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Contango Lessons

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In an influential article, Litzenger and Rabinowitz (1995)¹ noted that 80–90% of the time the oil forward curve is in backwardation, i.e. futures prices are often observed to be below the spot prices. They provide an explanation of backwardation using the analogy that ownership of oil reserves can be seen as holding a call option. If discounted futures prices are higher than spot prices and if extraction costs grow by no more than the interest rate, then all producers have the incentive to defer production and leave the oil in the ground. This gives the producers the option of leaving oil there rather than extracting it and incurring high storage costs, risks of sabotage, and so on. But if every oil producer waits, then there will be a shortage of oil today causing the price to rise. The net result is backwardation in which the oil price rises today to offset the advantage of waiting to see the price before oil extraction. Thus, according to this explanation, weak backwardation is a necessary condition for current production.

However, one striking feature in the current market has been the prolonged contango in the WTI forward curve. Figure 1 below shows that during the last 18 months or so, the nearby (delivery) futures contracts have been trading at a discount to the second month futures contract. Figure 2 which plot the WTI forward price curve shows a very steep slope with the nearby contract trading at a discount of almost \$5.5 to the March 2008 contract. So what can explain the current term structure?

Various explanations have been put forward to explain the current contango in crude oil markets. Advocates of the peak oil hypothesis consider that the current transition from backwardation to contango is due to a greater acceptance by market participants of peak oil. Simplifying greatly, peak oil theory predicts that oil production will reach a peak some time in the very new future after which production would start to decline. In the face of an expected growth in global demand, this implies that oil prices for future delivery should rise faster than prompt prices. This would imply a contango structure with the contango widening at the later segments of the forward curve as impending shortages become more acute ahead in the future. However, this implication is not supported by the data: the term structure of futures contracts for

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¹ Litzenger, R. and N. Rabinowitz (1995), 'Backwardation in Oil Futures Markets: Theory and Empirical Evidence', *Journal of Finance*, 50:1517–45.

long term maturities is in backwardation and the volume of outstanding contracts is relatively low which indicates that investors place little weight on peak oil predictions. After all, if market participants adhere to the view of peak oil, then they would have the opportunity to make large profits by buying the longest maturity crude oil futures contract that the market allows.

Figure 1

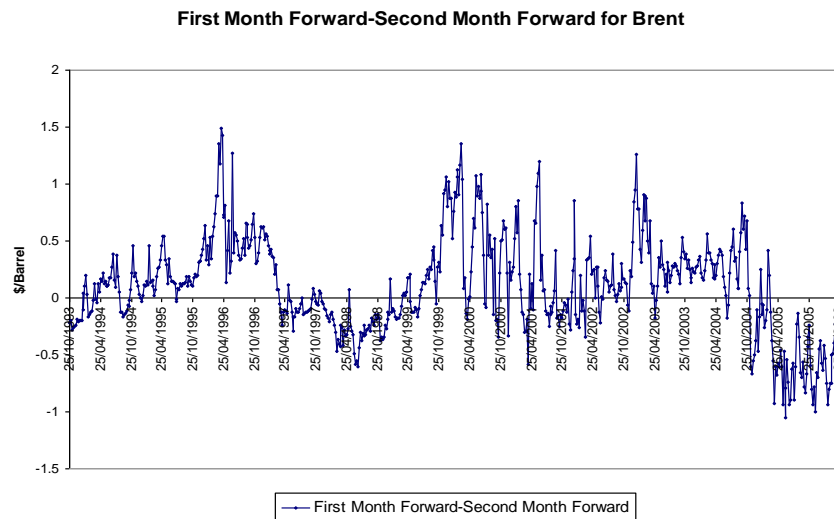
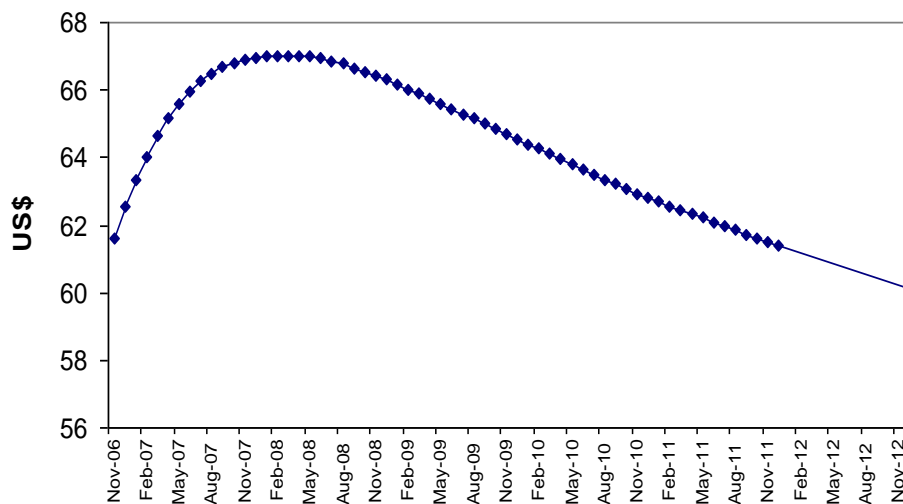


Figure 2- WTI Forward Price Curve (as of 21 September 2006)



Some have argued that the current price structure may be signalling that there is a need for precautionary inventories and oil market participants are responding to these needs. For instance, Petroleum Argus (19 June, 2006) argues that the market is signalling that “just-in-time inventories are no longer appropriate as OPEC has lost the spare capacity that enabled it to act as a buffer, shifting stock risk management down the crude supply chain to refiners. The contango is self-sustaining, as the

incentive for refiners to store more crude increases pressures on prompt supply and prices.” This view needs further clarification. In principle, greater demand for precautionary inventories should cause the price of oil for prompt delivery to rise and rather than creating a contango it should cause backwardation at least in the short term. This holds true as long as there is available storage capacity and enough crude oil available in the market. If on the other hand, storage capacity imposes partial adjustment of stocks or if there are not enough oil supplies for prompt delivery, then participants may want to meet precautionary inventories by buying futures contracts with longer maturities. This can create a contango.

The precautionary inventories explanation implies a fundamental shift in the behaviour of oil companies and refineries away from just-in-time inventory policy to a more ‘responsible’ policy of accumulating inventories in a tight market. It also implies that even when the market shifts back into backwardation, oil market participants are likely to continue to accumulate inventories for precautionary purposes. This shift would have important implications for the return on capital employed and given the pressure to maximize shareholder value it is unlikely that private companies would keep inventories when it makes commercial sense to scale them down. To make this case, it should be shown how precautionary inventories would maximize shareholder value.

Rather than resorting to explanations based on peak oil and/or transformations in the behaviour of market participants, others explain the current contango structure in terms of investors’ expectations of tighter crude oil market conditions in the future.² These expectations are not necessarily being driven by irrational factors as many observers suggest, but more likely by the future fundamentals of supply and demand for crude oil. These fundamentals include among other things factors such as expectations of growth in global demand, the supply response from OPEC and non-OPEC producers, the probability of hurricanes occurring and taking large chunks of crude oil out of the market, and geopolitical uncertainties (Iran, Iraq, Nigeria). As Peter Davies recently argued “the geopolitical situation, especially in oil producing countries has been perceived to have deteriorated. Oil production has been physically disrupted, expansion plans have been delayed and fears about future political stability have increased. This can to some extent be observed in the rise of long dated forward prices that have increased by at least as much as, and often more than, prices for more immediate delivery”.³

One must also introduce another important element: the lack of spare capacity which has had the effect of increasing the upside potential of financial investments and attracting large players such as banks, funds and institutional investors into the crude oil market. Greenspan recently noted that “when in the last couple of years it became apparent that the world’s industry was not investing enough to expand crude oil

² It is important to note the implications of this explanation are similar to that of the peak oil hypothesis with one major difference. The peak oil hypothesis is deterministic in the sense that it predicts that oil production will ultimately fall as reserves are used causing the oil price to rise in the future. Thus, the contango should involve long term maturities. In this explanation, there is uncertainty about how long the current market conditions would remain tight as the factors that are causing expectations of future shortages can change (conflicts can be resolved, demand can slow down, supply may respond etc...). As such, the explanation based on investors betting on future fundamentals does not require that the market be in a contango for the very long term maturities.

³ “Scramble to store Crude sustains contango”, Petroleum Argus Global Markets, 19 June 2006.

production capacity quickly enough to meet rising demand, increasing numbers of hedge funds and other institutional investors began bidding for oil”.⁴

How did the lack of spare capacity enhance the upside potential for investments? For most of the 1980s and 1990s, OPEC spare capacity, chiefly that of Saudi Arabia helped offset large demand and supply shocks and hence acted as a shock absorber. However, since the early 1990s, spare capacity has been in decline and by early 2004 had fallen to very low levels especially when measured as a percentage of global demand. In the absence of the capacity cushion, shocks can have a big impact on oil prices. In particular, when capacity constraints become the main force in the market, the following price dynamics are likely to emerge: an accelerated rise in average oil prices, an increase in oil price volatility and more frequent spikes in crude and product oil prices. These features make the oil market quite attractive for investors, especially when uncertainties plague the market. Specifically, tight market conditions, geopolitical uncertainties, and a thin spare capacity have made some of the bets on potential supply shocks extremely attractive. For instance, although the probability of a supply shock may not have changed compared to previous years or may even have increased slightly, the upside potential in the event of such a shock can be extremely high. And although inventories have risen, investors believe that in case of such a supply shock, the current level of inventories would not be enough to absorb the price rise.

If investors expect oil shortages to worsen over time as a result of a rational (or even irrational) assessment of future oil market fundamentals, they will increase the demand for oil futures contracts in expectation of an oil price rise. If the price of oil for future delivery rises higher than the price of oil for immediate delivery, this would prompt market participants with storage facilities to accumulate inventories, stock up their tanks and lock in a profit by selling futures contracts. Thus, by creating the incentive to accumulate inventories which are then shorted in the futures market, contango has the effect of keeping the price of oil for future delivery lower than it would have been in the absence of a contango.

In fact, some observers would go further, arguing that at some stage there has been an excess demand for the front month futures contracts ex-ante. The contango contributed to spreading this ex-ante excess demand over the various maturities of the futures contracts preventing the front month oil price from rising to very high levels. Specifically, if there are not enough sellers in the market to take the opposite position, investors who are interested in taking a long position may decide to buy oil for delivery at further away maturities. This has the effect of increasing the oil price for delivery at these maturities and widening the contango for further away months. The contango in turn provides the incentive for those with storage facilities to accumulate inventories and enter the futures market by shorting these longer maturities contracts. Thus, the contango is playing a positive role by relieving the pressure from front month contracts and spreading it over the forward curve.

As Figure 2 shows, the last time the crude oil market entered in a prolonged contango (which lasted more than 12 months) was in 1998. What is interesting to note is that contrary to the current contango which is associated with the upward trend in oil

⁴ Statement of Alan Greenspan before the Committee on Foreign Relations United States Senate, June 7, 2006

prices, the 1998 contango was associated with a declining trend in oil prices. The 1998 episode is an interesting one because it illustrates how the market can fall in reinforcing contango. Contango will encourage those with physical facilities to accumulate inventories. If rising inventories is interpreted by market participants as an increase in crude oil supply relative to demand i.e. a sign of an oversupply, the price of oil for immediate delivery would go down. This would widen the differential between the oil price for future delivery and prompt price increasing the size of the contango. This in turn will induce traders with physical capacity to augment their stock further, which will cause further decline in prompt prices and widen the contango. This reinforcing contango can continue for a period of time causing sharp falls in prompt crude oil prices. In such a situation, contango is associated with falling oil prices and large accumulation of inventories.⁵

In 1998, the oil market was trapped in such a reinforcing contango. A warm winter that year and the Asian crisis led to a dramatic decline in oil demand. Around the same time, OPEC decided to raise its quotas and increase supply. These two key factors resulted in a dramatic fall in prompt prices relative to oil prices for future delivery. This triggered the accumulation of crude oil which led to the decline in spot prices and encouraged contango in the market. It took large cuts in production led by Venezuela, Mexico and Saudi Arabia to help reduce the extent of the contango.

This time round the situation is quite different: the contango and the associated rise in inventories are occurring together with an upward trend in oil prices. Not long ago, the conventional wisdom was that building up inventories would depress oil prices. In a recent conference paper, Ed Morse has argued that this conventional wisdom may no longer be valid. High levels of inventories are no longer seen as a necessary sign of oversupply and hence do not exert downward pressure on prices.⁶ It is argued that the main reason behind this transformation is that in the absence of spare capacity, the market's perception of what constitutes high level of inventories has changed. With the decline of OPEC's spare capacity, the current levels of stocks (although high by historical standards) do not imply that markets are oversupplied.

A more plausible explanation is that the relationship between inventories and oil prices has not changed. Higher than expected levels of inventories still cause oil prices for prompt delivery to decline. However, there are other factors that are pushing prompt prices in the opposite direction shadowing the impact of inventories

⁵ Notice that this reinforcing mechanism can also work when a market is in backwardation. When a market is in backwardation, participants have no incentive to accumulate inventories as buyers of oil for the future will buy paper rather than buy oil at a higher price today and store it. As a result, physical stocks or inventories will go down. Lower inventories send signals to traders that there is a shortage of supply relative to demand. This has the effect of pushing spot prices higher. But this in turn will induce companies to hold lower inventories, which will in turn send signals of shortage driving prices up. Thus, backwardation could lead to reinforcing mechanism in which prices keep rising.

⁶ Edward Morse argues that "key truisms of the old market are that prices fall in a contango and that stock builds will undermine any price rise. However, in a structurally tight market, these 'truisms' may not be valid." See Edward Morse, "The Global Oil Market Outlook: Ten Lessons About the Petroleum Sector", presentation given at the 2006 Summer Fuels Outlook Conference Washington, D.C., April 11, 2006.

on oil prices. In other words, the decline in oil price caused by rising inventories is continuously being dominated by other factors causing oil prices to rise.

In short, there is nothing to suggest that the existing contango in the crude oil market reflects structural transformations in the oil industry, perhaps with the exception of the shortage of capacity which is making bets against future tight market conditions more attractive. Instead, as has been argued, it is still possible to analyze the current contango using the same previous relationships between contango and inventories and inventories and prices although the context in which the contango occurs needs careful analysis.