

# ***IMPACT PARAMETERS ON THE VOLATILITY OF THE WORLD OIL PRICE***

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## **Abstract**

The core objective of this paper is to analyse what can be learned from history with respect to typical features indicating significant price increases or decreases of the world oil price. To meet this objective features of supply, demand, and markets will be analysed with respect to the trend of these parameters for the periods 1980-1985 and 2003-2008.

The major conclusions are: While in the period 1980 – 1985 price increases were triggered by OPEC market power and price drops due to significant physical demand drops in the recent increases in world oil prices – 2003 - 2008 – were mainly triggered by significant increases in demand mainly “virtual” demand by means of futures. The decrease in 2008 was due to a burst of the speculation bubble that is to say due to a sign drop in virtual demand. Physically, demand as well as production increased only moderately. Yet, there was another factor: part of demand must be attributed to speculation storing oil and with derivatives especially in the last months in 2008 when prices skyrocketed.

Currently, it is not likely that prices will increase significantly once more in the next two or three years. The reasons are: Moderate economic growth and demand adaptations (=fuel switching and efficiency improvements) that has taken place in recent years of high prices.

Lessons learned from recent experience with the burst of the futures bubble for commodities in general will also make it unlikely that such speculative behaviour will lead to sign increases of the oil price in the next years.

## **1. Introduction**

At least since the oil crises of the 1970s and the dramatic price drop in the mid-1980s forecasting the oil price development has been a major challenge for energy economists world-wide. Yet it is amazing that most economists guessed repeatedly and considerably wrong. The most famous – and most embarrassing – disaster in this context was the report EMF 6 (1984) where the most famous energy economists of the U.S. predicted a further considerable rise in oil prices after 1985 to 100 US\$ and more.

What we know from today and from some major papers of Wirl (e.g. Wirl (1990)) is that a lot of features and indicators in the development in the early 1980s were completely misinterpreted. The recent turbulences in oil prices in 2008 pose new challenges to analyses of the impact parameters on volatility of oil prices.

The core objective of this paper is to analyse what can be learned from history with respect to typical features indicating significant increases or decreases of the world oil price. To meet this objective features of supply, demand, and markets will be analysed with respect to the trend of these parameters for the periods 1980-1985 and 2003-2008.

Fig. 1 depicts the historical development of the oil price. Of major interest is that in recent decades two significant periods of high prices and significant price changes respectively price drops can be identified: 1979 to 1985 and the recent period 2004 – 2008. Both of these high price periods were followed by a dramatic price decrease. The core question of this paper is: Are the factors bringing about the period of high prices between 2004 and 2008 comparable to those in the period 1979 to 1985? What were the basic fundamental mechanisms in these periods to first bring the price up and then let it drop? What were the gradients/levels of different features in comparison? And straightforward, is it likely, that oil prices in the next years will increase again considerably?

In principle there are (at least) the following explanations for the development of the oil price:

- i) physical fundamentals of demand & supply (short-term and long-term)
- ii) fiscal (e.g. currency) developments and strategic/speculation from the demand-side
- iii) strategic behaviour of suppliers (oligopoly game)

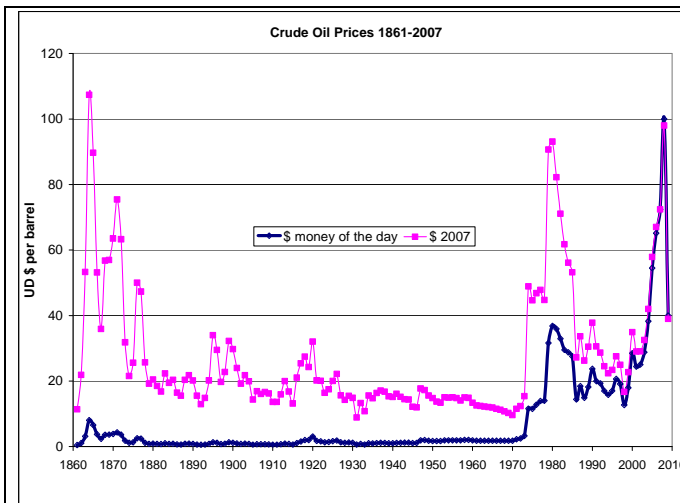


Fig. 1a. Development of the oil price 1861 -2009 (BP 2008, OPEC 2009, value for 2009 preliminarily)

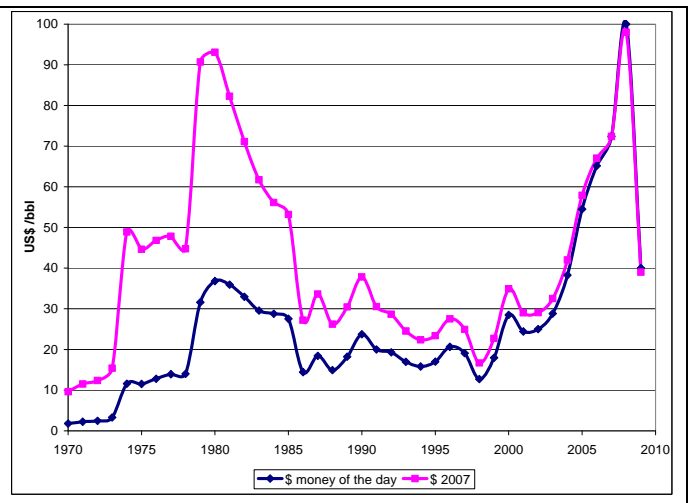


Fig. 1b. Development of the oil price 1970 -2009 (BP 2008, OPEC 2009, value for 2009 preliminarily)

## 2. Method of approach

The methodological steps of this analysis are:

- Describing the fundamentals of oil supply & demand in the world oil market;
- Discussion of the role of OPEC in the world oil market;
- Identification of possible relevant impact features on the development of the oil price parameters (On the supply vs the demand side, as well as market parameters);
- Discussion of the issue of physical short-term demand and speculative long-term demand;
- Comparison of these features for the two periods of investigation.

## 3. The world oil market

In the world oil market aside from a competitive market equilibrium two additional aspects play a crucial role.

On the supply-side: the cartel of OPEC plays an important role because it has the highest flexibility in production capacities. In the following it is analysed how the physical and the strategic cost curve interact with demand and the strategy of OPEC as a cartel.

On the demand-side: How does artificial demand for oil in futures contract markets impact the price

### 3.1 The cost resource curve at the supply-side

The figures 3a and 3b depict a stylistic cost curve of oil world-wide incl. the strategic component and the actual physical cost curve of oil world-wide in 2001. Of course the strategic component can make the effective costs completely non-relevant.

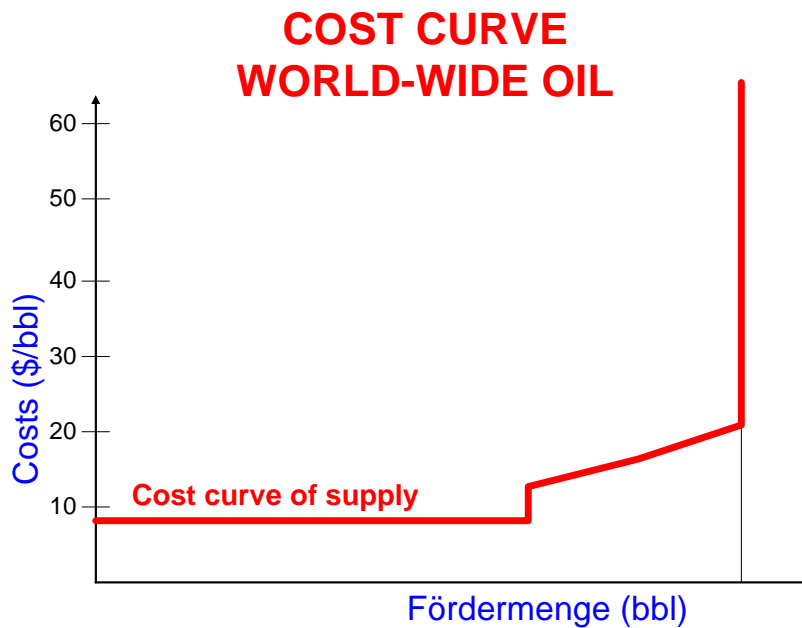


Fig. 2. Stylistic cost curve of oil world-wide incl. the strategic component

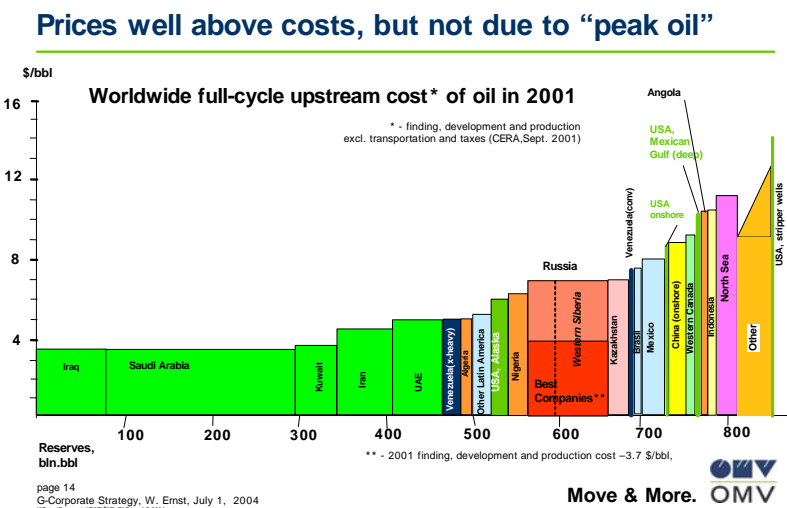


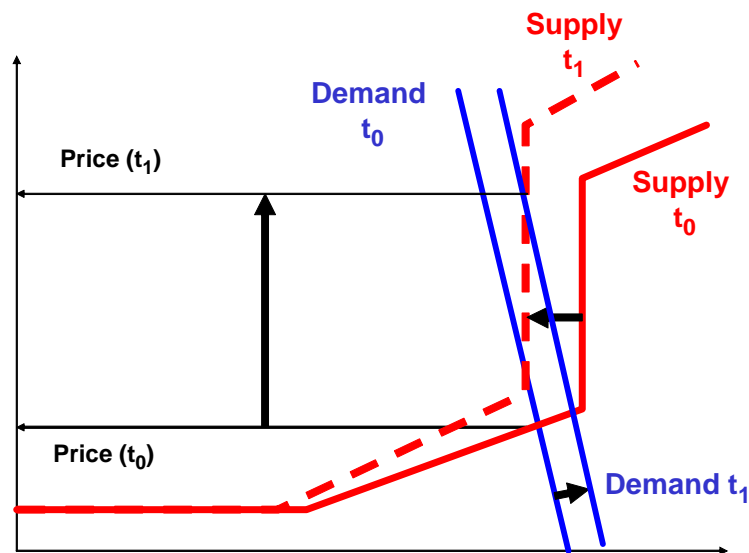
Fig. 3. Actual physical cost curve of oil world-wide in 2001 (Source: OMV (2004))

### 3.2 Demand-side

A major feature of physical world oil demand is that it is very sluggish, with time constants of 4 to 6 years until demand reacts to significant price changes, see Wirl (1990) or Wirl (2008) and Fig. 7.

### 3.3 The market

Fig. 4 combines the features of supply and demand. It is obviously that in the given situation of a sellers' market – when the intersection of supply and demand is in the steep part of the supply curve – in principle price volatility is very high.



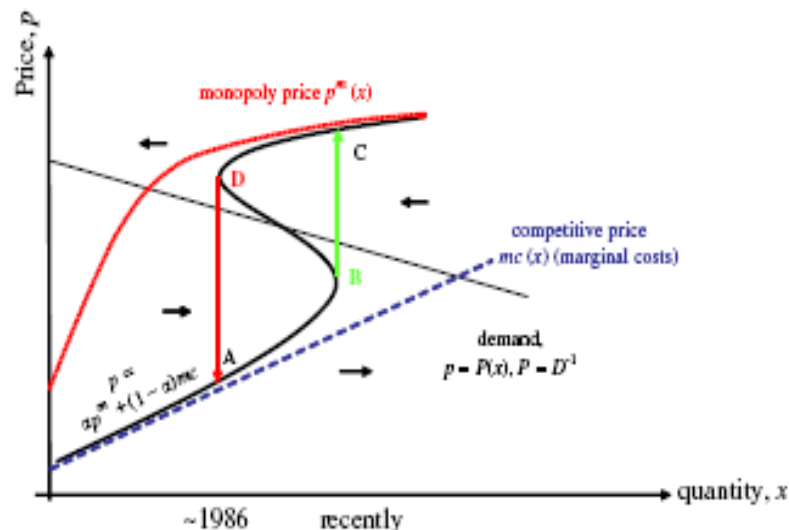
**Fig. 4.** Possible effects of small changes in current supply (incl. strategic behaviour with respect to production capacities) and demand on the oil price (incl. possible high speculative short-term demand for derivatives)

### 3.4 The role of OPEC in the world oil market

Of particular interest is which role OPEC – the largest supplier – in the world oil market plays. As Wirl 2008 depicts – see Fig. 5 – the optimal strategy for OPEC is cyclical:

Interpretation:

- If demand decreases, the strategic component will be ruled out, oil price decreases;
- If demand starts to increase again, the strategic component will step-by-step gain weight and the price will increase.



**Fig. 5.** Multiple market equilibria when OPEC is pending between cartel prices and competition (Source: Wirl (2008))

Yet, the feature of sluggish oil demand leads to the perception that for OPEC the time lag of reaction is quite high and, straightforward, once oil prices are high there is also this lag that allows to keep prices at a high level (until demand decreases significantly).

Summing up today OPEC may play a market dominating role with respect to the level of the oil price as long as the total level of consumption is high (in the range of the maximum of available production capacities). Only OPEC has the flexibility to extend production.

## 4. Results

The major results of this analysis are:

Physical consumption of oil world-wide increased until 2007 and decreased afterwards, see Fig. 6. Some important underlying explanations regarding demand increases in the years 2004-2007 are: decline in OECD countries started already in 2004 see Fig. 6. Physical demand growth between 2005 and 2008 was solely attributed to emerging countries (India, China) see Fig. 6 and Fig. 7.

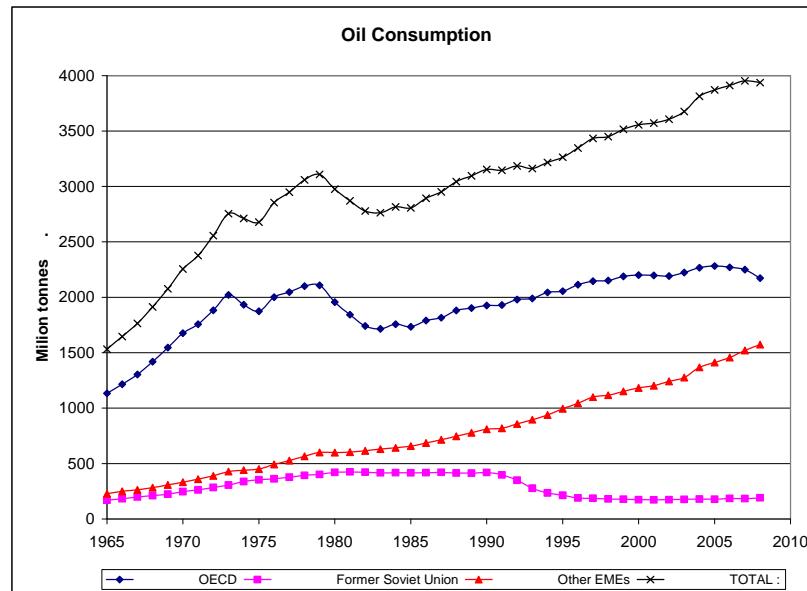


Fig. 6. Development of oil consumption world-wide and by category of economy 1965-2008 ((Source: OPEC(2009), BP(2008))

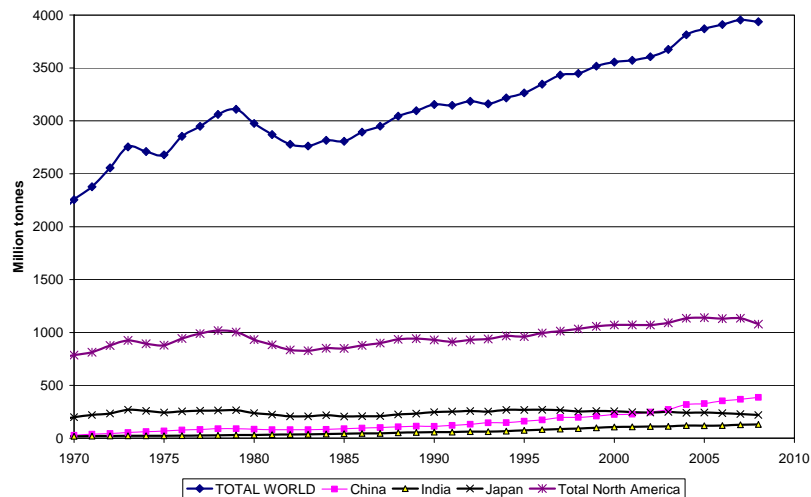


Fig. 7. Development of oil consumption world-wide and in India, China, Japan and North America 1965-2008 ((Source: OPEC(2009), BP(2008))

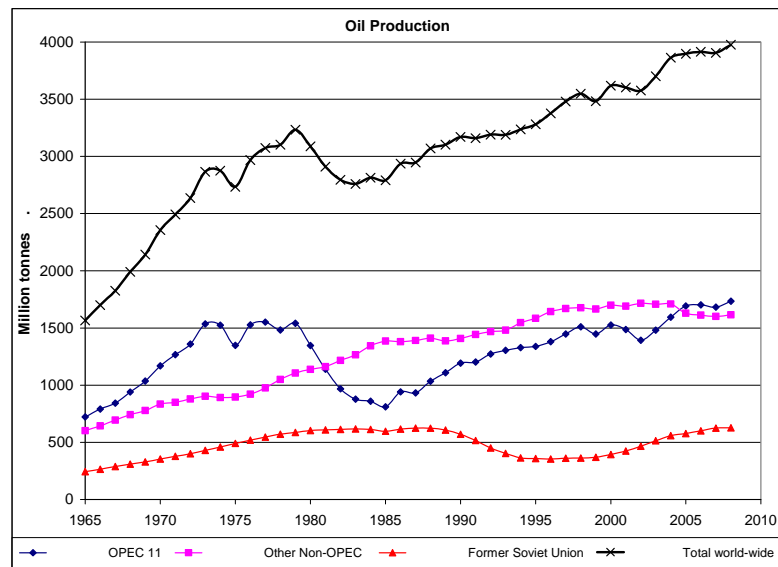


Fig. 8. Development of oil production world-wide and by category of producer 1965-2008 ((Source: OPEC(2009), BP(2008))

A frequent argument for explaining the recent price increases is that demand is over production. Yet, this argument is wrong as Fig. 9 depicts. Between 2000 and 2008 only in two years consumption outweighed production. So, at least up to now physical scarcity did not play a crucial role.

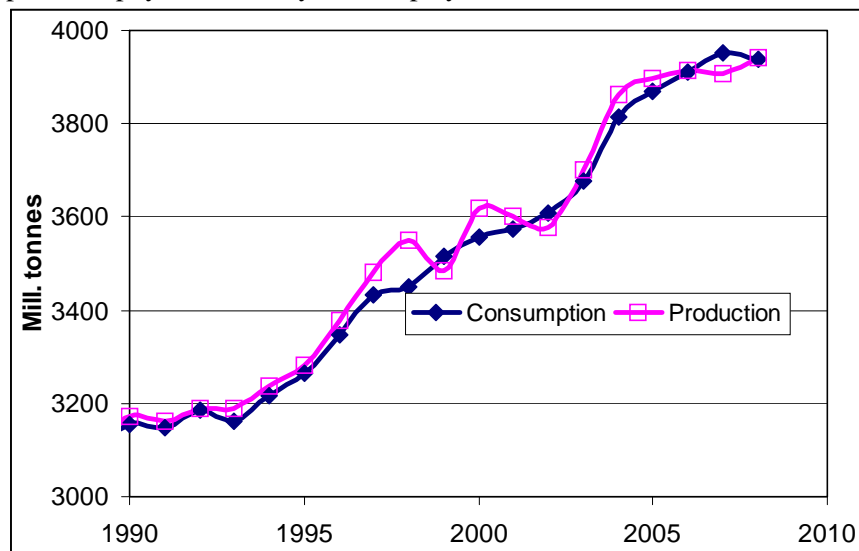


Fig. 9. Comparison of Development of oil production and oil consumption world-wide ((Source: OPEC(2009), BP(2008))

Between 1982 and 1985 high prices were maintained by the OPEC policy of adapting supply to demand, see Fig. 1. That is to say OPEC tried at every point-of-time to reduce supply to retain the price they had set. This policy was successful as long as all OPEC members stick to this policy. In 1985 when Saudi-Arabia cancelled this policy oil prices plummeted.

In the early 1970s as well as between 2003 to 2008 high prices were stimulated mainly by significant growth in consumption see Fig. 6, 10 and 11. In period 2003 to 2008 this effect appeared despite production increased, too (Fig. 4).

### 1982-1985: High cartel prices

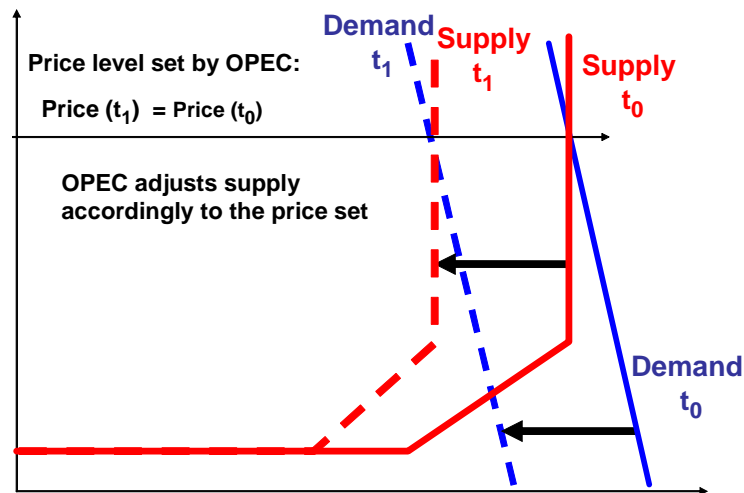


Fig. 10. Development of oil price 1982-1985: price set strategically by OPEC

### 2004 - 2008: Increasing demand (incl. speculation)

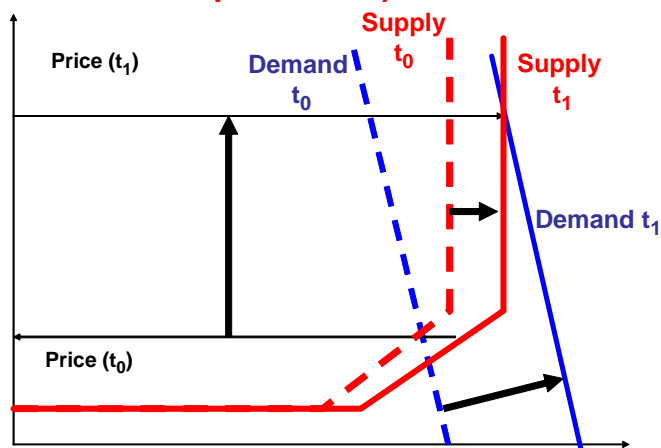


Fig. 11. Development of oil price 2004-2008: price driven by virtual demand increases

In this context it is important to state that there are two categories of demand: physical and virtual demand. Virtual demand is the additional demand due to future contracts that go beyond physical demand and which's position is closed before they have to be fulfilled physically. The price on spot markets depends on total current  $D_t$  demand and on the expected future demand  $D_{t+1}$ :  $p_t = f(D_t, D_{t+1})$

As long as  $D_{t+1}$  shows an upward gradient also the spot market price will go up, see Fig. 12 and 13.

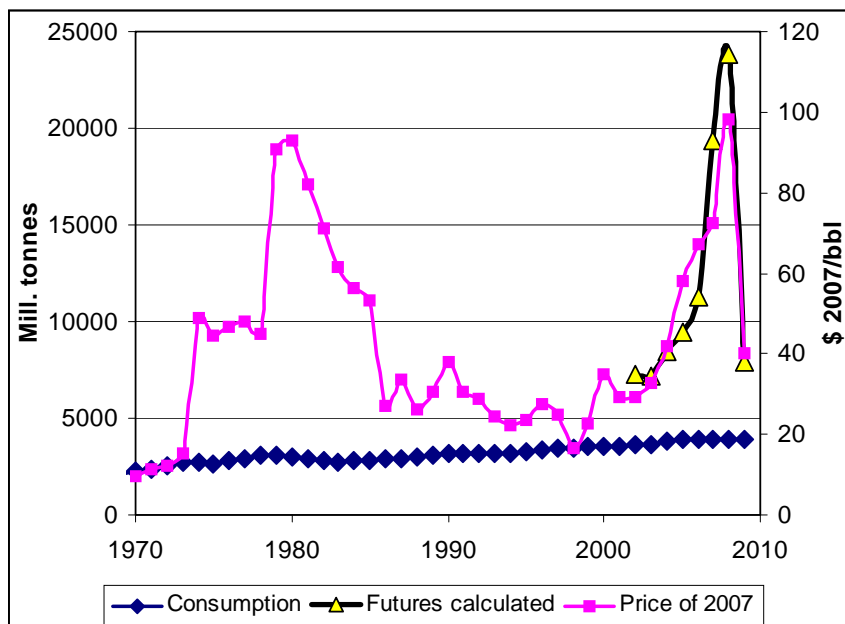


Fig. 12. Development of oil price and physical consumption vs total demand (incl. virtual demand) (Source: OPEC(2009), BP(2008), Abdolvand et al (2009), Der Spiegel 9/2008)

Once the turning point is reached – when the traders stop to believe in further price increases and sell instead of buying new future contracts also the price sign changes and prices drop.

**2004 - 2008: Increasing demand (incl. speculation)**

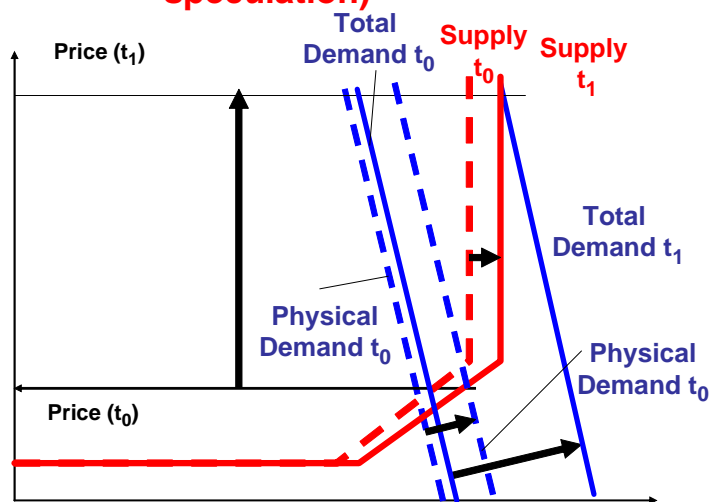


Fig. 13. Development of oil price 2004-2008: price driven by demand increases (while supply increased, too)

The results of comparing specific features for the periods 1980 to 1985 and 2003 to 2008 are summarised in Table 1. The wide majority of the investigated features indicate no significant increase in prices in the next future.

Table 1. Major features of oil markets with respect to increasing or decreasing oil prices

<b>FEATURE :</b>	<b>1982-1985</b>	<b>Current trend</b>	<b>Necessary feature for significant oil price increase</b>
<b>Trend in actual total world-wide oil consumption</b>	decrease	decrease	increase
<b>trend in total oil production</b>	stagnation decrease	increase	decrease
<b>OPEC forced to .... oil supply to maintain price level</b>	decrease	Increase	decrease
<b>Spare capacity</b>			
<i>absolut</i>	high (~9 Mill bbl/day)	low (~1 Mill bbl/day)	High
<i>trend</i>	constant	constant	Increase
<b>USA (and other non-OPEC countries) forced to ... production to reduce price level</b>	increase	Decrease	Decrease
<b>Share of OPEC in world-wide supply</b>	decrease	Stagnation	increase

## 5. Conclusions

The major conclusions of this analysis are:

- While in the period 1980 – 1985 price increases were triggered by OPEC market power and price drops due to significant physical demand drops;
- the recent increases in world oil prices – 2003 - 2008 – were mainly triggered by significant increases in demand mainly “virtual” demand by means of futures. The decrease in 2008 was due to a burst of the speculation bubble that is to say due to a significant drop in virtual demand. Physically, demand as well as production increased only moderately

Currently, it is not likely that prices will increase significantly once more in the next years. The reasons are: Moderate economic growth and demand adaptations (=fuel switching and efficiency improvements) that has taken place in recent years of high prices. Lessons learned from recent experience with the burst of the “futures bubble” for commodities in general will also make it unlikely that such speculative behaviour will lead to significant increases of the oil price in the next years. However, there are at least the following two potential reasons for significant increases: Due to consumption close to the maximum possible production OPEC might soon consider to rethink their oligopoly position. And looming peak-oil (for cheap oil) – at least in non-OPEC-countries – could also contribute to price increases in the next years.

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