices its way into storage (See It takes two to supercontango). Even as freight rates have spiked, WTI-Brent has compressed, closing US export arbs and forcing US barrels into storage. The collapse in WTI-Brent is reminiscent of 2015-16 and removes much of the economic edge that US refiners (particularly inland) enjoyed since the advent of shale. Still, the abundance of crude could help refiners as global oil demand returns to normal.

12109739

Timestamp: 13 March 2020 05:18PM EDT

Table 1: BofA Commodity Research Themes and Outlook

	View	Recent report links
Macro outlook	■ We forecast global growth of 2.8% in 2020, the lowest reading since 2009. Growth momentum was soft even before the coronavirus shock. China's aggressive quarantine measures point to a very weak 1Q. We expect lagged spillover effects due to supply-chain and tourism disruptions, and the spread of the virus outside China. We now look for a more "U-shaped" growth recovery, and a greater permanent loss in output.	• "Three reasons for sub-3% global growth" Feb 2020
WTI and Brent crude oil	■ We project Brent and WTI to average $45/bbl and $41/bbl respectively in 2020. ■ Our supply and demand forecasts suggest a 1.5mn b/d surplus in 2020. ■ In the US, producers are exhibiting capital discipline, yet we still anticipate 1.1mn b/d of liquids growth there in 2020. ■ Non-OPEC (ex US) supply is set to grow by 800k b/d, the fastest pace since 2010. ■ We forecast global demand growth to rebound from 0.25 mn b/d YoY in 2020 to 1.3 mn b/d during 2021.	• "It takes two to supercontango" Mar-20 • "Oil goes viral" Mar-20 • "Green shoots in EM oil demand" Jan-20 • "All eyes on security of oil supply" Sep-19
Atlantic Basin oil products	■ Gasoline forwards is suffering as excess production capacity collides with virus related demand weakness, and we forecast 2020 RBOB and EUROBOB cracks to Brent will average 4 and $2.5/bbl, respectively. ■ The one-off IMO2020 marine fuel demand switch has been overshadowed by global macro weakness and we forecast 2020 NYH diesel and EU gasoil cracks to Brent to average $14 and $12/bbl, respectively. ■ We see upside to LSFO (1.0%) due to IMO blending demand averaging $2.5/bbl in 2020.	
US natural gas	■ Winter never really had a chance due to Appalachian coal ceiling, and recent mild weather brought forward a "gasmaggedon". ■ We lower our 2020 price forecast to $1.99/MMbtu and believe Rockies coal and LNG provide a soft ceiling for summer nat gas. ■ In order to escape the low gas price environment, production response is likely needed to allow demand to catch up.	• "Gasmaggedon" Jan-20 • "Surplus MMbtu's could spell the blues", Oct-19
LNG	■ Global gas prices are sufficiently low to absorb current LNG surplus by forcing EU power sector to switch from coal to gas. ■ Recurring glut may drive 2020 LNG prices lower to repeat EU coal to gas switching, but Russia/Ukraine negotiations are a risk. ■ Global gas is more connected than ever, so a mild winter or worsening macro could be catastrophic for prices in all regions.	• "The big LNG short" Sep-19 • "Liquid gas implodes" Mar-19
Thermal coal	■ We expect Newcastle coal prices to continue to fall into 2020 on a weak seaborne balance and forecast an average of $68/mt. ■ Chinese imports will likely resume contract again in 2020 on soft domestic demand and new mine approvals adding to the domestic coal surplus.	• "Coal macro crunch" Aug-19

Source: BofA Global Research

Table 2: BofA Crude Oil Price Forecasts (end-of-period forecasts)

	units	Mar-20F	Jun-20F	Sep-20F	Dec-20F
WTI Crude Oil	($/bbl)	24.00	36.00	42.00	46.00
Brent Crude Oil	($/bbl)	28.00	40.00	46.00	50.00
US natural gas	($/MMBtu)	1.99	1.99	1.99	1.99

Source: BofA Global Research estimates

Table 3: BofA Commodity Price Forecasts (period averages)

	units	1Q20F	2Q20F	3Q20F	4Q20F	2020F	2021F
WTI Crude Oil	($/bbl)	49.00	31.00	40.00	44.00	41.00	51.00
Brent Crude Oil	($/bbl)	53.00	35.00	44.00	48.00	45.00	55.00
US NY Harbor ULSD (HO) Cracks to Brent Crude Oil	($/bbl)	15.00	11.00	14.00	16.00	14.00	
US RBOB Cracks to Brent Crude Oil	($/bbl)	4.00	4.00	5.00	3.00	4.00	
USGC 1% Residual Cracks to Brent Crude Oil	($/bbl)	10.00	-2.00	0.00	2.00	2.50	
NWE Low Sulphur Gasoil Cracks to Brent Crude Oil	($/bbl)	12.50	9.00	12.00	14.00	12.00	
NWE Eurobob Cracks to Brent Crude Oil	($/bbl)	5.00	-1.00	3.00	3.00	2.50	
NWE 1% Residual Cracks to Brent Crude Oil	($/bbl)	9.00	-3.00	1.00	3.00	2.50	
US Natural Gas	($/MMBtu)	1.99	1.99	1.99	1.99	1.99	2.30
Thermal coal, Newcastle FOB	($/t)	70.00	66.00	66.00	70.00	68.00	
Aluminium	$/t	1,719	1,764	1,830	1,830	1,786	1,830
Copper	$/t	5,812	5,400	6,250	6,750	6,053	6,250
Lead	$/t	1,906	1,900	2,000	1,900	1,926	2,212
Nickel	$/t	12,978	12,510	15,516	17,500	14,626	20,000
Zinc	$/t	2,175	1,900	2,249	2,403	2,182	2,381
Gold	$/oz	1,600	1,650	1,550	1,700	1,625	1,650
Silver	$/oz	18.06	18.54	17.42	19.10	18.28	19.41
Platinum	$/oz	966	1,100	1,200	1,200	1,117	1,300
Palladium	$/oz	2,472	3,000	3,000	3,500	2,993	2,625

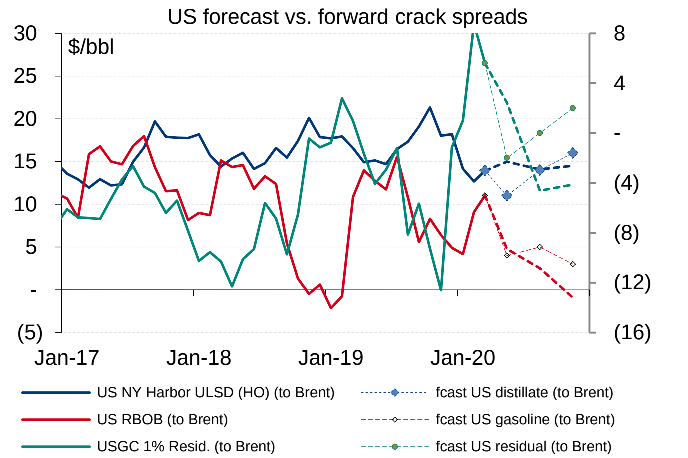
Source: BofA Global Research estimates

Products quarantined 'til further notice

We revise our refined product crack forecasts lower

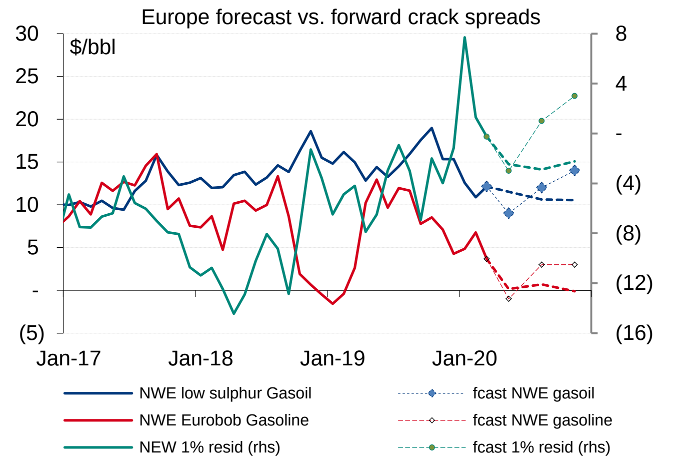
We revise our global crack forecasts lower, in light of growing global economic headwinds and demand crushing coronavirus quarantine measures. Signs of demand weakness are everywhere and new measures announced daily should cause demand to contract this year. Yet at the same time, global refining capacity is expanding at an accelerating rate, and will likely leave the market oversupplied until demand can regain its footing. Thus, we now cut our 2020 NYH ULSD-Brent crack and NYH RBOB-Brent crack forecast to $14 and $4/bbl, respectively (Chart 1). Meanwhile, we trim our NWE LSFO-Brent crack forecast to $2.5/bbl (Chart 2). We are generally bearish on cracks over the near-term and see upside versus the forward curves later in the year.

Chart 1: Thus, we now cut our 2020 NYH ULSD-Brent crack and NYH RBOB-Brent crack forecast to $14 and $4/bbl, respectively



Source: Bloomberg, BofA Global Research estimates

Chart 2: Meanwhile, we trim our NWE LSFO-Brent crack forecast to $2.5/bbl

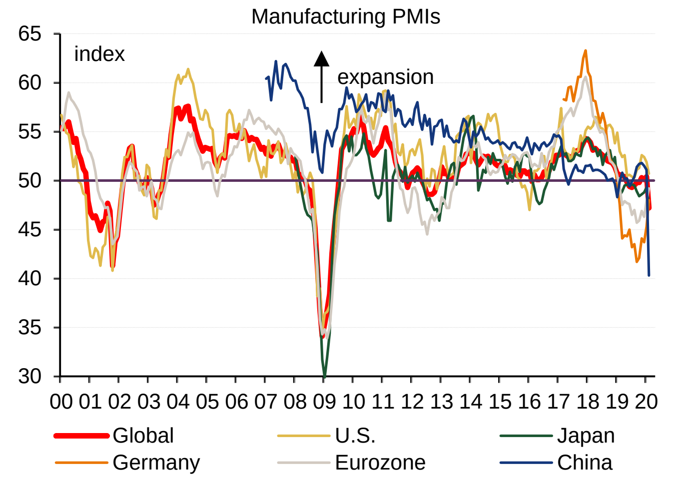


Source: Bloomberg, BofA Global Research estimates

Manufacturing activity has dramatically deteriorated…

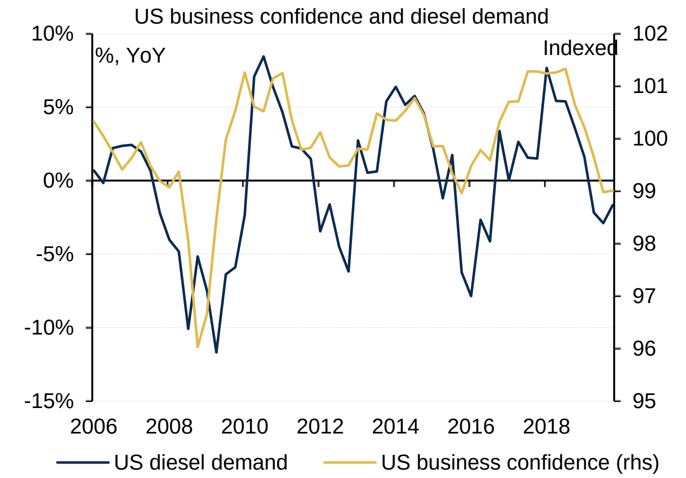
Global economic activity steadily slowed during 2019 and took a sharp turn lower in early 2020 as the COVID-19 coronavirus spread in China and eventually throughout the world. China's manufacturing PMIs have fallen to their lowest levels on record, and we expect activity in other countries will likely follow a similar path as the virus hits economic activity (Chart 3). Even in the US, which was viewed as a one of the few remaining sources of economic strength, business confidence had already dipped into negative territory at 2019-end (Chart 4). The spread of the coronavirus is likely to further dampen business confidence globally and should weigh heavily on industrial oil demand.

Chart 3: Global manufacturing PMIs have dropped sharply into contraction territory…



Source: Bloomberg

Chart 4: …and business confidence is likely to fall further in the coming months

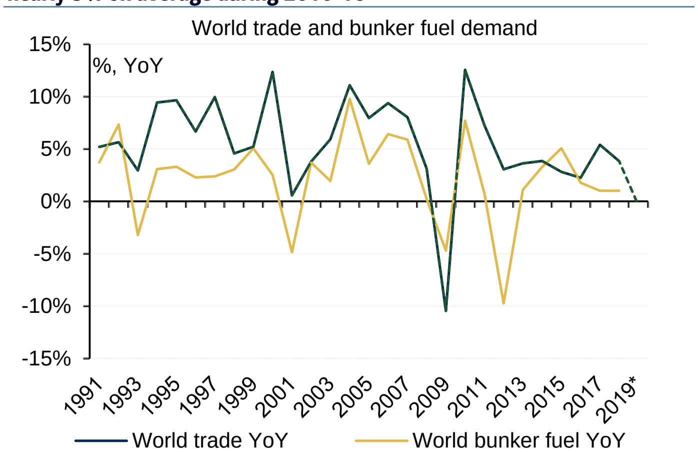


Source: Bloomberg

…which has been reflected in global trade and freight

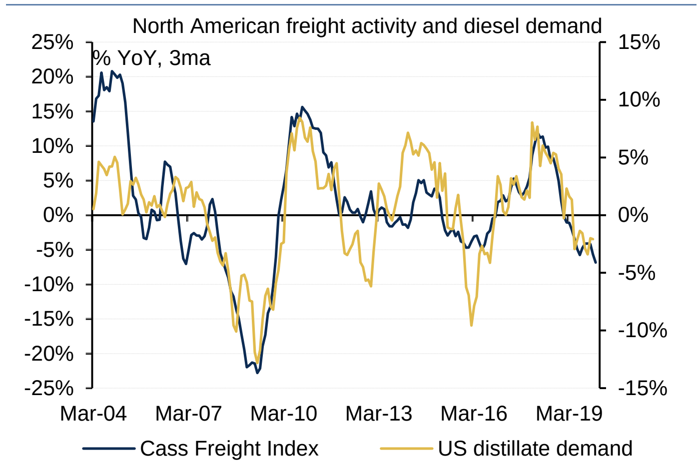
World trade was already showing signs of duress stemming from the US-China trade war last year. In 2019, world trade declined slightly after averaging nearly 5% growth YoY during 2010-18 (Chart 5). Last year's contraction was the first such occurrence since 2009 and likely led to a decline in bunkering demand YoY. More real-time data in North America suggests contraction in freight activity has continued (Chart 6) and anecdotal evidence out of China and elsewhere suggests that lackluster trade will persist for some time as the effects of the coronavirus ripple across the global economy.

Chart 5: In 2019, world trade declined slightly after growing at a pace of nearly 5% on average during 2010-18



Source: Bloomberg, IEA

Chart 6: Declining freight activity has had a negative impact on diesel demand in the North America

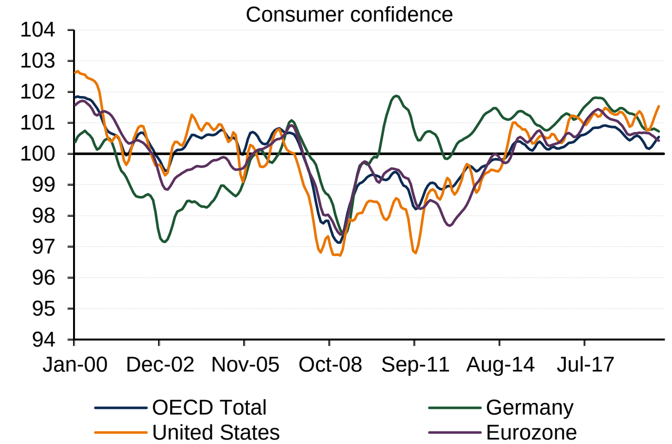


Source: Bloomberg

Global service sector activity has also taken a big hit recently…

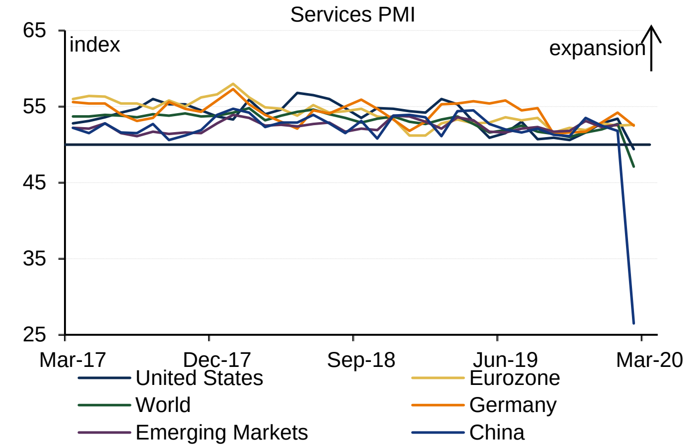
Consumer confidence held up surprisingly well last year, especially given the uncertain economic backdrop created by the US-China trade war. That said, confidence has been deteriorating in recent quarters (Chart 7). We have been watching this, along with service sector PMIs (Chart 8) as for indications of slowing consumer demand. Unfortunately, the coronavirus has fomented fear globally and altered normal behavioral patterns. Now, the global population is flying less, possibly driving less, and likely consuming less all around (outside of stockpiling goods). These changes are a harbinger of weak gasoline and jet demand to come, and as the virus spreads across developed markets, we expect the impact to strengthen.

Chart 7: Consumer confidence was trending in positive territory for many developed countries earlier this year...



Source: Bloomberg

Chart 8: ...but if service sector activity is any indicator, consumer confidence has plummeted in recent weeks

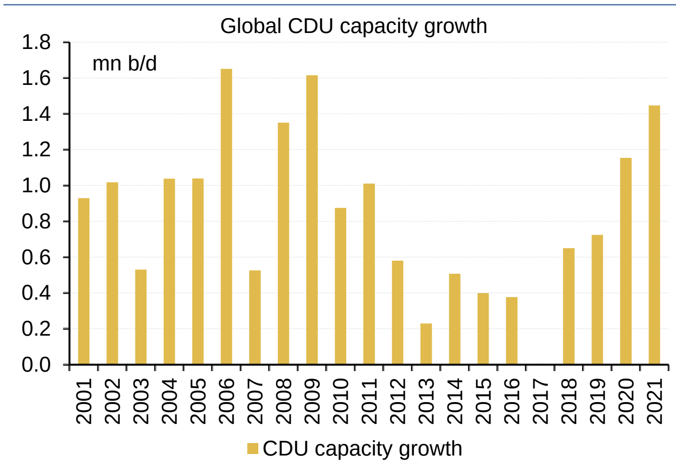


Source: Bloomberg

...so refinery capacity growth likely dwarfs demand in 2020

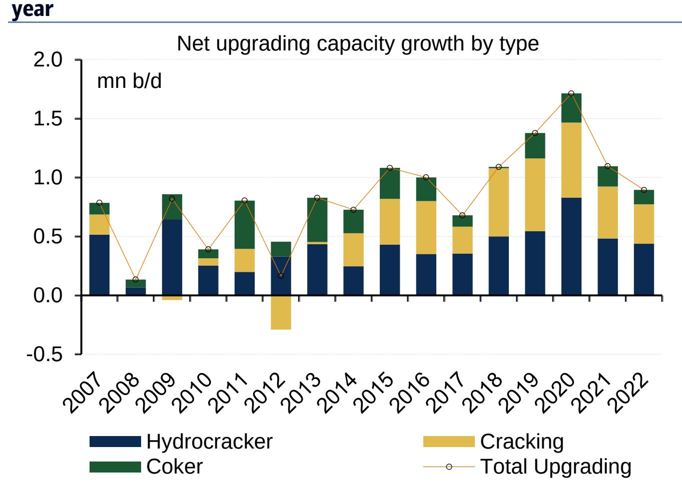
Global refining capacity is growing at an accelerating rate and is set to climb more than 1mn b/d YoY this year, thanks to start ups like Saudi Arabia's Jazan (400k b/d, 2Q/3Q20) and China's Zhanjiang (200k b/d, 3Q20) (Chart 9). At the same time global oil demand growth could fall to zero or negative, creating a significant mismatch between capacity and demand that will most certainly weigh on refining margins this year. Also concerning is the surge in upgrading capacity, which is likely to exceed 1.5mn b/d YoY this year (Chart 10). In certain demand scenarios, it could take until 2021 or beyond to absorb capacity set to start up in 2020 and capacity starts in 2021 on the CDU side are set to climb even higher.

Chart 9: Global CDU capacity expansions are set to accelerate in 2020-21



Source: BofA Global Research estimates

Chart 10: Upgrading capacity should outpace CDU capacity growth this year

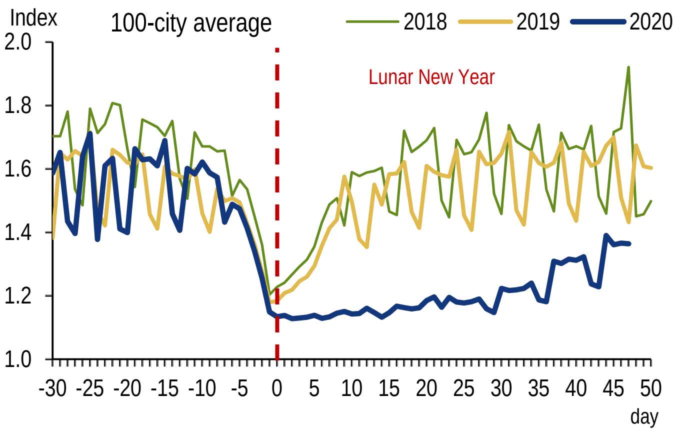


Source: BofA Global Research estimates

Depressed demand has already forced run cuts in China...

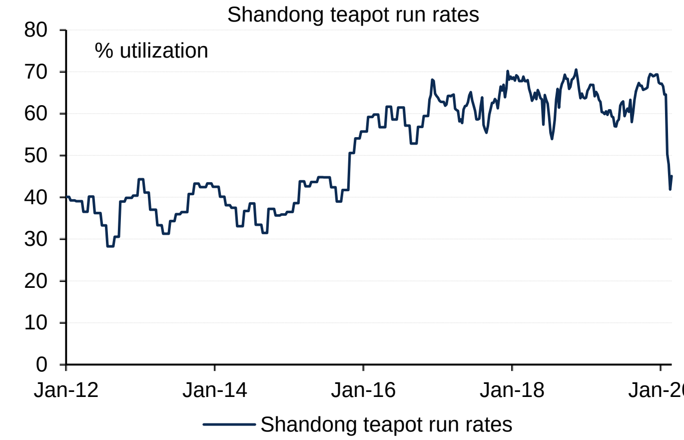
COVID-19 is having a devastating impact on refined product demand globally, most notably in China, where demand has utterly collapsed. Real-time congestion data across 100 major cities in China suggests that even 40 days after the Lunar New Year, traffic has not returned to normal (Chart 11). Other data, like coal demand, suggests that power demand remains quite subdued which likely translates into weak industrial activity and diesel demand. Another sign of weak demand there has been the sharp drop-off in refinery run rates in Shandong (Chart 12) and elsewhere. Refiners in Shandong, which have an estimated refining capacity of nearly 4mn b/d, have cut runs more than 20% from the highs of January. Now teapot run rates are at their lowest levels since 2016.

Chart 11: China's congestion index reflects a slow path to normalization following the outbreak…



Source: BofA Global Research, Wind, Gaode Map

Chart 12: …and refiners have been forced to cut runs on weak product demand and logistical constraints

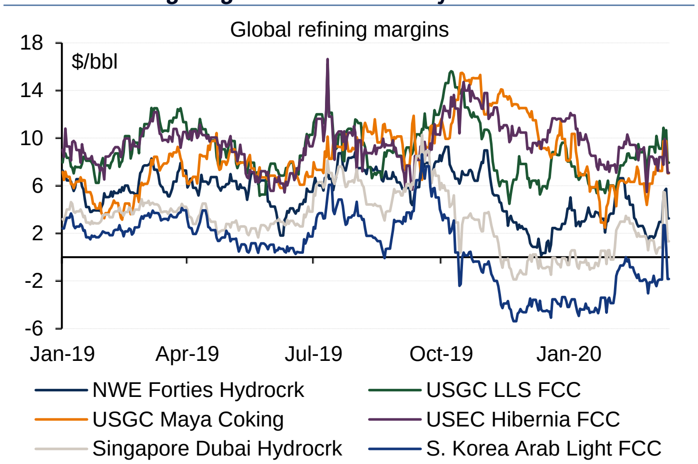


Source: Bloomberg

…which lent some support to global refining margins…

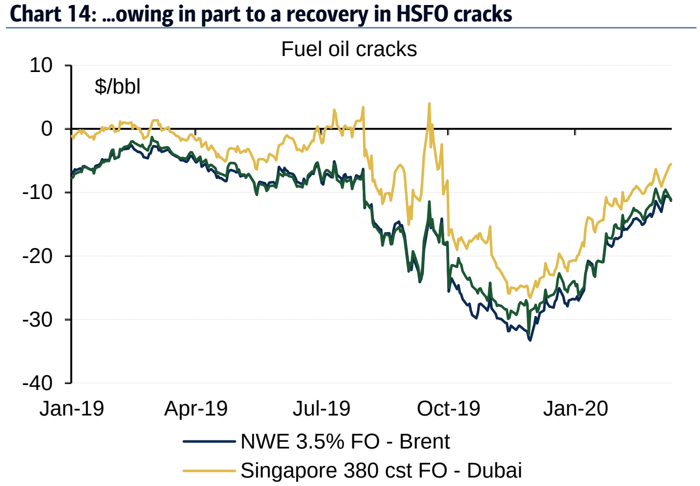
On the surface, global refining margins have held up surprisingly well given deterioration in demand recently (Chart 13), with margins in some regions are currently higher than they were for most of 4Q18. Reduced runs in China and elsewhere in Asia are supportive, but margins are also being skewed by the dramatic recovery in high sulfur fuel oil (HSFO) values since late last year. Meanwhile, gasoline, diesel, and VLSFO cracks have all collapsed. At their lowest point last year, HSFO cracks fell below -$30/bbl versus Brent (Chart 14) and have since staged a recovery as refiners seem to have found room to process even more residue in their cokers (see IMO making waves in the oil market). Furthermore, refiners with high fuel oil cuts are also likely the first to have cut runs globally, leading to a tighter fuel oil market in general.

Chart 13: Refining margins rebounded recently…



Source: Bloomberg

Chart 14: …owing in part to a recovery in HSFO cracks

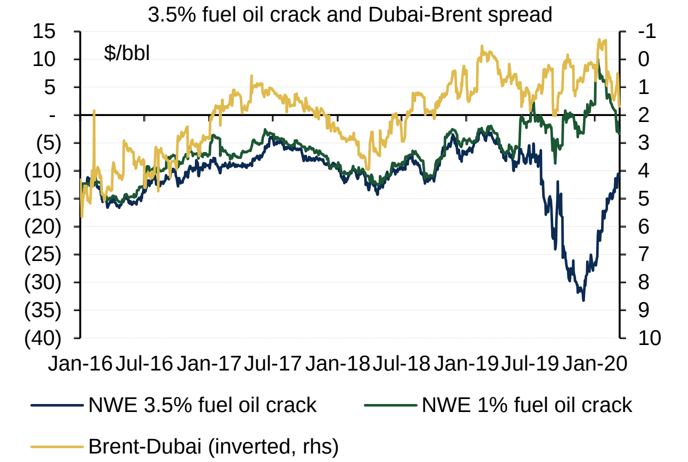


Source: Bloomberg

…along with HSFO's dramatic recovery in 2020

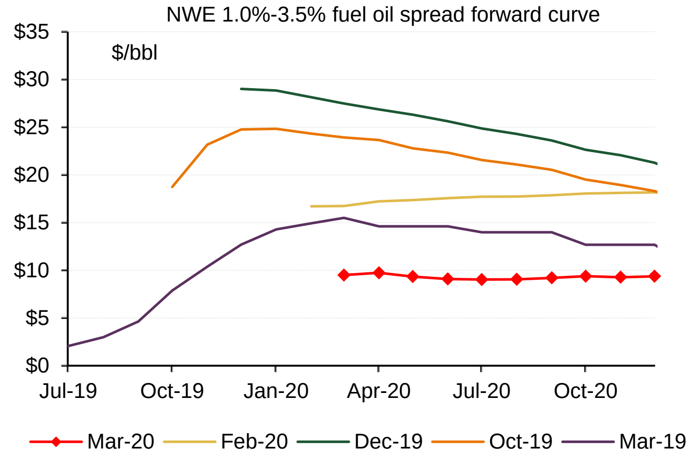
HSFO's notable outperformance in 1Q20 would leave market observers to believe IMO never happened. Indeed, since the beginning of the year, HSFO has outperformed low sulfur fuel oil (LSFO) and VLSFO by more than $20/bbl (Chart 15). Now, the forward curve for LSFO-HSFO is at its lowest level in quite some time (Chart 16). Several factors are influencing this trend. First, weak oil demand has forced refinery run cuts in Asia, which has likely curtailed fuel oil production, particularly HSFO output. Second, the steep discounts for HSFO in 4Q19 offered enough incentive for refiners to find ways to boost vacuum residue.

Chart 15: HSFO outperformed LSFO by a meaningful margin since the beginning of the year



Source: Bloomberg

Chart 16: Now, low-high spreads are tighter than we've seen in recent months

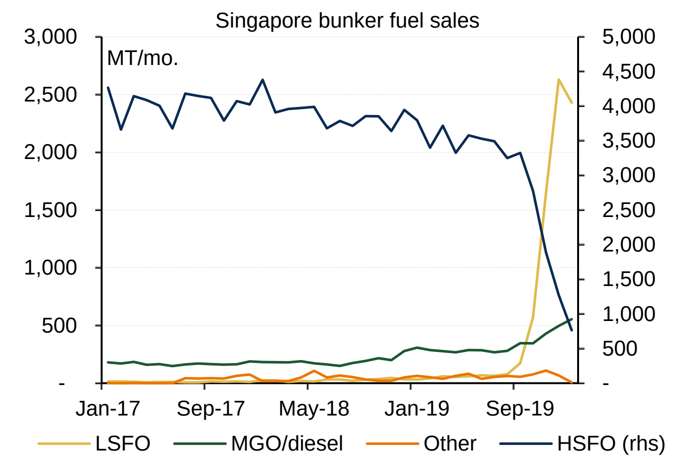


Source: Bloomberg

VLSFO has emerged as the main beneficiary of IMO…

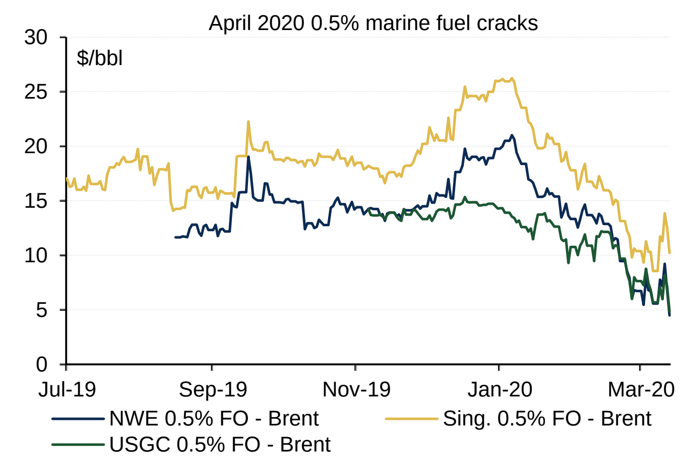
In recent months, VLSFO sales have almost entirely displaced HSFO sales in major bunkering ports like Singapore (Chart 17) and Fujairah. Meanwhile, demand for marine gasoil (MGO) has more than doubled but remains substantially lower than VLSFO demand. The surge in VLSFO demand pushed 0.5% marine fuel cracks to more than $25/bbl in Singapore and more than $20/bbl in Northwest Europe (Chart 18), making those fuels relatively more expensive than gasoil. After peaking near the start of 2020, VLSFO cracks have collapsed alongside other higher value fuels, falling below $10/bbl across all regions.

Chart 17: VLSFO has been the fuel of choice for IMO compliant shippers…



Source: Bloomberg

Chart 18: …but the recent bunker demand slowdown has caused VLSFO cracks to collapse



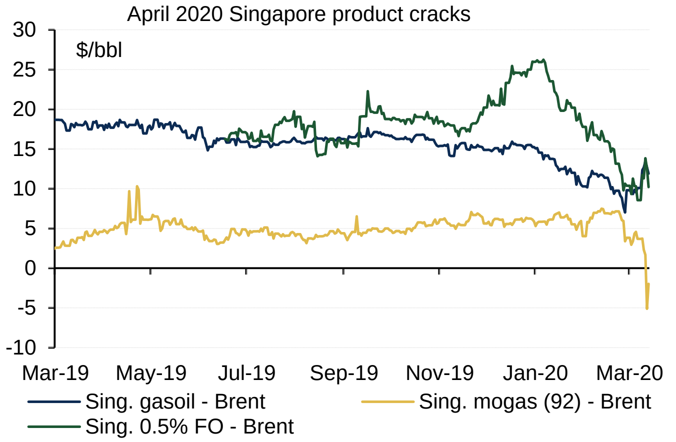
Source: Bloomberg

…but cracks have fallen back to earth on weak demand, rising supply

As IMO implementation neared, VLSFO cracks exploded higher, especially in Singapore, while gasoline cracks remained steady and gasoil cracks sold off (Chart 19). VLSFO's large premium to gasoline has encouraged refiners to forego running low sulfur vacuum gasoil (LSVGO) through the FCC to produce gasoline (see [Is MGO fool's oil or the real McCoy?]). Instead, refiners have sold it as blendstock for bunker fuel oil, resulting in significantly more VLSFO supply than occur if secondary units were utilized normally. This, along with deteriorating trade conditions and changes to China's VLSFO tax, likely helped pull VLSFO cracks back down to earth. Now, VLSFO trades tighter to gasoil on a

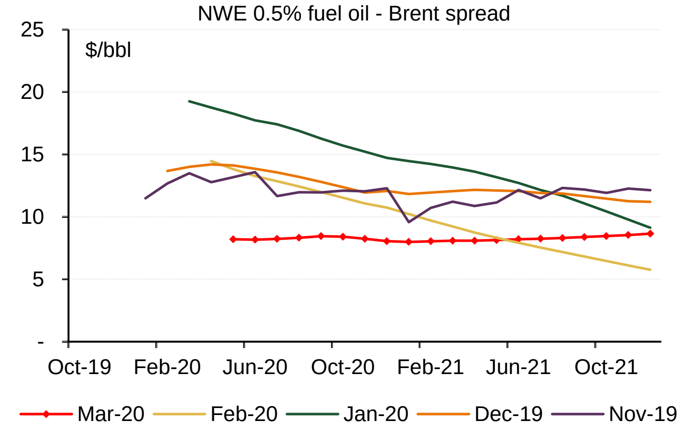
$/bbl basis and much closer to gasoline values. Also notable is that the forward curve for VLSFO cracks is at its lowest level in several months (Chart 20).

Chart 19: VLSFO's premium to gasoil and gasoline collapsed in 2020, cutting the incentive to lower FCC runs



Source: Bloomberg

Chart 20: Now, VLSFO cracks are at their lowest in recent months

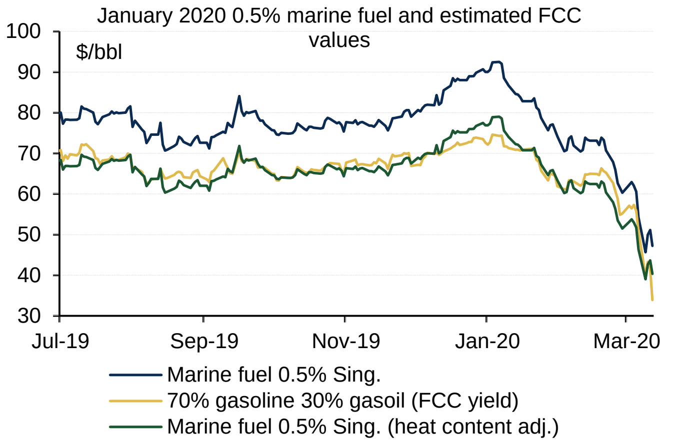


Source: Bloomberg

Softer VLSFO margins present a headwind to gasoline

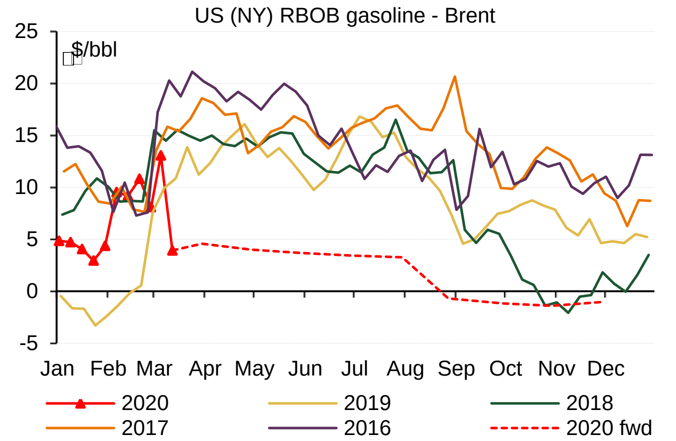
Until recently, 2020 gasoline and diesel prices have substantially outperformed VLSFO (Chart 21). On the surface, this would suggest incrementally higher gasoline yields. Unfortunately, margins on the whole remain soft despite significant run cuts in Asia and refinery outages and maintenance in the US. The RBOB-Brent forward curve points to multi-year low cracks heading into summer (Chart 22). Given the change in consumer behavior, we anticipate soft gasoline demand globally this spring. Sidelined capacity in Asia and new refinery starts are likely to limit upside, yet cracks should experience significant volatility in 2Q as refiners struggle to prepare for lackluster driving season.

Chart 21: Until recently, gasoline and diesel have outperformed VLSFO, which is likely leading to lower VLSFO production, all else equal



Source: Bloomberg

Chart 22: The RBOB-Brent forward curve points to multi-year low cracks heading into summer

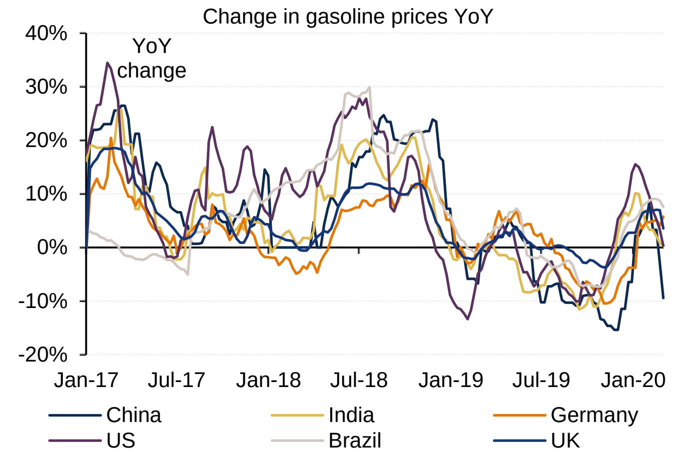


Source: Bloomberg

Despite lower prices, virus likely to weigh on gasoline demand…

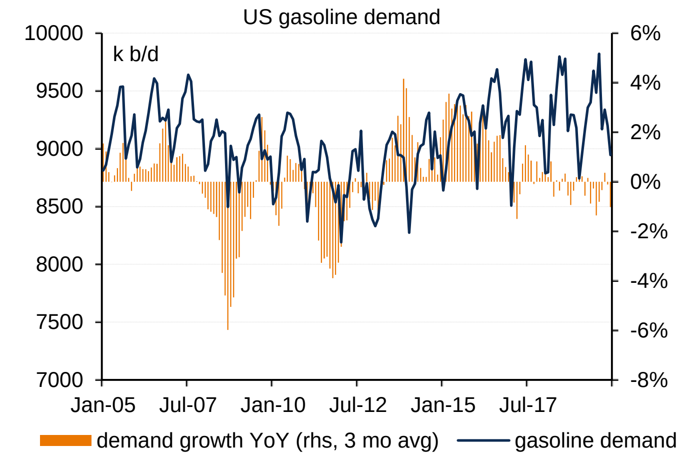
Gasoline prices around the world are flat or down year-over year (Chart 23). In a normal environment, this would stimulate driving activity, especially as we head into the driving season in the US. However, the positive price effect is likely to be more than offset by the adverse impact on miles driven from coronavirus as more self-isolate and work from home, causing a drop in both leisure and commuting miles. Consumers are less interested in going out to eat, attending social events, and traveling in general. We expect daily driving activity and leisure driving activity to contract in 2Q as the coronavirus spreads across the US and Europe. These factors present a stiff headwind to gasoline demand growth, which is already grinding to a halt or declining (Chart 24).

Chart 23: Gasoline prices around the world are lower YoY or very close to the same level seen last year



Source: Bloomberg

Chart 24: Working from home and reduced leisure activity present a stiff headwind to gasoline demand growth, which is already slowing

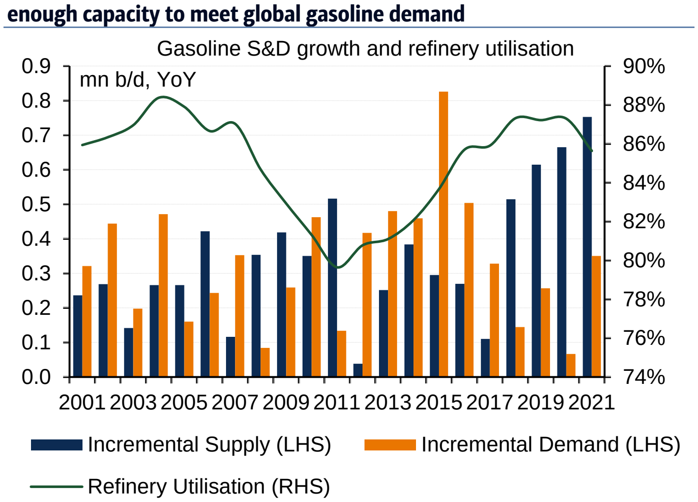


Source: EIA

…so gasoline cracks may take time to recover

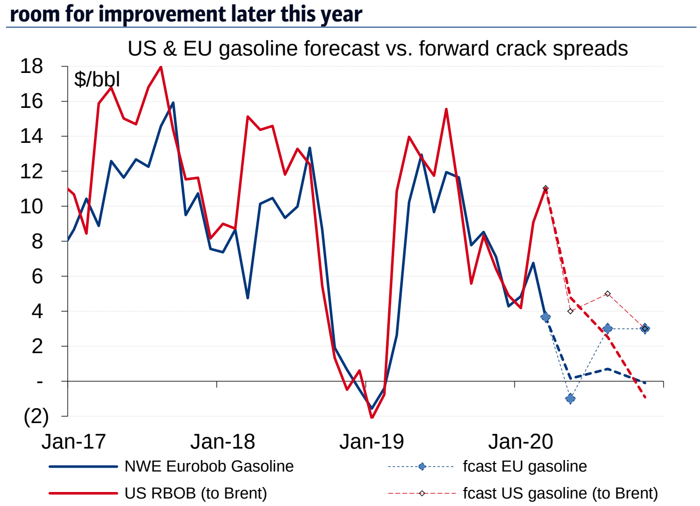
Before demand began to deteriorate, the gasoline market was already facing an overcapacity issue, which we have highlighted previously (see [Gasoline comes full circle]). In recent years, CDUs and secondary upgrading units have provided more than enough capacity to meet global gasoline demand (Chart 25). IMO helped mitigate this overcapacity issue by giving refiners an economic alternative to running FCCs at capacity. However, sluggish shipping has limited demand for VLSFO. In order for gasoline cracks to recover, several things likely need to occur. Driving activity needs to rebound, shipping needs to recover. We expect consumers to return to more normal travel patterns in 2H and may even see acceleration in leisure travel on the back of lower fuel prices, savings from hunkering down in 1Q/2Q, and the related cabin fever. In addition, a rebound in global trade in 2H should bolster demand for VLSFO, which could crimp gasoline supply just as demand is reawakening. Thus, while we are bearish gasoline cracks in 2Q20, we see room for improvement later this year (Chart 26).

Chart 25: CDUs and secondary upgrading units have provided more than enough capacity to meet global gasoline demand



Source: BofA Global Research estimates

Chart 26: Thus, while we are bearish gasoline cracks in 2Q20, we see room for improvement later this year

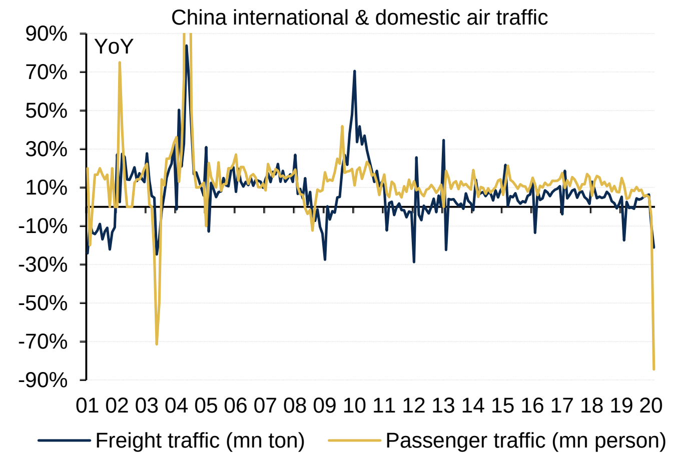


Source: Bloomberg, BofA Global Research estimates

Jet fuel pressured by travel bans, consumer fears

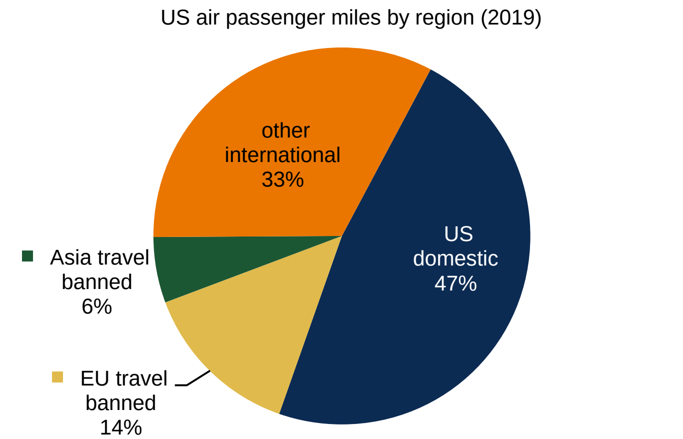
On a relative basis, jet fuel is the worst hit part of demand by the spread of the virus as air travel is the first thing to shut down to contain the spread between countries, and several nations now have effective travel bans in place. Chinese passenger traffic dropped 84% YoY in February (Chart 27) and most US and European flights to China have been grounded for weeks. The US just introduced a travel ban on Europeans (ex UK/Ireland) coming to the US, adding to a ban on China/Korea since late February. US air passenger miles are about 50/50 domestic and international, and 14% of that is international to/from Europe just banned and another 6% is from China/Korea (Chart 28). We estimate that the US travel bans on EU and Asia lower jet demand by 320 k b/d, and the decline in air travel between all countries and China is another 600 k b/d. In a normal year global jet fuel demand growth 2-300 k b/d YoY, which implies that at the moment global jet demand could be contracting by over 0.5 mn b/d YoY.

Chart 27: Chinese passenger traffic dropped 84% YoY in February



Source: CEIC

Chart 28: US air passenger miles are about 50/50 domestic and international, and 14% of that is international to/from Europe

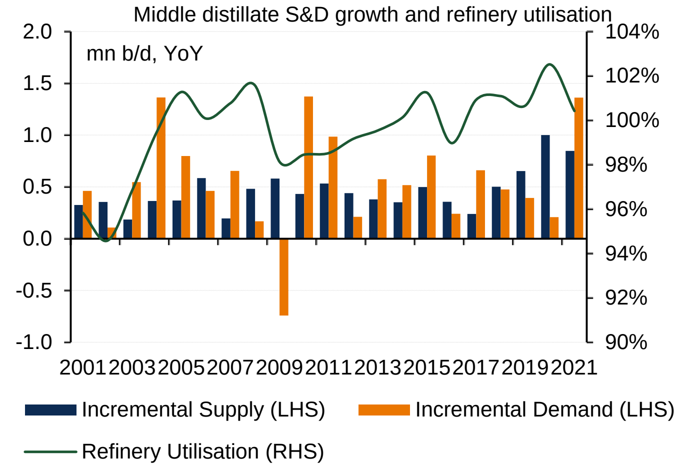


Source: US DOT

Diesel cracks bogged down by capacity, recover in 2H

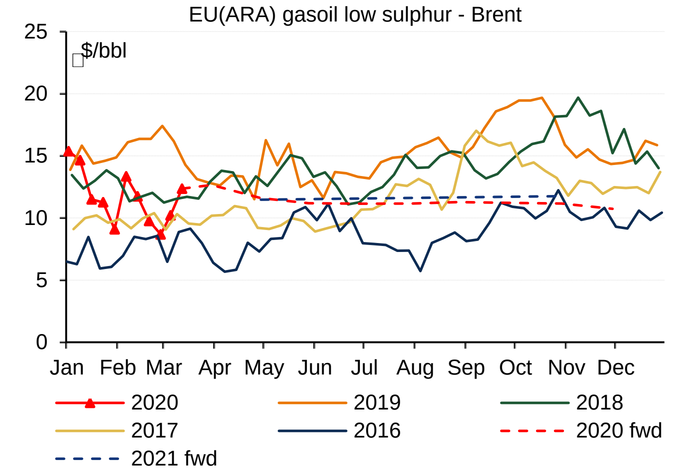
The diesel market is facing a trifecta of weakness on the demand side. People are traveling less, trade is contracting, and industrial production is floundering. Compounding this weakness has been the shipping industry's limited appetite for marine gasoil. We originally saw IMO as a one off bullish event for diesel in 2020 and we have been exceptionally disappointed in diesel cracks to say the least. Since 4Q of last year, our outlook for diesel balances has shifted from a deficit to a meaningful surplus (Chart 29). We see near term weakness for diesel cracks as regional quarantines are implemented but would expect a rebound in demand and cracks later this year as global industry gets back on its feet, restocking occurs, and stimulus likely hits the economy. Thus, we are bearish versus the curve near term and see upside by 4Q20 (Chart 30).

Chart 29: 2020 Middle distillate balances have shifted from large deficit to large surplus in the span of a few months



Source: BofA Global Research estimates

Chart 30: We see downside risk to gasoil and diesel cracks in 2Q and upside in 2H

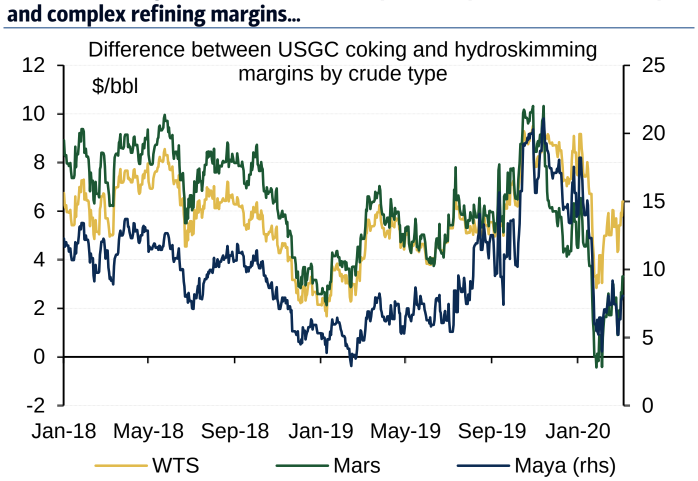


Source: Bloomberg

The return of high sulfur OPEC crude to weigh on HSFO

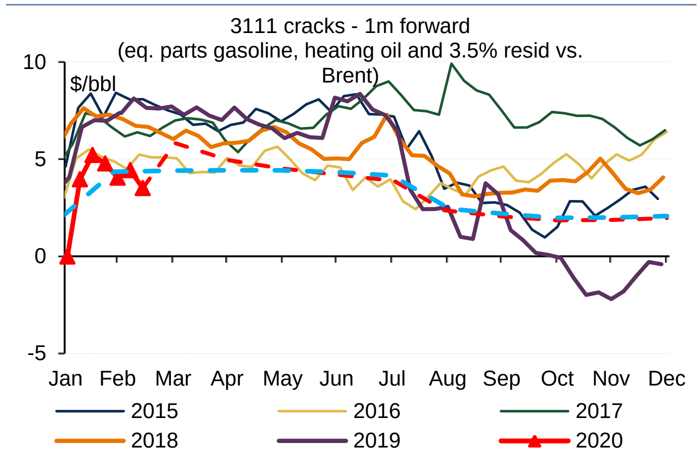
HSFO's recovery in 2020 has helped level the playing field for simple and complex refiners. Now the difference between coking and hydroskimming markets has compressed to pre-IMO levels (Chart 31), which would mean higher simple refiner runs, all else equal. Unfortunately, refining margins across most regions are relatively low due to the collapse in diesel and gasoline margins. The forward curve for a simple 3-1-1-1 cracks (gasoline, diesel, and 3.5% FO) is the lowest in the past 5 years for 1H20 (Chart 32). In our view, current crack levels do not incentivize normal run rates, but a return to normal would certainly hurt HSFO values from here.

Chart 31: Strong HSFO values have compressed spreads between simple and complex refining margins…



Source: Bloomberg

Chart 32: …making simple refiners marginally more economic

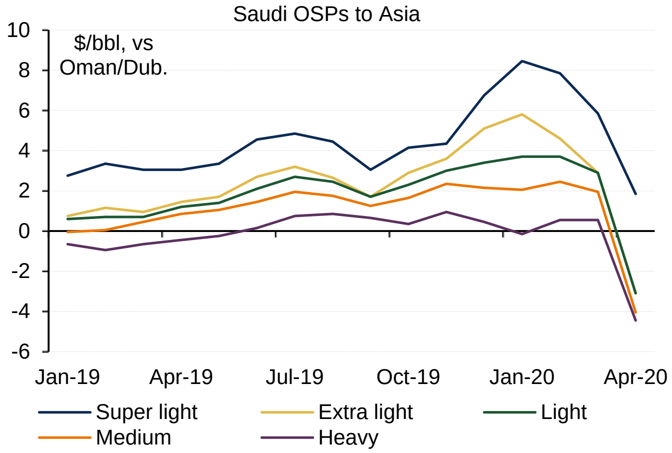


Source: Bloomberg

OPEC price war to widen sweet-sour spreads, weigh on HSFO

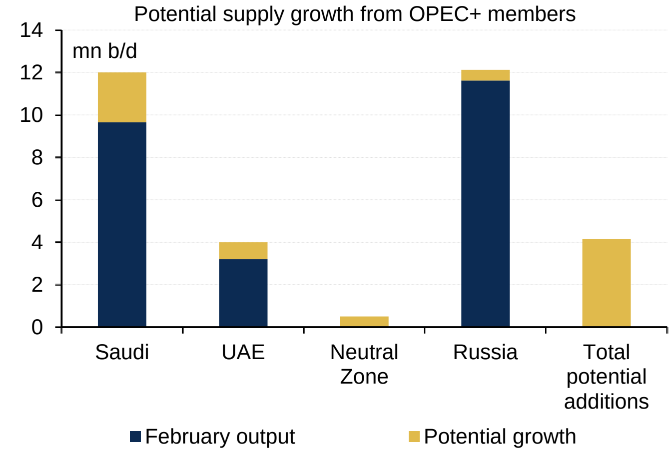
Saudi Arabia's decision to wage a price war by ramping up oil production from 9.7mn b/d to 12.3mn b/d and aggressively cutting OSPs (Chart 33) was followed by the UAE's announcement that it would also add another 1mn b/d to the market. Additionally, Kuwait will also likely see an output boost due to the Neutral Zone ramp up (500k b/d) and may lift output at its fields as well. Russia said it will boost output by 500k b/d in the coming months (Chart 34). The wave of new OPEC+ supply is likely to be primarily medium and heavy sour crude and will likely displace light sweet crude over time as shale producers dial back spending and see production declines. For this reason, we expect light-heavy spreads to strengthen. What's more, if Russia follows suit by aggressively cutting prices, they will add to the already significant volume of OPEC crude that is being sold below benchmark prices. Saudi's discounts give refiners substantial incentive to buy their barrels, which nearly guarantees a big margin uplift over benchmark barrels (WTI and Brent).

Chart 33: Saudi Arabia cut the official selling price of its crude oil to US, Asian, and European buyers



Source: Bloomberg

Chart 34: The market could see upwards of 4mn b/d of new supply from OPEC+ members in 2Q20

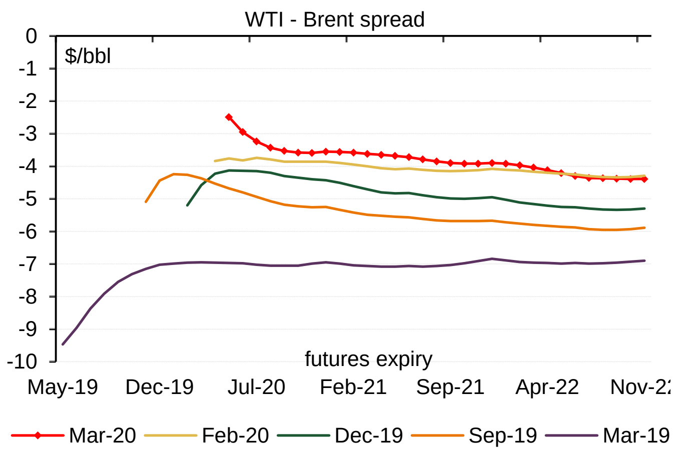


Source: IEA, BofA Global Research estimaes

Shale's impending demise puts US refining margins on notice

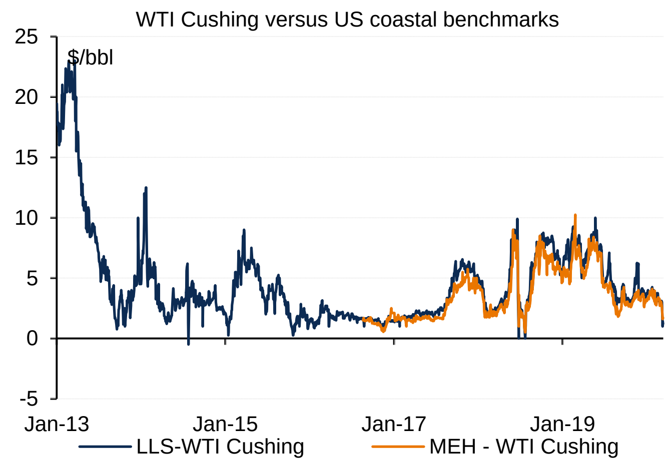
The collapse in oil prices following Saudi's announcement on Saturday has already forced US and Canadian E&Ps to slash 2020 upstream spending by upwards of 30-40%. We believe there is still momentum in North American upstream development, but this will slow over the year as service contracts roll off and producers dial back activity. We ultimately expect output to roll over in 2H20. This development is already having profound effects on WTI-Brent (Chart 35) and US differentials, which tightened immediately (Chart 36). Tighter WTI-Brent and inland-coastal spreads has reduced the advantage that US refiners have enjoyed since the advent of shale and should result in lower US runs, all else equal.

Chart 35: The impending surplus has compressed WTI-Brent spreads…



Source: Bloomberg

Chart 36: …and inland-coastal spreads, discouraging export volumes

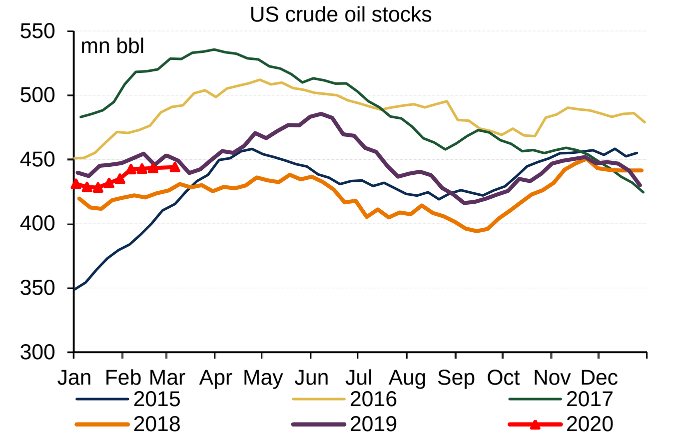


Source: Bloomberg

Appendix

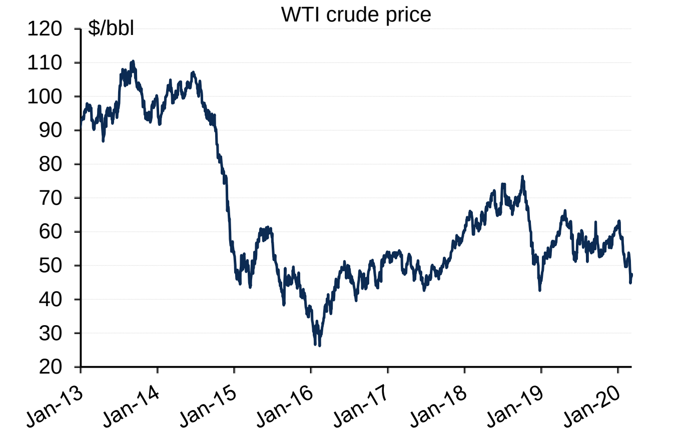
Petroleum US

Chart 37: US crude oil stocks



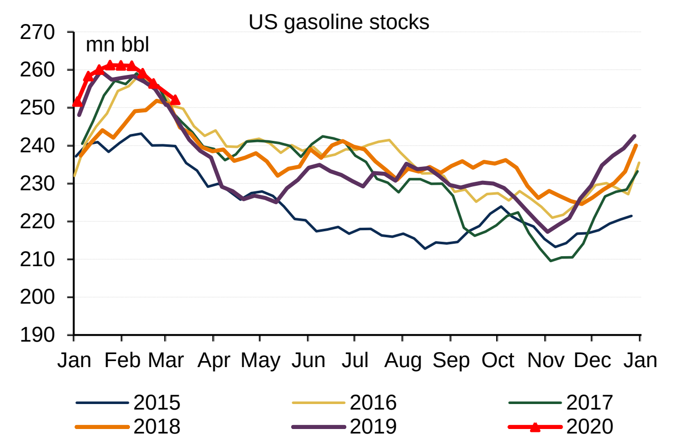
Source: US Department of Energy

Chart 38: WTI crude oil price



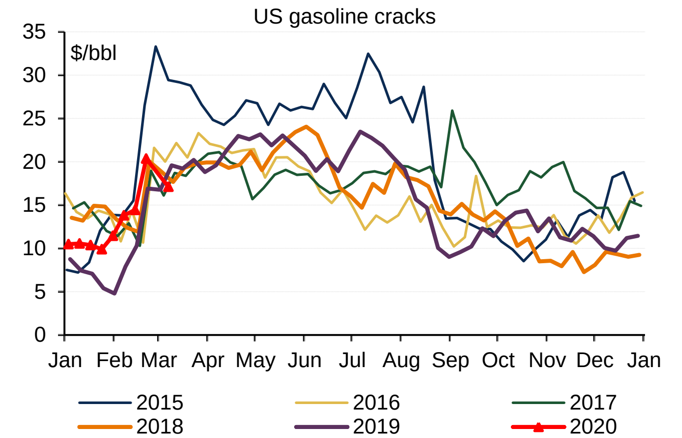
Source: NYMEX, Bloomberg

Chart 39: US gasoline stocks



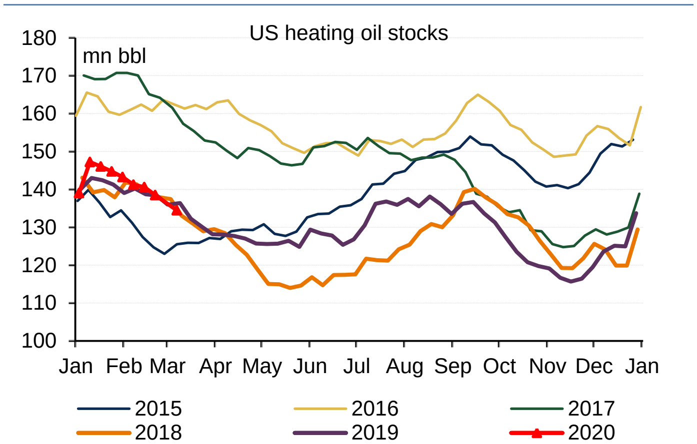
Source: US Department of Energy

Chart 40: US RBOB cracks



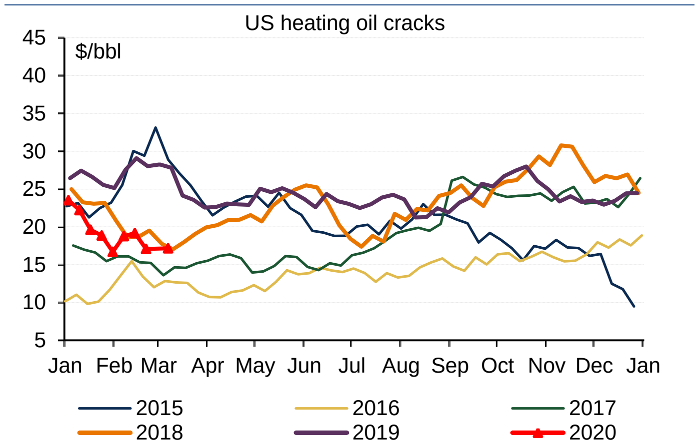
Source: NYMEX, Reuters

Chart 41: US distillate oil stocks



Source: US Department of Energy

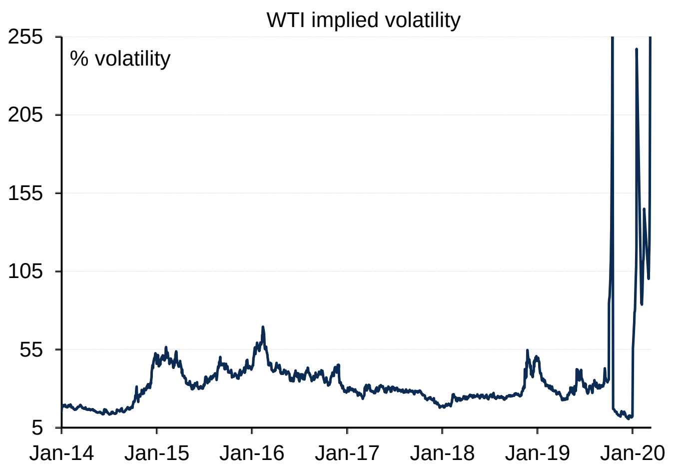
Chart 42: US distillate oil cracks



Source: NYMEX, Reuters

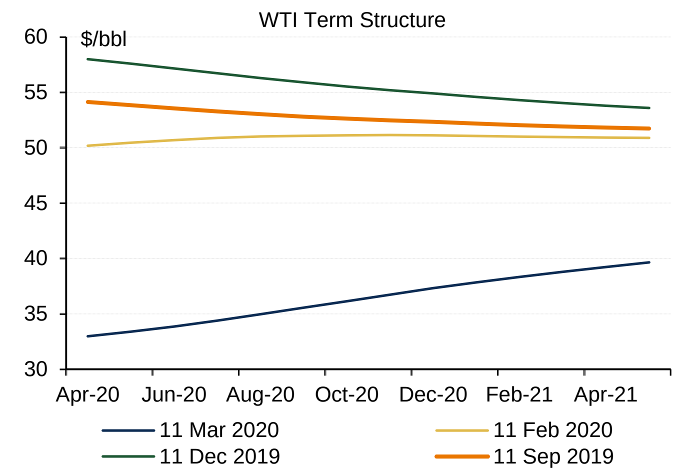
Petroleum US & Europe

Chart 43: WTI implied volatility



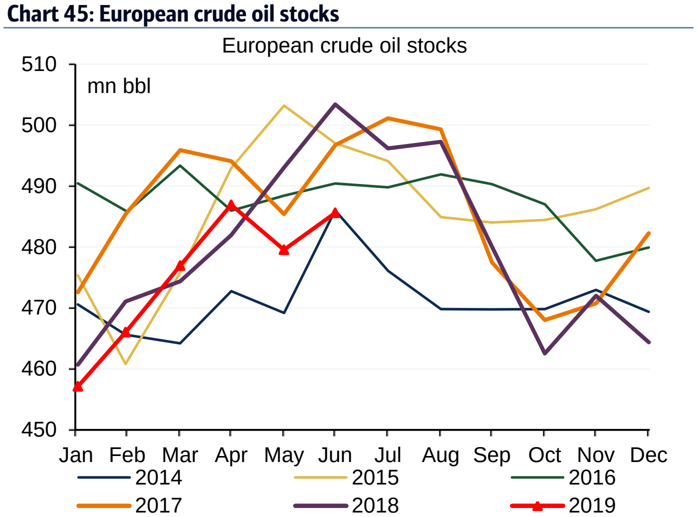
Source: NYMEX, Bloomberg

Chart 44: WTI term structure



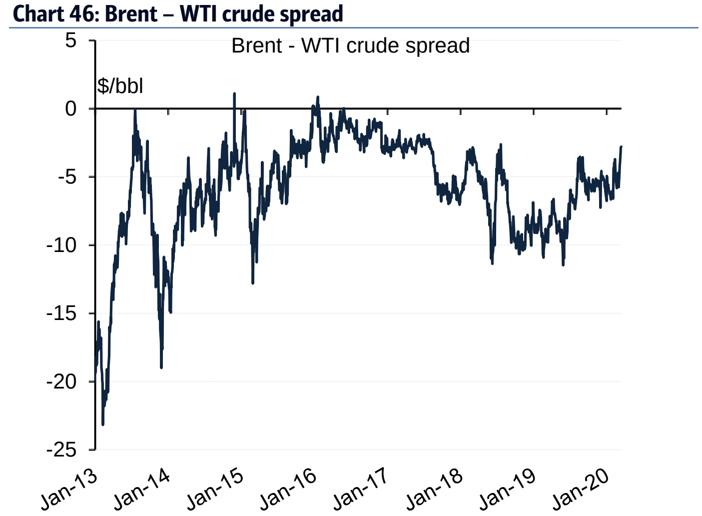
Source: NYMEX, Bloomberg

Chart 45: European crude oil stocks



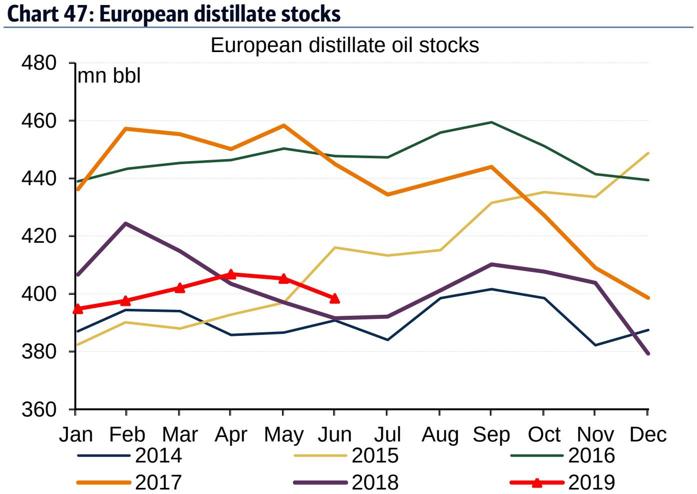
Source: Euroil

Chart 46: Brent – WTI crude spread



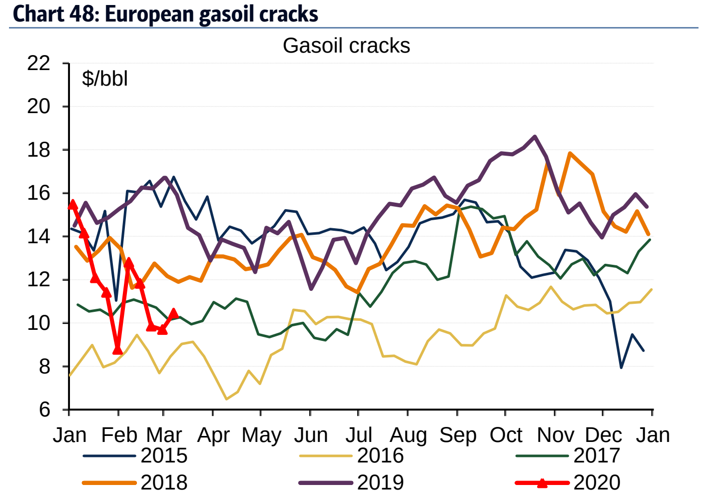
Source: IPE, Bloomberg

Chart 47: European distillate stocks



Source: Euroil

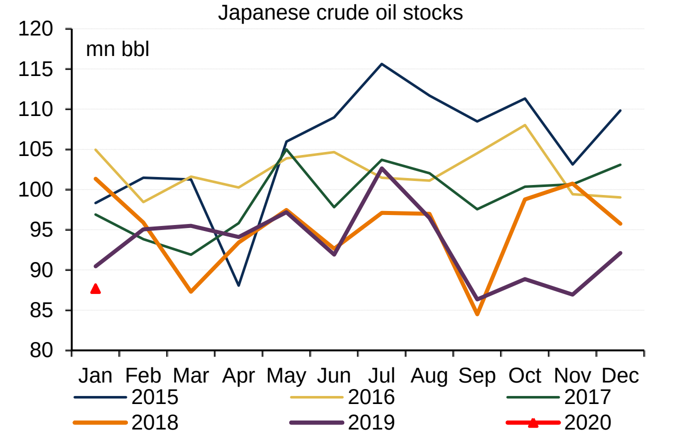
Chart 48: European gasoil cracks



Source: Reuters

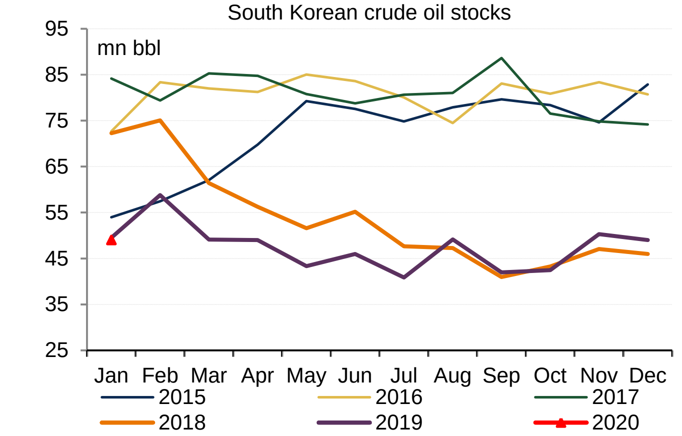
Petroleum Asia

Chart 49: Japanese crude oil stocks



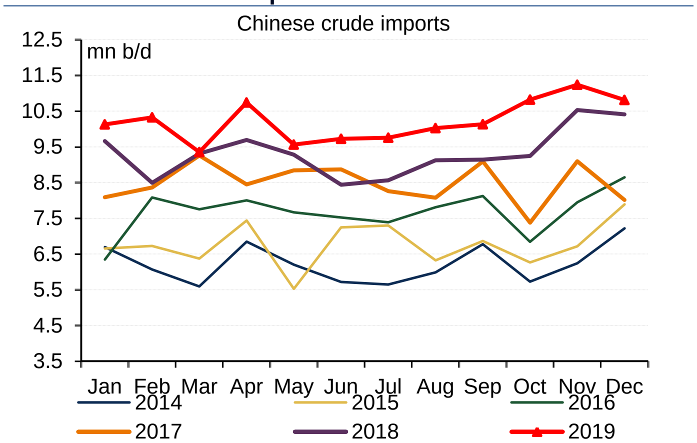
Source: International Energy Agency

Chart 50: South Korean crude oil stocks



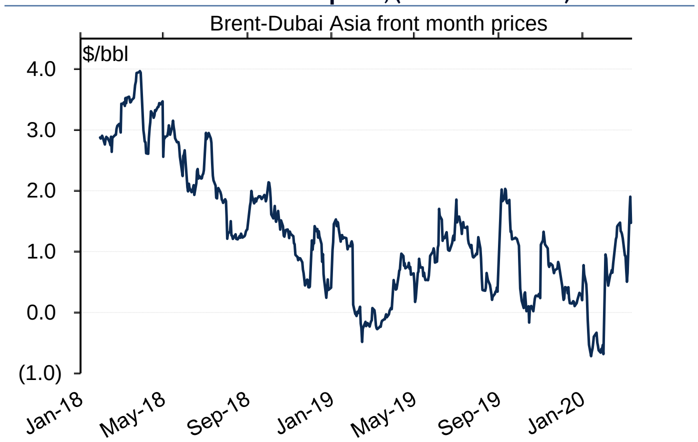
Source: International Energy Agency

Chart 51: Chine Crude oil Imports



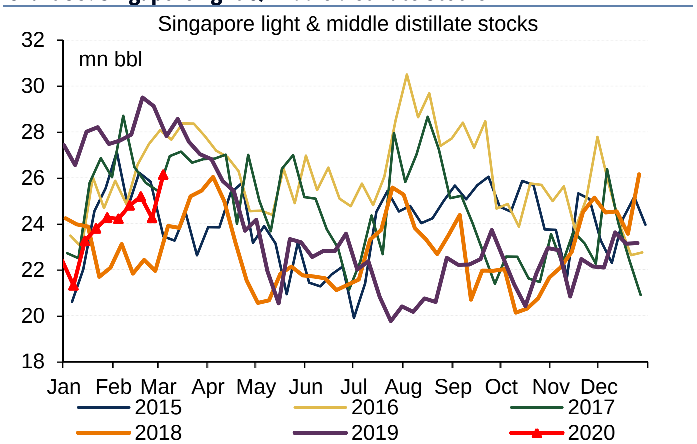
Source: Reuters

Chart 52: Brent – Dubai crude oil spread, (1 month contract)



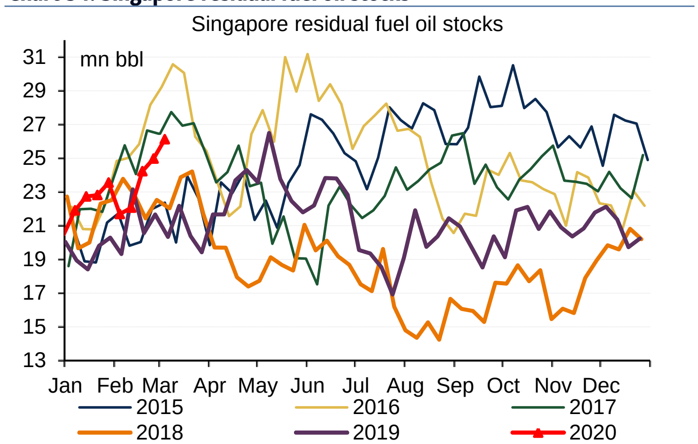
Source: Bloomberg

Chart 53: Singapore light & middle distillate Stocks



Source: Bloomberg

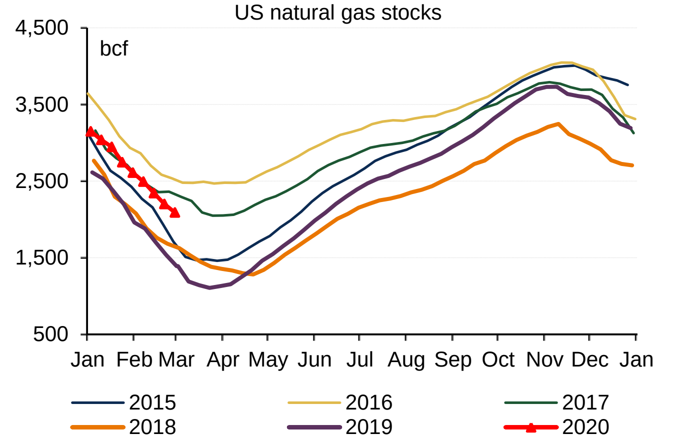
Chart 54: Singapore residual fuel oil stocks



Source: Bloomberg

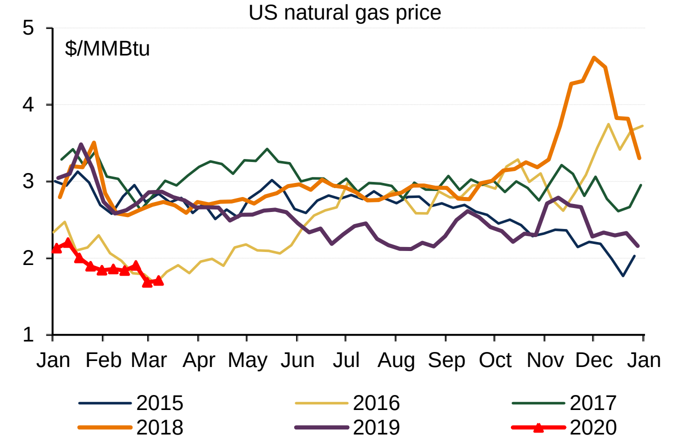
Gas & Power US

Chart 55: US natural gas stocks



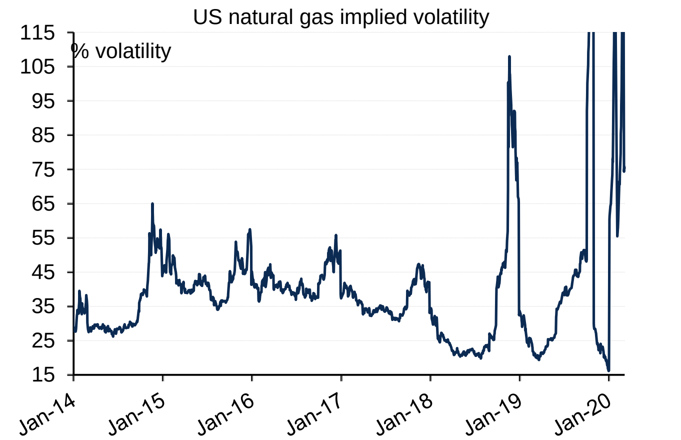
Source: US Department of Energy

Chart 56: US natural gas price



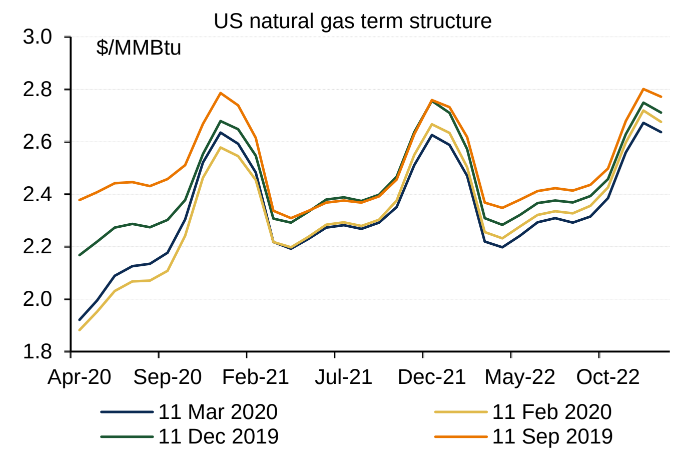
Source: NYMEX, Reuters

Chart 57: US natural gas implied volatility



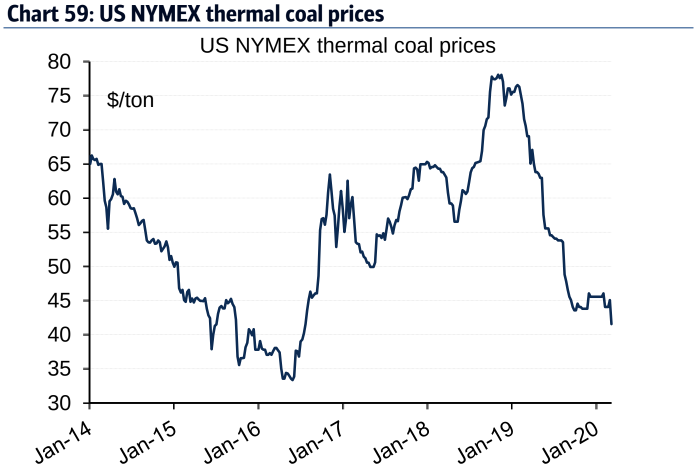
Source: NYMEX, Bloomberg

Chart 58: US natural gas term structure



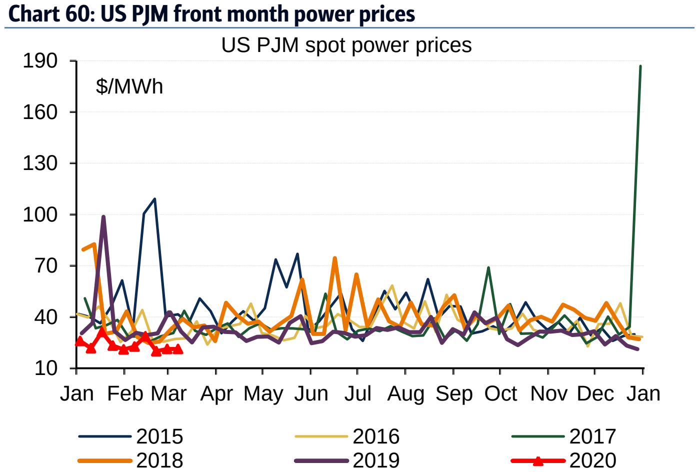
NYMEX, Reuters

Chart 59: US NYMEX thermal coal prices



Source: NYMEX, Reuters

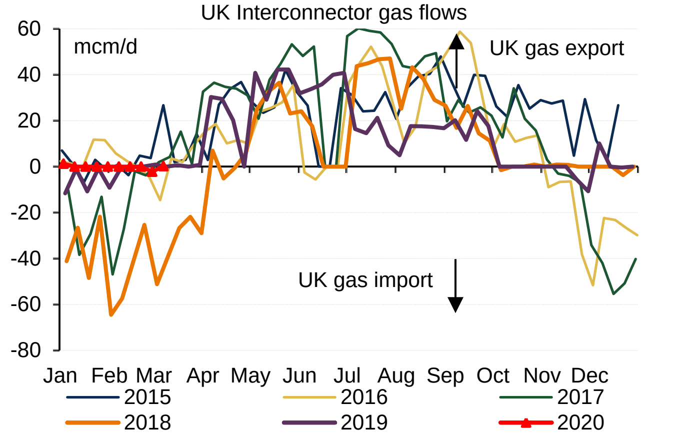
Chart 60: US PJM front month power prices



Source: NYMEX, Reuters

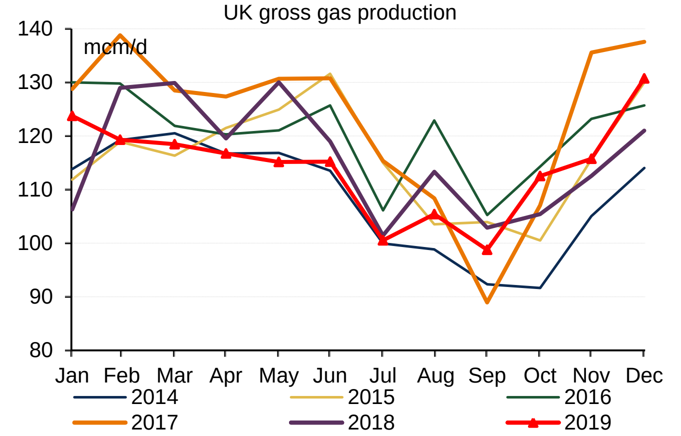
Gas & Power Europe

Chart 61: UK interconnector gas flows



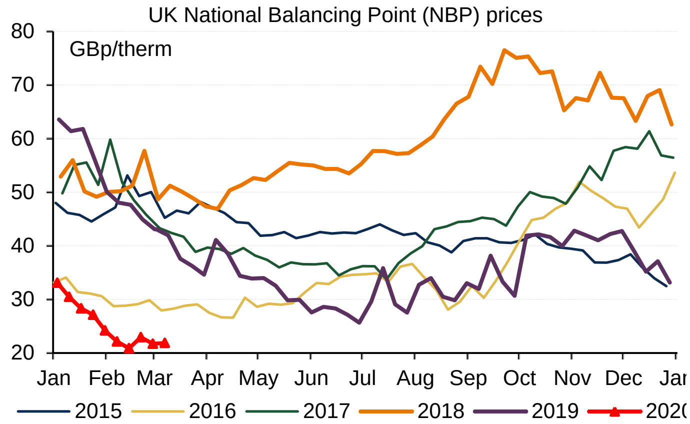
Source: UK Interconnector Flows

Chart 62: UK gross gas production



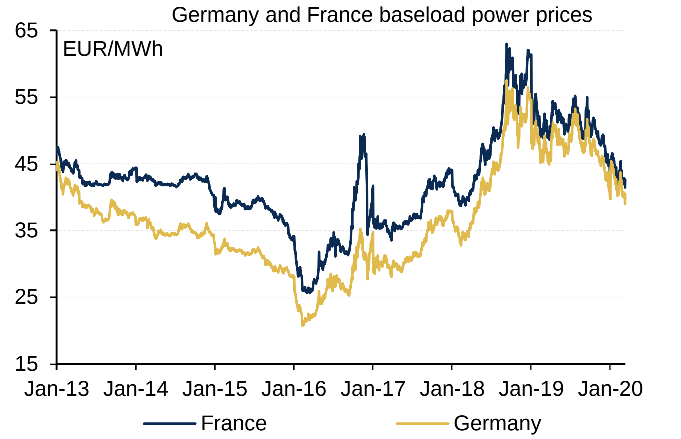
Source: UK Department of Trade and Industry

Chart 63: UK National Balancing Point (NBP) front month price



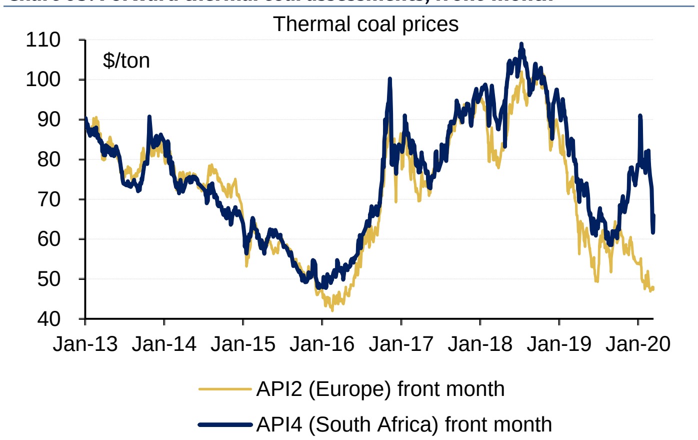
Source: Bloomberg

Chart 64: Germany and France baseload power



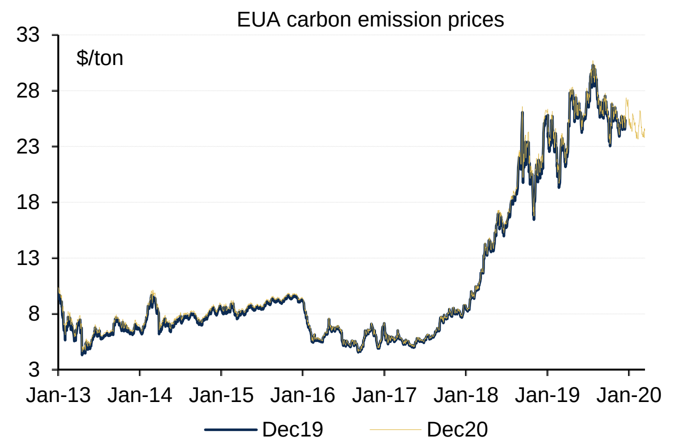
Source: Bloomberg

Chart 65: Forward thermal coal assessments, front-month



Source: Reuters

Chart 66: European CO2 emission price



Source: Bloomberg

Table 4: Global Commodity Research Publications - Past Topics

Date	Publication	Title
08-Mar-20	Commodity update	It takes two to supercontango
06-Mar-20	Commodity update	An oil marriage story
05-Mar-20	Global Energy Weekly	Liquids frac-pocalypse
03-Mar-20	Global Metals Weekly	Metals not immune to Covid-19
01-Mar-20	Commodity update	Oil goes viral
24-Feb-20	Global Energy Paper	Medium-term oil outlook
21-Feb-20	Global Metals Weekly	Coronavirus not a crown for metal fundamentals
20-Feb-20	Global Energy Weekly	Oil fights parasite
14-Feb-20	Global Metals Weekly	ESG #4: green steel
14-Feb-20	Global Energy Weekly	Honey, I shrunk OPEC
10-Feb-20	FICC Portfolio Monthly	Unlocking "value"
09-Feb-20	Global Energy Weekly	Oil demand edges closer to the cliff
05-Feb-20	Commodities and EM Strategy/ Economics	Coronavirus: commodity and EM fallout
03-Feb-20	Commodity Strategist	Virus concerns infect commodity markets
31-Jan-20	FICC Portfolio Monthly	Factor Signals for FX Hedgers
28-Jan-20	Global Metals Weekly	Gasmaggedon
26-Jan-20	Global Energy Weekly	Putting the CO2 genie back in the bottle
24-Jan-20	Global Metals Weekly	The future is now
17-Jan-20	Global Energy Weekly	Green shoots in EM oil demand
16-Jan-20	Global Metals Weekly	Tight supply squeezing copper higher
10-Jan-20	Global Energy Weekly	Deepwater revival
10-Jan-20	Quantitative Investment Strategies Tracker	DDM Performance Update – 2019 Q4
09-Jan-20	Global Metals Weekly	Stable geopolitical disequilibrium
06-Jan-20	Commodity update	Pandora's oil box
20-Dec-19	FICC Portfolio Monthly	Enhanced FX hedging with risk premia
20-Dec-19	Global Energy Weekly	Fifty shades of green
13-Dec-19	Global Energy Weekly	Is MGO fool's oil or the real McCoy?
06-Dec-19	Commodity update	OPEC+ delivers, now for the execution
06-Dec-19	Global Metals Weekly	How low can nickel go?
05-Dec-19	Global Energy Weekly	Air traffic mirrors two-speed economy
02-Dec-19	Commodity update	OPEC+: Extend and pretend
29-Nov-19	Global Metals Weekly	Shiny aluminium remains the dark horse
26-Nov-19	Global Energy Weekly	PJM power under siege
22-Nov-19	Global Metals Weekly	Can wind power copper?
19-Nov-19	Commodity Strategist	2020 – the year ahead: Commodity Outlook
19-Nov-19	Energy Strategist	2020 – the year ahead: Energy Outlook
08-Nov-19	Global Energy Weekly	Spreading some positive energy
08-Nov-19	Global Energy Weekly	Taking a crack at 2020
01-Nov-19	Global Energy Weekly	Gasoline comes full circle
01-Nov-19	Global Metals Weekly	LM(E)SG Week
28-Oct-19	Quantitative Investment Strategies Spotlight	DDM Performance Update – 2019 Q3
28-Oct-19	Commodity update	Freight: Wet over dry
28-Oct-19	Global Energy Weekly	Surplus MMbtu's could spell the blues
28-Oct-19	Global Metals Weekly	Copper mine supply disrupted
18-Oct-19	Global Energy Weekly	It pays to be sweet
18-Oct-19	Global Metals Weekly	The trouble with the "bubble" – nickel and LME warehousing
14-Oct-19	FICC Portfolio Monthly	The long and short of swaption volatility risk premia
11-Oct-19	Global Metals Weekly	Climate change in commodities
11-Oct-19	Global Energy Weekly	California cap and trade primer
03-Oct-19	Global Energy Weekly	Diesel in the driver's seat
03-Oct-19	Global Metals Weekly	Dysfunctional aluminium
27-Sep-19	FICC Portfolio Monthly	Demystifying the credit risk premium
26-Sep-19	Global Energy Weekly	The big LNG short
24-Sep-19	Quantitative Investment Strategies Panorama	There is more to low vol than duration
20-Sep-19	Global Energy Weekly	All eyes on security of oil supply
16-Sep-19	Commodity update	The big one
13-Sep-19	Global Energy Weekly	Enjoy the NGL rebound while it lasts
13-Sep-19	Global Metals Weekly	Steady PGM fundamentals, but fear subsides; primer on emission tests
06-Sep-19	Global Metals Weekly	Glencore sends cobalt on a round-trip
06-Sep-19	Global energy Weekly	IMO making waves in the oil market
29-Aug-19	Global Energy Weekly	Carbon can't escape the cycle
27-Aug-19	FICC Portfolio Monthly	Revisiting interest rates carry
26-Aug-19	Commodity Strategist	Trade war cuts both ways
23-Aug-19	Global Energy Weekly	Coal macro crunch
23-Aug-19	Global Metals Weekly	Nickel rallies on Indonesia, again
16-Aug-19	Global Energy Weekly	Slower shale + new pipe = tighter spreads

Table 4: Global Commodity Research Publications - Past Topics

Date	Publication	Title
15-Aug-19	Global Metals Weekly	Mapping the gold market
09-Aug-19	Global Metals Weekly	How bad can it get for copper?
09-Aug-19	Global Energy Weekly	A brief primer on biofuels
02-Aug-19	Global Metals Weekly	Quantitative failure and gold
02-Aug-19	Commodity update	Oil at the edge of a cliff
01-Aug-19	Global Energy Weekly	No rest for non-OPEC
26-Jul-19	Global Metals Weekly	Iron ore pulls up freight. Dry bulk rally does not spell sea change for commodities
25-Jul-19	Global Energy Weekly	Permian gains create Henry Hub pain
18-Jul-19	Quantitative Investment Strategies Spotlight	DDM deliveres steady performance in first 12M despite quant struggles
18-Jul-19	Global Energy Weekly	The fog of trade war and hot war
18-Jul-19	Global Metals Weekly	ESG #1: aluminum industry goes green
12-Jul-19	Global Energy Weekly	Gasoline: from famine to feast
02-Jul-19	Global Energy Weekly	Tailwinds for renewable power
28-Jul-19	FICC Portfolio Monthly	Inflation hedge carry
28-Jul-19	Global Energy Weekly	Testing plastic's durability in a downturn
21-Jun-19	Global Metals Weekly	Lithium update. What are hydroxide and carbonate
20-Jun-19	Global Energy Weekly	Europe feels global gas pain
14-Jun-19	Global Metals Weekly	Assessing China's long-term copper demand after the trade wars
14-Jun-19	Global Energy Weekly	Three macro puts and an oil cliff
10-Jun-19	Commodity Strategist	Making sense of the trade war madness
05-Jun-19	Global Energy Weekly	Final chapter of Northeast gas story
04-Jun-19	Commodity update	What just happened to oil?
31-May-19	Global Energy Weekly	Diesel's tug-of-war
31-May-19	Global Metals Weekly	The light metal is feeling heavy
24-May-19	Global Metals Weekly	Are rare earths China's key leverage?
24-May-19	Global Energy Weekly	NGL supply boom spurs doom & gloom
17-May-19	Global Metals Weekly	A letter from Barcelona: what miners think about commodities
16-May-19	Global Energy Weekly	Oil trapped between Iran and trade wars
10-May-19	Quantitative Investment Strategies Panorama	Momentum's moments
10-May-19	Global Metals Weekly	Silver to catch a break
10-May-19	Global Energy Weekly	Runnin' low on gas
03-May-19	Global Metals Weekly	A tale of two nickels
03-May-19	Global Energy Weekly	The oil endgame
30-Apr-19	FICC Portfolio Monthly	IBOR transition and quant: a first look
23-Apr-19	Global Energy Weekly	Nat gas jumps the gun on LNG
18-Apr-19	Global Energy Weekly	Houston, we have a blending problem
18-Apr-19	Global Metals Weekly	Copper projects will not swamp the market
12-Apr-19	Global Energy Weekly	Assessing the rise of an oil spike
12-Apr-19	Global Metals Weekly	Populism as protectionism or harmonious growth. China bails out metals again
05-May-19	Global Energy Weekly	Coal dragged down by global gas
02-Apr-19	Global Metals Weekly	Coppalypse after Steelmageddon? More upside to mined commodities
02-Apr-19	Commodity update	Adding cushion in Cushing
01-Apr-19	Commodity update	The Permian: where gas sellers pay you
29-Mar-19	FICC Portfolio Monthly	Enhancing returns with cluster momentum
27-Mar-19	Global Energy Weekly	Protectionism vs populism in oil markets
22-Mar-19	Global Metals Weekly	Solving the copper volatility puzzle
20-Mar-19	Global Energy Weekly	Liquid gas implodes
15-Mar-19	Global Energy Weekly	Too much light oil at the end of the tunnel
15-Mar-19	Global Metals Weekly	Gold: does de-dollarisation of FX reserves lead to re-goldification?
08-Mar-19	Global Energy Weekly	Headwinds force oil into slow hiking
09-Mar-19	Global Metals Weekly	Copper rallies as global growth slows
05-Mar-19	Commodity update	Pipeline delay may require Canada output cut extension
04-Mar-19	Global Metals Weekly	Inelastic demand meets inelastic supply. Palladium to rally further
01-Mar-19	Global Energy Weekly	Cracking down on trade
27-Feb-19	FICC Portfolio Monthly	The Carry Factor: Rates Edition
21-Feb-19	Global Energy Weekly	Nat gas summer doldrums
21-Feb-19	Global Metals Weekly	Zinc squeezes higher
15-Feb-19	Global Metals Weekly	China's aluminium exports still too high
14-Feb-19	Global Energy Paper	Medium-term oil outlook
08-Feb-19	Global Energy Weekly	OPEC's shrinking piece of a growing pie
08-Feb-19	Global Metals Weekly	Cobalt implosion
07-Feb-19	Commodity update	Mind the US LNG export gap

Source: BofA Global Commodities Research

Disclosures

Important Disclosures

BofA Global Research personnel (including the analyst(s) responsible for this report) receive compensation based upon, among other factors, the overall profitability of Bank of America Corporation, including profits derived from investment banking. The analyst(s) responsible for this report may also receive compensation based upon, among other factors, the overall profitability of the Bank's sales and trading businesses relating to the class of securities or financial instruments for which such analyst is responsible.
BofA Securities fixed income analysts regularly interact with sales and trading desk personnel in connection with their research, including to ascertain pricing and liquidity in the fixed income markets.

Other Important Disclosures

Prices are indicative and for information purposes only. Except as otherwise stated in the report, for the purpose of any recommendation in relation to: (i) an equity security, the price referenced is the publicly traded price of the security as of close of business on the day prior to the date of the report or, if the report is published during intraday trading, the price referenced is indicative of the traded price as of the date and time of the report; or (ii) a debt security (including equity preferred and CDS), prices are indicative as of the date and time of the report and are from various sources including BofA Securities trading desks.
The date and time of completion of the production of any recommendation in this report shall be the date and time of dissemination of this report as recorded in the report timestamp.

Recipients who are not institutional investors or market professionals should seek the advice of their independent financial advisor before considering information in this report in connection with any investment decision, or for a necessary explanation of its contents.
Officers of BofAS or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.
BofA Global Research policies relating to conflicts of interest are described at https://rsch.baml.com/coi
"BofA Securities" includes BofA Securities, Inc. ("BofAS") and its affiliates. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor if they have questions concerning this report or concerning the appropriateness of any investment idea described herein for such investor. "BofA Securities" is a global brand for BofA Global Research.
Information relating to Non-US affiliates of BofA Securities and Distribution of Affiliate Research Reports:
BofAS and/or Merrill Lynch, Pierce, Fenner & Smith ("MLPF&S") may in the future distribute, information of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by The Financial Service Board; MLI (UK): Merrill Lynch International, regulated by the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA); BofASE (France): BofA Securities Europe SA is authorized by the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers (AMF); BAMLI DAC (Milan): Bank of America Merrill Lynch International DAC, Milan Branch, regulated by the Bank of Italy, the European Central Bank (ECB) and the Central Bank of Ireland (CBI); BAMLI DAC (Frankfurt): Bank of America Merrill Lynch International DAC, Frankfurt Branch regulated by BaFin, the ECB and the CBI; Merrill Lynch (Australia): Merrill Lynch Equities (Australia) Limited, regulated by the Australian Securities and Investments Commission; Merrill Lynch (Hong Kong): Merrill Lynch (Asia Pacific) Limited, regulated by the Hong Kong Securities and Futures Commission (HKSFC); Merrill Lynch (Singapore): Merrill Lynch (Singapore) Pte Ltd, regulated by the Monetary Authority of Singapore (MAS); Merrill Lynch (Canada): Merrill Lynch Canada Inc, regulated by the Investment Industry Regulatory Organization of Canada; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y de Valores; Merrill Lynch (Argentina): Merrill Lynch Argentina SA, regulated by Comisión Nacional de Valores; Merrill Lynch (Japan): Merrill Lynch Japan Securities Co., Ltd., regulated by the Financial Services Agency; Merrill Lynch (Seoul): Merrill Lynch International, LLC Seoul Branch, regulated by the Financial Supervisory Service; Merrill Lynch (Taiwan): Merrill Lynch Securities (Taiwan) Ltd., regulated by the Securities and Futures Bureau; DSP Merrill Lynch (India): DSP Merrill Lynch Limited, regulated by the Securities and Exchange Board of India; Merrill Lynch (Indonesia): PT Merrill Lynch Sekuritas Indonesia, regulated by Otoritas Jasa Keuangan (OJK); Merrill Lynch (Israel): Merrill Lynch Israel Limited, regulated by Israel Securities Authority; Merrill Lynch (Russia): OOO Merrill Lynch Securities, Moscow, regulated by the Central Bank of the Russian Federation; Merrill Lynch (DIFC): Merrill Lynch International (DIFC Branch), regulated by the Dubai Financial Services Authority (DFSA); Merrill Lynch (Spain): Merrill Lynch Capital Markets Espana, S.A.S.V., regulated by Comisión Nacional del Mercado De Valores; Merrill Lynch (Brazil): Merrill Lynch S.A. Corretora de Títulos e Valores Mobiliários, regulated by Comissão de Valores Mobiliários; Merrill Lynch KSA Company: Merrill Lynch Kingdom of Saudi Arabia Company, regulated by the Capital Market Authority.
This information: has been approved for publication and is distributed in the United Kingdom (UK) to professional clients and eligible counterparties (as each is defined in the rules of the FCA and the PRA) by MLI (UK), which is authorized by the PRA and regulated by the FCA and the PRA - details about the extent of our regulation by the FCA and PRA are available from us on request; has been approved for publication and is distributed in the European Economic Area (EEA) by BofASE (France), which is authorized by the ACPR and regulated by the ACPR and the AMF; has been considered and distributed in Japan by Merrill Lynch (Japan), a registered securities dealer under the Financial Instruments and Exchange Act in Japan, or its permitted affiliates; is issued and distributed in Hong Kong by Merrill Lynch (Hong Kong) which is regulated by HKSFC; is issued and distributed in Taiwan by Merrill Lynch (Taiwan); is issued and distributed in India by DSP Merrill Lynch (India); and is issued and distributed in Singapore to institutional investors and/or accredited investors (each as defined under the Financial Advisers Regulations) by Merrill Lynch (Singapore) (Company Registration No 198602883D). Merrill Lynch (Singapore) is regulated by MAS. Bank of America N.A., Australian Branch (ARBN 064 874 531), AFS License 412901 (BANA Australia) and Merrill Lynch Equities (Australia) Limited (ABN 65 006 276 795), AFS License 235132 (MLEA) distribute this information in Australia only to 'Wholesale' clients as defined by s.761G of the Corporations Act 2001. With the exception of BANA Australia, neither MLEA nor any of its affiliates involved in preparing this information is an Authorised Deposit-Taking Institution under the Banking Act 1959 nor regulated by the Australian Prudential Regulation Authority. No approval is required for publication or distribution of this information in Brazil and its local distribution is by Merrill Lynch (Brazil) in accordance with applicable regulations. Merrill Lynch (DIFC) is authorized and regulated by the DFSA. Information prepared and issued by Merrill Lynch (DIFC) is done so in accordance with the requirements of the DFSA conduct of business rules. BAMLI DAC (Frankfurt) distributes this information in Germany and is regulated by BaFin, the ECB and the CBI. BofA Securities entities, including BAMLI DAC and BofASE (France), may outsource/delegate the marketing and/or provision of certain research services or aspects of research services to other branches or members of the BofA Securities group. You may be contacted by a different BofA Securities entity acting for and on behalf of your service provider where permitted by applicable law. This does not change your service provider. Please use this link http://www.bankofamerica.com/emaildisclaimer for further information
This information has been prepared and issued by BofAS and/or one or more of its non-US affiliates. The author(s) of this information may not be licensed to carry on regulated activities in your jurisdiction and, if not licensed, do not hold themselves out as being able to do so. BofAS and/or MLPF&S is the distributor of this information in the US and accepts full responsibility for information distributed to BofAS and/or MLPF&S clients in the US by its non-US affiliates. Any US person receiving this information and wishing to effect any transaction in any security discussed herein should do so through BofAS and/or MLPF&S and not such foreign affiliates. Hong Kong recipients of this information should contact Merrill Lynch (Asia Pacific) Limited in respect of any matters relating to dealing in securities or provision of specific advice on securities or any other matters arising from, or in connection with, this information. Singapore recipients of this information should contact Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this information.
General Investment Related Disclosures:
Taiwan Readers: Neither the information nor any opinion expressed herein constitutes an offer or a solicitation of an offer to transact in any securities or other financial instrument. No part of this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or any other person without the express written consent of BofA Securities.
This document provides general information only, and has been prepared for, and is intended for general distribution to, BofA Securities clients. Neither the information nor any opinion expressed constitutes an offer or an invitation to make an offer, to buy or sell any securities or other financial instrument or any derivative related to such securities or instruments (e.g., options, futures, warrants, and contracts for differences). This document is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of, and is not directed to, any specific person(s). This document and its content do not constitute, and should not be considered to constitute, investment advice for purposes of ERISA, the US tax code, the Investment Advisers Act or otherwise. Investors should seek financial advice regarding the appropriateness of investing in financial

instruments and implementing investment strategies discussed or recommended in this document and should understand that statements regarding future prospects may not be realized. Any decision to purchase or subscribe for securities in any offering must be based solely on existing public information on such security or the information in the prospectus or other offering document issued in connection with such offering, and not on this document.

Securities and other financial instruments referred to herein, or recommended, offered or sold by BofA Securities, are not insured by the Federal Deposit Insurance Corporation and are not deposits or other obligations of any insured depository institution (including, Bank of America, N.A.). Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counterparty default risk and liquidity risk. No security, financial instrument or derivative is suitable for all investors. In some cases, securities and other financial instruments may be difficult to value or sell and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance. Levels and basis for taxation may change.

Futures and options are not appropriate for all investors. Such financial instruments may expire worthless. Before investing in futures or options, clients must receive the appropriate risk disclosure documents. Investment strategies explained in this report may not be appropriate at all times. Costs of such strategies do not include commission or margin expenses.

BofA Securities is aware that the implementation of the ideas expressed in this report may depend upon an investor's ability to "short" securities or other financial instruments and that such action may be limited by regulations prohibiting or restricting "shortselling" in many jurisdictions. Investors are urged to seek advice regarding the applicability of such regulations prior to executing any short idea contained in this report.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned in this report. Investors in such securities and instruments effectively assume currency risk.

UK Readers: The protections provided by the U.K. regulatory regime, including the Financial Services Scheme, do not apply in general to business coordinated by BofA Securities entities located outside of the United Kingdom.

BofAS or one of its affiliates is a regular issuer of traded financial instruments linked to securities that may have been recommended in this report. BofAS or one of its affiliates may, at any time, hold a trading position (long or short) in the securities and financial instruments discussed in this report.

BofA Securities, through business units other than BofA Global Research, may have issued and may in the future issue trading ideas or recommendations that are inconsistent with, and reach different conclusions from, the information presented herein. Such ideas or recommendations may reflect different time frames, assumptions, views and analytical methods of the persons who prepared them, and BofA Securities is under no obligation to ensure that such other trading ideas or recommendations are brought to the attention of any recipient of this information.

In the event that the recipient received this information pursuant to a contract between the recipient and BofAS for the provision of research services for a separate fee, and in connection therewith BofAS may be deemed to be acting as an investment adviser, such status relates, if at all, solely to the person with whom BofAS has contracted directly and does not extend beyond the delivery of this report (unless otherwise agreed specifically in writing by BofAS If such recipient uses the services of BofAS in connection with the sale or purchase of a security referred to herein, BofAS may act as principal for its own account or as agent for another person. BofAS is and continues to act solely as a broker-dealer in connection with the execution of any transactions, including transactions in any securities referred to herein.

Copyright and General Information:

Materials prepared by BofA Global Research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of BofA Securities, including investment banking personnel. BofA Securities has established information barriers between BofA Global Research and certain business groups. As a result, BofA Securities does not disclose certain client relationships with, or compensation received from, such issuers. To the extent this material discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this material. BofA Global Research personnel's knowledge of legal proceedings in which any BofA Securities entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving issuers mentioned in this material is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, discussed with, and may not reflect information known to, professionals in other business areas of BofA Securities in connection with the legal proceedings or matters relevant to such proceedings.

This information has been prepared independently of any issuer of securities mentioned herein and not in connection with any proposed offering of securities or as agent of any issuer of any securities. None of BofAS any of its affiliates or their research analysts has any authority whatsoever to make any representation or warranty on behalf of the issuer(s). BofA Global Research policy prohibits research personnel from disclosing a recommendation, investment rating, or investment thesis for review by an issuer prior to the publication of a research report containing such rating, recommendation or investment thesis.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

The information herein (other than disclosure information relating to BofA Securities and its affiliates) was obtained from various sources and we do not guarantee its accuracy. This information may contain links to third-party websites. BofA Securities is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this information and is not incorporated by reference. The inclusion of a link does not imply any endorsement by or any affiliation with BofA Securities. Access to any third-party website is at your own risk, and you should always review the terms and privacy policies at third-party websites before submitting any personal information to them. BofA Securities is not responsible for such terms and privacy policies and expressly disclaims any liability for them.

All opinions, projections and estimates constitute the judgment of the author as of the date of publication and are subject to change without notice. Prices also are subject to change without notice. BofA Securities is under no obligation to update this information and BofA Securities ability to publish information on the subject issuer(s) in the future is subject to applicable quiet periods. You should therefore assume that BofA Securities will not update any fact, circumstance or opinion contained herein.

Certain outstanding reports or investment opinions relating to securities, financial instruments and/or issuers may no longer be current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.

In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with BofAS or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies.

Neither BofA Securities nor any officer or employee of BofA Securities accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this information.