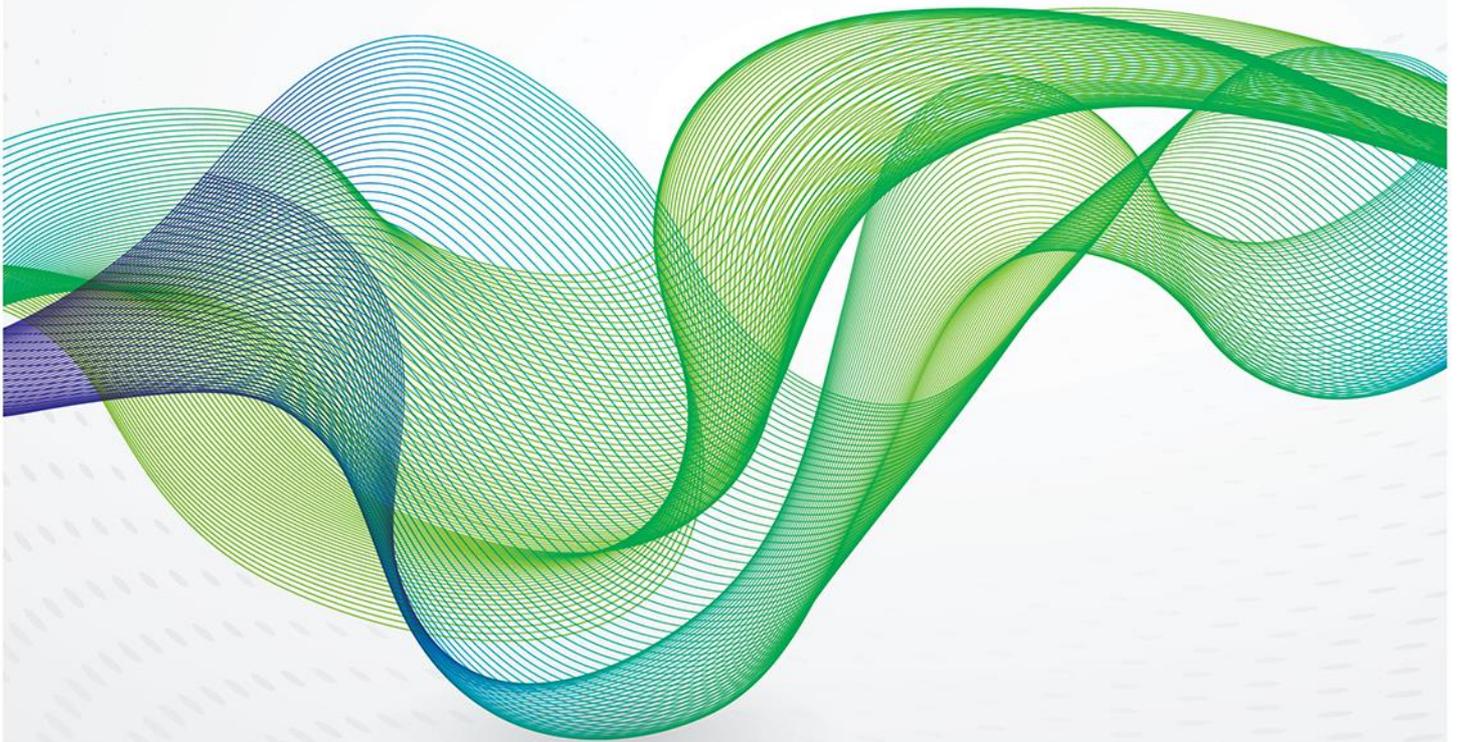




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Oil Markets in Transition and the Dubai Crude Oil Benchmark



OXFORD ENERGY COMMENT

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1. Introduction

Dubai crude oil has been the main Asian benchmark since the mid-1980s.¹ It is responsible for the pricing of almost 30 million barrels per day (million b/d) of crude oil currently exported to Asia. Since its introduction, Dubai production has diminished substantially. Dubai does not release figures for its crude oil production but, from the loading data and sales, it can be deduced that production has fallen well below 100,000 b/d in 2014, from a peak of 410,000 b/d in 1991. However, the benchmark has evolved into a ‘brand name’, allowing for the delivery of Oman and Upper Zakum grades of oil in a sophisticated process of price assessment during the so called ‘Platts Dubai window’, between 16.00 and 16.30 Singapore time.² At the same time, a large derivatives market has grown around this ‘brand name’, feeding back into the price discovery of the benchmark itself.³

The most notable and recent development in the Dubai benchmark has been the significant increase in the liquidity in the Platts ‘window’. In the first three days of trading in October 2014, a record 179 partials traded in the window.⁴ Figure 1 shows a steady increase in Dubai market liquidity in the window since 2011, particularly in the last two years.⁵ Figure 2 shows the number of physical cargoes delivered in partial trading has also increased in recent years. At the same time, Asian traders have become visibly more assertive in the market place. Some of them, such as Unipet and China Oil, are now regularly involved in setting the price in the Platts Dubai window, becoming ‘price makers’ rather than ‘price takers’.⁶

Figure 1: Platts Window Partial Dubai Trades delivered in partial trading

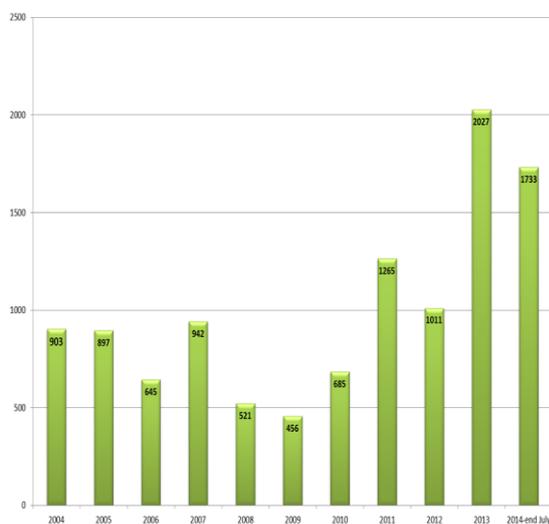
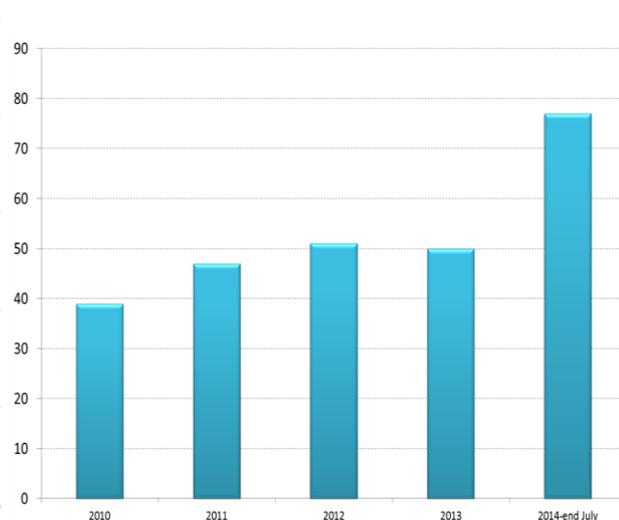


Figure 2: Number of Physical cargoes delivered in partial trading



Source: Platts

What has caused this increase in liquidity? To answer this question, this comment will look at the two recent shifts in international oil market dynamics. Firstly, Asian demand growth and the increase in US tight oil production, and secondly, the associated shift in crude oil trade dynamics. Then it will examine the changes within the Asian crude oil market, leading to the increased assertiveness of the regional players in the price formation process. Finally, this comment will consider some remaining issues with the Dubai market, and a possible way forward for Asian benchmarks in general.

II. Shifts in Oil Market Dynamics

Recent years have witnessed two main themes in the world oil markets. The first is a shift in demand from the developed to the developing world, particularly towards Asia and the Middle East (ME). The second is a large increase in light oil and gas production in the Americas.⁷ The consequences for the crude oil and petroleum product trade flows, as well as main price benchmarks, have been profound.

- United States East Coast (USEC) and Canadian refiners, traditional buyers of high gasoline yield crude oil from the North Sea (NS), West Africa (WAF) and North Africa (NA), have reduced their imports to a trickle, given the availability of locally produced, light sweet crude oil. This development and the lack of local pipeline capacity virtually disconnected the West Texas Intermediate (WTI) benchmark from the world oil markets. As a result, spot South American oil that priced against the weak WTI prices is regularly offered in Asian markets. Recently, we have witnessed US condensate being sold to Japan and Korea, and Alaska North Slope crude moving to Korea.⁸ Depending on the US legislation, this could become a regular feature and put pressure on ME and regional condensates sold in Asia. ‘Sweet’ barrels from the Atlantic basin, which mainly trade on spot basis and have no destination restrictions (unlike most OPEC crude oil), have become ‘swing’ barrels for the Asian refiners looking for cheaper feedstock.⁹ In a nutshell, it has become a buyer’s market.
- Given weak European demand and poor margins, European refineries have been closing down.¹⁰ Most of the new refinery capacity has been built in the ME and Asia at the expense of Europe. This has been exacerbated by the Russian tax incentives to increase product exports at the expense of the traditional crude oil, in order to maximise revenue.¹¹ Despite the slowing Chinese economy, the main demand drivers in the oil markets will likely be China and the ME.¹² As a consequence, the oil flows have shifted towards Asia from almost all the producing areas. Since the oil prices are set by the ‘marginal’ barrels and the region is a main buyer of these barrels, Asia is increasingly influencing global oil prices. Hence, delivered price of oil in Asia has become the key signal for the world oil markets.
- At the same time, ME producers have become more dependent on Asian buyers. This resulted in increased market power of the Asian consumers and a possible demise of the so called ‘Asian premium’.¹³ There is plenty of evidence that the Gulf producers have been involved in competition for a share in the Asian markets.¹⁴ SOMO of Iraq has been the main beneficiary by offering competitive official selling prices (OSPs) for its main export, Basrah crude oil.¹⁵ Iran has used its own vessels to sell crude on a delivered basis, offering discounted freight rates.¹⁶ In August this year, Kuwait agreed to almost double its exports to Sinopec, China on delivered basis.¹⁷ Iran, Iraq and Kuwait have all offered preferential credit terms to Asian buyers.¹⁸ In particular, India has benefited from being offered deferred payment of up to 90 days.¹⁹ Adnoc and Aramco have been offering oil at short notice from storage in Japan and Korea.²⁰ Venezuela has been selling oil on favourable terms to China on the basis of pre-financing arrangements.²¹ At the same time, NS crude has been struggling to sell without regular arbitrage buying from the East (see Table 1). Even Urals, the staple feedstock of the Mediterranean refining, has relied on Asian demand. In September 2014, Unipet purchased nine Baltic loading cargoes and co-loaded them on three large crude carriers (VLCCs) for transport to Asia.

III. Implications for Dubai Benchmark

The growing importance of Asia as a destination for oil from all over the world may have profoundly impacted the Dubai market. ‘Arbitrage’ barrels that normally trade against Brent and WTI benchmarks are generally being evaluated and sold on Dubai-related prices.²² This means somewhere in the supply chain, prices may need to be converted from other benchmarks to Dubai prices. The process

of arbitrage involves buying the benchmark other than Dubai (mainly Brent, rarely WTI) and selling Dubai swaps, in order to 'lock in' the differential that makes oil competitive in Asia. As Brent is the dominant international benchmark, Brent futures versus the Dubai swaps differential is also the dominant trading link between the two benchmarks.²³ It is known as EFS (exchange for swaps since Brent futures are 'exchanged' for Dubai swaps). For example, importing Brent-related barrels loading in the month of December to Asia and converting its price into a Dubai-related one, would normally involve a purchase of December EFS (buying December Brent futures and selling December Dubai swaps can be done as one trade by buying the December EFS). Then, as the cargo has 'priced in', usually following loading, December Brent futures would be rateably sold. Since the cargo is placed with an end user at a Dubai-related price, the swap would be simply left to 'price out'.

However, there is a problem. With an increasing volume of oil coming to Asia, there is a growing need to find sellers of EFS, or more precisely, buyers of Dubai swaps. The Brent futures are hugely liquid (daily volume in the front month on ICE is normally more than double the world production), so it is not hard to buy the Brent part of the EFS spread. However, Dubai swaps trade nowhere near as much. Recently, DME estimated that the size of the ME–Asia derivatives market is less than 4% of either the markets of the Americas or Europe.²⁴ Natural buyers for Dubai swaps are refiners, hedging their margins (selling product and buying crude swaps forward). But, the volumes of margin hedging do not necessarily coincide with the volumes or timing of the imported oil needing price conversion. At times, due to increasing volumes of arbitrage barrels, this means there may be an excess of sellers of Dubai swaps in the market.²⁵ It is important to note these volumes are not trivial. As Table 1 shows, WAF imports to Asia accounted for almost 2 million b/d in July this year, and this is in line with regular monthly volumes coming into the region.

Table 1: West African Exports to Asia, July 2014 (thousand barrels/day)

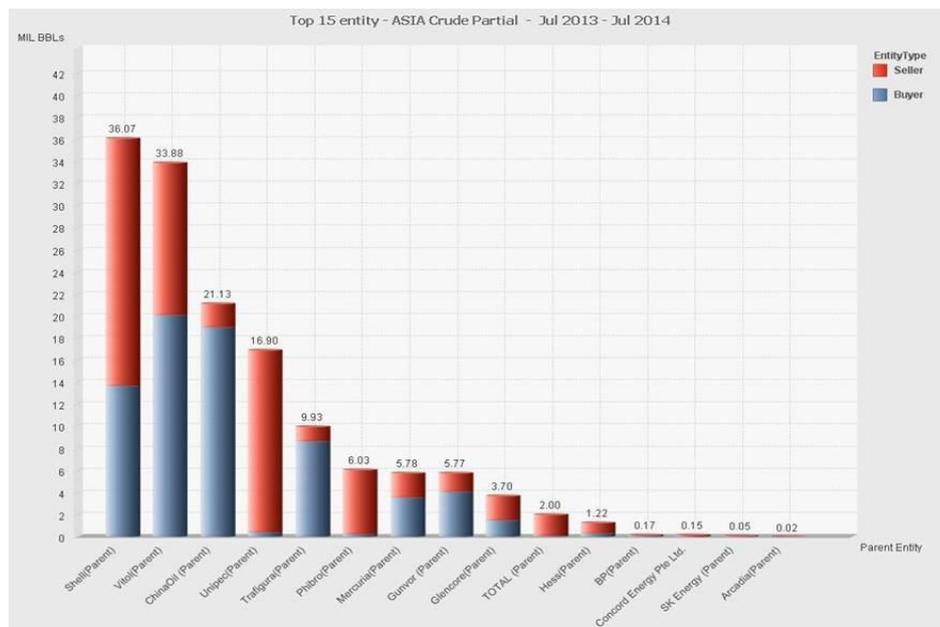
West African Exports to Asia, July 2014				
('000 b/d)	Nigeria	Angola	Other	Total
China	0	747	151	898
India	342	92	31	465
Taiwan	0	31	31	62
Indonesia	92	0	0	92
Japan	0	0	21	21
Other*	31	31	63	125
Total	465	901	297	1663
<i>June</i>	<i>414</i>	<i>990</i>	<i>423</i>	<i>1,877</i>

*Includes unidentified cargoes destined for Asia. Source: Energy Intelligence

Traditionally, the buyers of these swaps have been banks (acting as middlemen and reducing the risk of the margin hedging business connected to the regional refiners) and oil trading companies, generally buying the swaps on a speculative basis and thus providing much needed liquidity. However, as this large Dubai exposure could not be sold off in the market place with limited liquidity,

the traders holding large portfolios of Dubai swaps had only one option: to get involved in the Platts pricing window and 'defend' the 'fair value' of their Dubai portfolio. Indeed, this would explain Figure 3, which shows that the main players or 'price makers' in the Platts Dubai window are oil trading houses. It is important to note this does not imply that the Dubai benchmark will necessarily price above or below the 'fair market value'. However, it does imply that, while Platts is open to wider participation, the Dubai value during the Platts window is likely to be set by an elite of a few, self-selected traders.

Figure 3: Dubai Crude Partial – July 2013-July 2014



Source: Platts

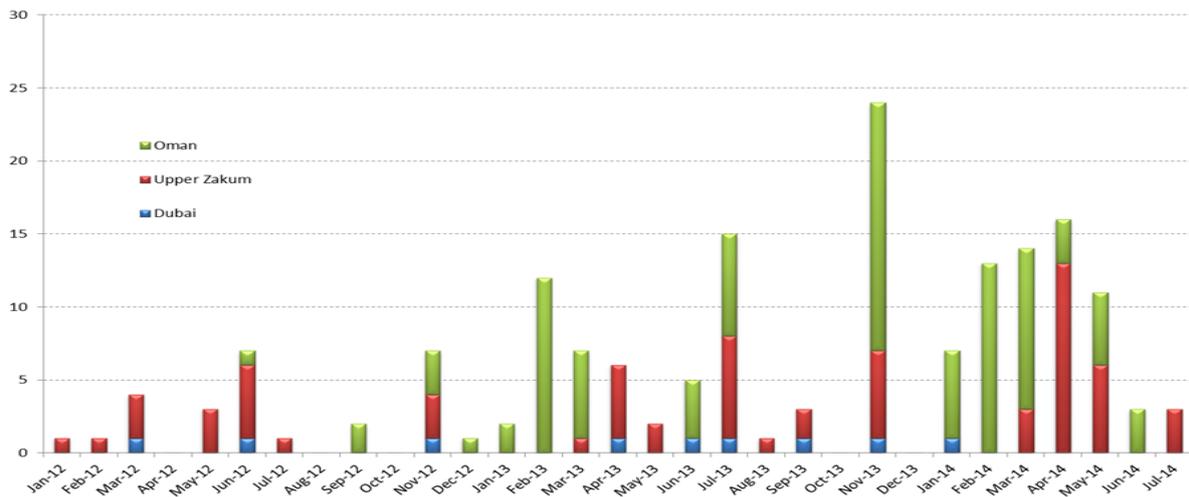
At this stage, it is worth briefly revisiting the process of price fixing of the Dubai benchmark. Firstly, Asian refiners normally buy oil over a calendar month of loading. Secondly, most physical crude trades as a differential to Platts Dubai assessment during a calendar month of loading, the value of which equates to the Dubai swap for that month. Refinery Linear Programming models use Dubai swap values as a common denominator for comparing different grades of crude oil.²⁶

Unlike Brent and WTI, Dubai has no liquid functioning futures markets.²⁷ However, the OTC markets for EFS and Dubai spreads frequently trade. Therefore, the way to establish a value of a Dubai swap is to use one of the two main benchmarks (normally Brent) and apply the EFS value to it. This is best illustrated by an example. Physical Dubai cargoes traditionally trade as a differential to Dubai assessments (equal to swap value). For example, physical Dubai loading in the month of October will trade as a premium or a discount to October Dubai, and would normally trade about two months earlier, during August. Also in August, the most liquid EFS market will be October (October Brent futures and Dubai swaps). By applying October EFS to October Brent futures, a trader can obtain the October Dubai swap value. During August 2014, the Dubai market was weak (in contango) and traded at a discount. Hence, the October Dubai value should equal the calculated October swap, minus some discount, depending on the perceived weakness of the market by buyers and sellers.

However, there are some further details to consider. As already mentioned, Upper Zakum and Oman crudes are deliverable into the Dubai contract (see Figure 4). As these two grades have higher net worth for most refiners, it is presumed they will be delivered at Dubai prices only when the Dubai price is above its 'true market value', providing the liquidity in the pricing 'window' and putting a 'cap' on the Dubai price, avoiding a possible 'squeeze'.²⁸ The trader may also use the Oman price²⁹ as a 'cap' at

which Dubai can be bid (given the Platts rules). To summarise, Dubai values are still calculated from Brent futures prices.³⁰

Figure 4: Platts Window: Physical Convergence in MOC by grade



Source: Platts

It is becoming increasingly obvious (see Figure 3) that large Asian companies such as Unipet, China Oil and SK are getting around the limited liquidity of the EFS market in one of the two ways. Either they are getting involved in the ‘market making’ process in the Platts window, thus ‘cutting out the middlemen’ (trading companies and banks) and essentially ‘fixing’ the Dubai (and hence EFS) price, or they simply do not hedge this exposure at all.³¹

This has been helped by three recent developments. Firstly, Platts Dubai contract has changed from 5% tolerance to 1,000 barrels (0.2%) and 20 partials (equating to 500 thousand barrels), converging to a full delivered cargo from an earlier 19 (or 475 thousand barrels). The earlier contract with 475 thousand barrels was making it difficult and costly for a seller to participate in the Platts window, as they had to take both volume and the tolerance risk into account.³² As a consequence, traders can now arbitrage Oman between the DME and Platts window, thus increasing liquidity, transparency and overall volumes in both. Since Dubai is the only major benchmark without a strong futures market to back it up, perhaps DME can do for Dubai what the International Petroleum Exchange (IPE) did for Brent?³³

Secondly, due to a change in marketing strategy, Abu Dhabi National Oil Company (ADNOC) seems to have sold more Upper Zakum cargoes without a destination restriction.³⁴ It is not clear whether this is a temporary or a permanent feature. However, it is clear that it has freed up more crude for sale in the Platts window³⁵. What is more, the production of the Zakum field is planned to increase to 750 thousand b/d in 2015, from the current level of about 600 thousand b/d. The issue here will be for Abu Dhabi to make a level playing field, with equal access to the additional volumes of Upper Zakum for all market participants. Otherwise, the players with better access to the barrels will have an advantageous position in the Platts Dubai window.³⁶

Finally, since the 2008 financial crisis, and particularly since the LIBOR rigging allegations,³⁷ there has been increased scrutiny of FX, commodity (particularly gold) and inevitably oil markets from various governmental regulating agencies. In May 2013, officers of the European Commission raided several oil companies and initiated an investigation into possible irregularity in the oil price fixing

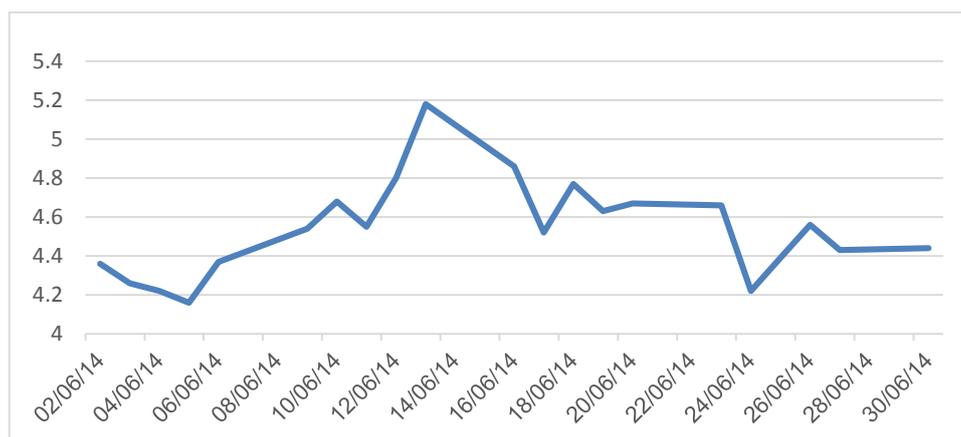
process.³⁸ Currently, the Commission is considering a range of proposals for further supervision and regulation of the oil industry. On 9 September 2014, the International Organization of Securities Commissions (IOSCO) decided that: 'It had no plan to further align guidelines for oil price reporting agencies (PRAs) with those for financial market benchmarks'.³⁹ Greater compliance requirements (and the associated cost) as well as the negative publicity, regardless of the outcome of such investigations, are likely to drive the trading activity and the associated price discovery⁴⁰ to the growing financial centres in Asia, such as Singapore and Shanghai.

IV. But Challenges Remain

Greater involvement of Asian traders and refiners and growing liquidity are good news for the Dubai benchmark. However, a few problems remain. Firstly, Dubai partials only trade on a fixed price basis (dollars per barrel, rather than a differential or a spread) during the half an hour period of the Platts window. This is an improvement to the period when it was trading exclusively as a differential to Brent. However, for the remainder of the trading day, all Dubai trades are still differentials to Brent (EFS) or spreads to other Dubai swap months (swap spreads).

Secondly, anecdotal evidence in the oil markets is that, whenever there is increased geopolitical risk in the ME, EFS tends to widen (Brent gets stronger relative to Dubai). This is clearly an anomaly since oil at risk should increase in price, i.e. the Brent/Dubai differential should narrow. A recent example of this phenomenon can be seen in Figure 5. During the month of June 2014 and the Islamic State (IS) offensive in Northern Iraq, EFS values rose only to fall a few days later when it was clear Iraqi oil production was unaffected. This anomaly is also common in financial markets and is referred to as the 'Portfolio Adjustment' problem. When faced with an increase in risk (and hence volatility) of the portfolio, a trader will reduce VAR⁴¹ by selling assets and increasing cash holding in the portfolio. In a large portfolio, where a quick adjustment is needed, the most liquid assets are likely to be sold.⁴² When faced with a risk to the oil production in Iraq, an oil trader is likely to hedge positions by buying very liquid Brent futures, even though the ME crude, including Dubai, is more likely to be affected. In trading jargon, Dubai prices tend to be 'sticky'.

Figure 5: Brent/Dubai EFS and ISIS Offensive, June 5, 2014

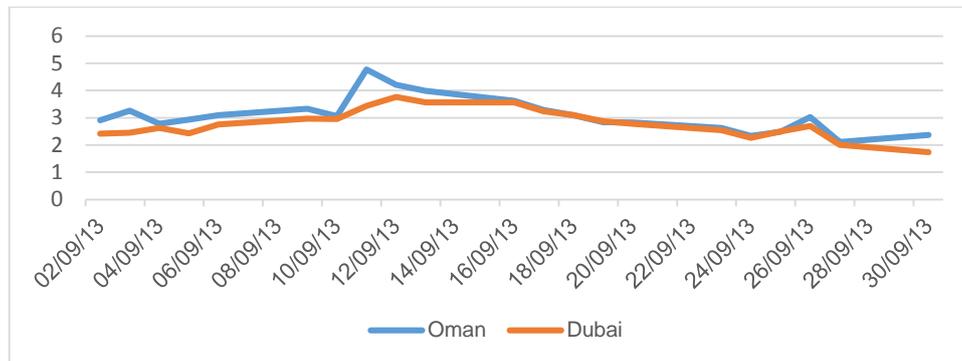


Source: Authors calculations from DME and Platts Dubai settlements

Thirdly, most ME oil is priced against the average of Oman and Dubai quotations. Historically, Asian refiners assume that the difference between the two prices is sufficiently small not to be seen as an important source of price risk. However, as Figure 6 shows, Oman/Dubai spread can diverge by a dollar per barrel, and often more. More importantly, there seems to be a difference in philosophy between ME producers and Platts. For Platts, there is really only one ME benchmark with Dubai 'brand' that currently encompasses the three grades of ME oil.⁴³ But given the Saudis and the other

ME producers are sticking to their ‘Oman/Dubai’ formula, Platts have no choice but to continue publishing the ‘Oman’ assessment as well.⁴⁴ Indeed, the Oman assessment is not even included in the ‘Key Benchmarks’ section of their flagship publication, Crude Oil Marketwire. The problem with this assessment is that Oman rarely trades on fixed price basis, and even bids and offers are rare.⁴⁵ That makes the assessment process hard, often subjective and potentially problematic for a crude that determines the price of several million barrels of oil imported to Asia each day.

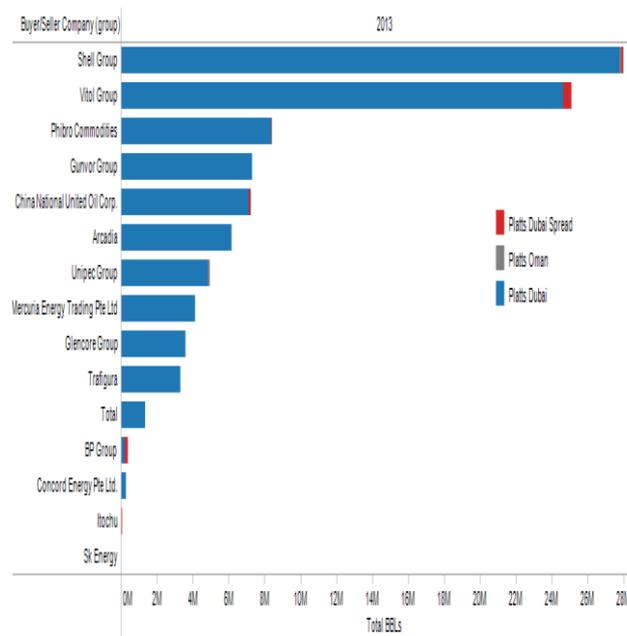
Figure 6: Oman and Dubai Values Over Dubai Swaps



Source: Authors calculations from Platts and DME settlements

Finally, one of the old problems remains⁴⁶. The Platts window is dominated by a small elite of self-selected ‘price makers’, with Shell and Vitol accounting for about a half of all the trades in 2013 (Figure 7). Half a dozen players account for almost all the deals. Few, if any, of the NOCs are involved.⁴⁷ Of course, participation of one or more large producers could also produce a biased benchmark. It should be noted that the Brent market also involves a small ‘self-appointed elite’ of participants. However, unlike Dubai, Brent has a hugely liquid futures market working in tandem with the Platts assessment process in providing the price discovery.

Figure 7: Counterparties in Platts Dubai MOC in 2013



Source: Platts

So what is the way forward for the Dubai market and the Asian benchmarks in general? While the Dubai benchmark has shown clear signs of improvement, there are also a number of potential alternatives. We have already mentioned the rise of DME, an exchange with the largest volumes of physical crude oil delivery in the world.⁴⁸ Oman production is high and the grade is well accepted by most Asian refiners.⁴⁹ It is loading outside the Straits of Hormuz, a potential geopolitical choking point for ME exports, and has no destination restrictions, making it an ideal regional candidate. Whilst this benefits the Platts Dubai benchmark as well, DME still needs to reach a critical mass of traded volumes to be a serious contender.⁵⁰

The other large exchange, ICE, has a useful price index for Brent futures called 'Brent 1 Minute Singapore Marker' which is a weighted average of all the Brent trades during the 'peak' Platts Dubai window.⁵¹ Since Brent futures are the most commonly used hedge for Dubai swaps during the window, the 'ICE Singapore Marker' is not just familiar to traders in Asia, but perfectly timed to capture their flat price risk as it coincides with the last minute of trading in the Platts Dubai window. It is not impossible to see it develop from a useful hedging index into a full blown benchmark, not unlike BWAVE.⁵² Also, almost all the Latin American barrels trade using the front ICE Brent settlement as a benchmark. Argus have a solid Oman assessment, which probably relies on DME settlement prices more than is admitted.

Finally, the Shanghai Futures Exchange is also planning a crude oil contract based on a medium sour crude oil (30-34 API), with a maximum sulphur content of 2%. It would include all the commonly traded ME crudes such as Oman, Dubai, Basrah Light, Upper Zakum, Qatar Marine and others, delivered in 600 kb cargoes to specified locations in China.⁵³ Starting a new contract is notoriously difficult and it is hard to predict whether the proposed futures contract will succeed. However, it should be noted that some of these contracts are quite complementary and reinforce each other. ICE Singapore marker helps traders hedge their Platts risk and DME Oman can be used to put a lid on the Dubai benchmark (physical delivery from DME can be used to in the Platts Dubai window). Given sufficient liquidity, DME Oman futures could be used to hedge Dubai swaps given they should have lower basis risk relative to Brent. At the same time, the Brent/Oman futures spread is a popular trade, approximating an 'East – West' arbitrage akin to EFS. The Asian market may be big enough for more than one benchmark.⁵⁴

V. Conclusion

In conclusion, recent shifts in the oil markets have caused the centre of gravity to move towards Asia. In particular, Asia has become the main destination for the incremental barrels of oil, thus playing a role in setting global oil prices. Quite naturally, Asian companies are becoming more involved in this process. Recent changes in the Platts Dubai window, as well as a greater availability of destination-free Upper Zakum have resulted in increased liquidity and hence better price discovery. Convergence of Dubai partials to 500 thousand barrels with 1,000 barrel tolerance has facilitated arbitrage between DME and the Platts Dubai window, benefiting both contracts. If the ADNOC policy to make additional volumes of destination-free Upper Zakum becomes a permanent feature, the Dubai market is likely to strengthen further. However, some weaknesses of the benchmark remain, needing further work. In particular, more players need to be involved in the 'price making' process. Apart from Dubai, there are potential alternative benchmarks. Some of them are complementary to each other and the future for Asian benchmarks may involve more than one of them. With the increased regulation in Europe and US, Dubai as well as other potential benchmarks in Asia, have a chance to play a leading role in the global price formation process.

¹ This comment is a follow up on Fattouh, Bassam. (2012), 'The Dubai Benchmark and Its Role in the International Oil Pricing System', *Oxford Energy Comment*. For this reason, historical and other facts concerning this market are not repeated here.

² Platts uses the Market On Close (MOC) to assess prices for crude oil, petroleum products and related swaps. The MOC is a structured process in which bids, offers and transactions are submitted by participants to Platts' editors. Following the close, Platts' editors examine the data gathered through the day and develop price assessments that reflect an end-of-day value. The Platts 'window' is the term market participants use to refer to the 30 to 45-minute period before the close of the market, when Platts no longer accepts new bids or offers in the price assessment process. More on this in footnote 7 below, as well as: <http://www.platts.com/IM.Platts.Content/MethodologyReferences/MethodologySpecs/Crude-oil-methodology.pdf>. Oman was introduced in January 2002 and Upper Zakum in February 2006. According to Platts, this should provide the contract with over one million b/d of deliverable physical oil.

³ Fattouh, Bassam. (2012), 'The Dubai Benchmark', p. 4.

⁴ 'Platts crude oil MOC sees record 85 trades; Four cargoes declared The Platts Market on Close process saw an all-time high volume of 85 trades on Friday that led to the declaration of four 500,000-barrel cargoes of crude oil loading in December. Friday's trade volumes bust the previous record high of 81 trades that was last hit Thursday. Unipet, BP and Total each declared a cargo of December-loading Upper Zakum crude to Chinaoil', *Platts News*, 3 October 2014.

⁵ In 2004, Platts introduced a mechanism known as the 'partials mechanism'. The smallest trading unit for the Dubai and Oman partial was set at 25 thousand barrels. Since operators do not allow the sale of cargoes of that volume, it meant that a seller of a partial contract is not able to meet his contractual obligation. Thus, delivery only occurs if the buyer has been able to trade 20 partials, totalling 500 thousand barrels with a single counterparty. Any traded amount less than that is not deliverable and is cash settled at the price set on the last day of the contract. Platts allows for the delivery of Omani crude oil or Upper Zakum against Dubai in the case of physical convergence of the contract. For example, on 31 July 2014, when the September Dubai contract was expiring, Platts recorded 77 trades in Dubai partials or 1.925 million barrels. On that day, Unipet, a trading arm of the largest Chinese refiner Sinopec, declared a physical delivery of two Upper Zakum cargoes to China oil, a trading arm of the second biggest Chinese refiner, Petro China.

⁶ The term 'price maker' is commonly used in the industry and simply indicates that the firm is involved in the process of setting up the price. See Figure 3: the two Chinese companies have been involved in the 'price-making' process for several years. However, they have significantly increased their level of activity in the last 12 months. China oil moved in the ranking from 5th in 2013 to 3rd in 2014 (up to July 2014) and Unipet from 7th to 4th in the same period. Source: Platts.

⁷ For a more detailed discussion see: Imsirovic, Adi. 'Asian Oil Market in Transition' *Journal of Energy Security*, April 2014 (http://www.ensec.org/index.php?option=com_content&view=article&id=520:asian-oil-markets-in-transition&catid=143:issue-content&Itemid=435)

⁸ See Brown, C. and Fattouh, Bassam. (September 2014), 'US NGLs Production and Steam Cracker Substitution: What will the Spillover Effects be in a Global Petrochemicals Market?', *Oxford Energy Comment*.

⁹ See Fattouh, Bassam and Sen, Amrita. (August 2014), 'New swings for West African crudes', *Oxford Energy Comment*.

¹⁰ Europe lost a nominal refinery capacity of just short of 2 million b/d since 2009. It is estimated that another 1-1.5 million b/d of capacity needs to be shut before 2018. Chinese new greenfield refinery projects between now and 2016 amount to an additional capacity of 2.3 million b/d. Planned ME refinery projects excluding Iraq between 2014 and 2018 amount to almost 3 million b/d. (All calculated from various Platts announcements).

¹¹ In spite of this, Russians have been able to increase their crude oil sales to Asia through the ESPO pipeline.

¹² According to the IEA 'Oil Market Report' May 2014, the bulk of the increase in the global oil demand will come from China (0.39 million b/d), ME (0.31 million b/d) and Latin America (0.19 million b/d).

¹³ See Doshi, T.K, and Imsirovic, A. (2013) 'The Asian Premium in crude oil markets: fact or fiction? In 'Managing Regional Energy Vulnerabilities in East Asia' edited by Zha Daojiong, USA: Routledge.

¹⁴ 'Gulf oil exporters' rivalry grows in battle for Asian buyers' *Reuters*, 3 December 2013.

¹⁵ Table 1 and Figure 6 show SOMO closely shadowing Aramco's OSP for a similar quality crude oil, Arab Medium (AM).



¹⁶ Of course this was also at least partly a result of sanctions on Iran. See: 'Iran offers to ship crude to India for free to boost sales', *Reuters*, 4 November 2013.

¹⁷ '...KPC managed to increase the supplies to Sinopec because it offered "a good deal"', *Reuters*, 18 August 2013.

¹⁸ Iraq offers to double credit period for Indian refiners if they buy more crude oil', *Reuters*, 11 November 2013.

¹⁹ Kuwait, like other producers, continues to 'lock in' buyers by investing in their refineries. See: 'Kuwait Petroleum Corp (KPC) aims to pick up a significant stake in Indian Oil Corp's IOC. NS Paradip refinery and supply about 60 percent of the oil needs of the plant, set to start up later this year...', *Reuters*, 3 September.

²⁰ See: 'Japan lifts volumes in Saudi crude oil storage deal, extend length', *Reuters*, 18 December 2013.

²¹ See: 'Latam oil producers look to Asia for sales of swollen stock', 19 October 2013.

²² There are clearly exceptions to this. Most Angolan barrels sold to China are probably priced on Brent Dtd basis. India buys WAF on same basis. It is impossible to know internal benchmarking for each refiner, but it is generally accepted that Dubai is the prevalent benchmark in Asia. This large Brent/Dubai exposure may be too large for the Asian paper markets to bear, resulting in refiners either internalising the exposure within their trading arms (such as Unipecc being a trading arm of China Petroleum & Chemical Corporation, or Sinopec) or taking on Brent exposure.

²³ As the Atlantic basin crude oil is normally purchased on pricing period a few days around or after the bill of lading, Brent futures are the common way to hedge such price. On the other hand, there is no liquid futures market for Dubai. Given that the ME producers and Asian refiners have traditionally been using the whole month of loading for the pricing period, making Dubai swaps a more convenient method of hedging Dubai price.

²⁴ 'Futures Insights' *DME*, August 2014 (Overview of the Sour Crude Derivatives).

²⁵ Even though more derivatives are being traded and cleared on exchanges, it is notoriously hard to make even approximate estimates of OTC ('over the counter' or direct trades between principals) swaps.

²⁶ Even the retroactive OSPs such as Abu Dhabi and Qatari ones reflect already known Dubai averages. For example, July OSP for the Upper Zakum grade, published in early August at \$106.80 is the equivalent of July Dubai + \$0.65 since, during July, Dubai averaged at \$ 106.15. A notable exception is Dubai OSP which is set as a differential to an average of the monthly settlements for Oman crude on DME.

²⁷ There are Dubai swaps 'lookalike' instruments trading on ICE and CME. The volumes of these trades have steadily been growing, but at the time of writing we had no volumes data available.

²⁸ Squeeze is usually defined as a situation in which a buyer buys all the available crude produced. When futures and forward markets are traded, the actual pricing exposure may exceed total production. For grades physically delivered in the Platts Dubai contract, see Figure 4.

²⁹ Oman cargo can be arbitrated – bought from DME exchange and sold into the Platts window, therefore linking the prices of the two.

³⁰ The conclusion that Dubai is a benchmark derived from Brent and not a centre of absolute price discovery remains valid: Horsnell, P. (1997) 'Oil in Asia: Markets, Trading, Refining and Deregulation', Oxford: Oxford Institute for Energy Studies.

³¹ Refiners can use different internal benchmarks too. Although it is generally kept confidential, it seems that Sinopec uses 5:4:1 (5 x Dubai i: 4 x Brent: 1 x WTI) as an internal benchmark and some Indian refiners also use a large element of Brent. The other difficulty is that most of these refiners have their own trading arms. While majority of the WAF, N. Sea and Latam barrels may be sold to them on Brent-related basis, it is impossible to tell how much exposure these trading arms keep on their own books and how much they simply pass on to the refining companies.

³² It is usually in the discretion of the operator or 'operational tolerance'.

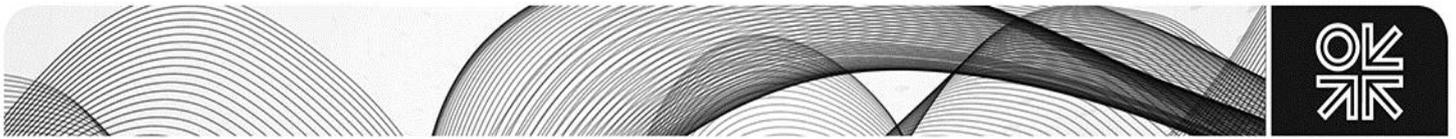
³³ See: Horsnell, P. and Mabro, R. (1993) *Oil Markets and Prices: The Brent Market and the Formation of World Oil Prices*. Oxford: Oxford Institute for Energy Studies.

³⁴ From January 2014, ADNOC introduced a new supply system for Murban, selling its former equity holders destination-free crude for a premium, widely believed to be 11 cents/bbl. Regarding Upper Zakum, there are about 15 destination-free cargoes, as Exxon and Impex have 42% of some 600 kbd production. However, at times, ADNOC seems to have offered its own additional or spot cargoes on destination-free basis.

³⁵ According to Platts, total production of Dubai, Oman and Upper Zakum is around 1.5 million b/d. This compares to one million b/d underpinning the North Sea Brent benchmark BFOE. Typically, more than one million b/d of Dubai, Oman and Upper Zakum are available to be freely traded in the market.

³⁶ There have been complaints that Shell had a preferential access to such barrels for loading in June 2014.

³⁷ US and European regulators have been probing a number of major banks for 'rigging' interest rates. See: 'Ex-Rabobank trader second to plead guilty to Libor rigging', *Reuters*, 18 August 2014.



³⁸ 'Oil company offices raided in EU pricing probe', *BBC News*, 14 May 2014. The Commission has not taken any action or issued any statements up to the time of writing this.

³⁹ 'Oil market pricing escapes linkage to financial benchmark regulations', *Reuters*, 10 September 2014.

⁴⁰ See: 'Don't blame PRAs for oil industry's structural failures', *The Financial Times*, 20 May 2013.

⁴¹ 'Value at Risk' is commonly used as a measure of risk in a trading portfolio.

⁴² An analogy could be made with emerging market securities. In case of a geopolitical risk in say, Indonesia, a fund manager may sell Turkish securities to reduce the VAR of her portfolio as these are more liquid. The price of Turkish securities is likely to fall even though there is nothing directly affecting this market.

⁴³ This is similar to Platts 'Brent' with delivery of Brent, Forties, Oseberg and Ekofisk (BFOE).

⁴⁴ Historically, physical Oman used to be traded extensively and hence the origins of the Platts Oman assessment and its inclusion into the Saudi pricing formula.

⁴⁵ There are rare exceptions, usually when Oman/Dubai values are diverging. In September 2014, when Oman settled \$1.895 over Dubai on the last day of trading, SK energy sold a number of Oman cash partials to Shell who were bidding the market and thus widening assessed Oman/Dubai spread.

⁴⁶ See Fattouh, Bassam. (2012), 'The Dubai Benchmark'. Of course, participation of one or more large producers could also produce a biased benchmark.

⁴⁷ One should note that it is becoming increasingly hard to distinguish 'oil traders' from other market participants. For many years now, most majors have had trading arms (Stasco, a trading arm of Shell, is possibly the biggest trading company in the world). However, more and more refiners (Unipecc, China Oil, Reliance, and others) have their own trading companies. Even producers such as Oman have a trading company (OTI) in a joint venture with Vitol. Finally, trading houses such as Glencore, Vitol and others have had both upstream and downstream assets for quite some time.

⁴⁸ Physical delivery for July loading was 13.1.

⁴⁹ Oman's oil production, including condensates, was 931,955 b/d in May 2014, the highest level in nine years, according to the Oman News Agency.

⁵⁰ Initially, DME spent too much time marketing the contract to the wrong customers (banks, 'high frequency' and 'black box traders'), neglecting the real physical Oman players and some serious operational problems with the contract at the time. This has changed with the new management. Will it succeed? Any contract, to become really big (Brent, WTI) needs an event or a 'tipping point'. Brent had it in the UK tax system, and WTI had it in the storage hub Cushing, among other things. DME may need one too. Platts' move to 500 kb (20 partials) is a positive change for DME, opening the arbitrage between the two and thus liquidity, but it may not be a game changer yet.

⁵¹ For detail, see: <https://www.theice.com/marketdata/reports/83>

⁵² Brent weighted average (of all trades during the day) is used by Saudi Aramco and others as a benchmark in their pricing formula for their European sales.

⁵³ 'Shanghai's crude oil futures contract', *Reuters*, 14 November 2014.

⁵⁴ A counter argument here is that one liquid benchmark is better than a few less liquid ones. However, the author's opinion is that only a competition among benchmarks can result in improved pricing process.