

of mean plus and minus one standard deviation (M&SD). Section 4 reviews the historical relationship between oil prices and stocks. A simple model is developed to check whether change in direction of relationship is statistically meaningful. Section 5 introduces the idea of “price neutral zone”. GDP response to high oil prices could delineate the economy digestive system. This issue is addressed in section 6. The effects of oil prices on supply side are considered by the effects on profitability of the whole supply chain among other variables. The lower supply side response to oil prices the lower downward price adjustment is expected. Section 7 deals with this issue. Last section concludes.

2. Structural change vs. cyclical

It is argued that the recent increase in oil prices is a cyclical movement and sooner or later the prices are landing to the previous long term level along with the disappearance of those reasons behind current surge in oil prices. It is believed that physical shortage due to unexpected booming demand especially in China, political situation in the Middle East and a spillover from other financial markets toward papers market have resulted the current situation. Regarding this view the current situation is perceived as cyclical. United States Congress (2005) harshly and incorrectly blaming OPEC for the recent development in the market and compares current price increase as another cyclical event similar to 1970s and believes that prices would practice the same steep decline. They believe the world is not running out of oil and this may be a first phase of another cycle.

On the other hand one could consider current development as a structural change in the oil market. The oil market was facing a relatively low average oil price for a long period of time. The average price during 1986 to 1999 was about \$17.12/bbl. This has provided less cash and incentive for enough upstream investments. The result is the current dwindling oil production excess capacity. Market structural school of thought conveys the following points:

- Industry does not intend to hold a big excess capacity. No one would like to bear the opportunity costs of excess capacity. Therefore oil market will operate on limited margin of excess capacity. OPEC members have already paid opportunity costs of excess capacity in 1980s.
- Industry has been fueled by huge amount of cash. But the cash is more used for buying back the shares by major oil companies to support their share prices rather than to be invested or being planned for upstream and downstream projects. Although there is enough cash but there is limited access to reserves by legal frameworks or sanctions (e.g. Iran has plans to increase the capacity

but are slowed down by US sanction). Considering the business as usual the oil production capacity would be gradually increasing but to a limited extent. This is in line with a less elastic response of OPEC and NON-OPEC countries to oil prices. The price elasticity of oil supply is very low, meaning a gradual increase of oil production in response to oil price increase. The “To BE” legal framework in upstream development of the four Persian Gulf tigers of OPEC (i.e. Iran, Saudi Arabia, Kuwait, and Iraq) would be very much similar to “AS IS” situation.

- Oil demand recently has less elasticity to nominal oil prices than before (or current real price elasticity of demand is less than before)

- The traditional relationship between the oil stocks and oil prices is broken meaning that even with excess oil supply and building up of stocks still the prices are increasing. This spells out that anxiety in the market, imbalance of demand for sweet-light and sour-heavy, bottlenecks of refinery capacity. These factors among other fundamental-oriented variables keep the oil price and petroleum stocks level a direct rather than an inverse relationship.

- Economies especially in China and OECD countries are not negatively responding to high oil prices in the short and mid term. This symbolizes a new digestive system for the economies. A lower negative effect of higher nominal oil prices on economic growth signifies the fact that oil demand growth rate will not be largely dampened.

- There is new neutral zone for oil prices in which at this higher level of oil prices the demand for oil is not sharply and inversely affected.

- The hurdle/planning oil price was \$15 to \$20 dollar. The expectation is changed and major oil companies considering 25\$ to \$30 in their new projects (Ghalib, 2005).

- The futures price of oil for up-to-6 years delineates upward adjustment while containing a weak backwardation. Although these higher prices adjust downwardly with lower prices in the spot market but this high level of futures price spell out a new expectation for the players in the market (Berkmen et al., 2005).

- This high oil prices can be translated to tightness of the entire oil supply chain from upstream to the mid and downstream but not the “peak oil” concept (Franssen, 2005). Oil industry will witness “peak oil” in the next decades, and in between will practice many adjustments.

- Oil price contains information of fundamental and non-fundamental variables in different market situation. Considering this assumption one could compare the statistical features of oil price in different period of time. Notion of structural change could be derived if different statistical features exist.

¹ Oil price in this paper refers to OPEC Reference Basket (ORB) price unless otherwise is mentioned. This basket does not refer to newly Infatim basket. For more on this see www.opec.org

If the above mentioned statements are valid, one could translate them as a non-cyclical evolution in oil market with the expectation of high oil prices. Although a concrete judgment needs to see at least next two years developments.

3. Oil price corridors

Three specific time intervals are recognized for oil prices during 1980-2005. As figure 1 shows oil prices in 1980-1985 has cyclical declining trend after a shock in price due to Iran's revolution. This period is characterized as relatively high average price with low standard deviation. Average price and standard deviation were about \$31bbl and \$3.8bbl respectively. Second period i.e. 1986-1999 distinguishes by low average price and standard deviation with a cyclical movement around the core price. This cyclical behavior is inherent to oil market. Average price and standard deviation were about \$17bbl and \$3.5bbl respectively. Except for 1991, Kuwait invasion, and 1999, Asia financial crises, oil prices are mostly hovering around the average prices in the corridor of average plus and minus one standard deviation. This period accompanies a considerable oil production excess capacity mainly created or held in early 1980s. The excess capacity is being used along the period.

Figure 1. Quarterly OPEC basket price

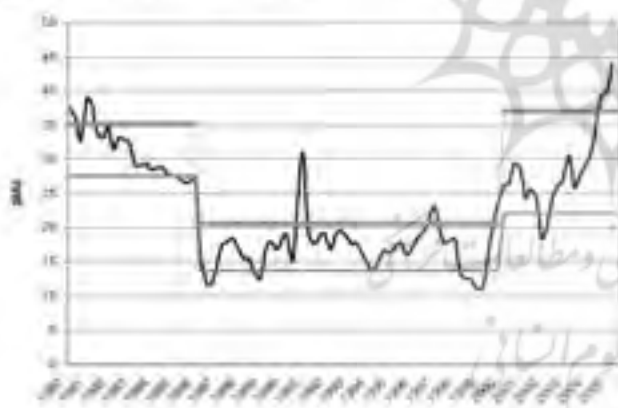


Table 1. OPEC quarterly basket prices

Period	1980-1985	1986-1999	2000-2005 ^a
Average	31.3	17.2	30
Standard deviation	3.8	3.5	7.4
Excess capacity (mmbbl)	8.2	3.9	2.8

Source: oil prices, OPEC, DSD, 2005; Excess capacity during 1990-2005 ETA, 2005; excess capacity 1980 1989 author calculation

* Excess capacity in second quarter of 2005 is estimated at 1.1 mbd.

The most recent period i.e. 2000- 2005 has a specific characteristic. Average price and the standard deviation

are high. The market is relied on a very limited excess capacity. The excess capacity is estimated at 1.1 million barrel per day in the second quarter of 2005. The oil price is out of the corridor in the year 2005. One can not ignore the effects of Hurricane Katrina and Rita and high fear factor for this behavior. Such a high average price along with high standard deviation single out the notions of a new structure. Removal of hurricanes effects along with gradual expansion in the entire chain of oil industry and gradual relaxation of oil demand would bring back the standard deviation at its long term level. Considering \$4 as the new price deviation, it is expected that the prices are softly landing and will be hovering around \$30. Therefore even with expansion of oil industry the average prices tend to a higher long term average than before, confirming a non-cyclical situation.

4. Prices and petroleum stocks

Simplifying the oil demand and supply balance in the world, it is expected that in every equilibrium point the excess supply goes to the stocks and the excess demand is fed by the stocks (i.e. Supply-Demand= D (stocks)). Stocks build up is translated as the excess supply and a notion of price relaxation. One could find such an inverse relationship historically although the relationship is not statistically strong. Figure 2 draws monthly oil prices and oil stocks within January 1988 to June 2005. The simple correlation coefficients within 1988-2003 and 2004-2005 are -0.25 and 0.75 respectively. This confirms the fact that there was an inverse relationship between the two variables (although not strong) but it is broken recently and a direct strong relationship emerged. To confirm this statistically, a simple econometrics model with monthly data is estimated as follows:

$$\text{Sample 1988-00: } L(P_t) = 38.012 + L(5T) + 0.006(LD) + 2.6(LP_{t-1}) - 0.38(LP_{t-2})$$

(0.76) (-0.58) (1.77) (15.81) (-4.8)

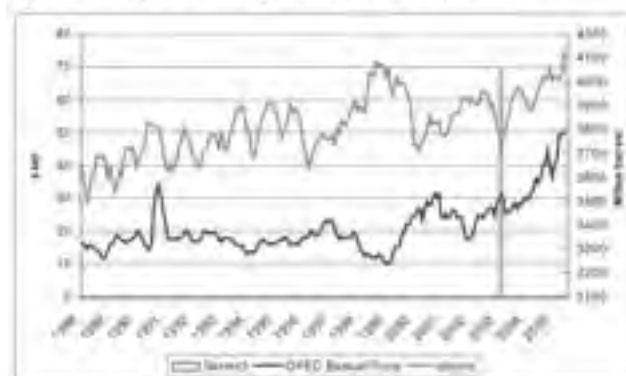
$R^2=0.88$

$$\text{Sample 2003-06: } L(P_t) = -5.7 + 0.73(L(5T)) + 0.92(LP_{t-1})$$

(-0.9) (0.90) (9.4)

$R^2=0.89$

Figure 2. Monthly OPEC basket price and OECD petroleum stocks



Where P and ST stand for nominal OPEC Basket Price (OBP) and OECD petroleum stocks respectively. The term D90 is a dummy variable for year 1990 (Kuwait invasion). The letter L specifies variables in natural logarithm. The response elasticity of price to petroleum stocks is -0.12 in 1998-2000. Although the t-statistics rejects null hypothesis weakly but confirms an inverse relationship. The response for the recent two years is 0.78 confirming a strong direct relationship.

Based on these results and other facts and figures the crack in the relationship is confirmed but we can not translate it to structural change but could be considered as a notion of non-cyclical movement in oil market. While the market is well supplied but still there is imbalance between demand for light-sweet oil and heavy-sour and the fear factor is dominated the market due to very limited excess capacity, it is natural the stocks are building up even when the prices are staying high. Returns of gradual calm to oil market will hold back the weak inverse relationship between price and stocks level.

5. Oil Demand in the Neutral Oil Price Zone:

Since crude oil price forms a small portion of production costs in OECD and many other countries, GDP of these countries are not affected by changes in prices in a certain range of oil prices. Therefore oil demand, ceteris paribus, is not affected within this oil price range even at the higher price band of the zone. For example CERA believes on the zone of price neutrality which lies in the range of \$15 to \$30 per barrel (WTI). In this price range oil demand is largely unresponsive to oil price movements (Stanislaw, 2004). It means that world economy especially the OECD economies could digest prices in this range and the oil demand is determined by other factors. Oil demand in China and OECD are being used to test this idea. Figure 3 shows China oil demand is oscillating but there is an increasing trend for oil demand along with oil prices evolution. Figure 4 draws oil demand versus oil prices. It is obvious that oil demand in the range of 10-30 dollar is in line with an exponential trend during 1995-2003. This trend is concave in the range of \$30-\$50 oil prices during 2004-2005. It is concluded that oil demand for China has been less responsive to oil prices in the range of \$10-\$30 but more responsiveness exists in the range of \$30-\$50. Therefore the new Neutral Zone in China could be located in between i.e. in the range of \$30-\$40 per barrel.

A simple econometrics model shows that oil demand responds positively to nominal oil prices in

China confirming a neutral price zone (no negative effects exist). In this model oil demand is a function of nominal oil prices and lagged oil demand variable. Elasticity of oil demand to nominal oil price² is shown in Figure 4. Regressions are rolled up and the periods are narrowed down in each try. The last regression uses the latest 16 observations. From this figure it is obvious that only in recent 16 months there is a negative response of oil demand to oil prices due to very high oil prices. Even at such high oil prices, the negative response elasticity is close to zero.

As shown in figure 6 oil demand follows a soft increasing trend in OECD countries. Although one could find many fluctuations around the trend line but the general understanding is that even at the higher prices the demand is hovering around 50 million

Figure 3. Monthly oil demand in China: 1995:01-2005:08

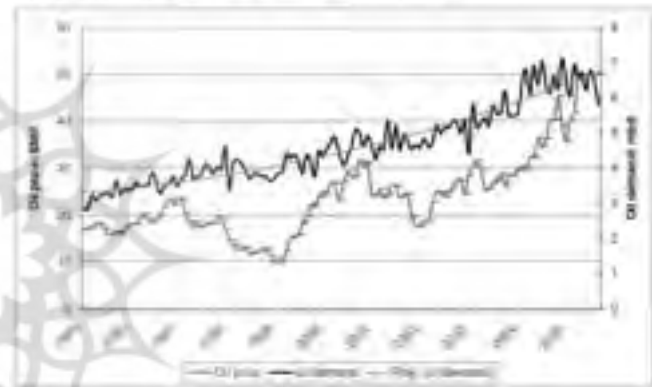


Figure 4. China oil demand vs. oil prices: 1995:01-2005:08

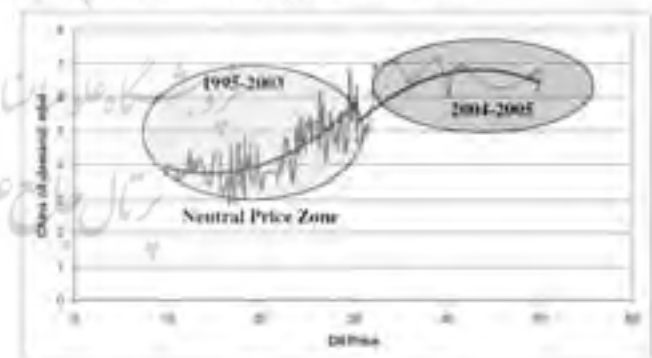
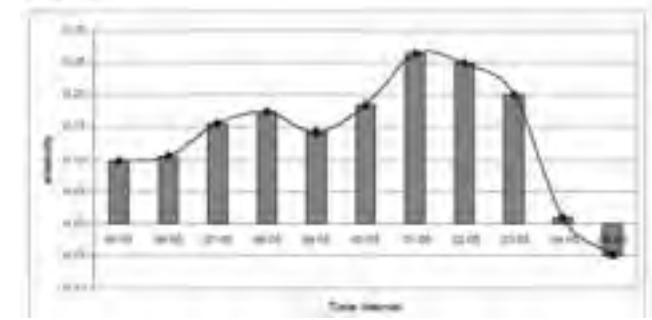


Figure 5. Response elasticity of oil to nominal oil price in China: rolled up regressions



² In the literature the price elasticity of demand is estimated using real oil prices. The intention here is not to estimate price elasticity though but demand reaction to nominal oil price.

Figure 6. OECD monthly oil demand: 1985/01-2005/07

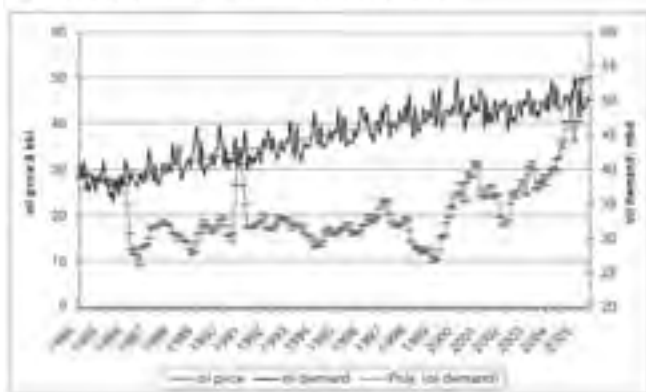


Figure 7. Neutral oil price zone for OECD countries (1984/01-2005/07)

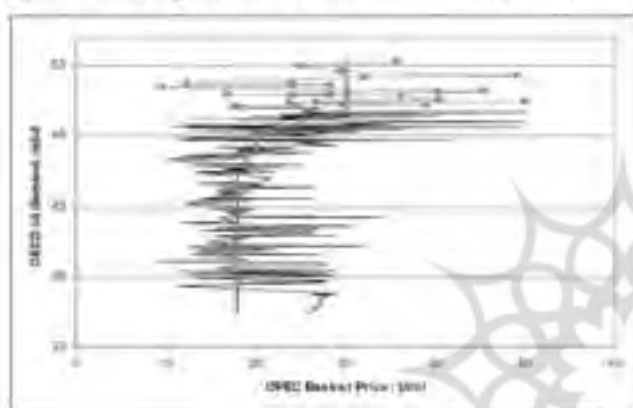
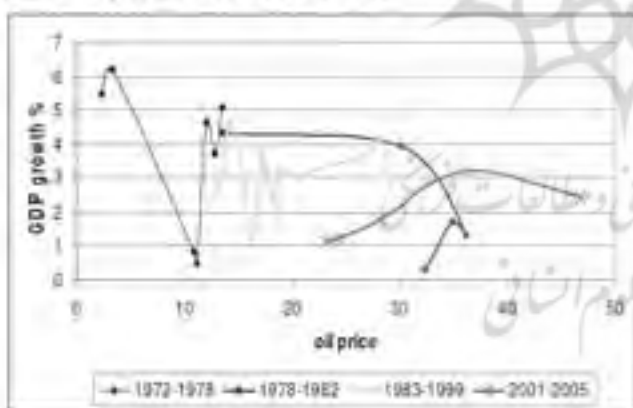


Figure 8. Oil price and OECD's GDP decoupling



barrel per day in the recent years. The most recent monthly changes in OECD oil demand compared with the same months in previous year show low negative effects of very high oil prices on oil demand. Figure 7 depicts how OECD oil demand is building up around the price corridors. Most of the oil demand evolution has been realized around the core price of \$18 bbl. OECD oil demand above 48mbd has experienced a moving core price which is settling around \$30 bbl. This can be considered as a notion of new neutral oil price zone centered around \$30 for OECD.

The results are based on nominal oil prices while

real oil prices are decreasing. Even with this surge in nominal oil prices the real prices are increased very softly (Mazraati, 2005). The real oil prices adjusted for inflation and currency depreciation is about \$22.6 in 2005. This is \$6 below the price in the base year i.e. 1980(OPEC, 2005) Depreciation of dollar against Euro, has provided cheaper oil for Euro-Zone. Therefore parts of OECD are importing oil with lower nominal prices thanUS(Slaibi et. al., 2005).

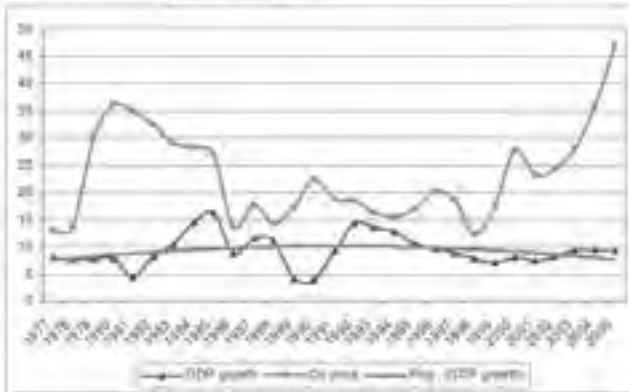
6. GDP and oil price decoupling

World GDP was based on very cheap oil in early 1970. After first price shock in early 1970 OECDs GDP responded negatively. The same response happened in early 1980 after the second oil price surge due to Iranian revolution. The only difference between these two periods is the range of price in which the economies have responded. The price range for the first period i.e. 1972-1978 was \$2-\$13 while it upgraded to \$13-\$36 in 1978-1982. The third period i.e. 1983-1999 is characterized with a wide range of oil prices (\$12-\$29) but a relatively stable GDP growth. OECD annual GDP growth was hovering around 3 percent. We can conclude that the decoupling of GDP and oil prices institutionalized in this period. From 2000 there is a new price range of \$23-\$46. The OECD real GDP growth response is completely different in this period with compare to others. Annual GDP growth increased along with oil price evolution and it is expected to decline softly if the prices are going to stay at this high level. The common feature for this historical analysis is that oil prices may have decreased the GDP growth but never made a negative GDP growth. Based on the historical analysis the OECD economies have developed a new digestive system in which it could stand higher oil prices. In this case at the average price of \$30 economy will not be affected and the new long term oil prices could be settled around this price.

Chinese real GDP growth shows no inverse relation with oil prices. Simple correlation coefficient of annual real GDP growth and oil price is about 18% during 1972-2005 confirming decoupling of the two variables. There are some GDP inverse reactions to oil prices but the economy has grown on the average at 9% per annum despite of oil price levels (see figure 9). Therefore if OECD and Chinese economies which the latter has considerable role in recent oil price surges could stand at higher level of oil prices, one could conclude that GDP would derive the oil market. The prices could stay higher than the pervious historical long term averages. One should not forget that the GDP growth is responding differently to high oil prices in developing countries. The oil demand may be affected by very high oil prices in

these countries which in turn could relax the world total oil demand.

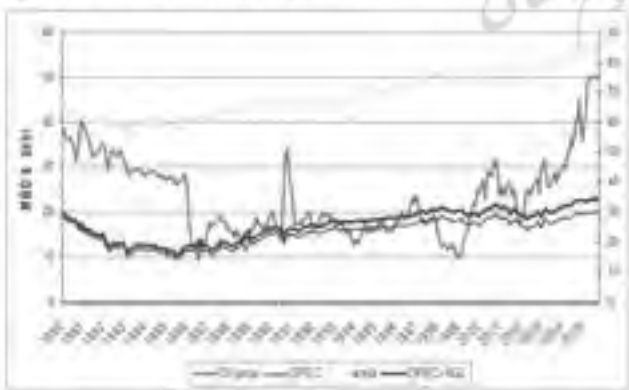
Figure 9. China GDP growth and oil prices



7. Supply side effects: OPEC and Non-OPEC response

A fast supply response to high oil prices can return calm to the oil market. Mixture of certain factors like availability of excess oil production capacity and crude type demanded in the market, along with many other technical factors in up and down stream forms very slow supply response to prices. Non-OPEC behaves commercially in the market. OPEC as a swing producer behaves differently. In some occasions OPEC behave based on, target revenue in which OPEC faces a backward bending oil supply curve. In other occasions like in recent 2 years OPEC acted based on competitive model. As shown in Figure 10, OPEC and Non-OPEC (producers) response to oil prices is very slow specially when the industry lacks enough excess capacity. The capacity building had a different behavior in 2000s with compared to 80s and 90s. The reason behind this can be outlined as follows:

Figure 10. OPEC and Non-OPEC oil production: 1980:01-2005:06



- OPEC paid huge opportunity costs in 80s and 90s for excess capacity. OPEC is not interested anymore in bearing such huge opportunity costs. Therefore the excess capacity will be limited to a certain extent.

- Oil majors have enough cash but prefer to use funds to improve the value of their shares through buying back the shares. Even investment increase in oil industry by oil majors is translated to supply with a long lead time. Expansion projects are time consuming.

- The oil prices stayed at a high level for a relatively enough long time. There is no consensus that oil prices are going to stay at high levels in the long run. The confidence is taking shape

- One should not forget that high oil prices increase cost of expansion in the whole supply chain of the oil industry. This may limit expansion in some areas.

To this end, oil producers respond positively but very slowly to high oil prices. The current situation is not comparable with the 80s and 90 due to lower levels of excess capacity. The current situation can not be related to the "peak oil" production issues. The current situation can be considered as an imbalance of supply and also an unexpected increase in demand for special types of crude. Using monthly OPEC and non-OPEC oil production within 1986:01-2005:06, elasticity of oil supply to price is estimated. Oil supply is considered as a function of nominal oil price and one-lagged oil supply variables. Table 1 contains the estimation results for a logarithmic functional form and OLS method.

Table 1. Elasticity of supply to oil prices

Period	1986:01-2005:06	2004:01-2005:06
OPEC	0.04	0.08
Non-OPEC	0.03	0.03
Producers	0.02	0.06

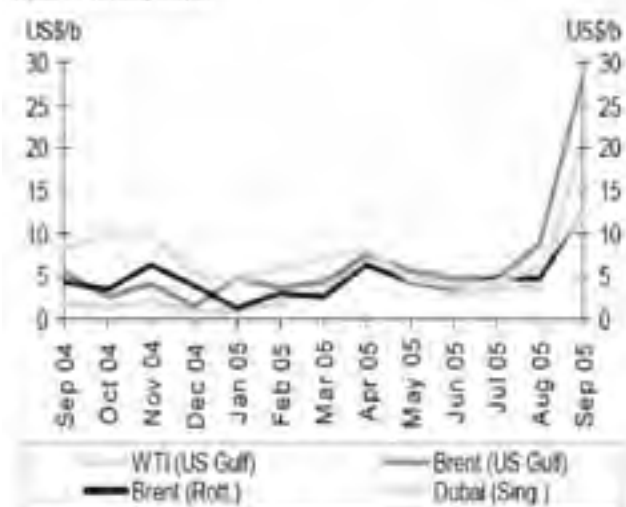
Although OPEC response is greater than Non-OPEC but still the elasticity is very small, confirming the low response to oil prices. The elasticities for the very recent data are even smaller. The positive elasticities confirm gradual upward supply adjustment in the industry.

It is expected that the excess capacity would increase gradually in the foreseeable future to a limited extent. The refinery margins are improved which would help the capacity building in the coming years (see figure 11).

8. Concluding remarks

Confirmation of a structural change versus a cyclical movement in the oil market needs affirmation of sustainable changes in some structural related variables. Such an affirmation is translated to this

Figure 11 Refinery margins



fact that oil prices are going to migrate from the traditional long term level to a new higher long term average.

- Higher average price along with higher standard deviation for a relatively long period of time characterizes the new situation in the market. With the gradual removal of oil industry bottlenecks the recent higher price corridor may be tightened. Even with the average price of \$30 per barrel and \$3.5bbl standard deviation (the realized long term standard deviation), prices will be hovering at a higher average level than before.

- The so-called inverse price-petroleum stock relationship is recently broken. This can not be considered necessarily as a notion of structural change. The price reaction elasticity to petroleum stocks during 1998-2000 is about -0.12 showing a very weak inverse relationship, while the null hypothesis is not rejected strongly. The most recent data gives a high positive direct relationship confirming the crash of the previous behavior. The inverse relationship will be restored while the demand on sweet-light crude is balanced and the magnitude of fear factor approaches to its previous historical level.

- Oil demand analysis in OECD countries and China (as the second largest oil consumer in the world) shows that the Neutral Price Zone is moving to a higher level. In 20\$-30\$ price zone the Chinese oil demand was fluctuating around the exponential increasing trend. In the \$30-\$50 though the demand is fluctuating around a logarithmic trend. The response elasticity of oil demand to prices shows that oil demand is neutral to higher level of oil prices. Only with the very recent high prices there is a very weak negative response. For OECD countries the

oil demand is building up with fluctuation around a new higher core prices. It is concluded that the neutral price zone is upgraded.

- Real GDP growth is decoupled with the oil prices in the range of about \$15-\$25. Even with the recent range of \$25-\$35 real OECD's GDP has increased on year-on-year bases in despite of price increases. This singles out a new era in which economy can digest higher prices and can be considered as a notion of structural change.

- The producer response to prices is very low and even with the most recent data is lower. This means a gradual expansion in the upstream. This slow response is seen in the whole chain of oil supply from the upstream to downstream. Even with better refinery margin, the refinery sector will be expanding gradually. These reactions along with the above-mentioned issues confirm that oil prices are expected to land softly at a new higher price level.

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