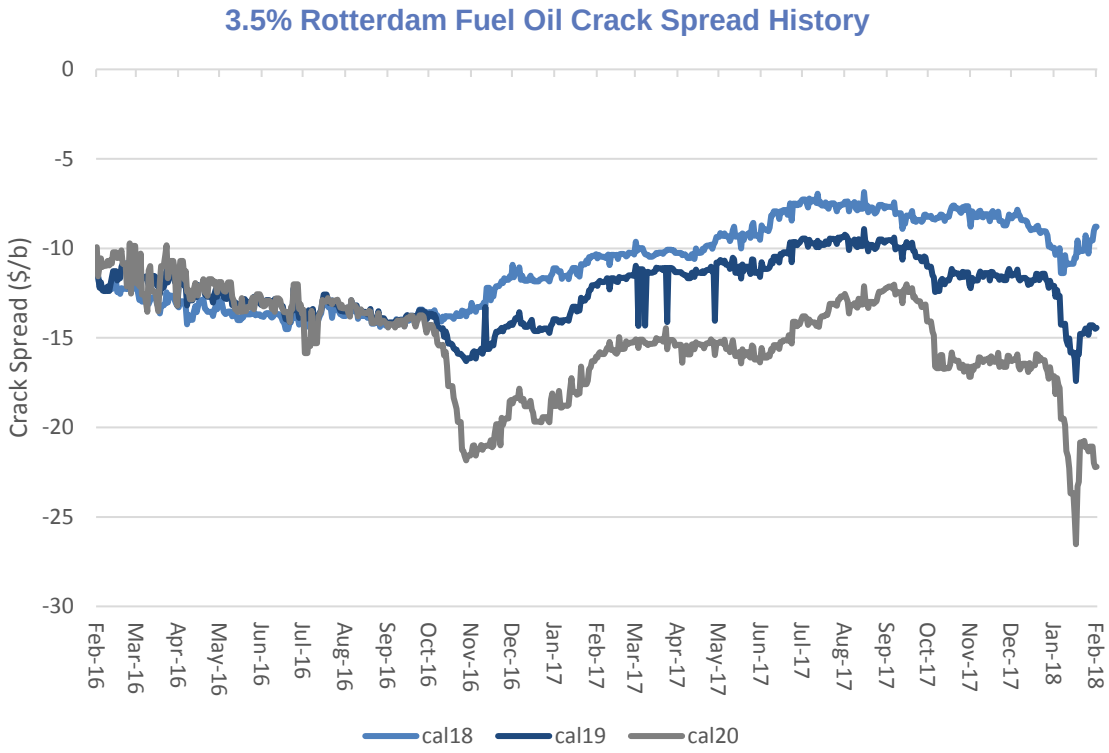
IMO 2020 Sulphur Cap – Implications for Oil Markets

When we first wrote about the International Maritime Organisation's sulphur cap last year, the 1st January 2020 commencement date still seemed a long way off. The discount of the forward price of fuel oil for 2019 and 2020 to the respective forward prices for Brent (the fuel crack spread), widened sharply when the cap was announced at the end of 2016. The 2020 crack spread for 3.5% barges fell from around -14 $/b to below -20 $/b. Fuel prices subsequently recovered and the 2020 crack spread increased over the summer of 2017 back to levels last seen before the cap was announced. However, more recently the crack spread has collapsed as the market has become aware of a glaring problem – neither the shipping nor refinery industries are making proper preparations for the sulphur cap. This should not just be a concern for refineries. It could and is having an impact across refined products, particularly middle distillates (diesel, gasoil, jet fuel) and is increasing pricing disparities between different grades of crude, so has and impact on producers too.



Data Source:Bloomberg and Investec

A brief recap

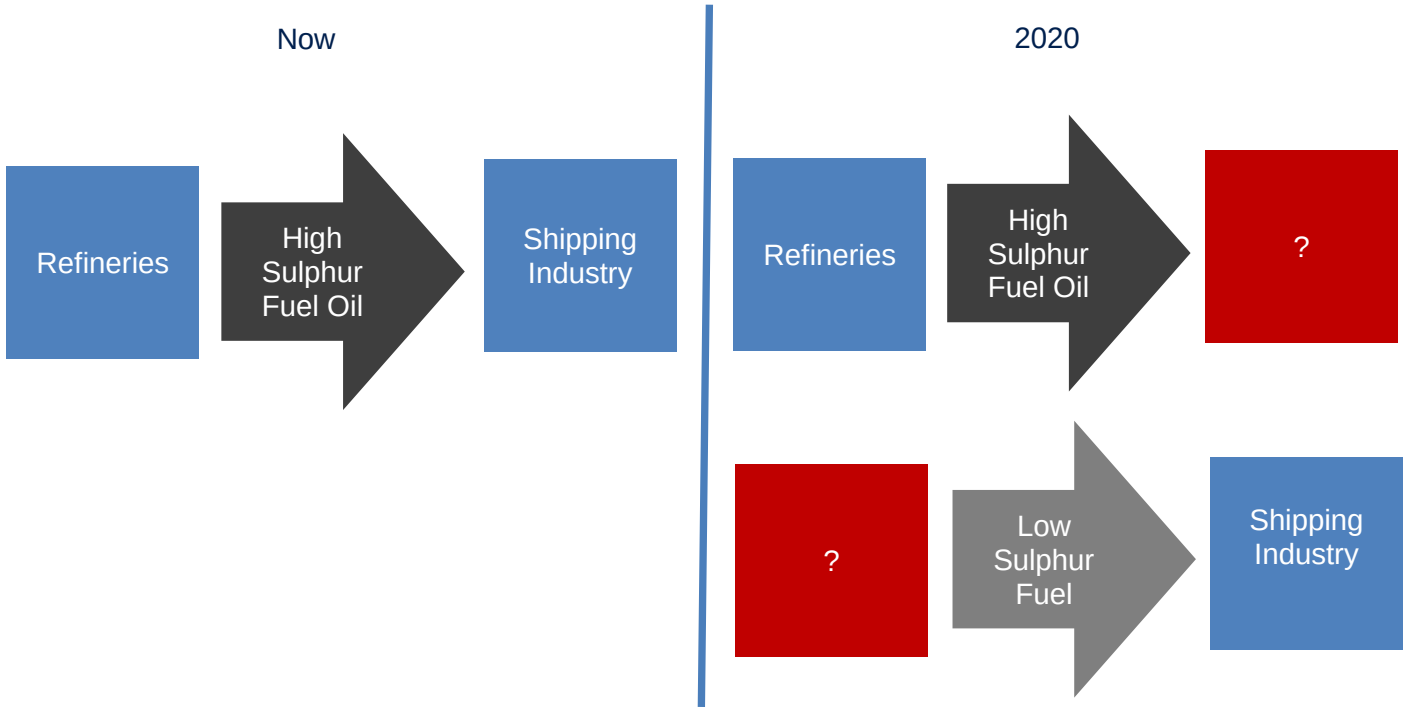
When the rules come into force on the 1st of January 2020, ships operating on the high seas will either have to have scrubbers fitted (which remove sulphur from exhaust gases) if they wish to continue burning high sulphur fuel oil (HSFO), or switch to using lower sulphur fuels – namely gasoil. It had always looked unlikely that shippers would opt to install scrubbers which are expensive to buy and fit, especially on older ships and such has proved to be the case. Another possibility would be switching to LNG, but, while that transition might well be a viable longer term solution, at the moment the limited availability of necessary infrastructure, the costs and practical difficulties of converting ships or replacing them, has put shippers off taking this route.

Instead, the shipping industry has taken the default choice which is to burn a lower sulphur fuel when the new rules come into force. However, this just passes the problem of complying with the sulphur cap onto refineries who could deal with it by:

- Processing more crude to produce more gasoil - the trouble with this approach is that you also get more of everything else, including more HSFO. There would need to some economic way of disposing of the HSFO
- Use lower sulphur crude - this could help, but would increase the premium of light sweet crudes (such as Brent and WTI) over heavy sour crudes such as (Dubai) and still leaves the question of what happens to the unwanted high sulphur fuel grades
- Install desulphurisation units to remove sulphur from refined products within the refineries

Installing desulphurisation units at refineries is perhaps the most effective of the above options as it isolates the real waste product (the sulphur itself) from the fuel. A large upfront investment is required however and the signs are that refineries have not been making those investments.

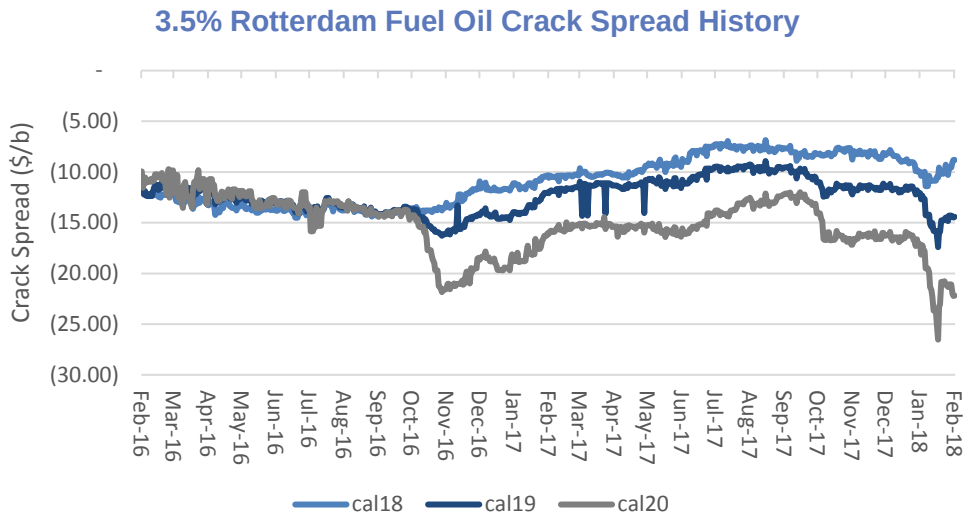
Overall, it appears that the refining and shipping industries are not well prepared for the upcoming changes. The market is becoming increasingly aware of this disconnect which is being priced into crack spreads, high-low sulphur product spreads and between sweet (low sulphur) and sour grades (high sulphur) of crude.



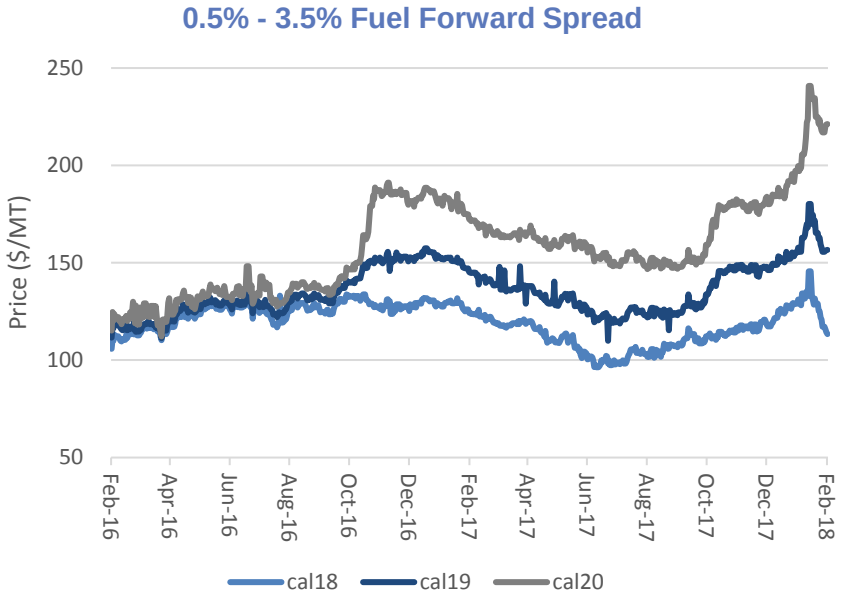
Data Source:Bloomberg and Investec

Pricing into the forward market

The high sulphur fuel oil crack spread chart below, shows the history of the discount of the 3.5% sulphur Rotterdam forward calendar year fuel oil swap in $/b[1] to the corresponding Brent forward swap. The discount for 2020 forwards, unsurprising, increased when the sulphur cap was announced, but widened dramatically early this year. There are suggestions that hedge funds have been getting on the band wagon and "shorting" the long dated crack spread – taking a view that fuel oil forwards will fall further relative to Brent.



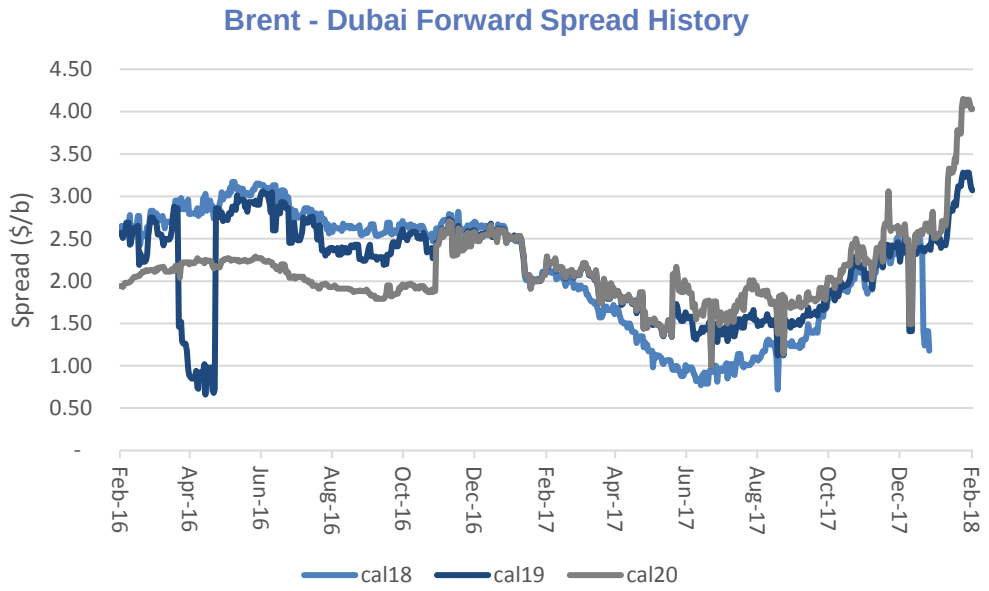
As there is no 0.5% sulphur derivative product that would comply with the minimum requirement of the sulphur cap available in Europe, we have created a synthetic product by weighting the price of 1% sulphur fuel oil and 0.1% sulphur gasoil to achieve a blended 0.5% sulphur product[2]. The chart below shows the premium of synthetic 0.5% sulphur forward prices and 3.5% sulphur fuel oil. This spread should represent the economics of owning a scrubber that could be crystallised by selling the spread (buying 3.5% fuel oil and selling the synthetic 0.5% product). In other words, if the discount of 3.5% to 0.5% is large enough, the cost of buying a scrubber might be justified.



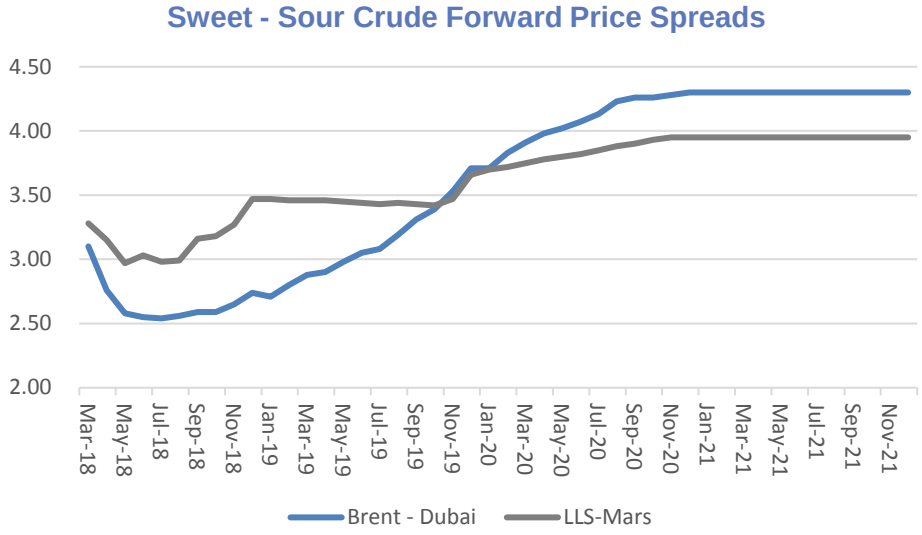
[1] Fuel oil prices in metric tonnes are converted into barrels at the rate of 6.35 barrels per metric tonne
[2] The weightings are 4/9 of 1% sulphur fuel oil and 5/9 of 0.1% gasoil

Data Source:Bloomberg and Investec

By selecting grades of crude with low sulphur contents (sweet rather than sour) like Brent, refineries can achieve lower sulphur product outputs from the crude they process than if they use high sulphur crudes like Dubai sour. Increases in the premium of the forward price of Brent over Dubai reflect an expected shift in preference from heavy sour to light sweet grades of crude due to the sulphur cap.



The forward curves shows a step-up in the premium of sweet over sour crude from 2020 onwards



Data Source:Bloomberg and Investec

An introduction to the economics of oil refining

To understand the full implications of the sulphur cap it is very helpful to be familiar with the economics and practicalities of oil refining. In order for a refinery to make money the average of the sale price of refined products, weighted by the proportions in which they are produced, must be greater than cost of the input crude oil:

Gasoline Price × Gasoline Weight
+
Jet Price × Jet Weight
+
Diesel Price × Diesel Weight
+
Gasoil Price × Gasoil Weight
+
Fuel Oil Price × Fuel Oil Weight

$>$

Crude Oil Price

The weighted average on the left hand side of the equation, minus the price of crude on the right, gives the refinery margin. For a refinery to operate sustainably this margin needs to be positive and sufficiently large to at least cover costs.

To a large extent the market price of the refined products and crude oil, move up and down in sympathy with one another, leaving the refinery margin broadly unchanged. However, this is not always the case. By subtracting the price of crude oil from the product prices we can write another equation for the refinery margin:

(Gasoline Price – Crude Oil Price) × Gasoline Weight
+
(Jet Price – Crude Oil Price) × Jet Weight
+
(Diesel Price – Crude Oil Price) × Diesel Weight
+
(Gasoil Price – Crude Oil Price) × Gasoil Weight
+
(Fuel Oil Price – Crude Oil Price) × Fuel Oil Weight

$=$

Refinery Margin

But the “Refined Product Price – Crude Oil Price” is the crack spread, so we can say:

Gasoline Crack Spread × Gasoline Weight
+
Jet Price Crack Spread × Jet Weight
+
Diesel Price Crack Spread × Diesel Weight
+
Gasoil Price Crack Spread × Gasoil Weight
+
Fuel Oil Price Crack Spread × Fuel Oil Weight

$=$

Refinery Margin

Now the chart of 3.5% Fuel Oil Crack spreads above shows how the fuel oil crack has become more negative. In order for the refinery margin to be maintained the crack spread for the other products have to increase and indeed they have done. This is a very important result, because it shows that if fuel oil becomes an unwanted waste product, it will be the consumers of other refined product that have to compensate refineries for disposing of it at fire sale prices. This cost would logically fall most heavily on middle distillate consumers (diesel, jet and gasoil) because this is the part of the barrel shipping companies will be switching to.

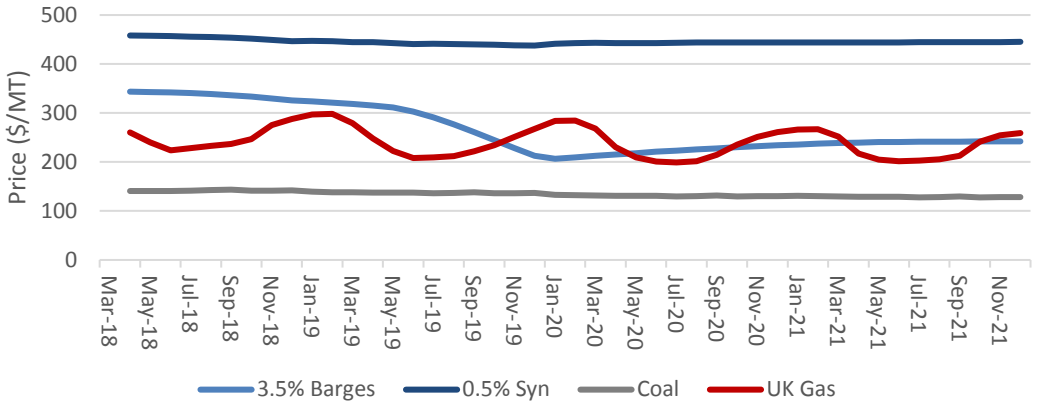
While there are many modern refineries in Asia and the Middle East that are able to remove sulphur and crack fuel oil into middle distillates, it looks likely there will be insufficient capacity to absorb all of the excess fuel oil when the cap comes in, from those refineries that cannot process it further. This is a potentially serious problem because those refineries that cannot reprocess the fuel oil inherent in crude must dispose of that fuel oil in some way in order to continue operating. If they can’t do anything with it they would have to shut down.

Data Source:Bloomberg and Investec

What might happen to prices?

The chart below shows the forward curves for 3.5% fuel oil, synthetic 0.5% and energy equivalent prices of natural gas and thermal coal. Firstly this gives an idea of the economics for shippers in choosing between high and low sulphur fuels and natural gas, but it also shows the price of an energy source that high sulphur fuel oil could substitute – thermal coal. The price for coal is between 150 and 130 $/MT in fuel oil equivalent terms. This might provide a floor to the price of fuel oil, but is dramatically lower than current prices.

Fuel Oil and Equivalent Forward Curves



It is estimated that 3m barrels per day (b/d) of high sulphur fuel oil demand from the shipping sector will need to switch to 0.5% sulphur fuel in 2020[3]. If the value of this 3m b/d of 3.5% fuel oil falls from current levels around 350 $/MT, by 200 $/MT to the price of coal and this cost is passed on to the value of the roughly 27m b/d of middle distillate produced, the cost of those middle distillates could increase by around 22 $/MT – not a massive increase. But dealing with unwanted fuel oil is only half the problem, because of the need for 0.5% fuel instead that will increase the relative price of low sulphur fuels, potentially dramatically. Plus the displacement of coal by an oil product would lead to an increase in the overall demand for crude thus pushing prices higher generally, while the opposite will be true of oil.

The bottom line is that in the absence of sufficient desulphurisation capacity, a home has to be found for the low sulphur fuel and while the shipping industry will experience the most painful cost increase, in switching from low to high sulphur fuel, costs will be passed on to everyone.

S&P Global Platts published estimates[3] that high sulphur fuel supply might decline by 1.4m b/d by 2020, but that still leaves 1.6 out of 3m b/d of surplus to dispose of. The same report suggests that the spread between high and low sulphur fuel could increase to levels as high 400 $/MT, with this increase being brought about by both downward pressure on high sulphur prices and upward pressure on middle distillates.

History a guide to the future?

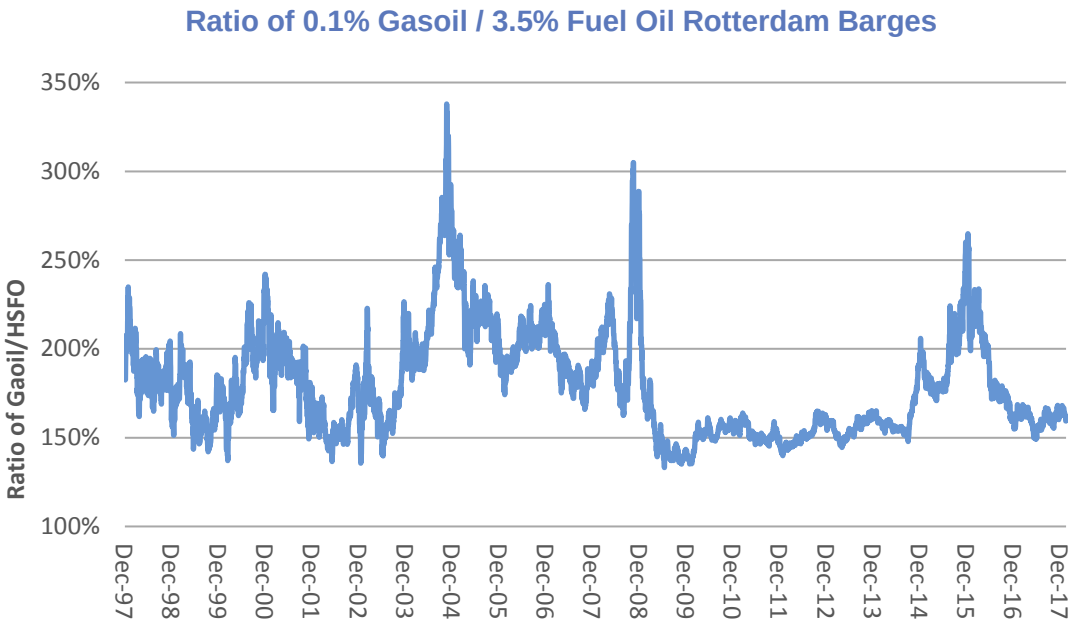
The chart below shows the historic spread between spot gasoil and fuel oil prices. The obvious peak is in 2007/8, but this could be explained by prices generally being at record highs.

0.1% Gasoil - 3.5% Fuel Oil Rotterdam Barges

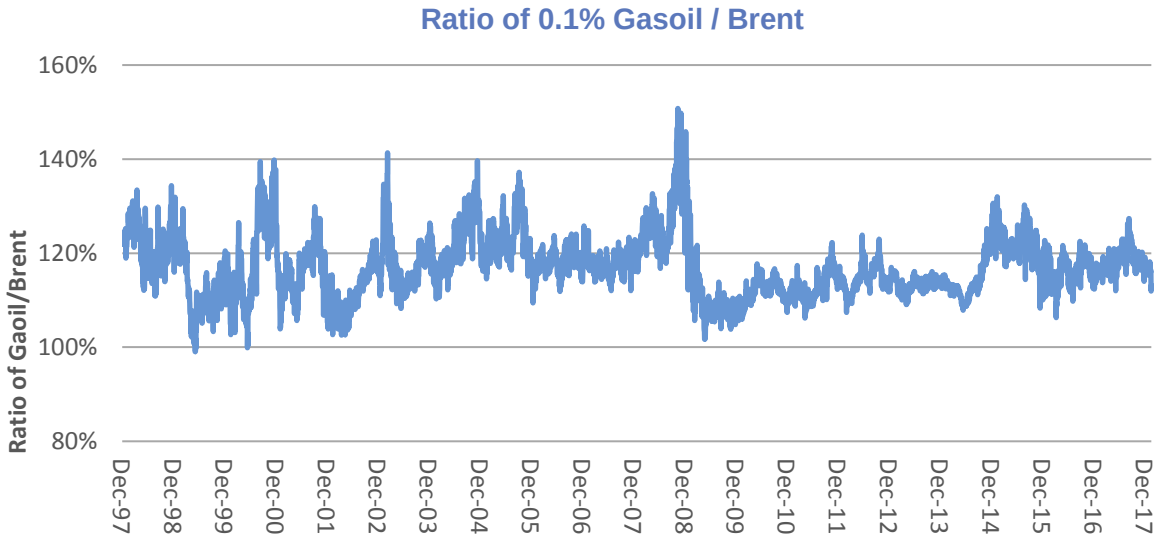
[3]Tackling 2020: the impact of the IMO and how shipowners can deal with tighter sulfur limit: https://www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/SR-tackling-2020-imo-impact-shipowners-tighter-sulfur-limits.pdf

Data Source:Bloomberg and Investec

Potential distortions from the general level of prices can be eliminated by looking at gasoil as a percentage of fuel oil. On this measure gasoil prices were at historic highs relative to fuel oil in 2004 and 2008. At the peaks, gasoil was over three times the price of fuel oil and much of the time gasoil was at least twice as expensive as fuel oil. During that period there was a decline in the use of fuel oil for power production while demand for middle distillates increased significantly, particularly due to Asian demand growth. After the financial crisis the price of gasoil stabilised at around 150% of the price of fuel oil as refining capacity to convert fuel oil into gasoil, increased. The rise in the ratio towards the end of 2015 as the residual product (i.e. fuel oil) fared badly in an oversupplied market.



These historic disruptions are apparent in the ratio of 0.1% gasoil and Brent too. Since the financial crisis this ratio has often been towards the bottom of its range - around 110 to 120% of the price of Brent. Before the crisis the ratio was often over 120% and sometimes as high as 140%. If this historic range gives us any guide to 2020 and beyond, even with Brent at 65 $/b we might see gasoil around 90 $/b or 680 $/MT – far higher than current forward prices. For jet fuel this equates to spot prices over 700 $/MT. While if Brent rose to 75 $/b gasoil might reach around 780 $/MT with jet over 800 $/MT.



Data Source:Bloomberg and Investec

Summary

The market is certainly in for an interesting couple of years. Over time it will adjust, but at the moment it is difficult to be sure how that will be achieved. In the meantime, the physical difficulties in managing the transition are likely to manifest themselves in volatility in the spreads between refined products, different grades of fuel and possibly the overall price of oil. One possible hope to mitigate the situation would be if the overall increase in oil demand over the next two years is met predominantly by growth in light sweet crude production, especially from the US, rather than heavy sour crude from OPEC members.

The impact on various players in the oil market might be as follows:

- **Refiners** – modern refineries in Asia and Middle East as well as coking plants in the US, will be better positioned to take cheap fuel oil and process it into middle distillates than older refineries in the US and Europe. If wide spreads between high and low sulphur fuels persist the case for investment in desulphurisation capacity may encourage refineries to upgrade

- **Shippers** – except for those intrepid few that have opted to buy scrubbers or even switched to LNG, the majority of shipping companies will be left trying to pass a significant increase in operating costs on to their end customers. As with the refineries and desulphurisation units, in time the case for investment in scrubbers, particularly if the technology advances, could encourage the shipping industry to take the plunge – especially on new vessels. In the meantime, sadly, it is possible that poor compliance in some jurisdictions may help to alleviate the situation somewhat

- **Middle distillate consumers** – middle distillate crack spreads have been relatively stable in recent years (absent the odd hurricane), but this may be changing. As the market starts to focus more and more on the possible upcoming disruption, the forward spreads could be further impacted. Plus, as we approach the end of 2019, real physical bottlenecks resulting from increased competition from consumers for the middle of the barrel, could lead to volatility in crack spreads at the short end of the curve and disparities in prices of the same product in different locations

- **Traders** – the physical traders that ship crude and products around the world to try and benefit from regional pricing disparities, could experience an increase in operating costs that might increase the threshold for shipments to be profitable. On the other hand disruptions caused by the cap may increase regional price disparities creating opportunities for traders.

- **Producers** – the direction of travel seems clear. Well before the transition from fossil fuel to other forms of energy can turn the tide of increasing oil demand, sulphur emission restrictions will lead to refineries favouring sweet crude. This change could be in sympathy with rising US production which is adding barrels of light sweet crude at the expense of OPEC that has limited its production which typically has a high sulphur content. An increase in shipping costs arising out of the cap could impact the economics of producing assets that are a long way from target markets

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