

# OPEC's optimal crude oil price

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## Abstract

In March 2000, OPEC decided to stabilise oil prices within a range of 22–28 US-Dollar/barrel of crude oil. Such an oil-price-level is far beyond the short and long run marginal costs of oil production, beyond even that in regions with particularly high costs. Nevertheless, OPEC may achieve its goal if world demand for oil increases substantially in the future and oil resources outside the OPEC are not big enough to accordingly increase production. In this case OPEC, which controls about 78% of world oil reserves, has to supply a large share of that demand increase. If we assume OPEC will behave as a partial monopolist on the oil market, which takes into consideration the reaction of the other producers to its own sales strategy, it can reach its price target. Lower prices before 2020 are probable only if the OPEC cartel breaks up. Higher prices are possible if production outside OPEC is inelastic as assumed by some geologists, but they would probably stimulate the production of unconventional oil based on oil sand or coal. Crude oil prices above 30 US-Dollar/barrel are therefore probably not sustainable for a long period.

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## 1. Introduction

From January 1999 to January 2000, oil prices surged from 10 to 30 US-Dollar/barrel, because Organisation of Petroleum Exporting Countries (OPEC) reduced its own production, and oil production in other countries did not increase enough to cover demand. In March 2000, OPEC decided to stabilise oil prices within a range of 22–28 US-Dollar/barrel of crude oil (OPEC Basket). For this purpose, a price-band-mechanism was introduced, according to which OPEC increases or decreases production if the price of OPEC-oil has been above 28 US-Dollar/barrel for 20 successive days or below 22 US-Dollar/barrel for 10 successive days. This mechanism could not prevent that oil prices increased above the upper limit from June to November 2000 and were below the lower limit from October 2001 to March 2002. Nevertheless, it obviously contributed to a price stabilisation during the year 2002.

An oil-price-level of 22 to 28 US-Dollar/barrel is far beyond the short and long run marginal costs of oil production, beyond even that in regions with particularly high costs (for example offshore). Therefore,

OPEC must have a strong position as partial monopolist on the oil market, to reach its price target. OPEC has a share of about 28% of world oil production. This seems to be low compared with other more or less effective resources monopolies.<sup>1</sup> Actually, oil production capacities are higher than necessary to supply world oil demand. In such a situation OPEC has to restrain its production to stabilise oil prices on a level beyond marginal costs. This is no easy task because the interests of member countries with large resources and small populations are different from those of countries with smaller resources and larger populations.<sup>2</sup> To solve this

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<sup>1</sup>In 1991, the share of the four countries producing most of world production was for rubber 82%, cocoa 67%, coffee 55%, tin 60% and oil 47%. Verleger (1993).

<sup>2</sup>In particular the gulf countries, Saudi-Arabia, Kuwait and UAE have large oil reserves and small populations, so that in future this group will increase its share in OPEC oil exports. The interest of this group is to assure—on top of high prices—a sufficient market for their oil in the long run. Other countries, like Iran and Iraq have a much higher population and will need an increasing share of their oil production for inland consumption in the future. These countries may be more interested in higher prices today, even if future oil revenues will be reduced, in other words they have higher discount rates than the other group of OPEC countries. Some authors have tried to identify the effect of different interest groups inside OPEC. Hnylicza and Pindyck (1976) introduced a model with a two-part cartel (saver/spender), Eckbo (1976) a three-part cartel (core/price/ maximizers/

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problem OPEC has to assure that costs and profits of its strategy are distributed in a way that benefits each member. Whether it is possible to achieve such a compromise is more a question of politics and diplomacy than of economics.

Nevertheless, in the longer run, the dominance of OPEC will increase, because about 78% of known oil reserves are located in these countries (data from year 2000). If world demand for oil increases substantially in the future and oil resources outside the OPEC are not big enough to increase production accordingly, OPEC has to supply a large share of that increase. So OPEC as a whole may be able to maximise its profits by restraining production increases.

A lot of studies have dealt with the oil price development which result from an oil market more or less dominated by OPEC. Already in the 1970s, [Salant \(1976\)](#), [Pindyck \(1978\)](#) and [Stiglitz \(1976\)](#), in the last years especially [Berg et al. \(1997\)](#), [Gately \(1995, 2001\)](#) and [Gately and Huntington \(2002\)](#) have discussed the influence of OPEC on oil prices. All studies mentioned differ between a partial monopolist OPEC and other oil producers, but the behaviour of these agents is modelled differently. In some studies (for example by Salant) it is assumed that the cartel accepts the production of the other producers as given (this corresponds to a Nash–Cournot approach), or it is assumed (for example by Pindyck) that the cartel takes into the consideration the reaction of the other producers to his own sales strategy (this corresponds to a Stackelberg Approach). Not only the approach applied but also the results<sup>3</sup> gained in these studies differ substantially.

In this article I assume that OPEC manages to balance the divergent interests inside the cartel and is able to anticipate the reactions of demand and oil producers outside OPEC on its production decisions. I further assume that it will try to maximise profits for the group as a whole in the long term. Based on these assumptions, a simple model was constructed, which allows to quantify the effects of different assumptions concerning economic growth, oil demand and oil supply elasticity and taxes on the possible development of oil prices. In the following section I briefly describe that model.

*(footnote continued)*

quantity maximisers). A good overview about the different approaches is given by [Alhajji and Huettner \(2000\)](#). In my opinion, OPEC can only influence prices if it acts consistent. In critical situations it even needs the help of producers outside OPEC. Therefore, I analyse here the effects of a stringent policy of OPEC as a whole.

<sup>3</sup>According to Pindyck, OPEC could have increased its profits by 50–100% by production restraint until 2000, later studies result in much smaller gains—according to [Berg et al. \(1997\)](#) only 19% at best.

## 2. A simple oil market model

### 2.1. Oil demand

I assume that oil demand depends on

GDP growth,  
crude oil prices,  
structural change and technical progress.

Furthermore, I assume that the influence of GDP and oil prices on oil demand is well represented by a potential function. Potential functions are widely used in economics. One well-known example is the Cobb–Douglas function in the area of production analysis. [Bohnen \(1982\)](#) and the DIW have used these functions to analyse and project energy demand and to estimate the influence of climate on energy consumption. These functions provide well-tested and robust approximations of the underlying processes. In the present case, this type of a function was chosen because it assumes both a constant price and income elasticity, which are easy to interpret.

Oil demand is specified in the following index form:

$$\frac{C_t}{C_{99}} = \left(\frac{Y_t}{Y_{99}}\right) \left(\frac{P_t}{P_{99}}\right) (1 - AEEI)^{t-1999},$$

where  $t$  is the time (year),  $C_t$  the oil consumption in  $t$ ,  $Y_t$  the gross domestic product in  $t$ ,  $P_t$  the oil prices in  $t$ ,  $a$  the income elasticity of  $C$ ,  $b$  the price elasticity of  $C$ . AEEI the rate of “autonomous energy efficiency improvements.”

The oil consumption ( $C_t$ ) of each region is projected using the demand indices calculated with the function described above.

### 2.2. Oil production

According to the reference case of the EIA, oil production in non-OPEC countries increases from 1999 to 2020 by only half as much as world oil demand. Thus, OPEC provides most of the increased supply, and its production roughly doubles. In principle, the large oil resources in OPEC countries may allow them to double their production until 2020. However, it is not certain at all if they would want to do this and whether they would be able to attract the capital needed for this development. Furthermore, the assumed big increase in oil production outside of OPEC (about a third) is very optimistic. This increase would require substantial technical progress in crude oil exploration and in the production of conventional and unconventional oil (oil production based on heavy oil, oil sand or coal, etc.). Geologists even argue that world crude oil production—including that of OPEC—will soon reach its summit or

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