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# Economic commentaries

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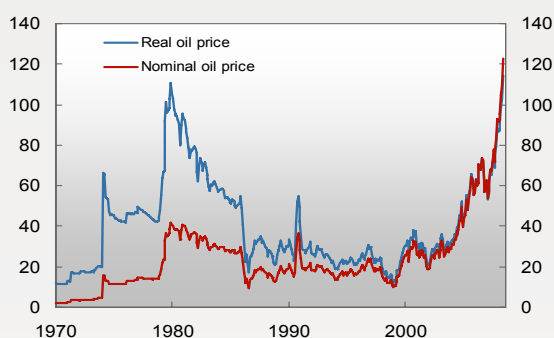
*Farooq Akram and Pål Winje, Senior advisers, Norges Bank Monetary Policy*

# The rise in oil prices - fundamental and financial factors

*Farooq Akram and Pål Winje, Senior advisers, Norges Bank Monetary Policy<sup>1</sup>*

Oil prices have risen sharply in recent years and are now record-high also in real terms (see Chart 1). Fundamental factors, such as oil supply and demand, are important explanatory variables for the price increase. Financial factors, such as the weak US dollar and low global interest rates, have also played a role. To date, there does not appear to be empirical support for the claims that pure speculation has driven up oil prices.

**Chart 1** Real oil price (Brent Blend) in USD. Deflated by CPI. In January 2007 USD. January 1970 – May 2008



Sources: Thomson Reuters and Norges Bank

## Fundamental factors

Demand for oil has grown strongly in recent years (see Chart 2). 2003-2007 was the strongest four-year period of growth in the global economy since the late 1970s. Growth was especially high in non-OECD countries (see Chart 3). Energy use in these countries increased due to industrialisation and greater prosperity. Emerging economies have accounted for more than 90% of growth in consumption over the past four years.

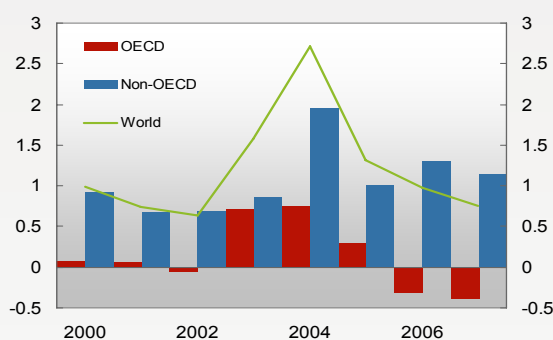
Demand for oil has remained high despite higher prices. Widespread price regulation and subsidies in many non-OECD countries have kept end-user prices artificially low. The percentage increase in end-user prices has also been relatively low in some OECD countries due to high indirect taxation of petroleum products.

Sustained brisk growth in demand for oil in non-OECD countries has been an important driver behind the rise

in oil prices, as the supply of oil cannot be increased substantially in the short term. Growth in non-OPEC oil production has slowed in recent years. After averaging more than 2% in 2000-2004, it fell to an average of less than 0.4% in 2005-2007. Growth in Russian production fell from an annual average of close to 9% in 2000-2004 to less than 3% in 2005-2007. Production is declining in several countries, including Mexico, Norway, the UK and the US.

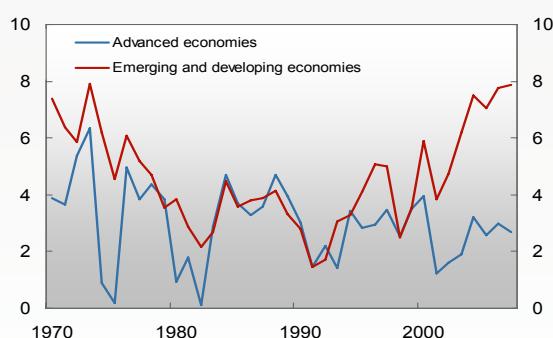
The International Energy Agency (IEA) is expected to revise down its projections of future growth in oil production in its next *World Energy Outlook*.<sup>2</sup> The need for investment in new production capacity – both to replace diminishing production at existing fields and to meet future consumption growth – is greater than previously assumed. However, investment has reacted more slowly to the rise in oil prices in recent years, and projects seem to be taking longer to complete than

**Chart 2** Annual change in world oil consumption. Million barrels per day. 2000 - 2007



Source: Energy Information Administration (EIA)

**Chart 3** Real GDP growth. Per cent. Annual growth. 1970 – 2007



Source: International Monetary Fund (IMF)

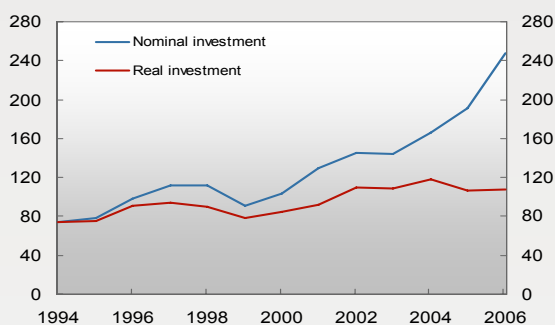
<sup>1</sup> We thank our colleagues in Norges Bank Monetary Policy for useful comments, and particularly Petter Ringstad Leinaas for his assistance with data and charts.

<sup>2</sup> *The Wall Street Journal*, 22 May 2008, "Fear of tighter oil supply may further rattle the market".

*Signed articles in this publication do not necessarily reflect the views of Norges Bank.*

earlier.<sup>3</sup> Exploration and development costs have also risen as a result of fewer, smaller and less accessible fields. In addition, there has been a sharp increase in the cost of drilling rigs and labour in the oil sector.<sup>4</sup> The real increase in investment has therefore been much smaller than the nominal increase (see Chart 4).

**Chart 4** Total investment<sup>1)</sup> of 53 national and international oil companies, 1994 – 2006. Billions of USD



<sup>1)</sup> Real investment is deflated by the US PPI for oil costs  
Source: International Monetary Fund (IMF)

The US Energy Information Administration (EIA) reports that total production costs (the sum of finding and lifting costs) for a barrel of oil in the Gulf of Mexico averaged almost USD 70 in 2004-2006.<sup>5</sup> Although the average elsewhere in the world is much lower, producers with the highest costs will push up prices over time if capacity is being utilised.

The increase in oil demand and dwindling production in non-OPEC countries have given OPEC greater market power, and it has shown a will to defend a much higher price than before. Two examples from recent years illustrate this. First, OPEC cut production twice when oil prices fell below USD 60 per barrel in late autumn 2006. This led to a sharp drop in OECD oil inventories in 2007 and helped to push prices back up again. Second, OPEC has yet to increase production even though oil prices are record-high, but Saudi Arabia unilaterally announced in mid-June that production will be boosted somewhat. OPEC argues that OECD oil inventories are in line with the average for the last five years, which indicates that production is sufficient. OPEC claims that oil prices are high primarily as a result of a weak USD, a shortage of refinery capacity, geopolitical uncertainty, and speculation – factors over which it has little influence.

<sup>3</sup> International Monetary Fund (IMF), World Economic Outlook, April 2008, Box 1.5, Why Hasn't Oil Supply Responded to Higher Prices?, see <http://www.imf.org/external/pubs/ft/weo/2008/01/index.htm>.

<sup>4</sup> Cambridge Energy Research Associates (CERA) publishes a cost index for upstream activity in the oil sector, which reveals that these costs have doubled since 2000, with most of the increase coming in the last three years, see [IHS/CERA Upstream Capital Costs Index: Cost of Constructing New Oil and Gas Facilities Reaches New High](http://www.cera.com/UpstreamCapitalCostsIndex/CostofConstructingNewOilandGasFacilitiesReachesNewHigh).

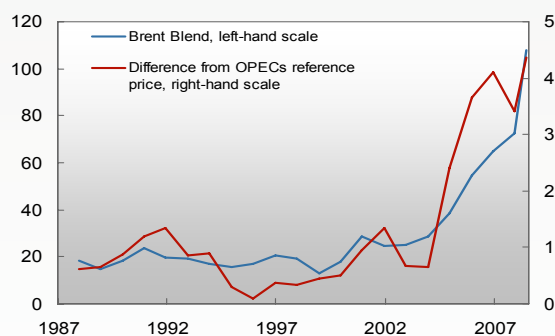
<sup>5</sup> EIA, Energy Information Sheets, Crude Oil Production, see <http://www.eia.doe.gov/neic/infosheets/crudeproduction.html>.

OPEC's reluctance to step up production can also be seen in another light. Member countries' export revenues have increased sharply in recent years. There is therefore little need for increased revenues in terms of government finances. If these countries believe that oil prices will continue to climb, it may be sensible from their point of view to limit production, especially if the return on investments of oil revenues is not particularly high.

Against the background of greater uncertainty about the situation in several key oil-exporting countries, the risk premium in oil prices has become considerable. For a given oil price, market participants are willing to hold larger inventories than before as a precaution against possible production shortfalls. Oil prices are high even though OPEC's spare production capacity has increased again slightly in recent years from a very low level, because market participants believe that the probability of substantial production shortfalls is now greater than before.

Refinery capacity has also been scarce, especially at more efficient and complex refineries that produce high-quality products such as gasoline, jet fuel and diesel – products for which there has been strong growth in demand. When these refineries are at full capacity, the use of less efficient and complex refineries increases. They need more crude oil to produce the same quantity of high-quality products, and they only manage to use a smaller share of lower-quality crude oil. Demand for and the price of crude oil therefore increase. Given the relatively higher supply of lower-quality crude oil in recent years, this has also led to increased price differentials between high- and low-quality crude oil (see Chart 5).

**Chart 5** Oil price (Brent Blend) and the difference from OPECs reference price. USD. 1987 – 2008<sup>1)</sup>



<sup>1)</sup> For 2008 the average of daily figures 2 January 2008 to 20 June 2008 is used  
Source: Thomson Reuters

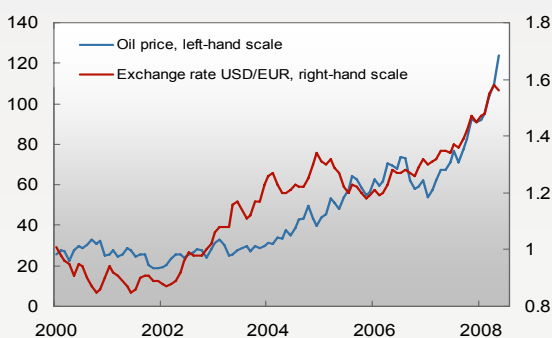
There has been heavy promotion of biofuels in recent years. With ordinary crude oil production in non-OPEC

countries being expected to stagnate, biofuels have grown in importance for the balance between supply and demand in the oil market. Especially in the past year, however, the negative consequences of the biofuel boom for food prices have become clear. The environmental benefits of biofuels are also smaller than previously assumed.

## Financial factors

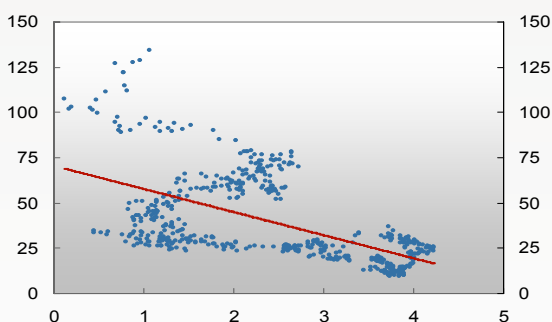
The weaker USD of recent times has contributed to higher USD oil prices (see Chart 6). Crude oil is traded almost exclusively in USD in the world oil market, but it is oil prices in the currencies of the different producer and consumer countries that are relevant to the supply of and demand for crude in the world market. When the US dollar depreciates, oil prices fall in the currencies of oil-importing and oil-exporting countries outside the US. This leads to lower oil supply and/or higher oil demand on the world market. As a result, the oil price in USD terms increase, particularly in the short term.<sup>6</sup>

**Chart 6** Oil price (Brent Blend) in USD and the exchange rate between USD and euro. January 2000 – May 2008



Source: Thomson Reuters

**Chart 7** Oil price (Brent Blend) and 5-year real interest rate<sup>11</sup> in the US. USD and per cent. Week 28 1997 – week 24 2008



<sup>11</sup> Government benchmark bonds. Constant maturity inflation-indexed, 5-year yield

Sources: Thomson Reuters and Norges Bank

6 Q.F. Akram and J.P. Holter (1996): Dollarkursens effekt på oljeprisene – en empirisk analyse [The effect of the dollar exchange rate on oil prices – an empirical analysis], *Penger og Kredit* 3/1996, pp. 195-206.

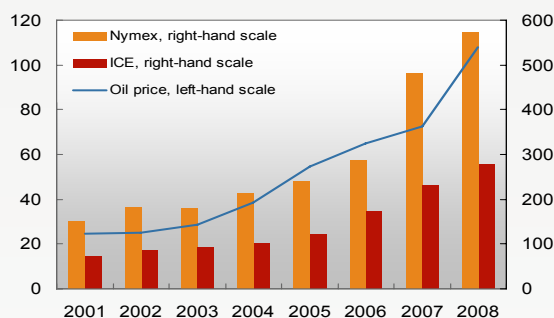
Lower real interest rates in recent years may also have led to higher oil prices (see Chart 7). There may be several reasons for this.<sup>7</sup> Low real interest rates can boost demand for crude oil because it becomes less profitable to invest in fixed-income securities than in commodities and other assets. Low real interest rates can also reduce the supply of crude oil, because it costs less to store oil for sale or consumption at a later date.<sup>8</sup>

Oil prices may react more strongly to interest rate changes in the short term than in the long term, in the same way as exchange rates.<sup>9</sup> For investments in crude oil to be as attractive as fixed-income securities, the real price of oil must be expected to grow in line with real interest rates, once we ignore risk and storage costs. This means that lower real interest rates, due to lower nominal rates or higher expected inflation, will be accompanied by higher oil prices in the short term for a given future price. Empirical studies support this relationship.<sup>10</sup>

## Speculation

There has been a sharp increase in crude oil derivatives trading in recent years (see Chart 8). Besides trading in standardised exchange-traded contracts, there is extensive trading in less regulated over-the-counter markets. Statistics for activity in these markets are lim-

**Chart 8** Oil price (Brent Blend) and average daily market volume for futures on crude oil at IntercontinentalExchange (ICE) and New York Mercantile Exchange (Nymex). USD and million barrels. 2001 – 2008<sup>11</sup>



<sup>11</sup> For 2008 the average of daily figures 2 January 2008 to 20 June 2008 is used

Source: Thomson Reuters

7 J.A. Frankel (2007): The effect of monetary policy on real commodity prices, in J. Campbell (ed.): *Asset Prices and Monetary Policy*, Chicago University Press, Chicago.

8 Substantial quantities of crude oil are stockpiled on both the supply side and the demand side. It may therefore be appropriate to differentiate between supply and production, and between demand and consumption. Supply can be defined as the difference between production and inventory changes, while demand can be defined as the difference between consumption and inventory changes.

9 J.A. Frankel (1986): Expectations and Commodity Price Dynamics: The Over-shooting Model, *American Journal of Agricultural Dynamics*, Vol. 68, pp. 344-348.

10 Q.F. Akram (2008): Commodity prices, interest rates and the dollar, mimeo, Norges Bank.

ited, but anecdotal information suggests that activity here has also increased sharply and is far higher than in exchange-traded markets.

The sharp increase in derivatives trading has coincided with the sharp increase in oil prices. The question has therefore been raised as to whether some participants in the derivatives market have driven oil prices higher than other fundamental and financial factors would suggest.

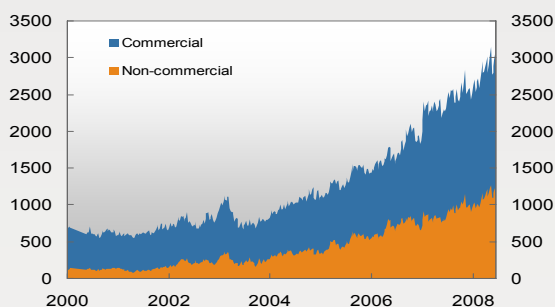
Broadly speaking, there are two types of participants in the oil derivatives market. Oil producers, refineries and airlines are examples of commercial participants, which have a commercial interest in the physical market for oil. They use the derivatives market to offload price and supply risk in their business operations. Banks, pension funds and the like are examples of non-commercial participants, which do not have a commercial interest in the physical oil market, but trade with a view to profiting from short-term price movements. This activity may also be motivated from a more long-term perspective, where investment in oil is viewed as a prudent diversification. As returns in the oil market do not fully correlate with returns in the bond and equity market, a certain allocation to the oil market could reduce variations in the overall return on investment without reducing expected returns.

Activity in the derivatives market is important for giving both commercial and non-commercial participants ample and reasonable opportunities to offload and spread risk. The market acts as a kind of insurance market, where some participants are willing to accept risk in return for a certain level of compensation, while others are willing to pay this compensation to reduce their risk. The derivatives market is also important for promoting the accurate pricing of oil, because active trading by large numbers of professional and well-informed participants with different interests helps to ensure that prices reflect all available information on relevant supply and demand conditions.

Activity among non-commercial participants on the New York Mercantile Exchange (NYMEX) has increased markedly in recent years (see Chart 9). Statistics for other commodities show that prices for coal, steel and iron ore, among others, have also increased sharply, even though there are not such well-developed derivatives markets for these commodities. Moreover, a large share of the activity of non-commercial par-

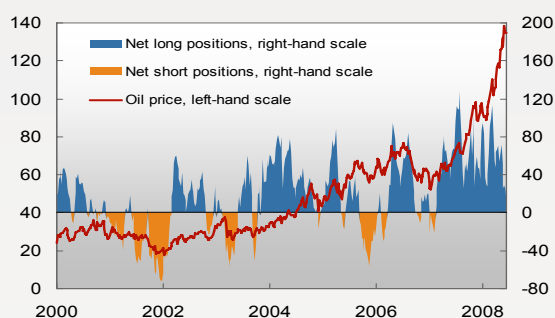
ticipants on NYMEX involves spreads; that is, taking a long position in one contract month and a short position in another. These transactions do not influence the level of the oil price.<sup>11</sup>

**Chart 9** Commercial and non-commercial participants' short open interests<sup>1)</sup> in the oil futures- and options market for crude oil. Week 1 2000 – week 25 2008



<sup>1)</sup> Number of 1000 contracts  
Source: Commodity Futures Trading Commission (CFTC)

**Chart 10** Oil price and non-commercial participants' net positions<sup>1)</sup> in the oil futures market for crude oil. Week 1 2000 – week 25 2008



<sup>1)</sup> Number of 1000 contracts  
Sources: Thomson Reuters and Commodity Futures Trading Commission (CFTC)

While oil prices have shown a clear upward trend, non-commercial participants' net long positions (which make a profit if oil prices rise) have not done so (see Chart 10). Since June last year, oil prices have doubled, while net long positions have almost halved.

To the extent that changes in non-commercial traders' positions correlate with changes in oil prices, closer empirical analysis reveals that speculators tend to follow price movements rather than cause them.<sup>12</sup>

If financial investors in the oil derivatives market were helping to push prices higher than the equilibrium in the physical spot market for oil, this would result in an

<sup>11</sup> Cf. US Commodity Futures Trading Commission (CFTC) chief economist Jeffrey Harris's testimony before the US Congress on 20 May 2008, see <http://www.cftc.gov/stellent/groups/public/@newsroom/documents/speechandtestimony/oeajeffharristestimony052008.pdf>.

<sup>12</sup> IMF, World Economic Outlook, September 2006, Box 5.1, Has Speculation Contributed to Higher Commodity Prices?, see <http://www.imf.org/external/pubs/ft/weo/2006/02/index.htm>.

increase in oil inventories – oil producers would want to supply more oil than oil consumers would be willing to demand.<sup>13</sup> However, oil inventories in the OECD countries fell from April 2007 to April 2008, while oil prices climbed by more than USD 50 per barrel.

To date, there is little empirical evidence that pure speculation has driven oil prices higher than the underlying fundamental and financial factors would suggest. In the US and elsewhere, there are nevertheless some who argue that the sharp increase in activity in the derivatives market must have played an independent role in the rise in oil prices. This applies particularly to the activities of index funds, which invest on a long-term basis in oil and other commodities to benefit from the diversification potential. The CFTC has therefore recently announced the formation of an interagency task force to examine the subject in more detail.<sup>14</sup> At their meeting in June 2008, the G-8 finance ministers also asked the IEA and the IMF to take a closer look at the fundamental and financial factors behind the rise in oil prices.<sup>15</sup>

<sup>13</sup> Professor Paul Krugman, a columnist in The New York Times, is one of several to stress this point. Martin Wolf in the Financial Times also refers to it frequently.

<sup>14</sup> See [CFTC Announces Interagency Task Force to Study Commodity Markets](#).

<sup>15</sup> Cf. statement following the meeting held in Japan on 13-14 June 2008, see [G-8 communiqué](#).