

Oxford Energy Comment

June 2006

OPEC's Discounts on Heavy Crude Oil: Is a New Policy Instrument Taking Shape?

Bassam Fattouh¹

Earlier this year in Caracas, OPEC announced that it would leave its production quota unchanged. This announcement was made despite the fact most OPEC officials recognize that oil markets are very well supplied. Saudi Arabia's oil minister Ali Naimi described the market as "oversupplied" while the President of Venezuela, Hugo Chavez declared that "some countries in the North want us to raise production, but there is sufficient oil in the market. In fact, we even think there is an excess of oil in the market". OPEC claims that the problem it faces is that their members can't find enough markets for their heavy crude. In the words of a senior Iranian delegate who attended the latest OPEC meeting in Caracas, "anybody who has oil of less than 30 API can't find buyers".² Several OPEC members are also concerned about rising global inventories which have recently reached high levels.

OPEC however had little choice but to keep its oil output targets unchanged; announcing production cuts in the current environment of high oil prices would have been politically damaging for OPEC, especially for its largest producer Saudi Arabia. The last thing that OPEC wants is to be seen as protecting a 70\$ oil barrel.

However, not everyone is convinced by OPEC's recent announcement. Some observers believe that OPEC members have already been reducing their supplies to keep inventories in check. For instance, the Wall Street Journal reported that "some analysts estimate that oil supply from OPEC nations is already well below the formal output quota of 28 million barrels a day... and is running as much as one million barrels a day less than a year ago... The reason for the cutbacks: while oil use is still rising, global inventories are now flush". The article then claims that "they are doing this by opting not to discount their heavy, high-sulphur grades of crude oil"³.

While increasing the discount to find markets for heavy crude oil is quite usual especially in a slack market and in face of competition from other heavy oil

¹ Bassam Fattouh is a Reader in Finance and Management in the Department of Financial and Management Studies, SOAS, University of London and Senior Research Fellow at the Oxford Institute of Energy Studies. This is a part of a larger project examining the behaviour of oil price differentials.

² Bhushan Bahree and David Luhnow "OPEC is poised to hold production goals steady", The Wall Street Journal, Monday, June 2, 2006

³ Bhushan Bahree and David Luhnow "OPEC is poised to hold production goals steady", The Wall Street Journal, Monday, June 2, 2006

producers, this comment explores the argument that OPEC may resort to reducing discounts on its heavy oil to reduce oil supplies in what is described by some as an oversupplied market. In theory and especially in current oil market conditions where prices are high and serious bottlenecks plague the industry, influencing the price differential between light and heavy crude oil may be an effective way of cutting production without resorting to quota cuts. If this is the case, crude oil price differentials could convey useful signals about the direction of future oil supplies and OPEC supply strategy. However, as is discussed in this paper, there is nothing to indicate so far that OPEC has been adopting this strategy.

Crude oil is of little use before refining and is traded for the final petroleum products that consumers demand. The intrinsic properties of crude oils determine the mix of final petroleum products. The two most important qualities of crude oil are viscosity (thickness or density) and sulphur content. Crude oils with lower density referred to as light crude usually yield a higher proportion of the more valuable final petroleum products such as gasoline and other light petroleum products by simple refining processes. Light crude oils are contrasted with heavy crude oils that have a low share of light hydrocarbons and require much more complex refining process than distillation (such as coking and cracking) to produce similar proportions of the more valuable petroleum products. Sulphur, a naturally occurring element in crude oil is an undesirable property and refiners make heavy investments in order to remove it. Crude oils with high sulphur content are referred to as sour crudes while those with low sulphur content are referred to as sweet crudes.

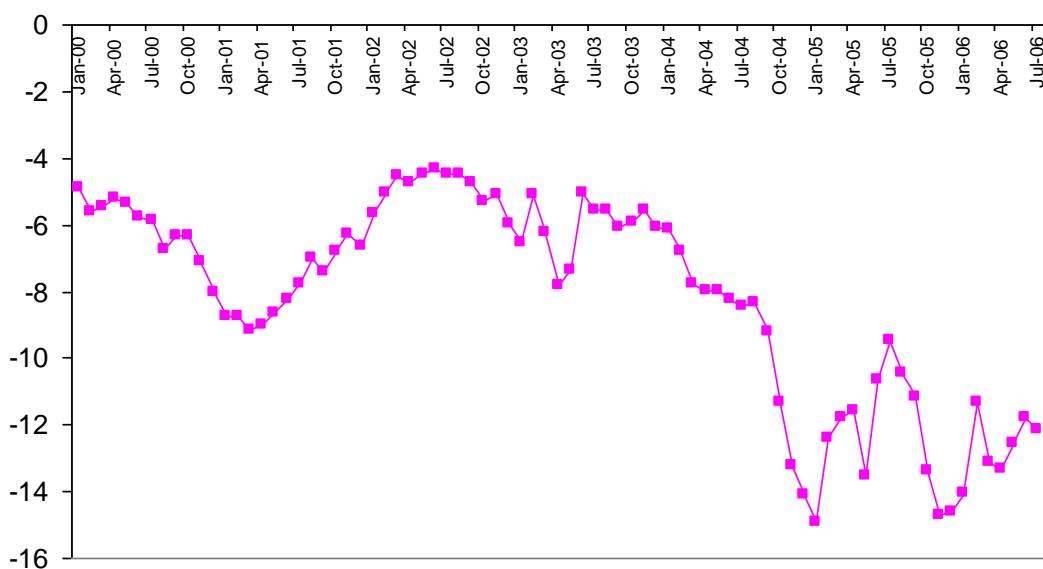
Since the type of crude oil has a bearing on refining yields, different types of crude oil fetch different prices. Crude oils that yield a higher proportion of the more valuable final petroleum products and require simple refining processes (the light/sweet crude variety) usually command a premium over those that yield a lower percentage of the more valuable petroleum products and require more complex refining processes (the heavy/sour crude variety).

However, differences in quality of crude oils are not the only determinant of oil price differentials and hence differentials are not constant over time. Among other things, changes in the prices of different petroleum products (or the gross product worth) lead to changes in crude oil differentials. For instance, asphalt is produced through refining of heavy crude and thus the heavy-light price differential is expected to decline before the driving season in the US when roads are re-asphalted. In the driving season, the higher demand for gasoline can widen the differential as gasoline is produced through the refining of light sweet crude oil. Another factor that may influence the differential is the heating season and whether the season turns out to be colder than expected. These factors suggest that movements in crude oil price differentials are likely to exhibit a seasonal behaviour. Factors outside the oil sector can also have an influence. For instance, when gas prices reach high levels, some utilities may switch to fuel oil. This would narrow the differential between light and heavy since fuel oil is a product of heavy crude. Environmental regulations and mandated modification of product specifications can also influence price differentials. The supply of heavy crude can also have an effect. If there is a supply disruption from a heavy oil producer or OPEC decides to cut supplies, the differential between heavy and light crude oil is likely to

narrow. In short, crude oil price differentials are influenced by a wide array of factors and are highly volatile.

Figure 1 plots the price discount of Saudi Arabia's Arab Heavy crude to spot WTI in dollars per barrel for the period January 2000– July 2006. Four important features emerge from this figure. As expected, WTI which is a sweet/light crude variety and trades at a premium compared to Arab Heavy which is considered as a sour/heavy crude variety. The second feature is that the price differential can reach very high levels. For exporters of low quality crude oils, this has important implications on their revenues. The third feature is the rise in the price differential in recent years. The average discount almost doubled from \$6.22 to \$11.77 between the periods 2000-2003 and 2004-2006 (until July). The fourth feature is the large variation in price differential between the two crude oils over time, especially in the last three years of the sample. For instance, between December 2003 and January 2005, the discount of Arab Heavy to WTI increased from \$6 to over \$14 and then fell back to \$9.45 in July 2005. By November 2005, the discount rebounded to \$14.50, but then declined to \$11 in February 2006. The main question is: what do these changes in price differentials convey?

Figure 1: Arab Heavy Discount to Spot WTI (in \$/Barrel)



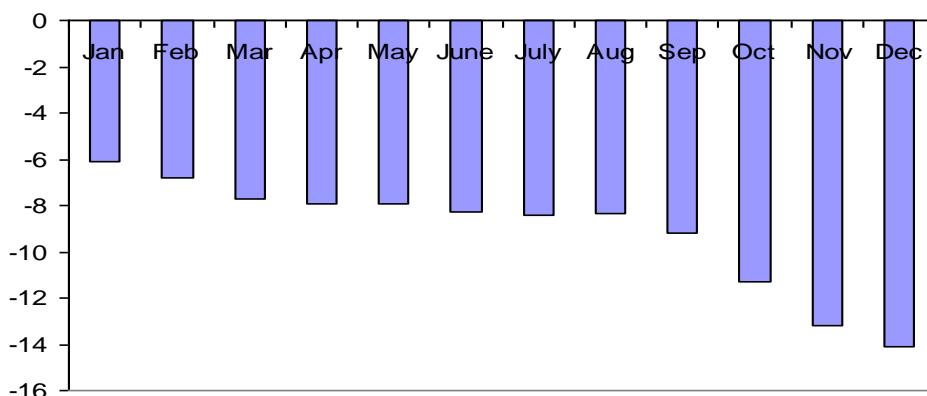
In order to provide a concise understanding of the behaviour of crude oil price differentials and determine the optimal differential, a refining optimization model with assumed product prices needs to be developed. These implied differentials then can be compared to the observed ones to assess whether they are wide or narrow. Array factors that influence price differentials also need to be identified. This exercise however is beyond the scope of this comment.⁴ Instead, we rely on readily available data on crude oil netback values from *Oil Market Intelligence* and detailed analysis of

⁴ This is the subject of the author's current research.

the evolution of Arab Heavy discounts to Spot WTI in the last three years. This approach, though incomplete, still enables us to assess whether there has been a recent shift in Saudi Arabia's discount policy.

In response to tight oil market conditions in 2004 which saw a large increase in incremental demand for crude oil, OPEC countries responded by producing close to their maximum capacity. In tight crude market conditions, one would have expected oil price differentials to narrow as buyers competed for whatever crude oil was out in the market. However, the opposite happened. As the table below shows, the Saudi Arab Heavy discount to WTI more than doubled in 2004 from \$6.10 in January to \$14.10 in December. What is interesting to note from Figure 2 is the absence of seasonality or cyclical movement in the movement of crude oil price differentials in 2004 despite the fact that movements in price differentials are subject to seasonal and cyclical factors. These large discounts increased the attractiveness of heavy crude oils to refineries which responded by increasing their imports of heavy crude and increasing the production of refined petroleum products to meet the rise in demand. Thus, the incremental demand growth for light petroleum products, mainly gasoline, was being increasingly met by imports of cheaper heavier crude oils. The large discounts also encouraged the build up of the Strategic Petroleum Reserves, two thirds of which are now made up of sour grades. But this behaviour of discounts suggests a contradiction: Why did Saudi Arabia and other heavy oil producers resort to large discounts on their heavy crude relative to light crude to secure markets when markets and buyers were supposedly out there?

Figure 2: Arab Heavy Discounts to Spot WTI in 2004



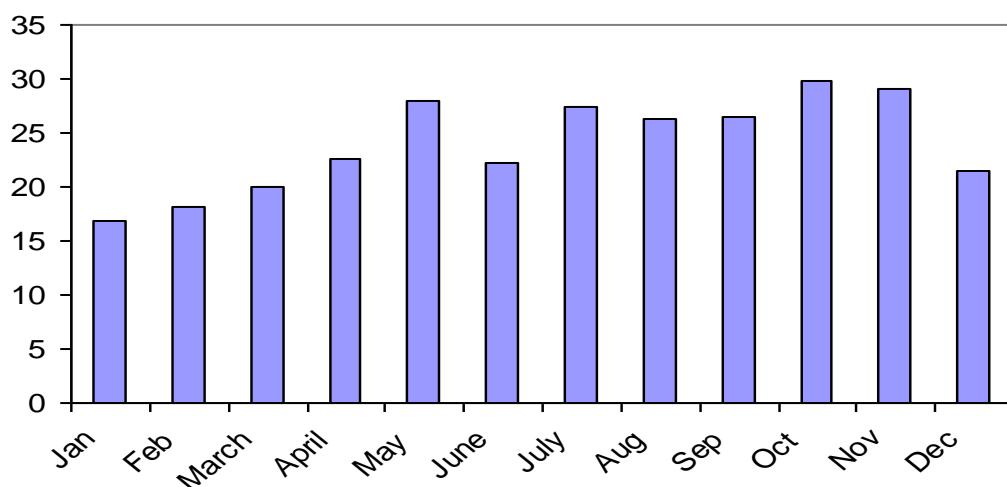
Source: Petroleum Argus Weekly

The most probable explanation is that these discounts have responded to changes in the relative prices of petroleum products. This explanation is based on the following three elements: an increase in demand for light products due to a number of factors including the mandated modification of product specifications and other environmental restrictions, the changing mix of crude production towards higher incremental volumes of sour and heavier crudes, and constraints on conversion capacity. In the face of an increase in demand for lighter product, refineries least able to deal with medium/heavy oil were forced to run heavier slates with the effect of producing a lower proportion of light petroleum products, such as gasoline, and

higher proportions of the heavy petroleum products such as residual fuel oil. The price elasticity of heavy products is high since these can be more easily substituted, while demand for gasoline is more inelastic because of the lack of substitutes. Thus, in order for the simple refineries to achieve zero or positive refining margins, they have to obtain a higher price for its light products. This widened the differential in the products market between light and heavy petroleum products which then fed back into the crude oil market resulting in a higher spread between heavy/sour and light/sweet crude oils. Thus, crude oil price differentials are set such that the marginal refinery is indifferent to running a heavier slate or a lighter one.

According to this explanation, the discounts of Arab heavy crude should follow the differentials in the products markets and hence differentials should widen. The figure below plots the differential between premium unleaded gasoline and fuel oil (3.5% sulphur). As can be seen from this graph, the differentials widened in the first half of the year and remained quite high.

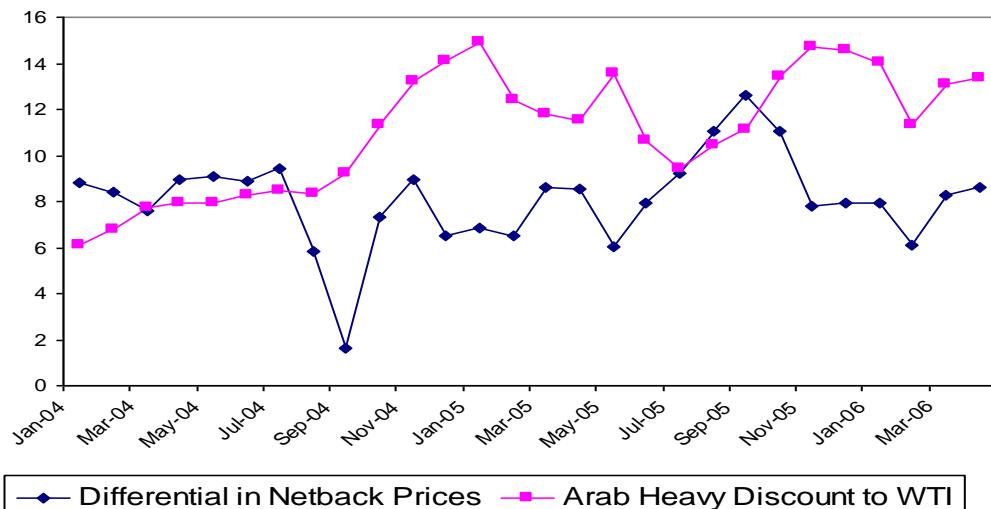
Figure 3: Premium Unleaded Gasoline-Fuel Oil Differential in 2004



Source: Petroleum Argus Weekly

This is also supported by Figure 4 below which plots the difference between (i) the WTI netback and Arab Heavy netback price differential (cracking, US Gulf Coast) and (ii) Arab Heavy discounts to WTI. As can be seen from this figure, until July 2004, the netback price differential was higher than that of the crude oil price differential. As argued above, this should have had the effect of widening the differential between light and heavy crude oils, as is shown in Figure 2. But what is interesting to note is that the crude oil price differential has risen faster than the netback price differential and since August 2004 (with a few exceptions in 2005), the Arab Heavy discount to WTI has been consistently higher than the netback price differential. In principle, this should have helped reduce the Arab Heavy discount to WTI. But this did not happen and the discount remained relatively high and only began to decline in the first few months of 2005; even then, the discount remained well above the netback differential.

Figure 4- Differential in Netback Prices and Discounts



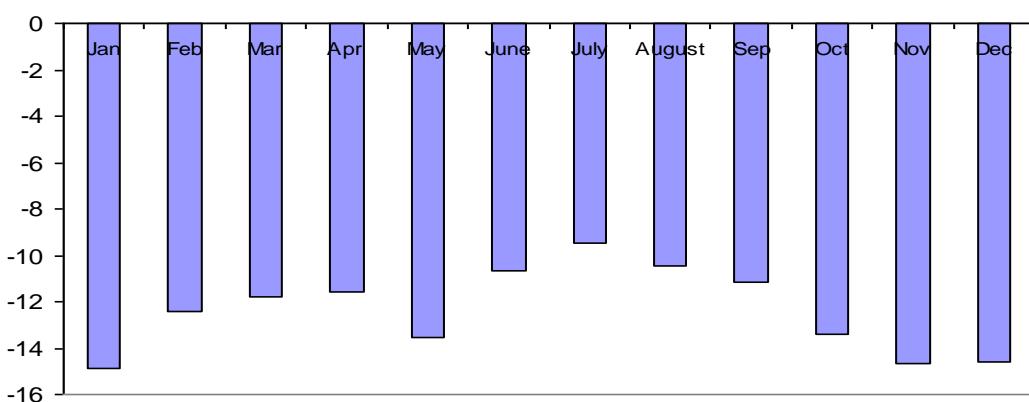
The wide differences observed in Figure 4 can be explained by a number of factors. Calculating the difference between the gross product worth (GPW) of a refined barrel and crude oil price (i.e. the margin for each of the crude oils) requires certain assumptions about refining costs and the set of yields from each barrel. These assumptions may not be accurate and refining costs are usually underestimated as they do not cover all aspects of the refining process. Furthermore, these calculations do not usually take into account the production of special products or issues relating to a refinery's degree of flexibility. Thus, the true margin for each of the crude oils is likely to be smaller than that which appears in the data. Consequently, the difference between the WTI netback and Arab Heavy netback price differentials and Arab Heavy discounts to WTI is likely to be smaller than that observed in Figure 4. Another important issue is the type of refining configuration used in these calculations and whether it is representative of the marginal refinery. Given the current bottlenecks in the refining industry, it is unlikely that cracking configuration would be representative of the marginal refinery as the increase in demand for light petroleum products may have pushed simple refineries to run heavier crude. However, these caveats should not obscure the fact that the difference between the WTI netback and Arab Heavy netback price differentials and Arab Heavy discounts to WTI was highly variable and that it has widened and become quite large during the period 2004–2006.

One plausible explanation is that some refiners may have taken advantage of the refining bottleneck issue and widening differentials and bargained for better terms on the heavy crude. The discourse in the media and trade press was (and still is) that it is very difficult and expensive for refineries to process heavy crude oil and that refiners are not interested in acquiring heavy crude unless it is offered at high discounts. This may have pushed some heavy oil producers to offer large discounts in order to entice buyers to lift their heavy crude. Did some oil refiners bluff heavy oil producers? Some suggest that this might have been the case. According to this view, if the issue

is technical refining difficulties concerning heavy crude oil, offering discounts cannot solve this structural problem.

In 2005, the differentials of Arab Heavy to WTI exhibited a slightly different behaviour than in 2004 and seasonality was visible again. In 2005, the WTI-Arab Heavy oil price differential declined on a monthly basis from \$14.90 at the beginning of the year to \$9.45 in July with the exception of the month of May which saw the discount increase by \$2 from the previous month. However, the moderate decline in the discount in the first half of the year was reversed in August and by the end of 2005, the Arab Heavy was at a discount of \$14.60 to WTI. This reverse can partly be explained by Hurricane Katrina which destroyed a large part of US refining capacity. OPEC reacted by making more of its heavy sour crude available to markets despite the fact that crude oil markets were well-supplied. This episode has clearly shown that the problem was mainly a refining one: if the concern was about fear of shortage of crude oil supplies, the market would have reacted by purchasing whatever crude oil was out there and consequently price differentials would have narrowed or even disappeared. In 2005, the opposite happened: the supply of heavy crude caused the differentials to widen considerably as supplies of heavy crude were plenty and refiners were only willing to buy heavy crude at large discounts. Another indication that the problem was mainly a refining one, rather than availability of crude oil, can be seen from the gasoline crack spread defined as the spread between the price of a barrel of gasoline and a barrel of crude oil. The main impact of Katrina was to raise the gasoline crack spread as the destruction of refining capacity led to a much faster rise in product prices than in crude oil prices. Usually when this occurs, the price of light/sweet crude oils increase relative to the heavy/sour crude variety.

Figure 5- Arab Heavy Discounts to Spot WTI in 2005



Source: Petroleum Argus Weekly

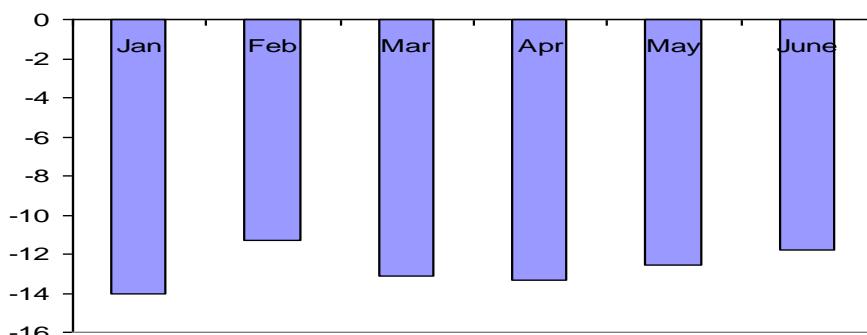
In fact, as Figure 4 shows, the difference between the Arab heavy discount to WTI and netback price differentials narrowed considerably and in August and September of 2005 the netback price differentials was higher than Arab heavy discount to WTI. This did not last long and at around the time that Katrina hit the US refineries, the difference between the two widened considerably.

As mentioned above, there have been suggestions that a new process may have emerged this year regarding crude oil price differentials. Since many observers consider the market to be oversupplied and given the historic levels of inventories encouraged by a contango market and uncertainty about the impact of oil price on demand, OPEC is seen to have the incentive to cut its oil supplies. Resorting to production cuts however is not feasible in the current environment of high oil prices and would be politically damaging for OPEC. On the contrary, in the current environment of high oil prices OPEC would like to be seen as contributing to oil market stability. To consumers this simply means more pressure on OPEC to increase production and supplies. Thus, contrary to the general belief, OPEC nowadays is in a defensive position: It is under pressure to increase production but at the same time it cannot ignore the market realities of a well supplied crude oil market, high crude oil and gasoline stocks and high oil prices.

One way in which OPEC producers can cut supplies without changing the quota levels is by reducing the discount of the heavy crude to WTI. This would decrease the attractiveness of heavy crude for oil refiners and affect their refining margins causing a reduction in their demand. Ali Naimi declared in the meeting in Caracas that "nobody wants heavy oil; there are no refineries that handle heavy oil". This is correct and more so if the discounts of Arab heavy to WTI decline. Thus, by playing the market, OPEC can induce a moderate reduction in supply without disturbing the market.

Although in principle changing the value of the discount on heavy crude oils relative to sweet crude oils can act as a useful policy instrument, we have not seen it in operation to date. As Figure 6 below shows, the discounts in 2006 have been volatile. The discount fell in February but rose again in March and April and declined once more in May and June. The latest figures suggest that the discount increased in July to reach close to \$11. The discounts remain quite high which does not support the above hypothesis.

Figure 6- Arab Heavy Discounts to Spot WTI in 2006



Source: Petroleum Argus Weekly

Thus, crude oil price differentials are unlikely to convey signals about OPEC supply strategy since the behaviour of crude oil price differentials has been driven by market forces and refining bottlenecks. This is related to a more fundamental issue. With minor exceptions, OPEC members have been willing to supply crude oil whenever there is demand for it. It is unlikely that any OPEC member will turn down requests for oil in the current environment of high oil prices. To suggest that OPEC will use the discount to reduce supplies presupposes that OPEC will behave differently.

In summary what we have seen so far this year is a decline in demand for OPEC oil which has been met by a reduction in supply. Petroleum Argus reported in June that “Saudi Arabia has cut production in response to limited appetite for its crude from capacity-constrained refiners”. In fact, in the current situation where markets are perceived to be well supplied, rather than falling, we could witness an increase in discounts on Arab heavy to entice buyers. On the other hand, as Figure 4 shows, the difference between the Arab heavy discount to WTI and netback price differentials may suggest that differential could narrow. But what is important to stress is whether the discounts rise or fall, these movements are not policy induced.

So far, OPEC has not used discounting of its heavy crude as a policy instrument to cut supplies. This however does not preclude it considering such a policy in the future.