

HIGH OIL PRICES — IT'S THE FUNDAMENTALS

Fundamental things apply

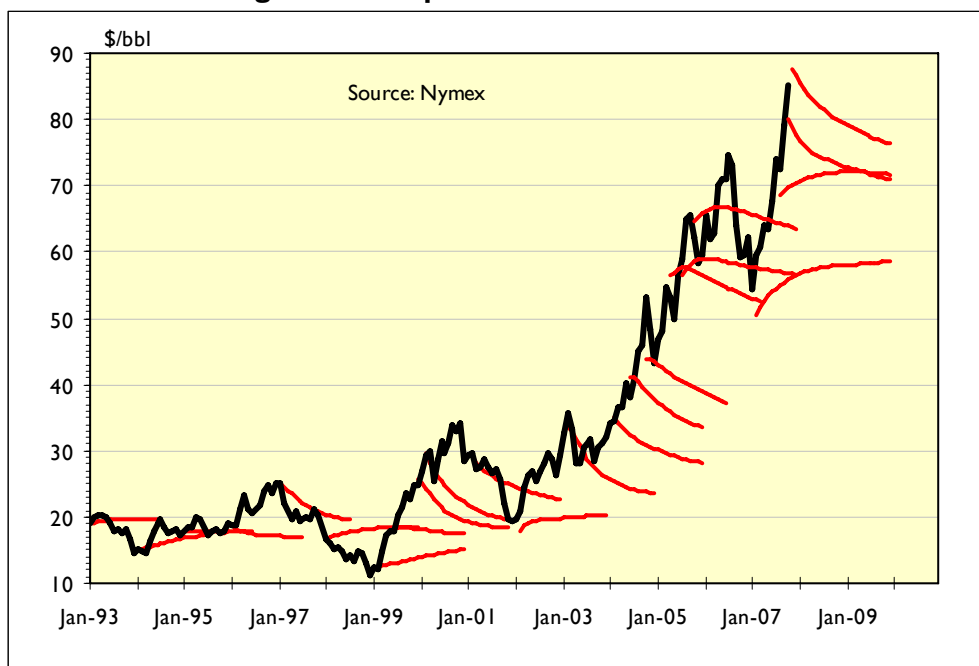
Why are oil prices so high? The price of oil has trebled over the past four years, but the industry cannot agree on the reasons why. Many analysts and market commentators argue that the dramatic surge in oil prices from around \$30/bbl for WTI in 2003 to over \$90/bbl today cannot be explained by conventional oil market fundamentals. Instead, they argue that oil prices are being driven up by speculative investment in oil futures markets and fears of supply disruptions

Such views are widely shared throughout the industry. In a recent statement, OPEC's Secretary General, Abdalla Salem El-Badri, said that 'fundamentals are not supporting current high oil prices [which are] largely being driven by market speculators'. ExxonMobil's Chairman and Chief Executive, Rex Tillerson, says that the high price of oil is 'hard to explain', having argued in

September that 'the fundamentals behind supply and demand do not support \$70 oil', while analysts at Lehman Brothers say that 'the surge in oil markets to \$90 ... seems underpinned more by financial flows and political risk than by fundamental factors'.

Blaming political uncertainty, supply fears or investment funds for rising oil prices is not only attractive but also convenient for many in the industry, because it draws attention away from the real problem facing the oil market — a shortfall in investment both upstream and downstream. If the rise in oil prices is in some way artificial or unjustified, there is less need for the industry to take action to remedy the situation. It is also unhelpful, because it does not provide any useful insight into why oil prices are rising and whether they may rise or fall in the future.

Figure 1: Oil prices and forward curves



* This article is based on a presentation made the CGES' associate David Long at the CGES' 6th one-day seminar, 'Oil price determination— futures or fundamentals?', held in London on 18 October 2007.

Market fundamentals — supply, demand and capacity constraints — remain the key to understanding why oil prices have risen so sharply over the past four years. Although it is true that oil — and other commodity markets — have attracted huge interest from investment funds keen to make a profit from the upward trend in prices, this cannot explain the sustained increase in prices for a wide range of primary commodities. It is clear that something more fundamental is going on linked to the remarkable growth of the world economy, which has expanded at an average rate of just over 5% per year since 2003.

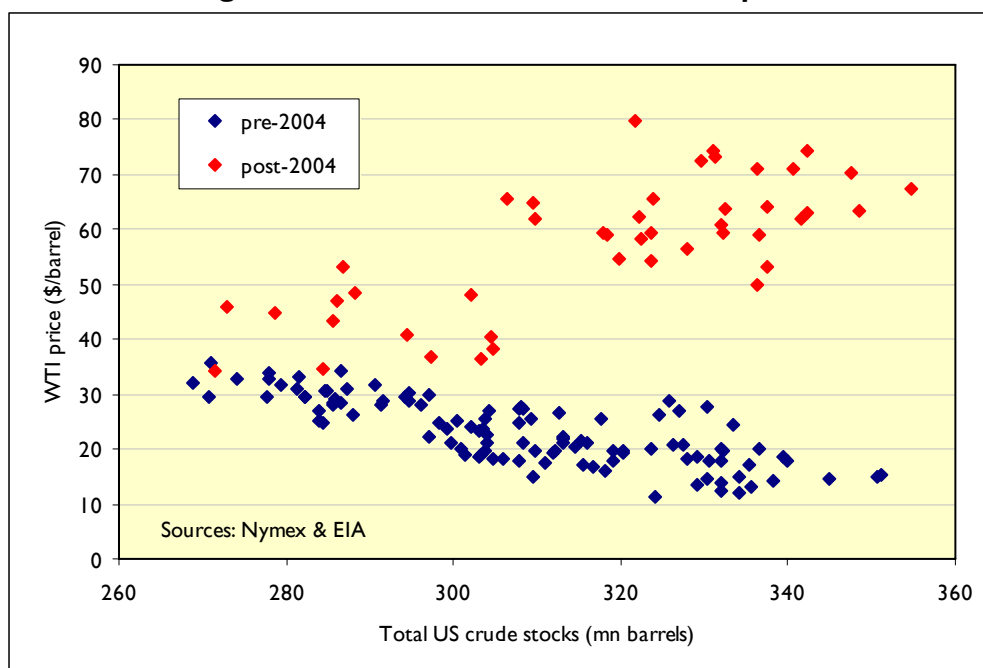
Brave new world

Rapid economic growth has transformed global commodity markets — including oil — by eliminating the overhang of surplus production and processing capacity that kept prices low after the last commodity market boom in the 1970s. After 25 years of struggling with excess capacity, both upstream and downstream, the oil industry now faces capacity constraints that are driving the upward march of prices. In a capacity-constrained world, prices are no longer set by the marginal cost of surplus supply, but must rise to a level that limits oil demand to what the industry can actually supply.

This key change in the oil pricing mechanism is one of the reasons why many analysts are struggling to understand why prices are rising. In the past there appeared to be a simple relationship between market fundamentals and the level of oil prices. Plotting the level of crude oil stocks held by companies against the level of oil prices showed that oil prices generally rose as stocks fell and vice versa (see Figure 2). Since the level of crude stocks is also a good indicator of whether the market is under or over-supplied, analysts used this inverse linear relationship as a convenient tool to explain the behaviour of oil prices.

However, the long-standing inverse relationship between stocks and prices broke down after 2003 as oil prices rose above their historical trading range from \$10/bbl to \$30/bbl. Furthermore, although the initial rise in prices during 2004 to \$50/bbl was still associated with low stocks, subsequent increases during 2005 and 2006 from \$50/bbl to \$70/bbl were associated with high stocks, producing a new — and counter-intuitive — positive relationship between the level of crude stocks and oil prices. As a result, many analysts argued that rising oil prices could not be justified by market fundamentals (i.e. the level of crude oil

Figure 2: US crude oil stocks and WTI prices



stocks) and must therefore be due to non-fundamental factors such as fears of a future supply disruption (the 'fear premium') or a flood of speculative investment as hedge funds buy oil futures in the hope of making a profit, fuelling a self-perpetuating upward spiral in oil prices.

Neither of these explanations stands up to closer scrutiny. First, there is no necessary underlying economic relationship between the level of crude oil stocks and oil prices. The real relationship is between stocks and the shape of the forward oil price curve and this relationship has held up throughout the entire period (see Fig. 3). When crude stocks are low, the crude oil market is in backwardation — with prompt crude prices trading at a premium to those for future delivery and when crude stocks are high the crude oil market is in contango — with prompt crude prices trading at a premium to those for future delivery.

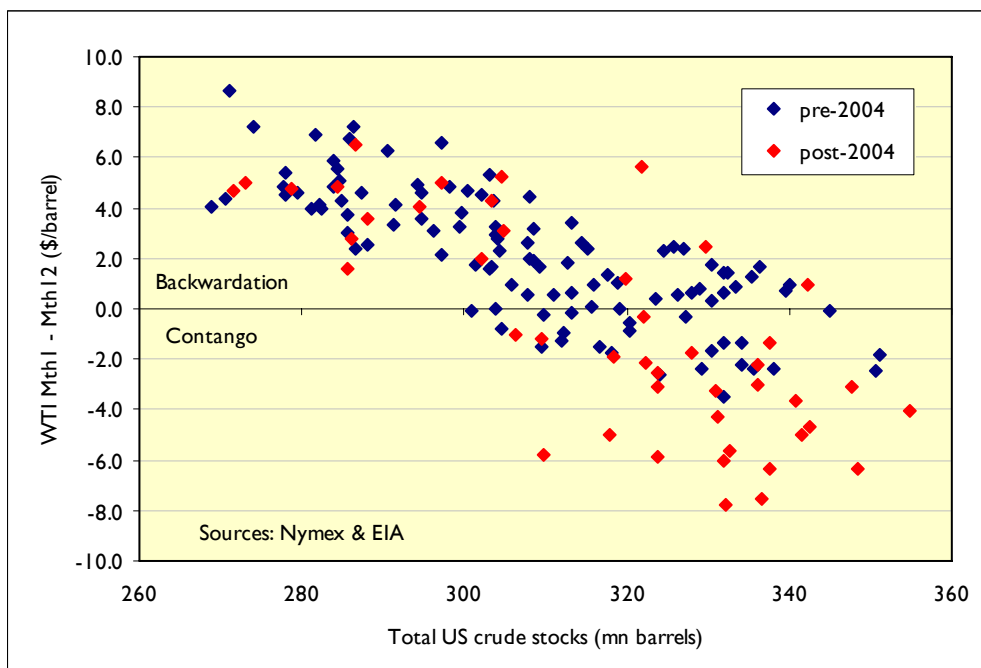
As Figure 3 shows, there is a strong inverse relationship between the total level of crude oil stocks in the US market and the forward price spread between the nearby and twelve-month-ahead Nymex WTI crude oil futures contracts. When crude stocks fall, the nearby WTI price rises

relative to the twelve-month-ahead price, twisting the shape of the forward curve from contango to backwardation. Importantly, this inverse relationship between the level of stocks and forward price spreads remained intact during the period of steeply rising prices from 2004 onwards, when the oil analysts' simple 'rule of thumb' linking stocks and absolute prices broke down.

The economic rationale for the stock-spread relationship is that the forward price spread between the nearby contract and future delivery months represents the premium that companies are prepared to pay for immediate access to the physical commodity. When the market is tight and crude stocks are low, the prompt premium rises in order to encourage companies to release oil from storage, but when the market is well-supplied and crude stocks are high, prompt prices must fall below future delivery months in order to reward companies for holding oil in storage. Thus, the level of crude oil stocks determines the shape of the forward oil price curve not the general level of oil prices.

Secondly, there is no credible evidence that investment by speculators is responsible for the

Figure 3: US crude oil stocks and forward price spreads



trebling of oil prices over the past four years. While there is no doubt that rising oil prices have attracted more investment from participants with no underlying physical position in the oil market and that the level of investment in oil derivatives, including oil futures, has increased sharply since 2003, the argument is — at best — circumstantial. Over the past four years, average open interest on NYMEX's WTI crude oil futures market has more than doubled (see Figure 4), but the relative market shares of hedgers and speculators remained broadly stable and there is no sign that speculative activity has come to dominate the oil futures market.

Hedgers — i.e., commercial investors with an underlying position in the physical oil market — remain by far the largest group of participants in the crude oil futures market, averaging 63% of the total long positions and 62% of the total short positions over past four years. By contrast, speculators — i.e., non-commercial investors with no position in the physical oil market — still hold a much smaller share, averaging 15% of the longs and 12% of the shorts over the same period. The remaining long and short positions are held by 'non-reporting' investors, who hold small positions of less than 300 contracts.

Although non-commercial investors clearly play an important role in the operation of the crude oil futures market, boosting liquidity and improving the process of price discovery, their activities are dwarfed by the much bigger hedging activities of commercial investors, who trade futures contracts as a counterpart to their underlying physical position. Despite widespread claims that speculative activity by non-commercial investors is responsible for rising oil prices over the past four years, causality tests by the CGES¹ and others² show that changes in speculative positions in the crude oil futures market *follow* changes in crude oil prices rather than the other way round.

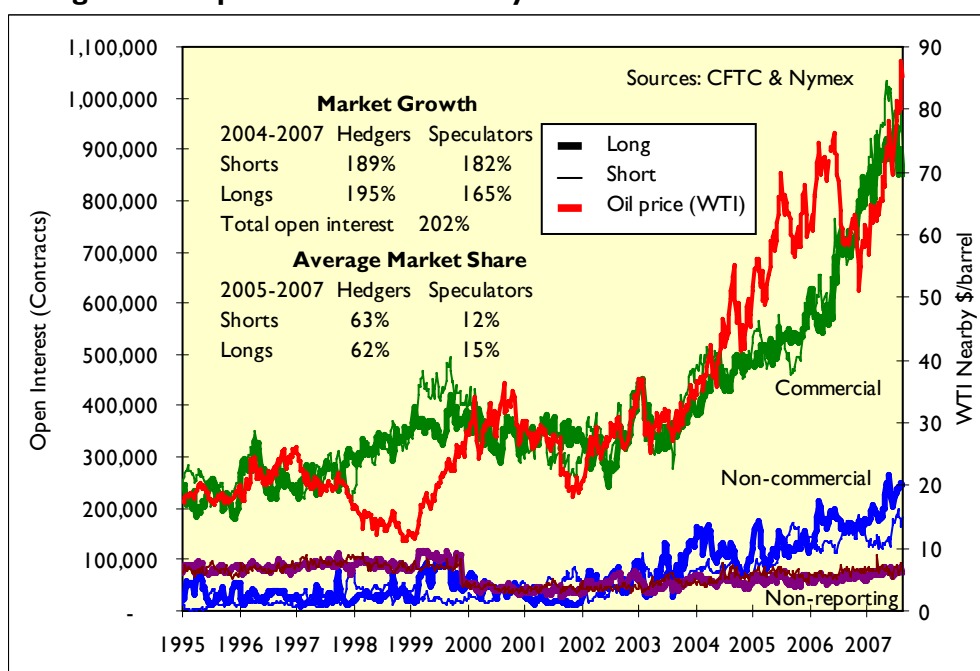
Why are oil prices so high?

The real explanation for rising oil prices over the past four years is to be found in market fundamentals, in particular:

- strong demand for transport fuels,
- downstream refinery bottlenecks, and
- upstream supply rationing by OPEC.

The story begins with an unexpected surge in oil demand during 2004, which soaked up spare capacity both upstream and downstream and

Figure 4: Open interest on the Nymex WTI crude futures market



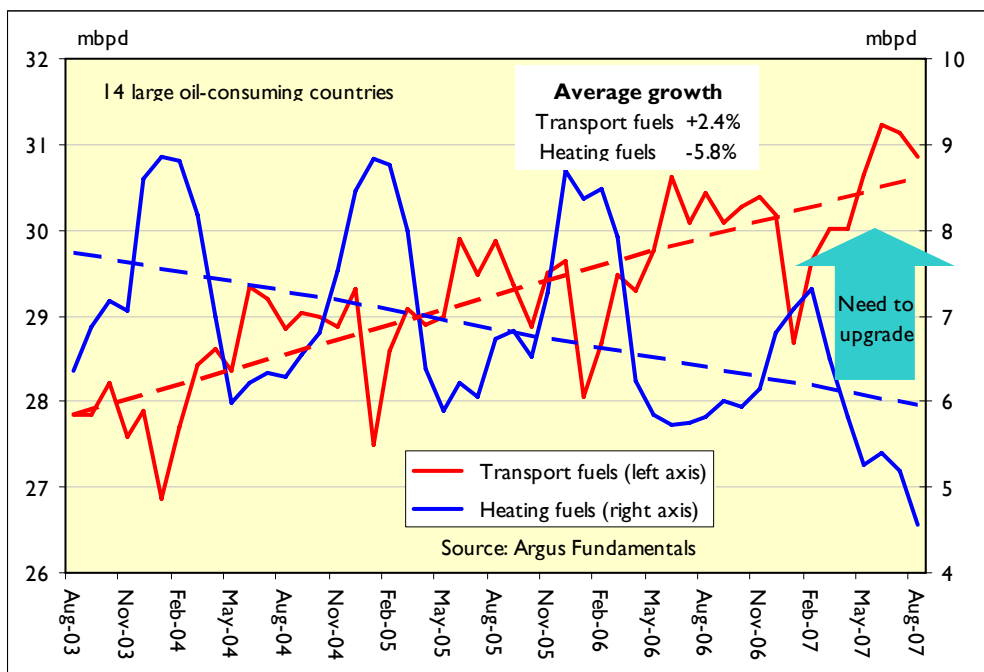
caught the oil industry by surprise. Over the previous ten years, world oil demand had grown at an average rate of 1.5% per year (about 1.2 mbpd, but in 2004 oil demand increased by nearly 4% (3.1 mbpd) as the world economy boomed with the help of China and India. As a result, OPEC's cushion of spare capacity almost disappeared and refinery utilisation rates improved sharply, starting prices on an upward trend as the industry struggled to respond to the sharp rise in oil demand.

Since 2004, world oil demand growth has slowed sharply to just over 1% per year as rising oil prices counteracted strong global economic growth, but the overall slowdown in oil demand masks an underlying change in the composition of demand that is challenging the capacity of the oil industry to supply the mix of products that consumers want to buy. With the global economy continuing to expand at around 5% per year despite rising oil prices, demand for oil as a transport fuel is growing strongly. At the same time, demand for oil as a burning fuel has declined sharply, putting pressure on the oil refining industry to produce more transport fuel and less burning fuel from each barrel of crude oil it processes.

Since there are no effective substitutes for oil in the transport sector, demand for gasoline, jet fuel and diesel is relatively unresponsive to price changes in the short-run. In addition, taxes and duties in developed countries and subsidies in developing countries help to cushion the impact of rising wholesale prices for consumers, further dampening the impact of higher prices on demand. As Figure 5 shows, transport fuel demand has grown by an average of 2.4% per annum over the past four years in the 14 large oil-consuming countries monitored by *Argus Fundamentals*.

Oil, however, faces strong competition in the burning sector from natural gas, coal and electricity, making oil demand much more responsive to wholesale price changes in the short- and longer-run. Oil's use in industry, heating and power generation was already in long-term decline before 2004, for oil is more expensive than competing fuels, and the sharp rise in oil prices over the past four years has accelerated this decline as consumers switched away from oil wherever possible. As a result, demand for oil as a burning fuel fell by an average of 5.8% over the period in the 14 large oil-consuming countries monitored by *Argus Fundamentals* and the rate of decline has

Figure 5: Demand for transport and burning fuels



accelerated in the past year as oil prices reached record levels.

The rapidly changing shape of the demand barrel is putting a strain on the global oil refining system, which needs to upgrade more of its product output into high-quality transport fuels. Although companies are investing in more upgrading capacity, divergent trends in the demand for transport fuels (+2.4%) and burning fuels (-5.8%) over the past four years as a result of rising oil prices have created an unexpected need for extra upgrading capacity that the industry did not anticipate and is finding very difficult to respond to, opening up wide price spreads between light and heavy products. Moreover, the problem was compounded by the worsening quality of crude supply, as more heavy crude yielding reduced amounts of transport fuels came onto the market as OPEC output initially rose in response to higher oil demand.

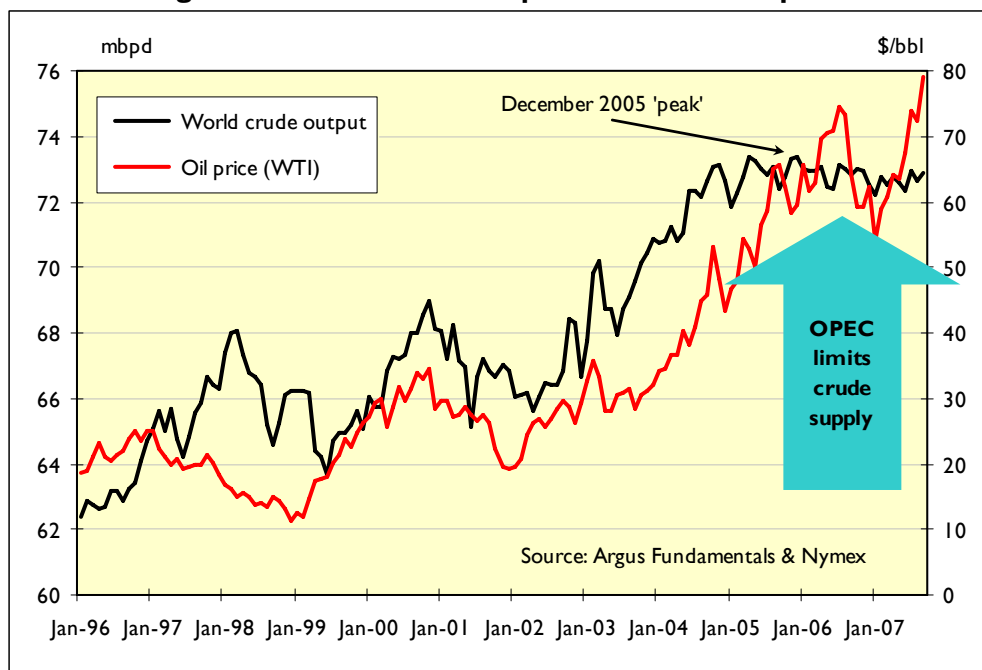
In consequence, there is a growing mismatch between the mix of products that the global refinery system can make and the mix of products that consumers want to buy. With upgrading capacity fully-utilised, any increase in the demand

for transport fuel can only be met by running more crude oil through the distillation units, which perforce generates more burning fuel (for which the market is shrinking) as an unavoidable by-product. This poses a problem for refiners, since they can only satisfy the growing demand for transport fuels by accumulating a surplus of unwanted burning fuels, which can only be sold at much lower prices.

In a free and competitive market, prices would adjust to solve the joint production problem so that there is no mismatch between the mix of refinery output and the mix of consumer demand. As Paul Frankel argues in his classic book on the oil industry, *Essentials of Petroleum*, 'each product sells at the price its market can bear', but this is not the case at the moment. Consumers can clearly afford to pay a high price for transportation fuels since demand is still growing despite the sharp increase in the price of oil over the past four years. However, consumers are not prepared to pay a high price for burning fuels, since demand is falling because there are cheaper alternatives.

In principle, there should be no problem meeting rising demand for transportation fuels, because

Figure 6: World crude oil production and oil prices



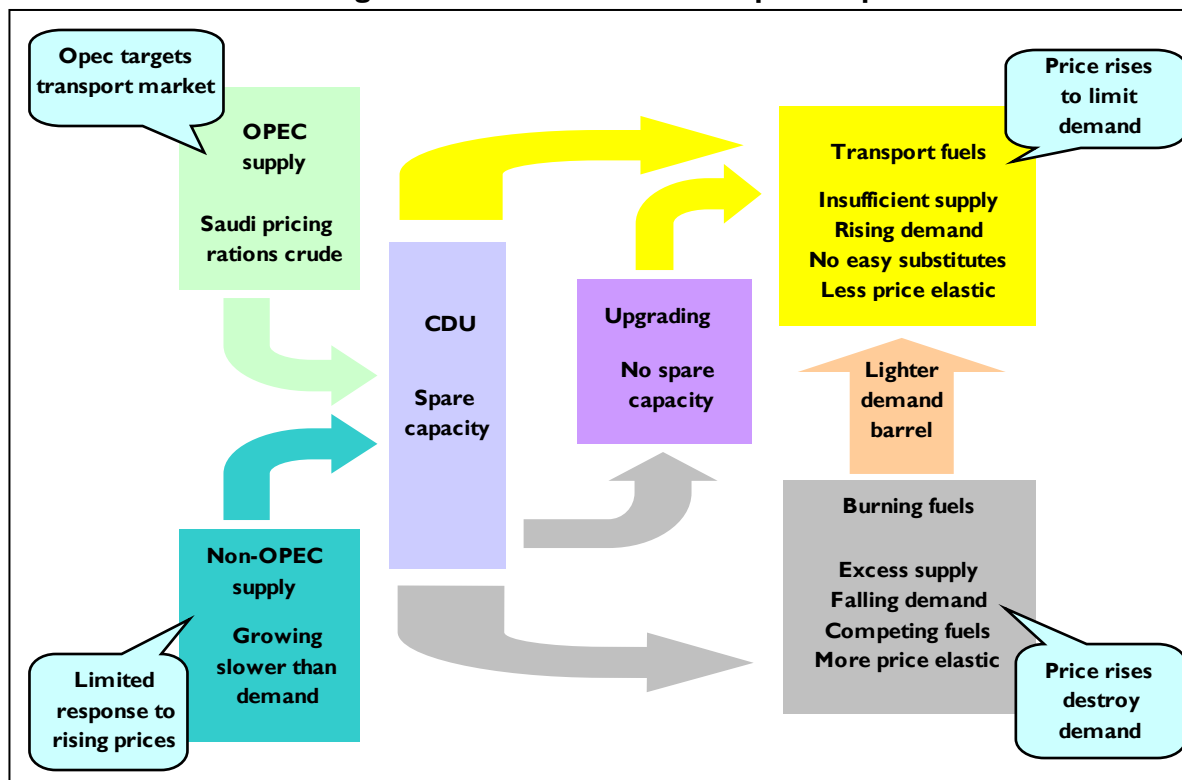
there is still spare crude oil distillation capacity available to refiners. However, this capacity is not being used, because OPEC is restricting the supply of crude oil in order to prevent prices from falling — which would inevitably happen once refiners begin to accumulate surplus burning fuels that could only be sold to consumers at much lower prices.

Despite growing demand for oil over the past four years, global crude supply actually ‘peaked’ in December 2005 at just over 73 mbpd and has not exceeded that level since then (see Fig. 6). Although proponents of ‘peak oil’ have been quick to claim that this ‘peak’ supports their theory, it is not a geological ‘peak’ in crude production, but a political and economic ‘peak’ resulting from direct action by OPEC to restrict its crude supply in order to prevent prices from falling. While non-OPEC crude supply has continued to rise slowly since December 2005, OPEC has cut its output, claiming that the market is over-supplied and there is ‘no demand’ from refiners for extra crude.

In one sense, OPEC’s action is entirely understandable. Supplying additional crude to the market would almost certainly depress oil prices, because the extra barrels could only be processed in crude distillation units, which inevitably produce surplus burning fuel — heating oil and residual fuel oil — that could not be sold to consumers at the high prices prevailing today (see Figure 7). Furthermore, surplus fuel for burning also competes with crude, since it can be used as an alternative feedstock for refinery upgrading plant and converted into transport fuel. This is what happened during 2006, when oil prices slumped at the end of the year as refiners, finding themselves with high product stocks after boosting runs to meet summer gasoline demand, felt obliged to cut back on crude purchases.

At the same time, it is clear that OPEC’s action in restricting crude supply is also contributing to the upward trend in oil prices. By restricting crude supply to prevent prices from falling, OPEC is also restricting the supply of transport fuels to a rapidly expanding global economy, forcing up the price of these fuels faced by consumers so that demand

Figure 7: Fundamentals force prices up



matches the available supply. Although there are alternative sources of transport fuel other than crude oil, such as natural gas liquids (NGLs), liquefied petroleum gas (LPG) and biofuels, refinery output remains by far the most important source and still supplies the marginal barrel. The only way to produce more transport fuel in the short-run without new investment in refinery upgrading capacity or alternative fuels is to run more crude through a distillation unit.

Since there is spare distillation capacity available around the world there is no fundamental constraint preventing refiners from running more crude oil — that is, if it were made available by OPEC at the right price. In fact, as Figure 8 shows, aggregate capacity utilisation rates for crude distillation units in the US, EU, China, India and Singapore actually fell over the past two years as the growth in new capacity outstripped the increase in runs. In 2004 and 2005, refinery utilisation rates rose sharply in response to rising demand and widening crack spreads for light products relative to crude, but the trend reversed in 2006 as OPEC's supply constraint began to bite and new capacity came on stream in China and India.

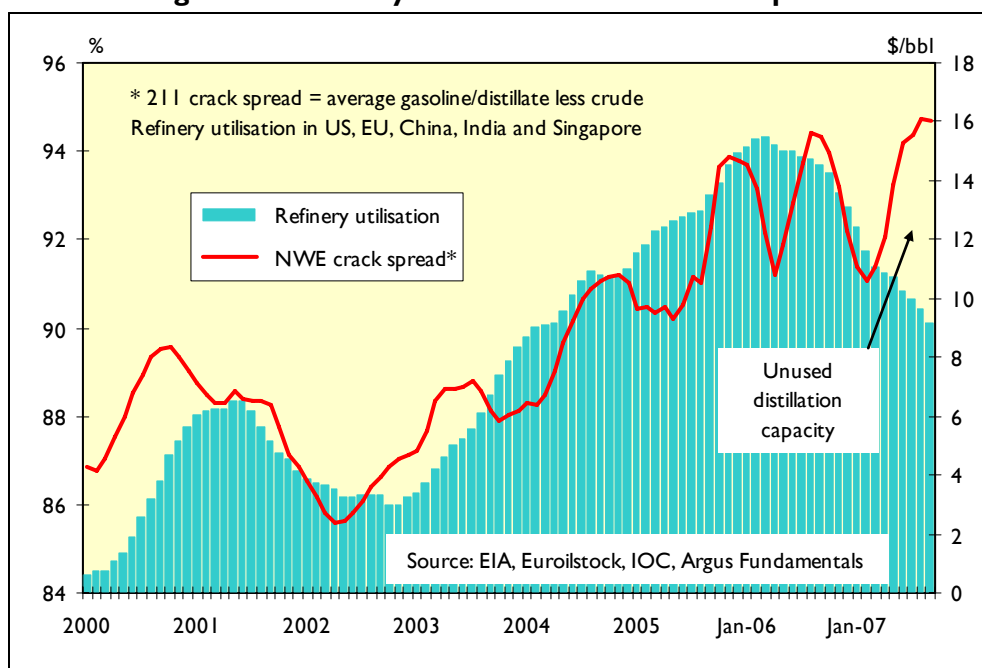
The main reason why refiners are not buying more crude oil to run through distillation units is that the

only producer with enough spare capacity to make a difference — Saudi Arabia — is unwilling to sell its crude at affordable prices for a simple refiner without upgrading capacity. In order to make its crude affordable for such a simple refiner, Saudi Arabia would need to sell the crude at much lower prices than it gets from a complex refiner with upgrading capacity (see Figure 9). CGES analysis of Saudi Arabia's term crude pricing formulae for Arabian Heavy crude — which constitutes the majority of the spare production capacity held by the Kingdom — indicates that a simple refiner buying Arab Heavy crude would typically be operating at a loss, whereas a complex refiner buying the same crude would earn a good margin. Since the beginning of 2006, the average difference in value between a complex yield and a simple yield for a refiner processing Arab Heavy on the US Gulf Coast was just over \$10/bbl, which gives some idea of the extra discount that Saudi Arabia would have to offer to sell additional barrels to refiners with spare distillation capacity.

No equilibrium at current prices

The argument that rising oil prices are based on market fundamentals has important implications for future price trends, since it suggests that the oil market is in a state of permanent disequilibrium.

Figure 8: Refinery utilisation rates and crack spreads

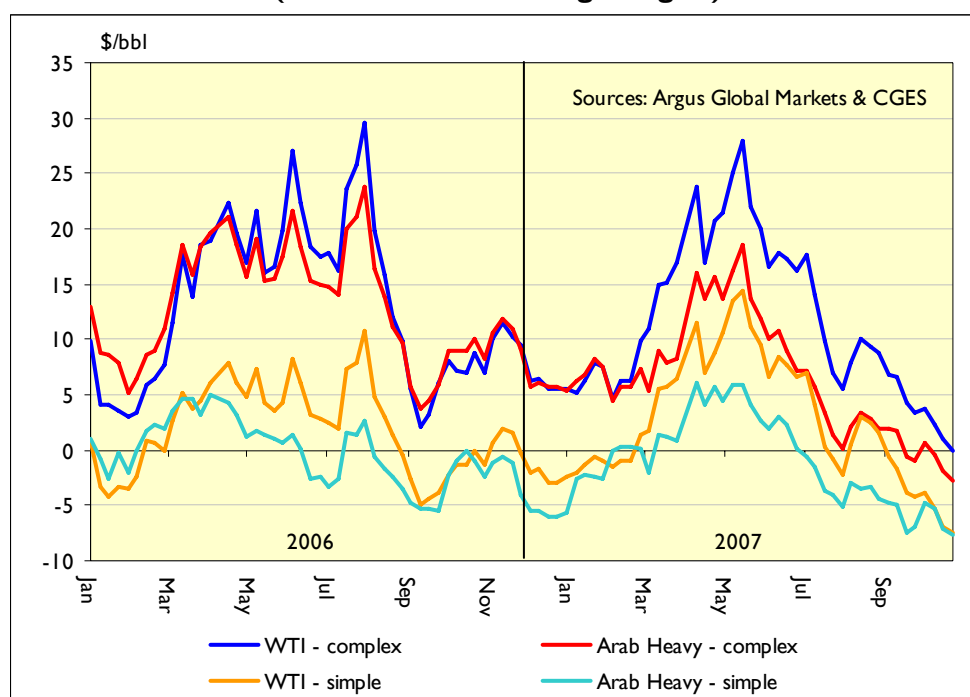


With upgrading capacity fully-utilised, oil prices can only go up or down, since there is a mismatch between what the refinery system can make and what consumers are prepared to buy. Any attempt by OPEC to 'balance' the market at the current high price level is ultimately doomed to failure, because the market is either going to remain short of transport fuel — for which consumers will pay a very high price — or have too much burning fuel — for which consumers will only pay a much lower price, determined by the price of competing fuels.

As long as OPEC rations crude supply in order to prevent prices from falling, oil prices will continue

to rise in order to make the demand for transport fuels match the amount that the refinery system can produce. However, if OPEC boosts crude supplies in order to prevent prices from rising further, then oil prices will fall sharply, because the price the market will bear for surplus burning fuel is much lower than the price the market will pay for desirable transport fuels. This poses a problem for OPEC, since its member-countries enjoy high oil prices and are very reluctant to see prices fall, yet at the same time they realise that there is a limit to how high oil prices can go without damaging the global economy and triggering a subsequent price collapse.

Figure 9: Saudi pricing and refinery economics (US Gulf Coast refining margins)



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- 2 'Market growth, trader participation and derivative pricing', Haigh, Michael S, Jeffrey H Harris, James A Overdahl, & Michel A Robe, CFTC, Social Science Research Network, April 2007, <http://ssrn.com/abstract=966692>
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