

Interne notater

STATISTISK SENTRALBYRÅ

88/4

15. mars 1988

THE IMPACT ON THE NORWEGIAN ECONOMY
OF LOWER OIL PRICES

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1. INTRODUCTION

We would like to point out that the analysis was carried out mainly in the winter of 1985/86, and completed by the summer of 1986. Developments after that point of time have not been taken into consideration. The long time between completion and publication of the analysis stems from the fact that time is a scarce resource, and partly that two of the authors left the Central Bureau of Statistics in 1986. Still, we have chosen to publish the analysis as an Internal Paper at this late stage in order to document the work that was done.

In this report we analyse some effects of lower oil prices on the Norwegian economy. The analysis falls in three parts. The first discusses two scenarios concerning the price of crude oil by using a model of the world oil market. The second part reviews some studies of international macroeconomic repercussions of lower oil prices. Thirdly, on the basis of projected oil price paths and assumptions concerning international repercussions the effects on the Norwegian economy of lower oil prices are analysed by means of a macroeconomic model.

As mentioned before was the analysis carried out before the devaluation of the Krone in May 1986. This devaluation was undertaken partly to counteract some of the developments outlined in this report, particularly the huge deficits likely to occur on the current account for the rest of this decade if the oil price remains at a low level. We do not, however, believe that the devaluation has reduced the significance of the analysis presented in this report. This belief is based partly on a article by Bowitz et al. (1986) analysing the effects of the devaluation. A main conclusion to be drawn from that study is that the devaluation will have only moderate real effects on the Norwegian economy. The improvement on the current account, for example, is in no year projected at more than 2 billion NOK. It is, therefore, our view that the analysis presented in this report bear much relevance concerning the impacts of lower oil prices, even though the economic development in the near future may be different from our figures. The results in Bowitz et al. (1986) also explains why a devaluation scenario was not studied in this report although there seems to be fairly strong evidence suggesting that the Krone - particularly after the devaluation - is closely related to the crude oil price. This feature is discussed in an appendix to the report that reviews some possible effects of lower oil prices on exchange rates among the major currencies.

2. THE CRUDE OIL MARKET

The purpose of this chapter is to investigate the crude oil market in the years to come, and to analyse which factors are the determinant ones. Special attention is given to the question: can the oil price stay low for a long time, for example throughout the rest of the century?

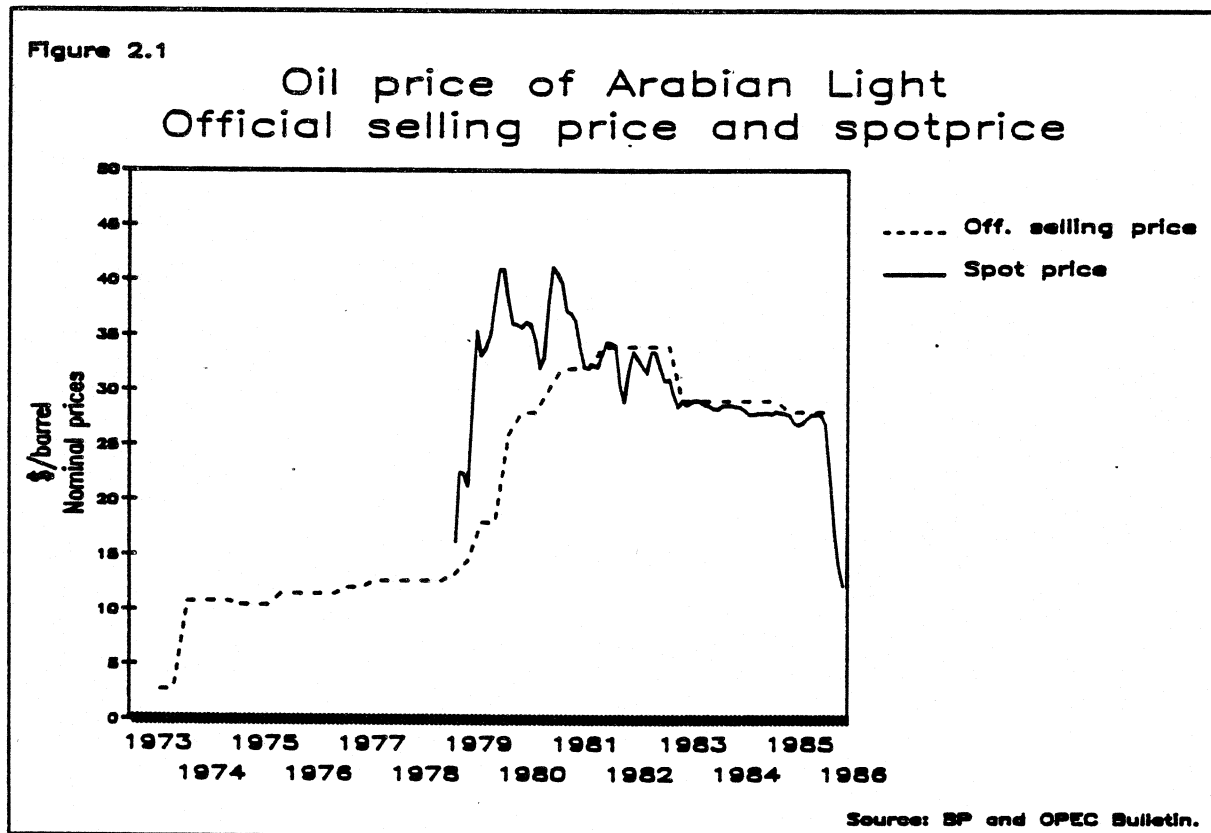
The crude oil market has been characterized by a growing imbalance between production capacity/potential supply and demand since the early 1980's. Consequently, crude oil prices have been under heavy downward pressure. During the summer of 1985, OPEC was forced to reduce its crude oil production well below its self imposed production ceiling of 16 millions barrels per day (mbd) to avoid spot prices from plummeting. Despite these efforts, the spot price of Arabian Light was \$26.50 per barrel in June 1985, \$1.50 per barrel below the official selling price.

Saudi Arabia accepted to play the role as a swing producer, and the Saudi production was not more than 2.0-2.5 mbd in the summer of 1985 (IEA (1985)) as compared to a production capacity of 9 mbd. Saudi Arabia stuck to official prices. Events during the autumn of 1985 showed that the Saudi policy stance had changed. Significant volumes of crude oil were sold on "net-back" price agreements based on spot market prices of refined products and the volumes marketed were raised to Saudi Arabia's quota of 4.35 mbd. At the December 1985 OPEC ministerial meeting, it was furthermore decided that OPEC should start to defend its overall market share rather fiercely.

The market was tight before the ministerial meeting, but the change in OPEC's strategy reduced the spot price by \$5 per barrel. After the meeting OPEC increased production well beyond the 16 mbd production mark, partly due to increased Saudi Arabian production, and in mid-January 1986 the spot price plummeted well below \$20 per barrel. OPEC wanted other producers to cut back production, primarily UK and Norway. The strains put on the weaker OPEC members have been great, and proposals of a return to the old strategy of defending prices instead of market shares have emerged. The development of the oil market both in the short term and the medium term depends primarily on the action and behaviour of OPEC. The following sections will investigate the future market situation and outline scenarios for the crude oil price through 2000. Before doing so, we will start by a quick review of the evolution of events that led to today's depressed market.

2.1. The crude oil market after the Iranian revolution

In 1978, the official selling price of Saudi Arabian Light was \$12.70 per barrel. Spot prices were at an equivalent level. In the autumn of 1978, the Islamic revolution in Iran took place. In a few months, Iran's oil production fell from 6 to 0.5 mbd and the exports were completely cut off. Due to reduced supply, speculative stock building and the Saudi Arabian threat to reduce production in opposition to the Camp David negotiations, the crude oil price soared through the next year. By the end of 1979, the Saudi Arabian Light spot price peaked at \$40 per barrel (see fig. 2.1), an increase of more than 200 per cent from the 1978 level. The spot price then decreased somewhat in the first part of 1980.



The world had not seen the full consequences of the Iranian revolution before a new shock hit the world oil market: the war between Iran and Iraq. Again spot prices rose sharply, and at the end of 1980 it was above

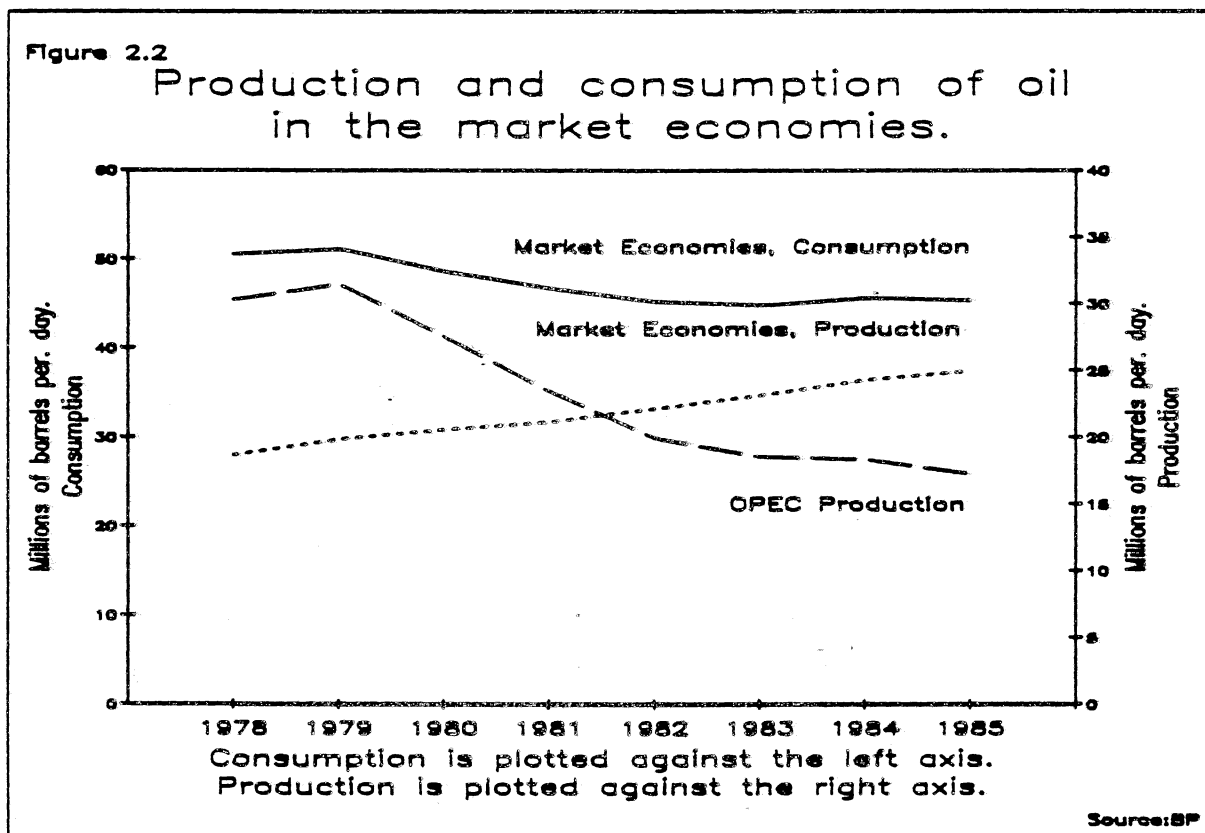
\$40 per barrel again. During this period, the official selling price increased steadily and in 1981 it reached \$34 per barrel. Official prices were fixed at this level until the first quarter of 1983.

A careful explanation of market behaviour through the Iranian revolution and early phases of the war with Iraq obviously entails more details than has been revealed here. Important to what followed was the fact that the price was dramatically increased and that the official selling price was not reduced when the initial reason for the price hike (curtailment of exports from Iran and Iraq) was gone. This is usually called the "ratchet" effect.

One reason why this dramatic price increase and the ratcheting was possible, is the following. Consumption of oil is closely related to the use of fixed capital and thus, a low short-run price elasticity can be observed. This explains why prices skyrocketed when total production was reduced only marginally after the Iranian revolution and the war between Iran and Iraq. When the oil price was dramatically increased, export revenues of the OPEC countries also increased. Many of these countries have limited possibilities to absorb increased revenues in the domestic economies in the short run. These countries have no strong incentives to keep their exported volume up after an oil price increase, thus the "ratchet" effect comes into effect.

Higher oil prices had significant effects on consumption in the long run. Consumers started to substitute away from oil in a much greater pace than expected by the conventional wisdom. At the same time, producers outside OPEC found high cost oil fields economic to develop and exploration increased. This development is described in figure 2.2. Consumption in the OECD area fell each consecutive year between 1979 to 1983. In 1984, it increased marginally before decreasing again in 1985. Oil production in non-OPEC countries has increased steadily. The average production increase has been close to 1 mbd per year. As a result of this, the OPEC production has fallen dramatically from over 31 mbd in 1979 to just above 17 mbd in 1985.

The downward trend in consumption made it difficult to support official selling prices. In the first quarter of 1983 the official selling price of Arabian Light was reduced by \$5 per barrel to \$29 per barrel. In the end of January of 1985 the price was again reduced, this time to \$28 per barrel. But this price reduction was not sufficient, and market developments eventually resulted in a price war in the winter of 1986.



2.2. A high price and a low price scenario

In this chapter two price scenarios are outlined; the high price and the low price scenario. The "high" and "low" refers to the outcome of two possible OPEC strategies.

The model used in this paper to analyse the crude oil price is the World Oil Market (WOM) model of Lorentsen and Roland (1985). WOM is a very simple and open model and might be characterized as a framework facilitating consistent reasoning about the market given exogenous assumptions about key parameters.

The model distinguishes between three demand areas: USA, the rest of the OECD and less developed countries (LDC). Demand from each region is defined as a function of GDP, present and lagged real price of petroleum products and prices on alternative energy. The supply side comprises; OPEC, the rest of the market economy producers and net supply from centrally planned economies (CPE).

The two scenarios are based on best guess estimates of critical exogenous parameters such as economic growth, exchange rates, prices of

competitive fuels and costs of transport, refining, storage and distribution of crude oil. Estimates of GDP growth and exchange rate developments are outlined in more detail in chapter 3 and in the appendix. In this chapter, only the main conclusions are reported. Before doing so, it seems proper to discuss behavioural assumptions on the supply side of the crude oil market.

Supply from producers outside OPEC and CPE-countries is projected by an econometric resource-base sub-model in WOM following Weyant and Kline (1982). Three central hypotheses are made: First, a constant fraction of known, recoverable reserves are produced each year. Second, the fraction of undiscovered oil-in-place discovered in a particular year is price responsive. Third, the optimal recovery factor depends on the price of oil. Adjusting to the optimal recovery factor is time consuming. All parameters in the model are of course subject to a considerable degree of uncertainty. Most important is probably the estimate of the remaining, undiscovered resource base of crude oil. Sensitivity analysis on this parameter will be carried out later.

With regard to net export from the CPE area we assume that the Chinese production and exports are increasing slowly over the next 5-8 years. Despite a constant or slightly decreasing production in USSR, we judge it likely that this country is able to support today's level of net export due to considerable efforts to substitute natural gas for fuel oil in domestic energy consumption. Altogether we assume that net export of crude oil and petroleum products from the CPE-area remain roughly constant at 2.4 mbd after 1985.

In our high price scenario, growth projections on an aggregate level from the LINK-model (see chapter 3) are as follows: GDP in the OECD-area increases by 3.3 per cent per year and by 4.6 per cent in the LDC's from 1984 to 1990. Later growth rates decline somewhat. Over the whole period 1984-2000 average growth is 3.0 per cent for industrialized countries and 4.5 per cent in less developed countries. Growth rates in 1985 and 1986 are in accordance with OECD Economic Outlook (OECD (1985)). In the low price scenario the GDP-growth is increased in the years with low prices as described in chapter 3. Thus, GDP nearly doubles by year 2000 in the LDC-area and increases by 55 per cent in the OECD area from 1985.

In the appendix, our expectations about long run equilibrium exchange rates are outlined. The pace of adjustment from present values to the long run stable equilibrium in the high price scenario is shown in

table 2.1. We assume that the dollar presently is 14 per cent overvalued relative to a basket of OECD currencies and 10 per cent overvalued relative to a basket of LDC-currencies. In the low price scenario, the exchange rate is reduced in accordance with the results in the appendix.

Furthermore, both in the high price and the low price scenario we assume competing fuel prices to stay constant in real terms and costs of transportation, refining, storage and distribution to follow the general GDP-deflator. Finally, indirect taxes levied on crude oil or products are constant.

Table 2.1. US dollar against a basket of OECD- and LDC-currencies, 1984-2000.

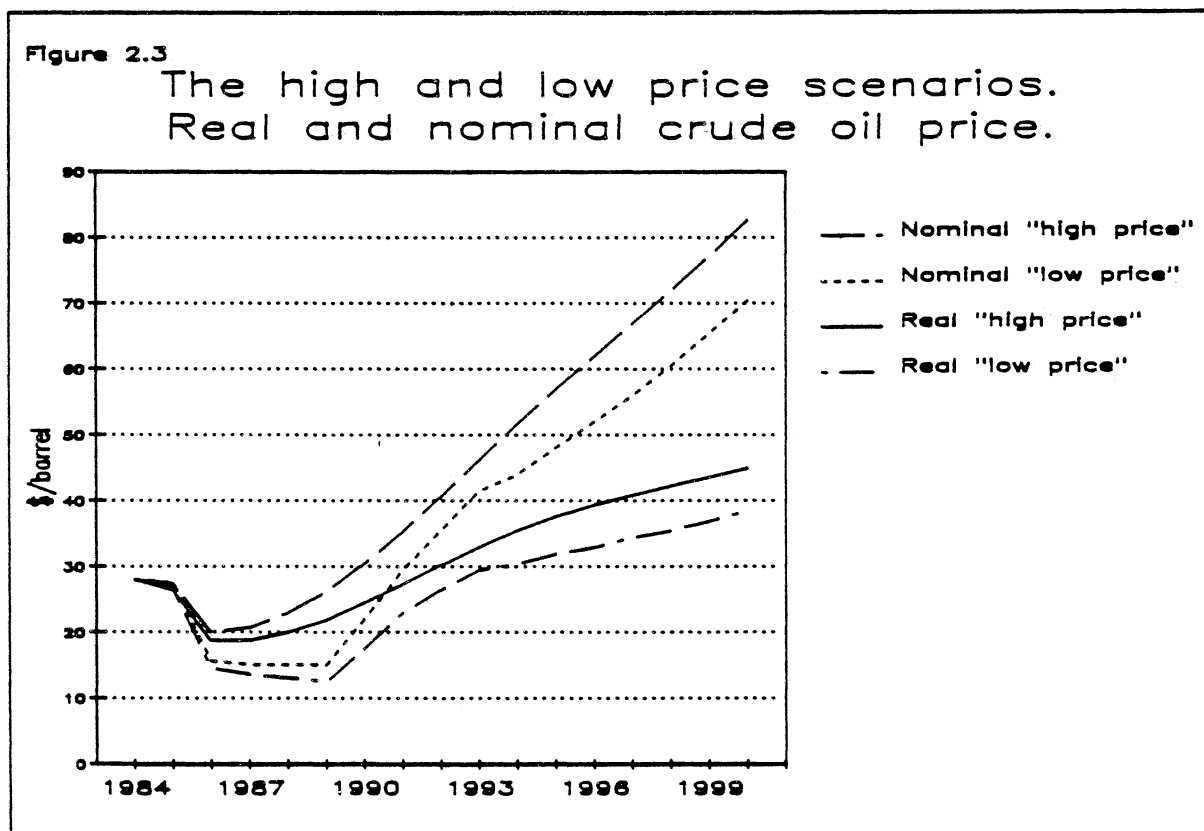
	1984	1985	1986	1987	1988	1989	1990	1991-2000
US \$/OECD-currency basket	1.00	1.05	0.86	0.74	0.74	0.74	0.80	0.86
US \$/LDC-currency basket	1.00	1.03	0.95	0.90	0.90	0.90	0.90	0.90

Of utmost importance for the future development of the crude oil market is the assumptions made about the behaviour of the OPEC member countries and their collective decisions at ministerial meetings. In the high price scenario, we assume that OPEC members after adjusting the price level of crude oil to \$20 per barrel in early 1986, are able to agree on production quotas despite the extreme pressure against the cohesion within OPEC and the financial problems some countries are faced with. This implies that Saudi Arabia is still willing to play the role of a swing producer. In the weak market expected over the next few years, OPEC in accordance with earlier behaviour, are assumed to support nominal prices and be flexible on output. Over time, when capacity utilization is increasing to more tolerable levels, prices will start to increase. To sum up, in this scenario OPEC is assumed to have adjusted the price level once and for all in January of 1986 in order to reduce the supply pressure and stimulate demand. Then quotas are again restored and enforced and OPEC as a whole acts as the swing supplier in the market.

Alternatively, in the low price scenario, OPEC's market power is reduced for the following reason. The fundamental precondition for OPEC to maintain market control in a weak market is its ability to be a swing producer. This ability hinges on Saudi-Arabias willingness to take the

greatest swings in production. Revenue losses experienced over the last 2-3 years from extremely low production and long term interests in a market for crude oil could induce a change in the strategy of Saudi-Arabia, and thus reduce this country's ability to carry the bulk of the costs involved in OPEC controlling the market. Altogether, this implies that when OPEC decides on quotas, costs of these measures have to be evenly distributed between member countries. This severely limits OPEC's market power and forces the organization in a weak market to a larger degree to undercut prices to defend volumes.

Based on the above referred parameters and assumptions on OPEC behaviour, production, consumption and market clearing prices were projected by the WOM-model.



As indicated by table 2.2, the crude oil price in real terms decreases from \$28 per barrel in 1984 to \$26.50 per barrel in 1985. In the high price scenario the real crude oil price falls to \$18.50 in 1986, equivalent to \$20 in nominal terms. As outlined above we assume that OPEC

production quotas are respected. From 1986 the real crude oil price starts to rise and reaches the 1985 price level again by 1991. Average annual real growth rate from 1991 to 2000 is 5.6 per cent in the high price scenario.

Table 2.2. The crude oil price in the low price and the high price scenario.

	Real crude oil price (1984 prices)		Nominal crude oil price	
	High price	Low price	High price	Low price
1984	28.0	28.0	28.0	28.0
1985	26.5	26.5	27.5	27.5
1986	18.5	14.5	20.0	15.5
1987	19.0	13.5	21.0	15.0
1988	20.0	13.0	23.0	15.0
1989	22.0	12.5	26.0	15.0
1990	24.5	17.5	30.5	22.0
1991	27.5	23.0	35.5	29.5
1992	30.5	26.5	40.5	35.5
1993	33.0	29.5	46.0	41.5
1994	35.5	30.5	51.5	44.0
1995	37.5	32.0	57.0	48.0
1996	39.5	33.0	62.0	52.0
1997	41.0	34.5	67.0	56.0
1998	42.5	35.5	72.0	60.5
1999	43.5	37.0	77.0	65.5
2000	45.0	38.5	83.0	70.0

Due to economic growth and falling prices in real terms, demand picks up, in particular in the LDC's. At the same time, production in the non-OPEC countries peaks in 1985 and starts to decline slowly. OPEC regains a firm grip on the market in the late 80's. OPEC's real income from oil production is more than 50 per cent higher in 1990 than in 1985, and by the end of the century it has increased by nearly 170 per cent. This can be seen combining table 2.2 and 2.3.

Demand in USA in year 2000 is not very much higher than today. It reaches its highest level at 17.7 mbd in 1990. The peak in 1990 is explained by the fact that demand in the model is a lagged response over five years to prices, and the crude oil price in constant 1984 dollars is very low in the years from 1986 to 1990.

Demand from the rest of the OECD-countries increases more than demand in US. This is caused by movements in exchange rates between OECD currencies and the US dollar. In the 1990's, the US dollar is worth 14 per

cent less than it was in 1984. This reduces the price on petroleum products measured in national currencies correspondingly.

Table 2.3. Demand and supply of crude oil in different regions in the high price scenario. (mbd).

	Demand				Supply			Stock changes and statistical errors	Total ¹⁾
	USA	Rest of OECD	LDC	Total ¹⁾	OPEC	non-OPEC	Net supply from CPE		
1984	15.2	18.8	11.8	45.7	18.5	24.3	2.4	0.5	45.7
1985	15.0	18.1	12.3	45.3	17.4	25.1	2.4	0.5	45.3
1986	15.6	19.1	13.1	47.8	21.0	24.4	2.4	-	47.8
1987	16.6	20.0	13.9	50.4	24.5	23.5	2.4	-	50.4
1988	17.2	20.6	14.6	52.4	27.2	22.8	2.4	-	52.4
1989	17.5	20.7	15.2	53.4	28.8	22.3	2.4	-	53.4
1990	17.7	20.5	15.9	54.1	30.0	21.7	2.4	-	54.1
1991	17.5	20.0	16.4	53.9	30.4	21.1	2.4	-	53.9
1992	17.1	19.7	17.0	53.8	30.6	20.8	2.4	-	53.8
1993	16.8	19.4	17.6	53.8	30.3	21.2	2.4	-	53.8
1994	16.4	19.3	18.3	54.0	30.0	21.6	2.4	-	54.0
1995	16.1	19.3	19.0	54.4	29.1	22.9	2.4	-	54.4
1996	16.0	19.3	19.7	55.0	28.4	24.1	2.4	-	55.0
1997	15.9	19.4	20.5	55.8	27.9	25.4	2.4	-	55.8
1998	15.8	19.6	21.3	56.7	27.6	26.7	2.4	-	56.7
1999	15.8	19.8	22.2	57.8	27.5	27.9	2.4	-	57.8
2000	15.9	20.0	23.1	58.9	27.5	29.9	2.4	-	58.9

1) Totals calculated before rounding.

Demand from developing countries shows the most dramatic increase. In year 2000, consumption has nearly doubled compared to 1984. With an income elasticity of unity and a very low price response, this result is not surprising given that a 4.5 per cent annual growth rate doubles the level of GDP by 2000.

Non-OPEC supply peaks at 25.1 mbd in 1985, then slowly declines to 20.8 mbd in 1992 before starting to increase again to nearly 30 mbd at the end of the period as a response to higher real oil price in the 1990's. Supply from OPEC increases steadily from the 1985 low level to the early 1990's, when production supercede 30 mbd. Later, production falls off to less than 28 mbd in year 2000 when non-OPEC supply increases as a result of the higher real crude oil price in the 1990's.

In the low price scenario the real crude oil price slides down to \$12.5 per barrel and competes effectively against other sources of energy.

By the end of the 1980's OPEC's market power is again very strong. Table 2.4 shows the change in demand and supply in the low price scenario compared with the high price scenario. Production from OPEC has increased 5 mbd around 1990 to a level that means a huge increase in OPEC's production capacity from today's level. The production increase has been possible because of an increase in demand and a reduction in supply from non-OPEC.

As mentioned before the OPEC strategy in the low price scenario is to defend market shares and to preserve a market for oil in the future, but by the end of the 1980's demand is so high that OPEC has to adjust prices.

Table 2.4. Change in demand and supply of crude oil in the low price scenario from the high price scenario. (mbd).

	Demand			Supply			Net supply from CPE
	USA	Rest of OECD	LDC	Total ¹⁾	OPEC	non-OPEC	
1984	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0
1986	0.3	0.6	0.1	1.0	1.6	-0.5	0
1987	0.7	0.9	0.2	1.8	3.0	-1.2	0
1988	0.8	1.0	0.3	2.2	3.7	-1.5	0
1989	1.3	1.2	0.5	3.0	4.9	-2.0	0
1990	1.7	1.1	0.4	3.2	5.4	-2.2	0
1991	1.6	1.0	0.3	3.0	5.3	-2.3	0
1992	1.5	1.0	0.3	2.8	5.1	-2.3	0
1993	1.4	0.9	0.2	2.6	4.9	-2.4	0
1994	1.2	1.0	0.3	2.5	5.0	-2.5	0
1995	1.2	1.2	0.3	2.6	5.2	-2.6	0
1996	1.2	1.3	0.3	2.9	5.8	-2.9	0
1997	1.3	1.4	0.4	3.1	6.3	-3.2	0
1998	1.4	1.4	0.4	3.2	6.6	-3.4	0
1999	1.4	1.4	0.4	3.2	6.8	-3.6	0
2000	1.4	1.4	0.4	3.2	6.9	-3.6	0

1) Totals calculated before rounding.

From 1989 to 1991 the real crude oil price increases by 84 per cent. Thus, in this scenario a third oil price shock is embedded. But it is important to notice that the oil price will stay below the high price scenario for the whole period and the OPEC production is increased nearly 7 mbd by the end of the century compared with the high price scenario. The real crude oil price is \$6.5 per barrel lower in the low price scenario than in the high price scenario in 2000.

Our high price scenario of future crude oil prices is in the higher range of what today seems to be a consensus forecast. One possible explana-

tion can be that central parameters are wrongly assessed in our model, i.e. price elasticities are too low and/or income elasticities too high etc.

Demand functions are estimated on data from 1970 to 1982. During the major part of that period, the crude oil price was far below the level of today. The point here is that the price on products in one or several markets may have passed a threshold level compared to prices on coal, natural gas or nuclear energy. This effect, if real, may not have been captured in estimated elasticities. The income elasticities in the demand functions also imply a strong functional relationship between economic growth and oil consumption. Some are arguing that a decoupling of economic growth and oil consumption have taken place. Table 2.5 shows estimated price and income elasticities used in the price scenarios.

Table 2.5. Estimated price and income elasticities.

	USA	Rest OECD	LDC
Direct price elasticity			
first year	-0.25	-0.50	-0.15
second year	-0.25	-0.25	-0.05
long term elasticity, (after 5 years)	-0.94	-0.91	-0.25
Cross price elasticity with respect to alternative energy			
first year	0.04	0.08	0.08
second year	0.10	0.40	0.20
long term elasticity, (after 5 years)	0.20	0.58	0.39
Income elasticity	0.70	0.80	1.00

In spite of all uncertainties we judge the high price scenario to be our best guess of future crude oil prices given one very important precondition: the OPEC countries being able and willing to act as a swing producer and keep control over the market.

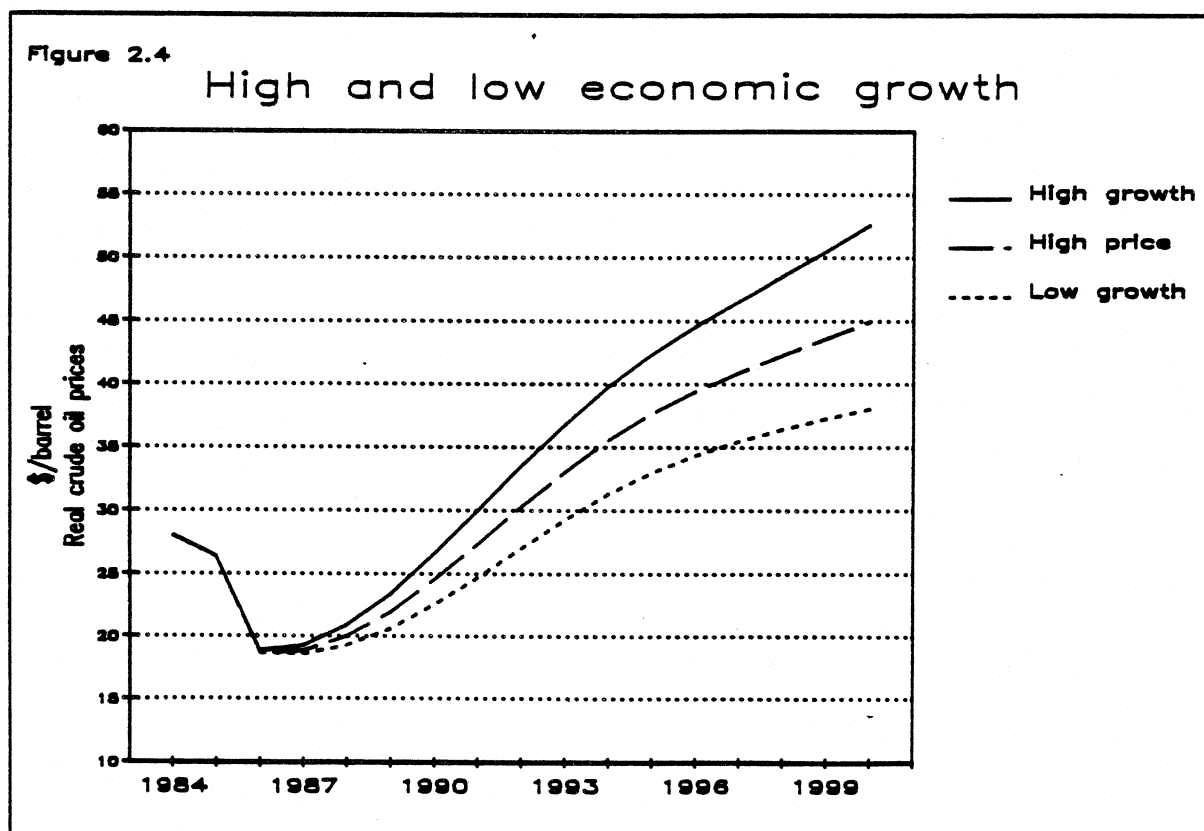
2.3. Sensitivity analysis

In this section, we highlight the sensitivity of our price scenarios to changes in critical parameters such as GDP-growth, net crude import from the CPE area, the dollar exchange rate and the possibility of discovering a huge new oil province somewhere in the world.

2.3.1. GDP growth rates

We now study the impact of higher or lower GDP growth than what was specified in the high price scenario. GDP growth rates have to be given exogenously to the WOM-model. In the low economic growth case, we assume that the GDP growth rate in OECD is only 2 per cent per year as compared to 3 per cent in the rest of the world. In the high economic growth scenario, growth rates are 4 and 6 per cent in OECD and LDC's, respectively. The GDP growth rate in 1985 is the same in all scenarios. Resulting crude oil price trajectories are shown in figure 2.4.

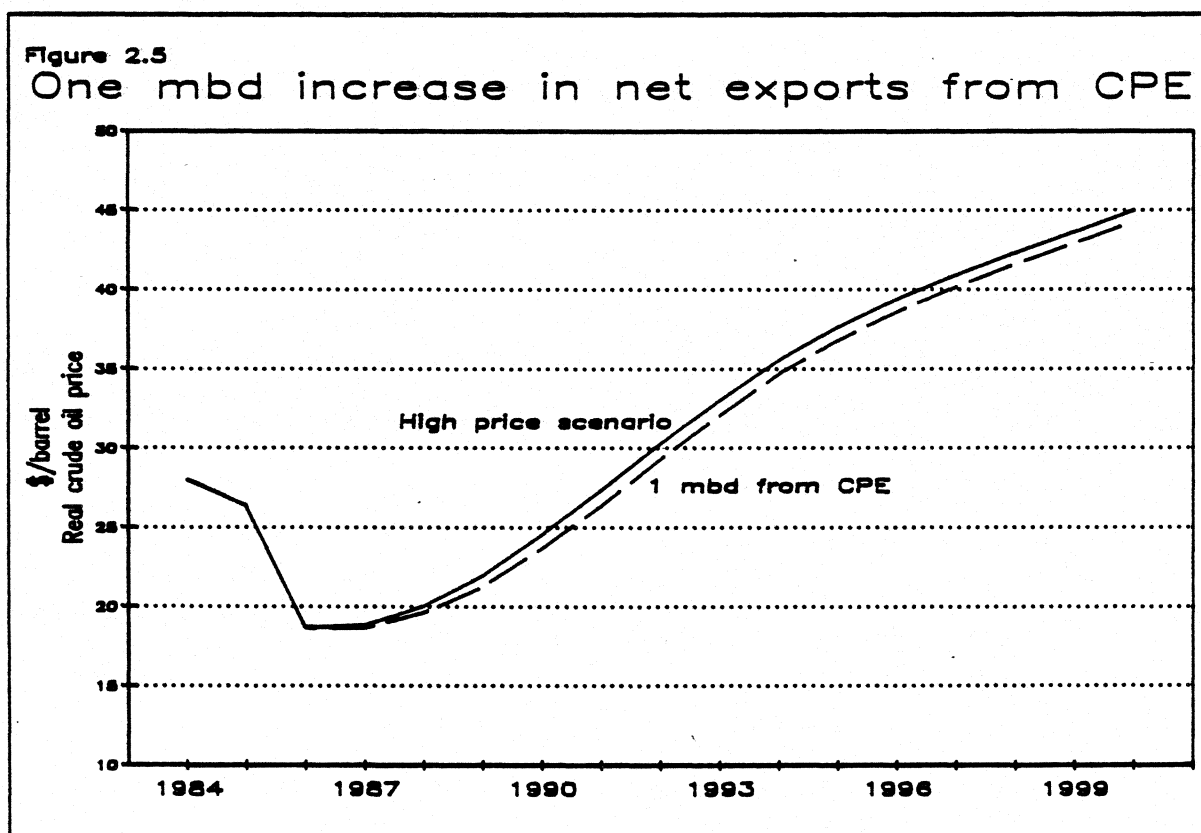
The figure shows that the price trajectory is significantly shifted by a change in the GDP growth rate. In year 2000, low economic growth results in a real crude oil price 15 per cent lower than in the reference scenario, whereas high economic growth will give a 17 per cent higher price. In 1993, which is the time horizon of the macroeconomic part of this study, the difference is approximately 12 per cent up or down (\$3.50-4.00 per barrel).



2.3.2. Net exports from the centrally planned economies

In this scenario we increase net exports from the centrally planned economies gradually by 0.25 mbd per year in four years from 1986 to 1989. The net export from the CPE's is then 1 mbd higher after 1989 compared to the reference scenario. The resulting real crude oil price trajectory is shown in figure 2.5 (or later in table 2.7).

As figure 2.5. shows, there is a very modest reaction in real crude oil prices. In 1989 when the increase in CPE's net export is completed, the oil price is only 50 cents lower than in the reference scenario. In the beginning of the 1990's, the difference increases to about one dollar, and by the end of the century the difference is again reduced to 50 cents.



2.3.3. The US dollar exchange rate

Contrary to the reference scenario where the dollar was assumed to be depreciated by 14 per cent against other OECD-currencies, we now assume exchange rates to stay constant at their 1985-levels. The obvious effect of this is that prices measured in national currencies of crude oil delivered to the refinery sector, will follow the dollar price, not drop by 14 and 10 per cent in the OECD outside US and in LDC's, respectively. Higher prices leads to lower demand, hence crude oil prices are reduced measured in US dollars.

In 2000, the dollar price would in this scenario be \$1,5 per barrel lower than in the high price scenario as shown in figure 2.6. Demand in the US will of course increase. Changes in demand are shown in table 2.6.

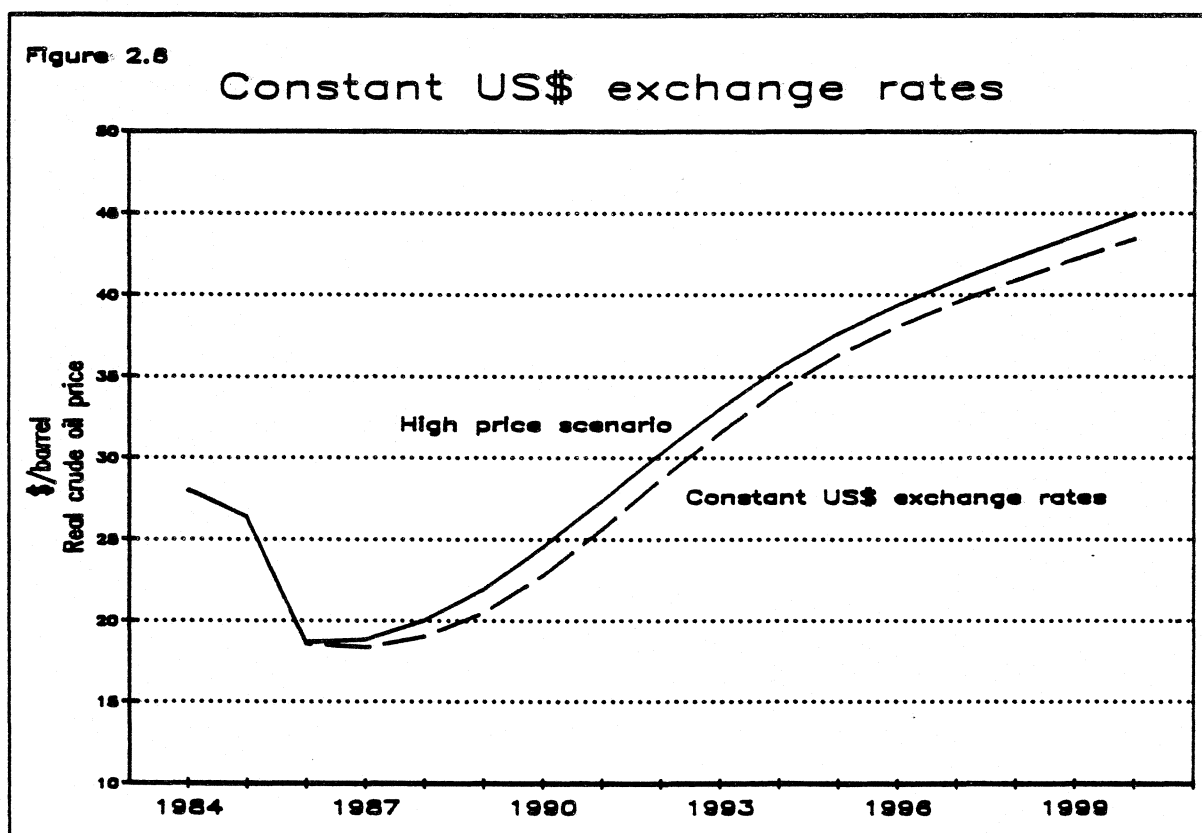


Table 2.6. Change in demand when exchange rates are constant at the 1985 level.

	Change in demand (mbd)			
	USA	rest OECD	LDC	Total ¹⁾
1984	0	0	0	0
1985	0	0	0	0
1986	0	-0.5	0	-0.6
1987	0.1	-1.2	-0.1	-1.2
1988	0.1	-1.4	-0.1	-1.4
1989	0.2	-1.5	-0.1	-1.4
1990	0.4	-1.4	-0.1	-1.1
1991	0.4	-1.1	-0.1	-0.8
1992	0.4	-1.0	-0.1	-0.7
1993	0.4	-1.1	-0.1	-0.8
1994	0.4	-1.1	-0.2	-0.9
1995	0.3	-1.2	-0.2	-1.1
1996	0.3	-1.3	-0.2	-1.2
1997	0.3	-1.3	-0.2	-1.3
1998	0.3	-1.4	-0.3	-1.3
1999	0.3	-1.4	-0.3	-1.4
2000	0.3	-1.4	-0.3	-1.4

1) Deviations are due to before rounding.

2.3.4. Discovery of a significant crude oil province

Our projection of supply of crude oil from market economies outside OPEC is in the long run very much determined by our estimate of the remaining undiscovered resource base. Estimates of the resource base are obviously subject to great uncertainty. To illustrate the consequence of this uncertainty on the price, we study the consequences of discovery of a huge new oil province.

According to BP (1986), Norway and United Kingdom at the end of 1985 had 24 billion barrels of proven reserves. This is approximately 15 per cent of proven reserves outside OPEC and the centrally planned economies. To simulate a huge new oil province, we increased the resource base from 1986 to 1989 with the equivalent of the North Sea.

In year 2000, the real crude oil price will then be \$41.50 per barrel, a reduction of \$3.50 per barrel from the high price scenario. The increase in supply from the market economics is 2.5 mbd in year 2000.

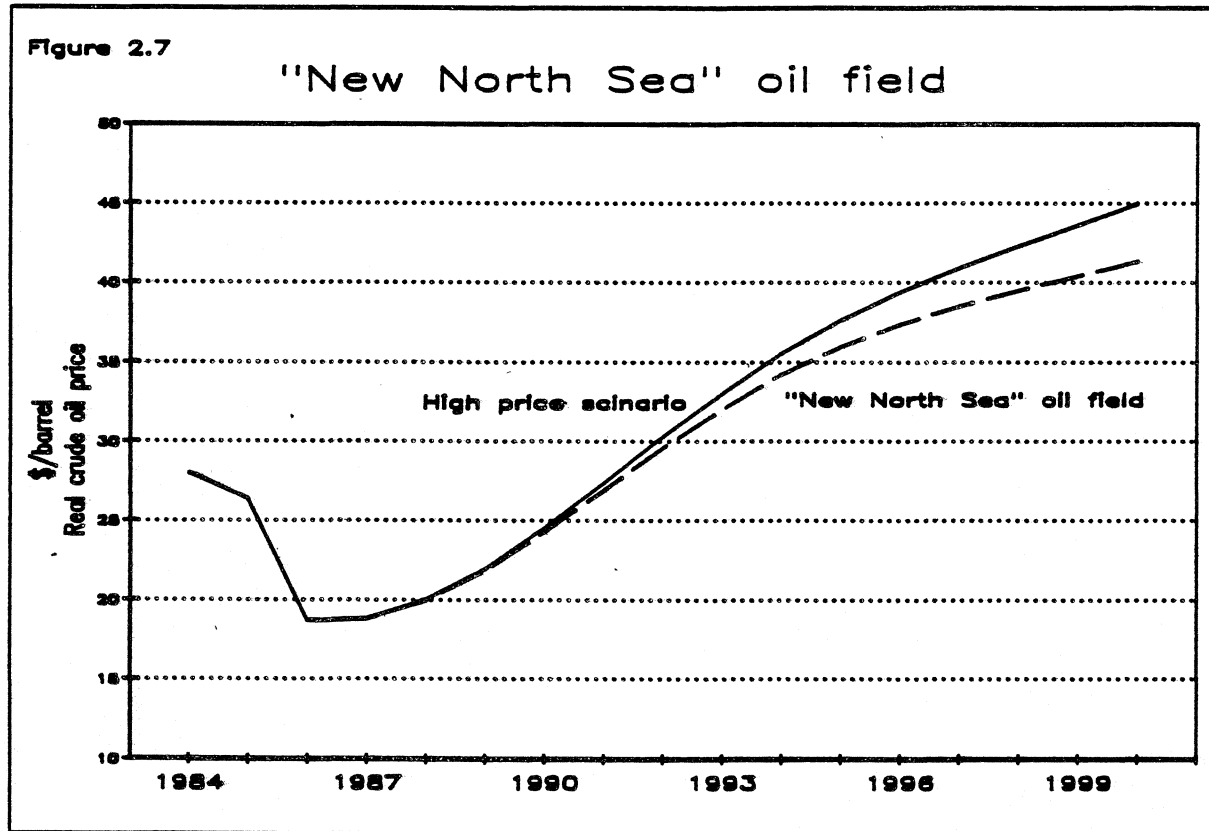


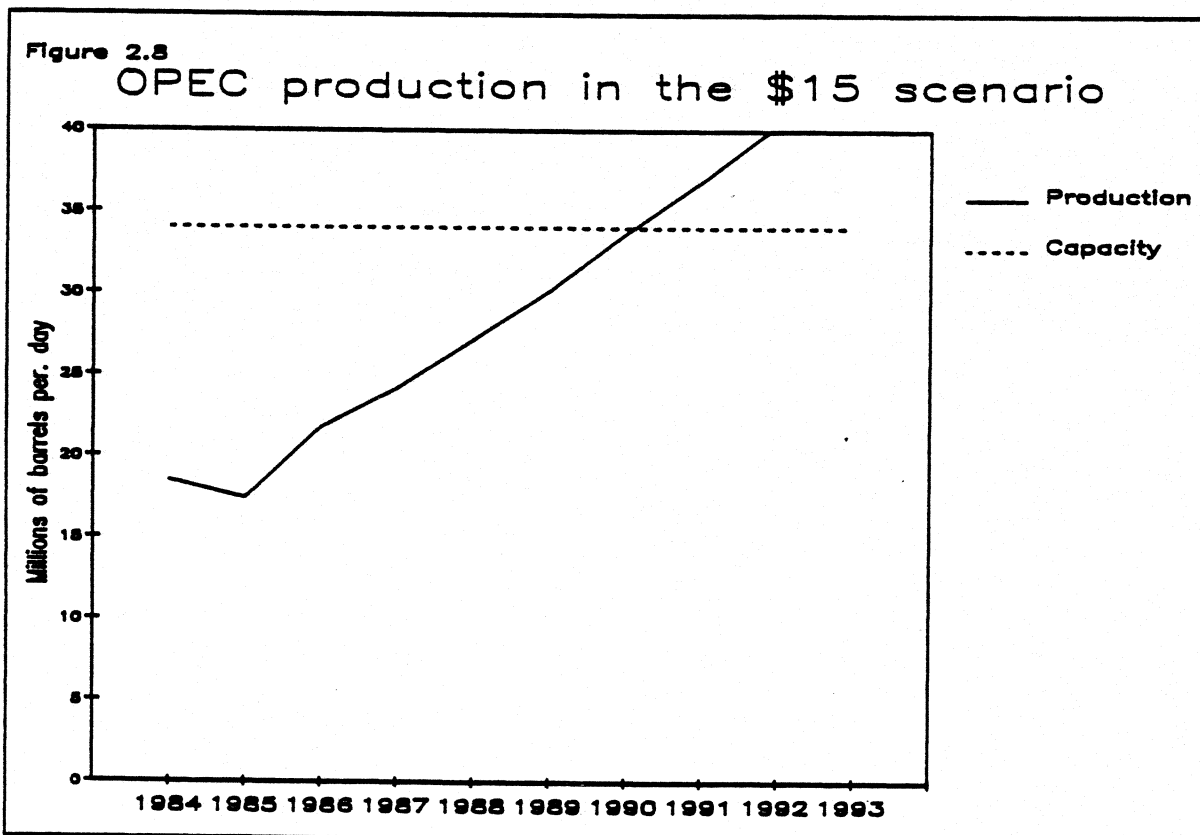
Table 2.7. The crude oil price sensitivity scenarios, 1984-dollar per barrel.

	High price	Low growth	High growth	CPE	US\$ rate	Oil province
1984	28.0	28.0	28.0	28.0	28.0	28.0
1985	26.5	26.5	26.5	26.5	26.5	26.5
1986	18.5	18.5	19.0	18.5	18.5	18.5
1987	19.0	18.5	19.5	18.5	18.5	19.0
1988	20.0	19.5	21.0	19.5	19.0	20.0
1989	22.0	20.5	23.5	21.5	20.5	22.0
1990	24.5	22.5	26.5	23.5	23.0	24.5
1991	27.5	24.5	30.0	26.5	25.5	27.0
1992	30.5	27.0	33.5	29.5	28.5	29.5
1993	33.0	29.5	37.0	32.0	31.5	32.0
1994	35.5	31.5	40.0	34.5	34.0	34.5
1995	37.5	33.0	42.5	37.0	36.5	36.0
1996	39.5	34.5	44.5	38.5	38.0	37.5
1997	41.0	35.5	46.5	40.0	39.5	38.5
1998	42.5	36.5	48.5	41.5	41.0	39.5
1999	43.5	37.5	50.5	43.0	42.0	40.5
2000	45.0	38.0	52.5	44.5	44.5	41.5

2.4. More on OPEC

In this section we elaborate on the consequences of different OPEC behaviour. In the first scenario we study the consequences of an OPEC decision to keep the oil price at \$15 per barrel. This scenario presumes that in OPEC's perception, this is the price reduction necessary to stabilize the market in the short run and secure high demand growth and market for their large crude oil reserves in the future. Saudi-Arabia is the country which has most to gain from such a strategy and which is most likely to consider such a policy.

At a real price of 15\$ per barrel, oil competes effectively with most other energy carriers. In addition, this price will considerably reduce supply from other producers. This scenario is called the "\$15 scenario". The low price stimulates demand very much and gives room for an increased OPEC production. Figure 2.8 shows the production from OPEC that is necessary to keep balance between supply and demand in the oil market. The figure shows a large increase in OPEC's production and after a few years



the production will exceed any possible capacity for OPEC. Thus, this is a very unlikely scenario and is by no means feasible in our model.

In the next scenario it is assumed that what we observe in the oil market today is the end of OPEC: the crack down scenario. In the crack down scenario, OPEC breaks up entirely in 1986. OPEC production increases to above 27 mbd from the third quarter. In 1987 we assume that OPEC production rises further to 34 mbd and this level is held through year 2000. Table 2.8. shows production quotas, production and production capacity in 1985 by country.

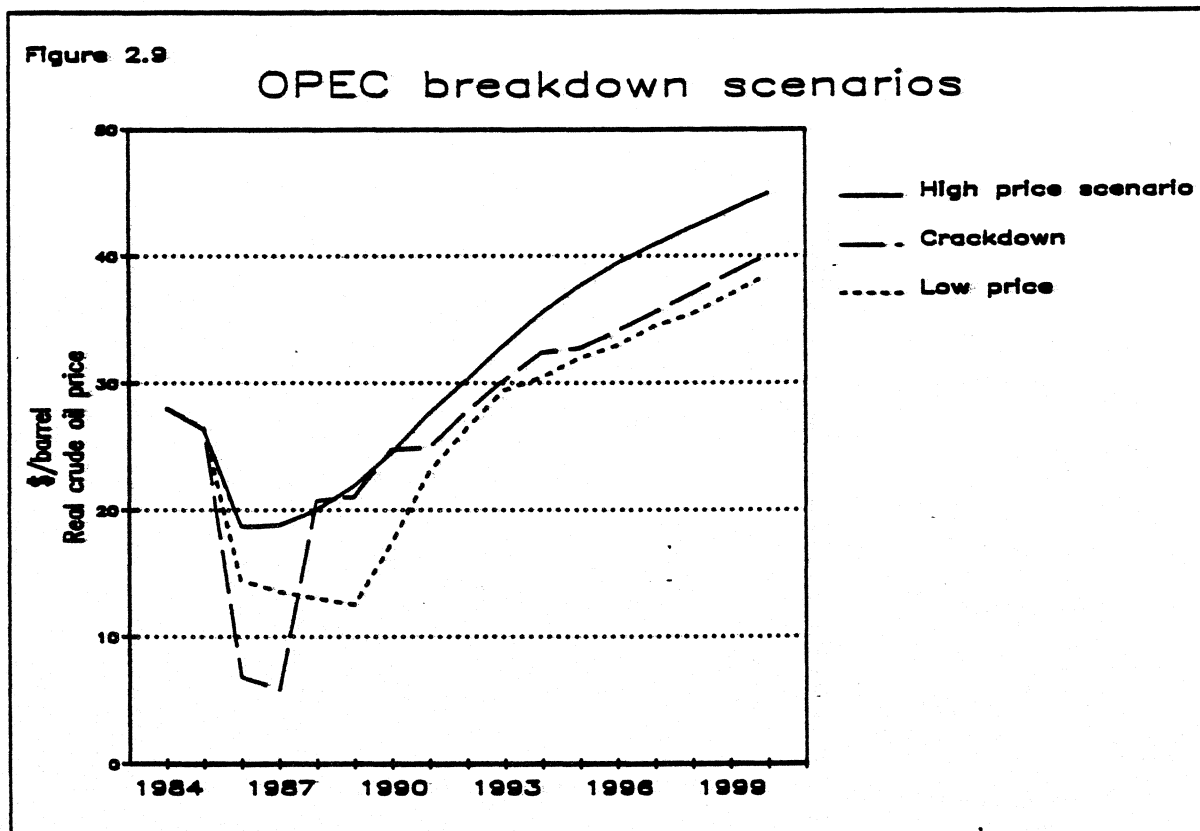
Table 2.8. OPEC production quotas, production and capacity in 1985. (mbd).

	Quota ¹⁾	Production ²⁾	Capacity ²⁾
Saudi Arabia	4.353	3.388	8.800
Iran	2.300	2.192	3.000
Iraq	1.200	1.433	1.900
Kuwait	0.900	1.024	2.300
UAE	0.950	1.203	2.300
Qatar	0.280	0.306	0.500
Venezuela	1.555	1.670	2.500
Nigeria	1.300	1.472	1.800
Libya	0.990	1.056	1.500
Indonesia	1.189	1.256	1.700
Algeria	0.663	0.631	0.800
Gabon	0.137	0.153	0.200
Ecuador	0.183	0.277	0.300
OPEC-total	16.000	16.063	27.425

Sources: 1) Oil and Gas Journal. (1985).

2) PIW, (1986). Capacity is defined as maximum production sustainable for several months without regard to government ceilings.

In figure 2.9. the real crude oil price in the crack down scenario is shown together with the high and low price scenarios. The figure shows prices falling through the floor, to about 5\$ per barrel in 1986 and 1987 in the OPEC crack down scenario. Then the price surges back to the range of the high price scenario within 2-3 years because of the enormous pull demand gets from the low price. In 1986 total demand will be more than 6 mbd higher than in the high price scenario. The price increase in 1988 which gets the oil price back in the range of the high price scenario curtails much of the increase in demand and in the second half of the 1990's demand is approximately 2 mbd above the high price scenario. Production outside OPEC is reduced by approximately 3 mbd compared with the high price scenario.



2.5. Ad valorem tax on petroleum products

Several consequences of a considerable fall in the price of oil might not be all that desirable to importing countries. If one expects that the low price will last only for a few years, one would not want to reverse the process of investing in more energy effective equipment or start to substitute back to fuel oil from other energy sources despite a favorable relative price. On the contrary, one would probably want investors to make decisions in accordance with what is believed to be long term trends in the energy market.

To reduce dependence of imported crude oil, a number of countries have adopted policies aimed at stimulating production from domestic sources of energy and to some extent protect these industries from international competition. This is notably in FRG, UK and France with regards to coal. Furthermore, in most European countries nuclear power is protected some way or another. In US, an important effect of lower prices on oil would be a

reduction in domestic production, as this production to a large extent is marginal. A reduction in crude oil production would in addition create considerable trouble in the financial community. A number of banks are deeply involved in financing crude oil exploration and development on behalf of small independent companies likely to go bankrupt in this environment.

Other arguments on behalf of the OECD countries against strongly downwards fluctuations in domestic prices could be added. Of course other, and possibly stronger arguments, in favor of lower prices could be made. Of greatest importance is probably the gigantic income transfers from OPEC to OECD and an improvement in balance of payments. These advantages could of course be gained even if prices to domestic costumers did not change.

To illustrate consequences for the crude oil market of the oil consuming countries introducing ad valorem taxes on petroleum products in such a way as to ensure product prices to domestic consumers to stay constant despite the fall in the crude oil price on the world market is studied. When the crude oil price begin to rise again, the tax rate is held constant. In table 2.9. the increase in the tax rates above the 1984 level are shown.

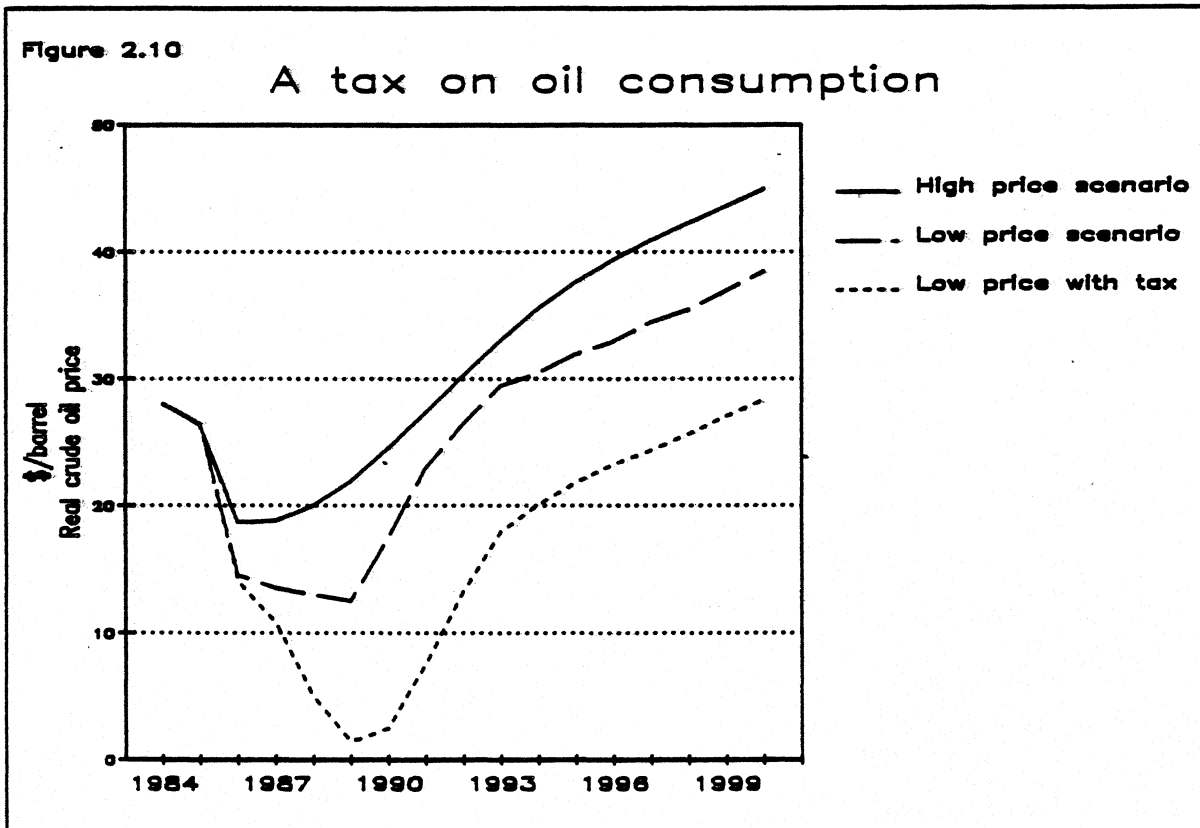
Table 2.9. Ad valorem tax on petroleum products, per cent above the 1984 level.

	USA	Rest OECD	LDC
1985	2.9	0.5	1.3
1986	20.0	21.7	18.3
1987	41.8	40.8	36.2
1988-2000	50.0	50.0	50.0

Figure 2.10. shows the real crude oil price in the tax scenario. The crude oil price in this scenario stays low for a very long time. This is a very important difference from other scenarios presented earlier in this study where the oil price collapses. In the low price scenario and the crack down scenario, prices will jump back to the high price trajectory in a few years. In the \$15 scenario, OPEC production reaches impossible levels after a few years.

In the low price scenario OPEC's strategy is to increase its market shares. That could be obtained partly be increased demand and partly by reduced supply from other producers. When a tax is levied on oil products, a reduction in the crude oil price will not increase demand because the product price is held constant, and consumption increases only slowly

because of GDP growth. The only way to increase OPEC's market share is then a reduction in non-OPEC production. This production adjusts very slowly and OPEC's struggle for market shares will go on for a long time. This explains the depth of the crude oil price slide.



2.6. A low price on crude in the long run - is it possible

As mentioned in connection with our high price scenario, our projections of future crude oil prices are probably in the higher range of what seems to be a consensus forecast, in particular if you look at the very steep increases projected in the 1990's. Even in the low price and the OPEC crack down scenario, prices increase very rapidly after a few years and stabilize somewhere relatively close to the high price scenario in the second half of the 1990's.

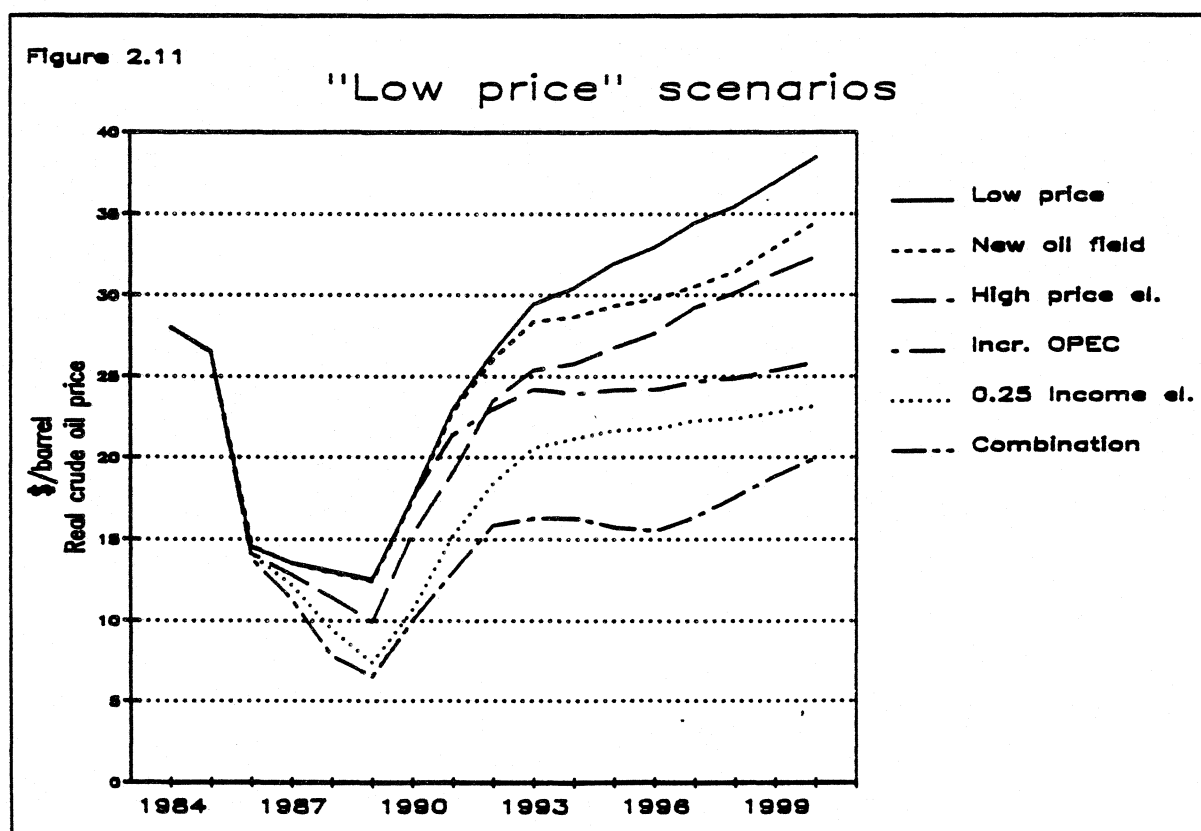
In the oil industry, some people seem to argue that the crude oil price could stay constant at a price lower than what prevail today over several decades. Arguments supporting this view are decoupling of demand

for crude oil and economic growth, fierce competition between crude oil and other sources of energy (something close to a backstop technology in some end-uses) or discoveries of significant new hydrocarbon provinces.

To assess the probability of each of these events to come true is difficult. In the following, they are specified in such a way that by our judgement they are outliers if looked at separately, but not altogether unlikely.

The following parameters have been changed:

- * Decoupling of crude oil demand and economic growth: income elasticities are set at 0.25
- * Fierce competition from other sources of energy: the price elasticity equal to -2.0 in the long run in the OECD area and -1.0 in the LDC's.
- * An optimistic resource base assumption: In the area outside OPEC and the centrally planned economies, one new crude oil province with the size of North Sea is discovered from 1986 to 1989. In addition, net exports from CPE's increase gradually by 2 mbd above today's level.
- * OPEC production capacity increases gradually from 1991 to 2000 by 15 mbd.



In all other respects, these scenarios are similar to the low price scenario. Figure 2.11 shows the price paths calculated when the above mentioned exogenous variables are varied one by one. The range of possible price trajectories widen considerably compared to the earlier presented sensitivity analysis. Prices down to \$23 per barrel (1984-dollar) in 2000 now become feasible.

The next question obviously is: Now, if each of these parameter changes are possible, what is the probability of a combination. We are not able to answer this question in an accurate way. A priori, we see no reason to believe that one or the other outcome is correlated in one way or another. Thus, if they are judged possible but rather unlikely one by one, a world combining high price elasticities, decoupling of demand, an increase in OPEC capacity and an optimistic view of the resource base seem highly unlikely. Still, the possibility cannot be ruled out. In figure 2.11 this combination is labelled the combination scenario. In this world, the real price of crude oil is falling to 1989, and then gradually increases to \$20 per barrel by 2000.

This leads us to conclude that a price on crude oil permanently at or below \$20 per barrel in constant terms is not viable in the long run. A slump in real prices is likely to come over the next 5-8 years, the depth of the price slide and the length of the period being uncertain. Despite this, by 1995 the real price of oil is most likely to be at or above the level that has prevailed in recent years. How high prices are likely to increase above today's level probably depends to a high degree on competition from other fuels, the development and costs of "backstop technologies" and the overall OPEC production capacity developed.

In the short run, as response to short term shocks in the market, prices could possibly fall through the floor as shown in the OPEC crack down scenario. Despite these possibilities, such prices are not viable or sustainable in the medium or long term.

3. INTERNATIONAL MACROECONOMIC REPERCUSSIONS

3.1 Introduction

In this chapter the effects on the world economy of a reduction in the price of oil is discussed in more detail. A number of studies have been devoted to this issue, and we will comment on some of them later. We have, however, had the opportunity to make our own simulation experiments on a global model system, the LINK model. In section 3.2 we start with a brief description of the LINK system. We review the most important macroeconomic effects of a fall in the oil price and present results from the LINK simulations. In section 3.3 we report results from a few other studies in order to see if there consists a consensus view.

3.2. The LINK model system¹⁾

Project LINK is an international macroeconomic model system headed by professor Lawrence R. Klein. A documentation is found in Waelbroeck (1976). The aim of the project is to make consistent predictions of the world economy. The way to accomplish this is to run models for different countries simultaneously, and at the same time ensuring that exports and imports of goods for every single country add up on a world basis. The system takes explicitly account of the fact that a change in imports for one country implies a change in exports for other countries and vice versa. The linking of the national models is achieved by a trade matrix distributing world trade of goods among different countries. In principle all countries in the world are represented in the model system. About 70 countries, including Norway, have their own country models, while the rest is included in area models.

1) The authors wish to thank Christian E. Petersen, Project LINK, who helped out with the simulations on the LINK-system.

3.2.1. The world economy in the reference scenario

The first step in the LINK computations employed in the present study is to generate an economic development based on high oil prices, which may then be used to analyse the effects of lower oil prices. Our high price path is to a considerable extent determined by our oil price assumptions, as described in chapter 2, in addition of course, by a number of macroeconomic assumptions and economic policy responses on national level. In this way we obtain predictions of the world economy that are consistent with our assumptions regarding the oil price. Currently, the LINK-system is capable of making predictions through 1990.

Table 3.1 show the results for GDP in constant prices both for world total and for some main areas in the high price scenario. According to the simulation results, projected GDP growth will rise from 2.9 per cent in 1985 to 3.7 per cent in 1987. This increase is partly explained by the

Table 3.1. World Gross National Product (1970 U.S.\$).

	1985	1986	1987	1988	1989	1990	Mean
	*** Growth Rates ***						
Industrialized countries .	2.6	2.6	3.5	3.3	3.2	2.5	3.0
North America	2.4	2.6	4.0	3.7	3.4	2.4	3.1
Developed East	4.3	3.5	3.5	3.3	3.2	3.1	3.5
EEC	2.2	2.0	2.5	2.5	2.7	2.5	2.4
Rest of industrialized .	2.3	2.4	2.8	2.9	3.1	2.9	2.7
Developing countries	4.1	4.6	5.2	5.1	4.6	4.8	4.7
OPEC	2.0	4.1	5.0	3.9	4.3	2.7	3.7
Africa	2.9	2.7	3.0	2.9	3.0	3.1	2.9
Asia incl. China	5.7	5.5	5.7	5.7	5.5	5.6	5.6
Middle East non-oil	3.7	5.1	6.5	4.7	4.4	4.5	4.8
Western Hemisphere	2.5	3.5	4.6	4.8	3.6	4.3	3.9
C.P.E excl. China	2.9	3.1	3.2	3.0	3.2	3.1	3.1
World total	2.9	3.1	3.7	3.6	3.5	3.1	3.3

projected fall in the oil price. From 1988 on the growth rate starts to decrease and approaches 3 per cent towards the end of the period. When we look at subgroups of countries, our calculations indicate that developing countries will experience a somewhat stronger growth and industrialized countries a somewhat slower growth than the average. Among developing countries, Asia (incl. China) in particular show high growth rates, while Africa is predicted to exhibit rather sluggish growth. Fastest growth among industrialized countries is expected in the newly industrialised countries,

NIC's, while EEC will experience a rather low growth. We note that OPEC is predicted to show growth rates near the average when we look at the entire period.

Table 3.2. World trade balances (f.o.b).

	1985	1986	1987	1988	1989	1990
	*** Billions of U.S.\$ ***					
Industrialized countries .	-44.94	-45.11	-19.36	-13.41	-7.11	-18.3
North America	-99.82	-108.34	-94.45	-84.08	-66.38	-49.10
Developed East	49.75	58.86	67.46	73.03	68.63	62.04
EEC	9.27	6.44	8.85	-0.18	-8.43	-31.23
Rest of industrialized .	0.05	1.95	2.62	1.84	3.24	4.85
Developing countries	38.96	24.26	11.26	6.54	6.61	22.18
OPEC	38.51	26.35	17.06	16.91	17.05	39.54
Africa	-3.68	-4.43	-5.29	-6.03	-6.83	-7.61
Asia incl. China	-1.19	-3.46	-5.79	-9.06	-9.43	-14.08
Middle East non-oil	-16.28	-16.79	-17.81	-18.98	-20.28	-21.72
Western Hemisphere	21.60	22.57	23.09	23.70	26.11	26.04
C.P.E excl. China	10.96	6.70	4.60	7.04	6.20	13.11

Trade balances of different regions are shown in table 3.2. Industrialized countries are predicted to maintain a deficit throughout the entire period, which, however, will decrease in current dollars from 1986 and onwards. On the other side developing countries (including OPEC) will all together enjoy a surplus throughout the entire period. The size of the surplus, however, will decrease significantly until 1990, when it is projected to show a steep rise due, among other things, to the rise in the oil price. If we look at more disaggregated groups of countries, we find significant differences. Among the industrialized countries, North America is responsible for the major part of the huge trade balance deficit. The import surplus of North America will, however, show a steep decline from 1986 on, measured in current dollars. This development is entirely due to developments in the US, which in our high price path will experience a reduction in the import surplus of about 30 per cent from 1985 to 1990. The EEC is predicted to move into a deficit position in 1988, and show a continuous deterioration in their trade balance from then on. Among developing countries we note that OPEC will enjoy a substantial surplus in their trade balance in our high price scenario.

3.2.2 Impacts on the world economy of lower oil prices

Having rambled through the development of the world economy in our high price path, we now turn to the low price scenario. For convenience we repeat our oil price assumptions from chapter two:

	1985	1986	1987	1988	1989	1990
	*** PRICE/BARREL***					
High price path U.S.\$	27.5	20.0	21.0	23.0	26.0	30.5
Low price path U.S.\$	27.5	15.5	15.0	15.0	15.0	22.0
Pct. deviation	0	22.5	28.5	34.8	42.3	27.9

At this point we will again emphasize that our analysis shows that the oil price plummet is a temporary one. This is particularly important in connection with assessing possible policy reactions to the fall in the oil price. This is a very complex question. Recent history gives little guidance on this issue, as policy reactions in connection with the two oil price hikes in the 1970's were vastly different. Furthermore, policy reactions to a price plummet are not necessarily symmetrical to those of a price rise. Due to this great uncertainty we have chosen not to include any policy reactions in the LINK simulations reported below. Another reason for this is that assessment of policy reactions in the LINK system, with its huge number of country models and policy variables, is a most demanding task. This is even more so because the simultaneity of the model system implies that effects of a given set of policy reactions are very difficult to predict beforehand. An iterative procedure, implying repeated simulations, may thus be necessary. All in all, the LINK simulations of a low price scenario reported in section 3.2.3 highlight partial effects of a lower oil price. In section 3.3 we comment on a number of analysis concerning the effects of policy reactions to a plummet in the oil prices. Finally, in section 3.4, we sum up the different results reported and decide upon what "multipliers" of lower oil prices to use for the world economy in chapter 4.

The impacts on the world economy of a decrease in the price of oil work through a number of channels. For one, we have a redistribution of income from oil-exporters to oil-importers. Given no change in the volume of traded oil, plummeting oil prices lead to a decrease in export revenues for

oil-exporting countries and a decrease in import outlays for oil-importing countries. The effect of this change in incomes resembles that of a change in direct taxes or transfers from the public to the private sector. GDP is not affected directly. However, to the extent that real private income and thus private demand is affected, so is GDP. A decrease in the price of oil lead to a downward shift in export and import prices; after a while these prices have worked their way through the system and inflation is also reduced. This is certainly so in our scenarios because the oil price decreases relative to the reference path for several years. In the case of a heavily traded good like crude oil, an additional effect of lower oil prices is caused by the trade linkages between national economies. In the case of oil-importing countries these linkages tend to reinforce the expansive effects of lower oil prices on the world economy, as increased real income and following increases in imports boosts exports revenues for the trading partners. However, oil-exporters face the opposite situation with lower export prices and lower real income. These countries will decrease import demand and generate a contractive effect on the rest of the world.

The simulation results from the LINK-system may be viewed as an attempt to assess the net effect of all the mechanisms described above. Of course there are a lot of uncertain elements in these calculations, hence results should be interpreted with great care. However, it is our view that the simulation results reported below give a useful indication of the impact of lower oil prices.

3.2.3. Simulation results

As already mentioned, the LINK simulations presented in this section concerns the impact of lower oil prices alone, no changes with regard to economic policy etc. are made. In table 3.3 we show results for GDP in constant prices. As expected, the simulation results indicate an expansive impact on world GDP of a decrease in oil prices. In 1986, the first year of lower oil price, GDP for world total increases by almost 0.5 per cent. In 1987 the increase is projected at about 0.7 per cent. The effect of lower oil prices rises throughout the entire period considered. Part of this GDP increase is caused by higher private consumption. Lower oil prices lead to lower import prices, which in turn decrease the private consumption deflators in all countries. Nominal incomes in the household sector are likely

to decrease to a less extent, both because of sticky nominal wages and because direct taxes are not fully indexed. Private consumption is also boosted by the wealth increase that follows a lower price level. Lower import prices also mean lower costs in the business sector. Although the producer prices will decrease somewhat, this is not enough to offset an increase in profits. This tends to increase business investments, even though rising real interest rates may partly offset this.

When looking at subgroups of countries, we find very significant differences among them with regard to effects on GDP. This is shown in table 3.3 and figure 3.1. From table 3.3 we see that in the first part of the period, industrialized countries enjoy the largest gain of lower oil prices. The developing countries show a somewhat weaker effect during the first years. However, towards 1990 the impact on real GDP is higher in developing countries than in industrialized countries. Ironically enough it is the OPEC-countries that experience the highest GDP-gain as a result of lower oil prices. This somewhat strange result is partly due to the fact that no contractive policy measures are undertaken in this scenario. The result then stems from the fact that demand for oil increases following

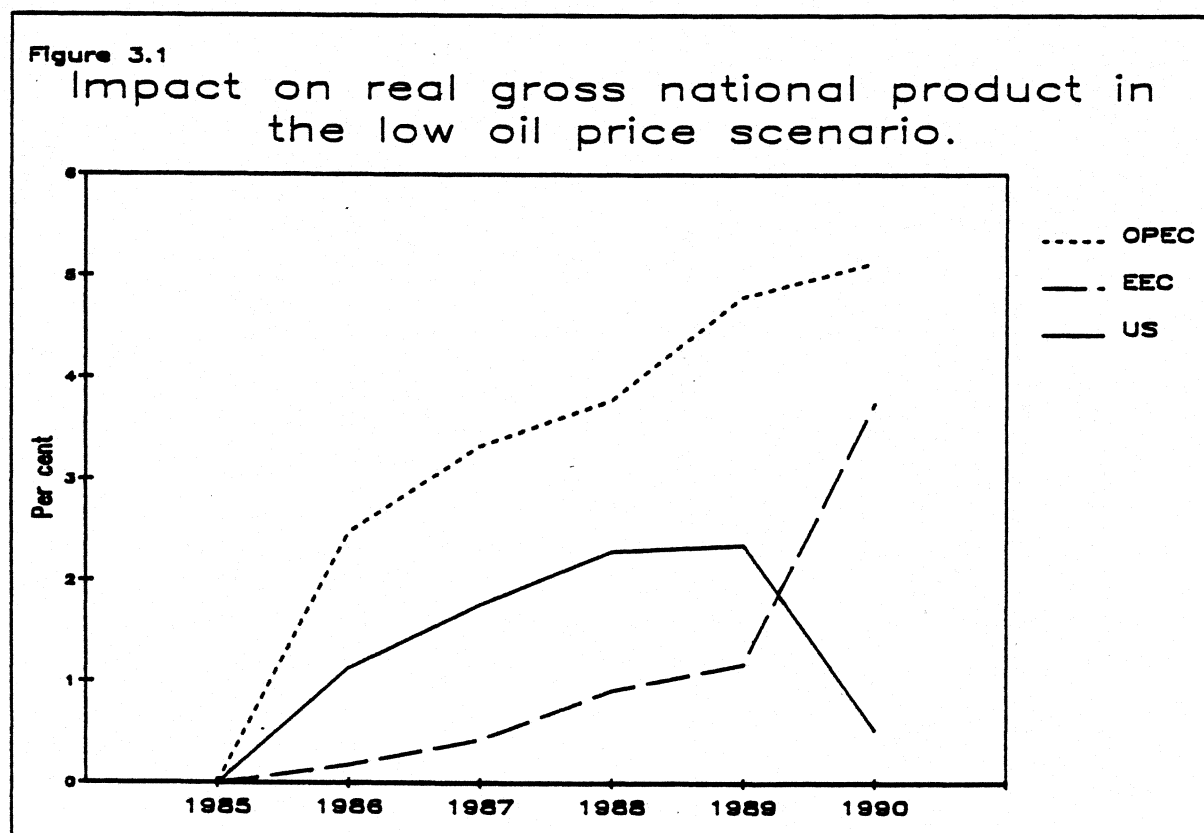


Table 3.3. Impact on real world gross national product in the low oil price scenario.

	1986	1987	1988	1989	1990
	*** Percentage deviations ***				
Industrialized countries .	0.59	0.97	1.46	1.62	2.09
North America	0.99	1.57	2.07	2.14	0.78
U.S.	1.14	1.77	2.30	2.36	0.52
Developed East	0.02	0.03	0.31	0.39	1.74
EEC	0.18	0.43	0.92	1.18	3.75
Rest of industrialized .	0.08	0.32	1.20	1.87	8.02
Developing countries	0.39	0.62	1.01	1.33	3.40
OPEC	2.49	3.33	3.79	4.80	5.14
Africa	0.12	0.06	0.33	0.44	3.40
Asia incl. China	0.04	0.17	0.56	0.81	3.40
Middle East non-oil	0.85	1.43	2.54	2.71	5.23
Western Hemisphere	0.28	0.42	0.73	0.98	2.53
C.P.E excl. China	0.04	0.08	0.12	0.15	0.35
World total	0.45	0.72	1.11	1.28	2.01

plummeting oil prices, hence exported volumes from oil exporting countries are increased. Private consumption also rises for similar reasons as in industrialized countries. The business sectors may experience a decline in profits and thus hold back on investment, but rising domestic activity may partly offset this.

Among industrialized countries, USA experiences the most positive effect on real GDP with an increase of 1.1 per cent in 1986. In the following years the effect reaches more than 2.3 per cent. In our low-price scenario the crude oil price jumps 7 dollars in 1990. From table 3.3 it follows that in this year, the US GDP-gain decreases dramatically. The EEC-countries gain very little from falling oil prices initially; GDP increases by only 0.2 per cent relative to the high oil price scenario in 1986. However, the effect gains strength in the following years and in 1990 GDP is projected to be 3.75 per cent higher than in the high oil price scenario.

Before concluding our discussion of the results in table 3.3, note that negative impacts on real GDP are almost non-existent. All areas will gain as regards real GDP following plummeting oil prices. This shows that the expansive effects in the oil importing countries more than offset possible contractive impacts on the oil exporters. This contraction is, however, almost non-existent in our low oil price scenario because we have

assumed no policy responses. Thus world activity and trade increases, creating higher GDP growth in the whole world. For some countries, however, the impact is negligible. This is e.g. the case for the centrally planned economies excluding China. These countries have relatively weak trade linkages with the rest of the world, and thus gain relatively little from the increased activity in the Western hemisphere.

In table 3.4 and 3.5 we report results for unemployment and inflation in the OECD-countries. The unemployment rate will be somewhat smaller relative to the high price path following lower oil prices. Most of this is due to developments in North America, where the average unemployment rate will decrease by as much as 2.5 percentage points at the most due to higher GDP-growth. As regards inflation, it will be significantly lower in the first years of the period. For OECD total the inflation rate decreases by 0.8 percentage points in 1986 and 0.4 percentage points in 1987. In Northern America the inflation rate catches new strength already from 1988 on, while for EEC it stays lower relative to the high oil price scenario for most of the period. This is also shown in figure 3.2.

Table 3.4. Impact on OECD unemployment rates in the low oil price scenario

		1986	1987	1988	1989	1990
		*** Per cent ***				
OECD	1)	9.1	8.9	8.6	8.4	8.4
	2)	8.9	8.6	7.9	7.4	6.7
North America	1)	7.6	6.9	6.3	6.0	6.1
	2)	7.2	6.0	4.7	4.3	3.5
Developed East	1)	3.4	3.7	3.7	3.7	3.8
	2)	3.4	3.7	3.7	3.7	3.8
EEC	1)	11.1	10.9	10.8	10.8	10.7
	2)	11.1	10.7	10.3	10.6	9.8
Rest of OECD	1)	16.2	16.7	16.5	16.4	16.2
	2)	16.0	16.5	16.3	15.9	14.5

Notes

1): Unemployment rate in the high oil price scenario

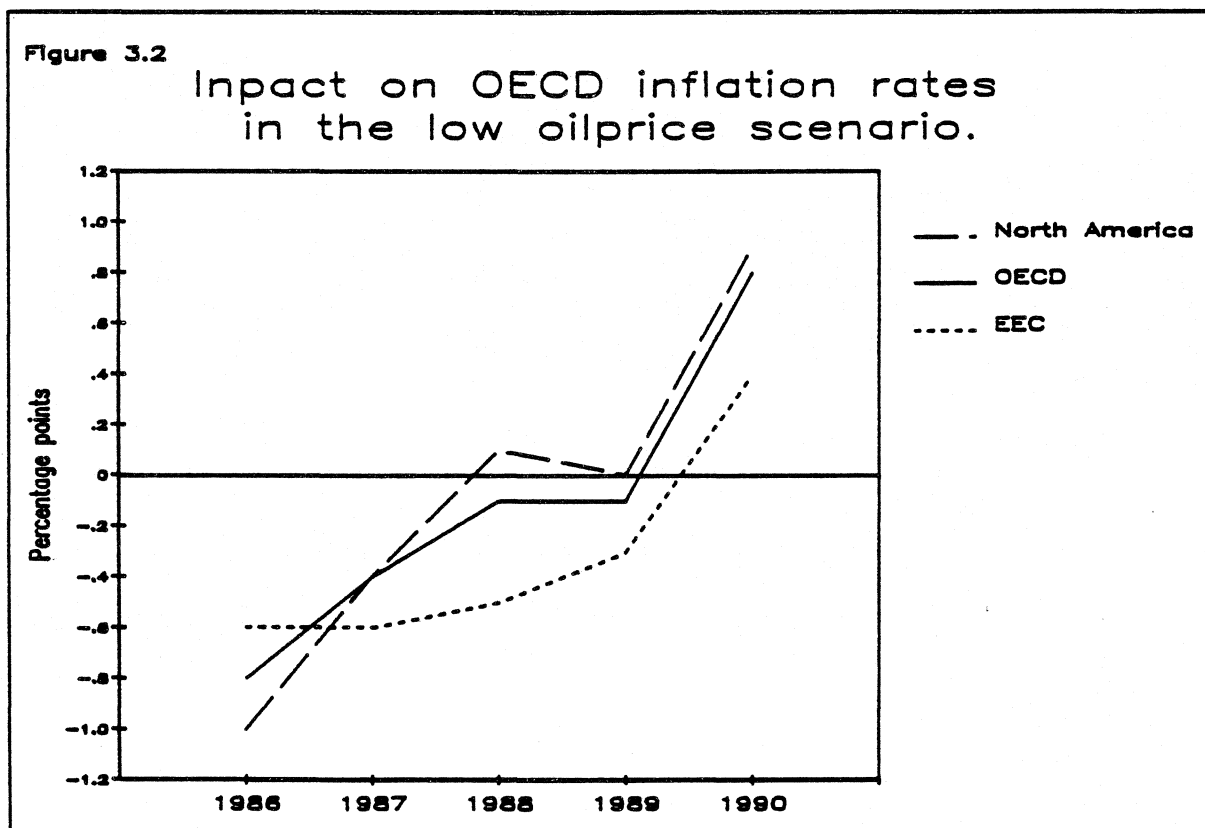
2): Unemployment rate in the low oil price scenario

Table 3.5. Impact on OECD inflation rates in the low oil price scenario.

		1986	1987	1988	1989	1990
		*** Percentage change ***				
OECD	1)	4.0	4.0	4.3	4.3	5.4
	2)	3.2	3.6	4.2	4.2	6.2
North America	1)	3.4	4.1	4.5	4.3	5.7
	2)	2.4	3.7	4.6	4.3	6.6
Developed East	1)	2.9	2.7	2.4	2.6	2.9
	2)	2.5	2.5	2.2	2.5	3.5
EEC	1)	4.1	3.2	3.7	3.9	4.6
	2)	3.5	2.6	3.2	3.6	5.0
Rest of OECD	1)	10.9	9.6	9.5	9.9	11.6
	2)	9.5	9.0	9.4	9.7	12.7

Notes

- 1): Inflation rate in the high oil price scenario
 2): Inflation rate in the low oil price scenario



We have seen above that the impact on real GDP of lower oil prices is positive for all areas. However, when looking at trade balances we find much larger differences. This is shown in table 3.6. As can be seen from the table, world export measured in current dollars is projected to decrease by 3 per cent relative to the high oil price scenario in 1986. This effect increases to 3.7 per cent in 1987, and reaches its highest in 1989 at 4.4 per cent. Export prices for world total is reduced somewhat more than nominal exports, so the impact on world exports in constant prices is projected to increase over the entire period. As regards the trade balance, this is severely weakened for the OPEC-countries. Lower oil prices lead to a decrease in the OPEC trade surplus of almost 20 billion US-dollars in 1986. In 1987 the reduction relative to the high price path surges to 27 billions and in 1989 to more than 50 billion dollars. Compared to comfortable trade surpluses in the reference path, the OPEC-countries will experience a trade deficit in the case of our low oil price scenario. The weakened trade balance for OPEC corresponds to a significant improvement for the industrialized countries. In the EEC, the projected improvement in the trade balance is almost 40 billion dollars at the peak in 1989. This is sufficient to avoid a trade deficit for EEC as a whole. For North America, the projected impact on the trade balance of lower oil prices is close to

Table 3.6. Impact on world trade balances (f.o.b) in the low oil price scenario.

	1986	1987	1988	1989	1990
	*** Billions of U.S.\$ ***				
Industrialized countries .	25.3	34.9	44.2	64.4	40.8
North America	1.0	0.3	-0.8	1.2	9.2
Developed East	9.5	12.1	15.7	22.3	12.0
EEC	11.4	18.6	26.5	37.8	34.1
Rest of industrialized .	2.7	3.1	2.2	2.3	-13.0
Developing countries	-17.4	-24.1	-31.8	-47.6	-44.3
OPEC	-19.3	-27.0	-35.6	-51.8	-41.9
Africa	-0.6	-0.7	-0.6	-0.6	1.6
Asia incl. China	1.6	2.4	2.8	2.7	-7.1
Middle East non-oil	0.2	0.1	-0.5	-1.1	-6.6
Western Hemisphere	0.7	1.1	2.1	3.2	9.8
C.P.E excl. China	-7.9	-10.7	-11.7	-15.7	4.5
	*** Per cent ***				
World exports	-3.0	-3.7	-4.0	-4.4	1.7
World export price	-3.4	-4.5	-5.6	-6.4	-4.4
World exports real	0.4	0.8	1.6	2.2	6.1

zero. The main factor behind this, is the development in the US, where the decrease in the value of total imports is less articulated than in other industrial countries. One reason for this is that oil constitutes a smaller share of total imports in the US than in other OECD countries. Moreover, because of the relatively large GDP increase, US import volumes show a rather high increase.

At this point it is appropriate to note some difficulties concerning the interpretation of LINK results. The model system is huge, and to some extent it works (for us) like a "black box". It is almost impossible to have a good overview of all the country models, thus some of the effects generated by the system may be hard to understand and interpret. However, in spite of these short-comings, it is our view that the LINK simulations provide some useful insight into the problem of international macroeconomic repercussions of lower oil prices.

3.3. Other studies

Having emphasized the limitations regarding the LINK-computations reported in the preceding section, we now shortly review some other studies of international macroeconomic repercussions of a fall in the oil price.

In tables 3.7 and 3.8 we have listed conclusions from four different studies in addition to our own LINK results. We have scaled the figures so as to represent a 25 per cent decrease in the price of oil, assuming that it is permissible to assume that the models used are log-linear.

Table 3.7. Impact on GNP of a 25 pct. decrease in the price of oil.
Per cent.

Source Area	OECD (1983)			DRI (1984)			Powell & Horton (1985)			DRI (1986)			LINK		
	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.
OECD total	0.6	0.9	1.2										0.7	0.9	1.1
USA				0.7	1.4	1.6									
Major Seven 1)							0.25	1.0	1.3						
Big Four 2)										0.7	1.4	1.3			

1.y.: First year effects

2.y.: Second year effects

3.y.: Third year effects

1) USA, Canada, Japan, UK, France, Germany, and Italy.

2) UK, France, Germany and Italy.

We note from table 3.7 that first-year effects on GNP of the oil price decrease is predicted to be in the range of 0.6-0.7 per cent. The exception is Powell & Horton at only 0.25 per cent. OECD (1983) assumes unchanged government expenditure in nominal terms. The effect on the general price level of a fall in the price of oil thus leads to an implicit change in the stance of fiscal policy; in this case towards more expansive policy. DRI have, in both studies, assumed an ease in monetary policy. However, Powell and Horton also make some policy assumptions; namely that the US, France, Italy and Canada reduce their deficits. This means that automatic stabilizers are allowed to work in connection with the higher activity level following a decrease in the oil price. Japan, Germany and the UK, however, are assumed to ease fiscal policy so that budget deficits are held unchanged. The second - and third-year effects on GNP are in all five studies estimated at 1-1.5 per cent, DRI being slightly higher than the others. If we compare with the LINK-simulations, we find similarities when looking at first year effects. In the second and third year, the LINK results seem to predict a more modest impact on GNP. We have not included any policy responses in the LINK simulations, which may explain the differences.

In table 3.8 we have listed the results for inflation.

Table 3.8. Impact on GNP-deflator of a 25 per cent decrease in the price of oil. Per cent.

Source Area	OECD (1983)			DRI (1984)			Powell & Horton (1985)			DRI (1986)			LINK		
	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.	1.y.	2.y.	3.y.
OECD total	-1.5	-2.5	-3.0										-0.7	-0.8	-0.9
USA				-0.6	-1.1	-1.2									
Major Seven 1)							-0.8	-1.5	-0.5						
Big Four 2)										-0.7	-1.7	-1.7			

1.y.: First year effects

1) USA, Canada, Japan, UK, France, Germany, and Italy.

2.y.: Second year effects

2) UK, France, Germany and Italy.

3.y.: Third year effects

Note that while the two DRI-studies and Powell & Horton show similar results, OECD (1983) reports a far stronger impact on inflation rates of a fall in the oil price (see table 3.8). We have not been able to find an explanation for this difference. However, all four studies predict that second-year effects on inflation should be almost twice that of the first-year effect. The LINK-results show comparable results for inflation

in the first year, but later the effect is somewhat weaker. One reason for this may be that the LINK models contain a number of exogenous prices that have not been adjusted in the low price scenario.

3.4. Conclusion

In the previous sections we have seen that different studies may come to somewhat different conclusions regarding the impact on GNP and inflation in the world economy of a fall in the price of oil, depending among other things on the model being used and the assumptions being made. However, to evaluate impacts of lower oil prices on the Norwegian economy we need an assessment of the impacts on Norwegian export markets and import prices. Any assumptions made on these issues contain great uncertainty. Consequently, results should be viewed more as a possible, rather than the most probable outcome. We have chosen something like "middle of the road" - impacts in the light of the results reported above. For GNP in the countries constituting Norway's main trading partners we have assessed the impact to be 0.6 per cent in the first year, 1 pct. in the second and 1.3 per cent in the third year. Considering GNP-deflators in the same countries the deflators are reduced by 0.7 per cent in the first year and 1.5 per cent from then on. As the real oil price is expected to increase rapidly around 1990 we assume that output is reduced and inflation is higher so that the positive development disappear in the 1990's.

4. IMPACTS ON THE NORWEGIAN ECONOMY OF LOWER OIL PRICES

With reference to the scenarios that have been calculated for the development of the crude oil price and the international macro-economic impacts estimated by the LINK-system, this section looks on the effects of lower oil prices on the Norwegian economy. We start by describing a scenario for the Norwegian economy based on the high price scenario for the crude oil price. This path is used as reference path for the analysis of lower oil prices. The impact of lower oil prices is analyzed first assuming no change in economic policy. Thereafter the low price scenario is combined with an assumption of a more restrictive Norwegian economic policy. The calculations are made on a version of the CBS model MODAG W, where also wage rates and unemployment are determined endogenously, cf. Cappelen and Longva (1986). In MODAG W output and employment are generally determined by domestic demand and the activity level for Norway's main trading partners. Imports of goods and services depend on the level and composition of domestic demand. In addition price competitiveness for Norwegian goods plays a role for the determination of import shares and for the development of exports. Prices on Norwegian goods and services are determined in the model as functions of domestic production costs, capacity utilization and import-prices. If Norwegian prices increase faster than import-prices, Norwegian producers loose market shares. A loss of market shares can according to the model, be a consequence of low productivity growth depending on the development of investments, or high wage growth as a consequence pressure in the labour market. Prices on other goods such as, agricultural prices, electricity prices or the nominal interest rate (all exogenous variables) also affect market shares. Even if supply side factors are present in the model, they are relatively weak and do not change the fact that according to MODAG W, output is mainly demand determined except for production in sectors based on primary resources (agriculture, fishing, oil and gas, hydro-electricity) where output are exogenous and net exports mainly supply determined.

4.1. The high price scenario (HPS) for the Norwegian economy, 1986-93

In this section we present the most important exogenous assumptions on which we base our scenarios for the Norwegian economy, and the results

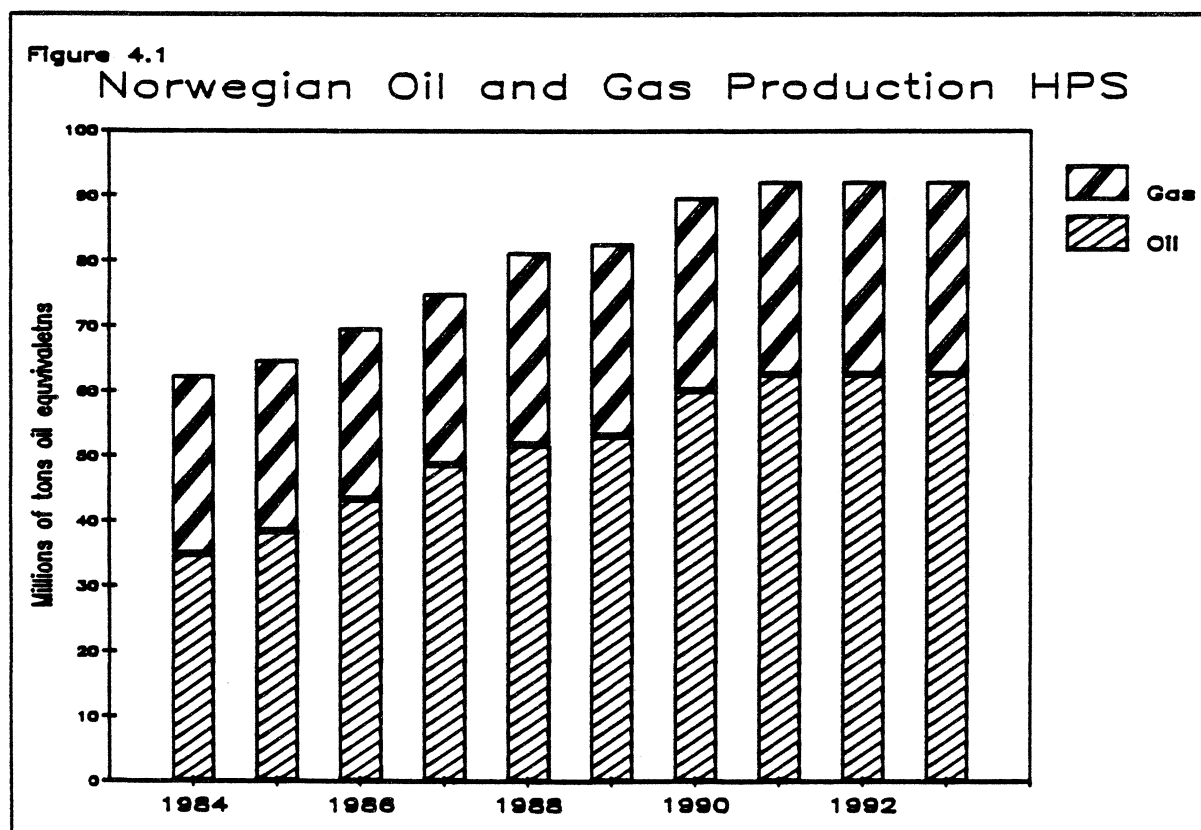
given a high price scenario for the crude oil price.

The growth rate for public consumption and public gross investment is assumed to be in line with the last government long term program, cf. St.meld. nr. 83 (1984-85). Direct tax rates are adjusted in line with inflation in the period 1986-89 and thereafter increased by 1 per cent each

Table 4.1. Assumptions regarding the international economic development in HPS. Annual growth rates in per cent.

Variable	1985-89	1990-93
Import prices (traditional goods)	4	4.5
GDP main trading partners	3.5	3
Nominal oil price in NOK	-9	19

year. Government transfers are assumed to increase in line with wage-growth and the increase in the number of pensioners. Table 4.1. shows some important exogenous assumptions. The assumptions regarding production of oil and gas are shown on figure 4.1, while assumptions regarding the crude



oil price are shown on figure 4.2. In 1986 the high price scenario is based on a crude oil price of \$20 per barrel and a dollar exchange rate of 7 NOK. The dollar exchange rate is assumed to fall to 6 NOK in 1987. HPS thus implies a crude oil price in Norwegian kroner of 125 NOK per barrel in 1987 which is almost half the 1985 price. As oil prices are assumed to increase in the late 1980s, we assume that the dollar exchange rate is gradually increasing to 7 NOK in 1991 and is thereafter constant. In Norwegian kroner the crude oil price is back at the same nominal level in 1991 as in 1985. Investments in the oil sector which have increased enormously since 1984, are supposed to decrease somewhat from 1986 to 1990 and later increase somewhat again. The level of investment in the oil sector in the 1990s is roughly as in 1984 and 1985.

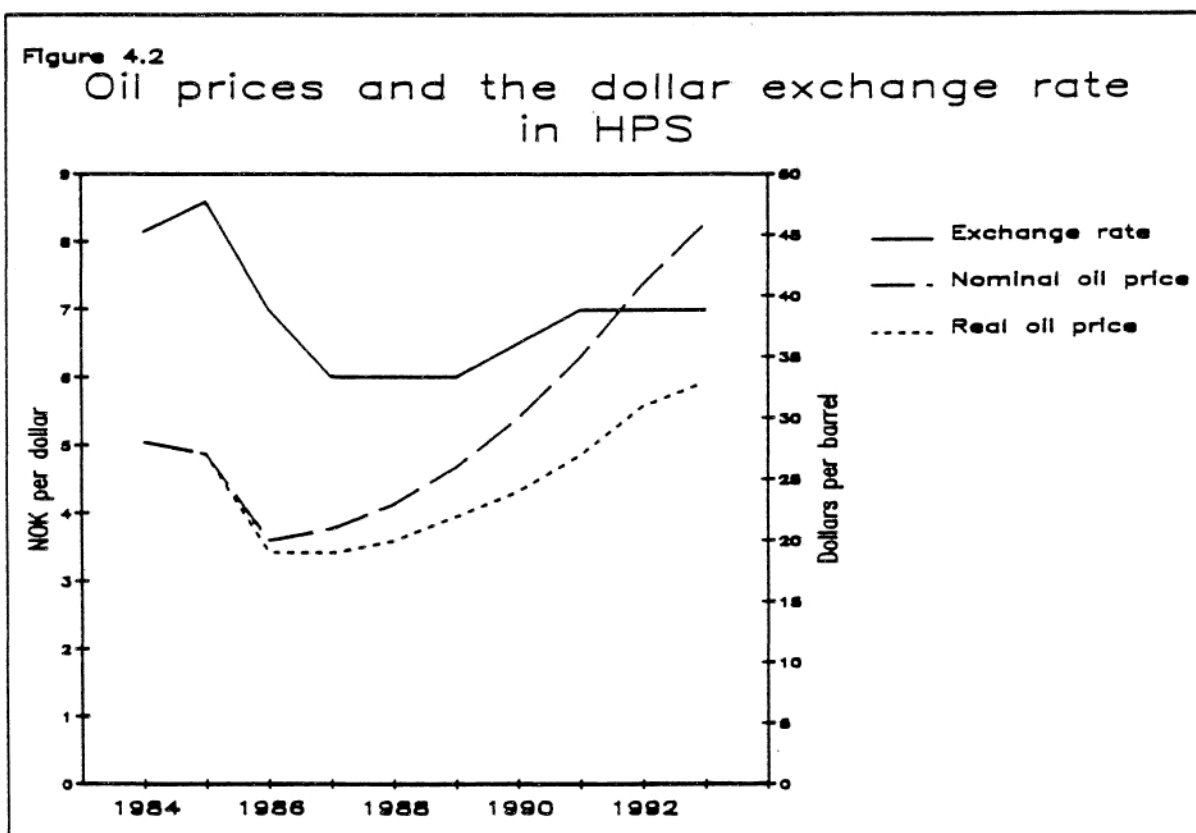


Table 4.2. shows average yearly growth rates for some macroeconomic variables, while figure 4.3. shows the development each year for output, employment and unemployment.

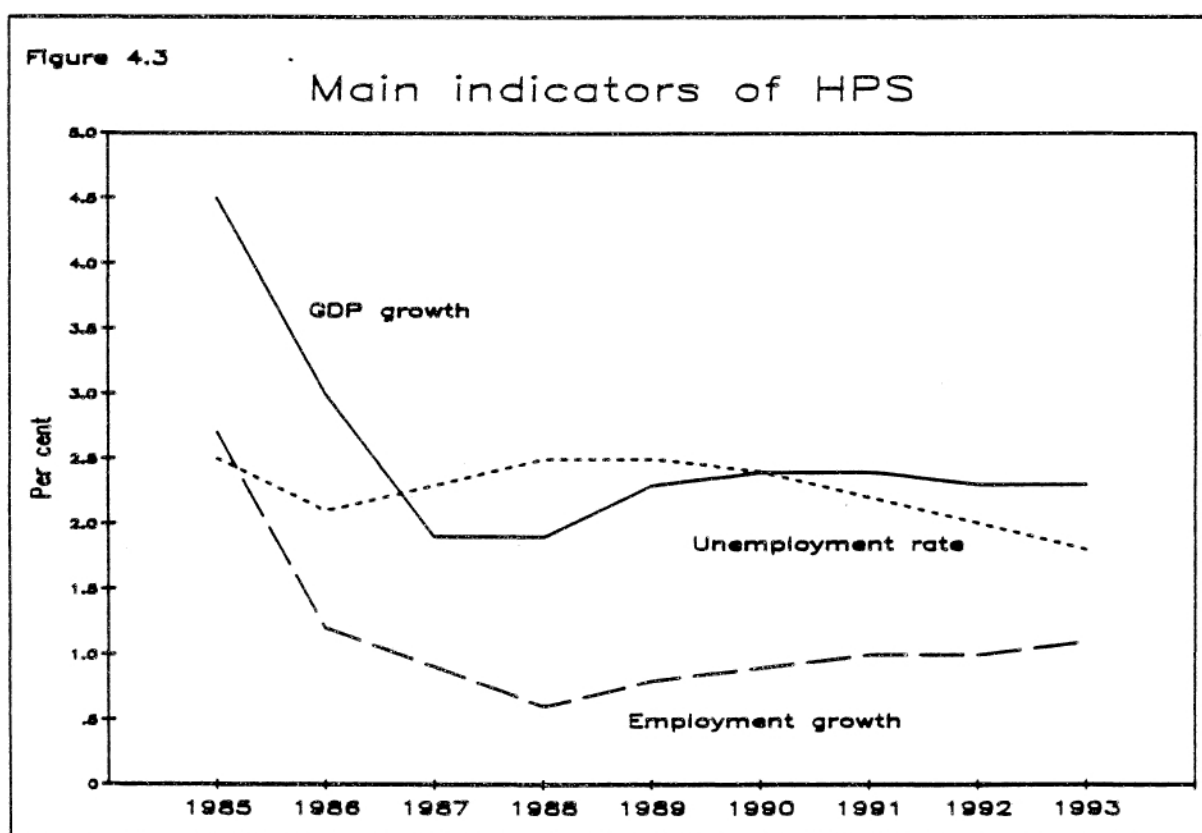
Table 4.2. Macroeconomic development in HPS. Annual growth rates in per cent.

	1984 1) Bill.NOK	1985-1989	1990-1993
Private consumption	208.0	3.6	2.1
Public consumption*	84.0	2.8	2.9
Gross investments 2)	109.6	1.6	0.8
Shipping and oildrilling* ..	4.2	-5.0	0.0
Oilproduction and pipelines*	28.5	1.4	1.2
Housing	16.4	0.5	-0.7
Other sector	47.2	1.4	0.7
Public sector*	13.4	0.0	0.0
Exports	215.4	3.9	2.9
Oil,gass and shipping	114.8	3.9	1.8
Mainland	100.6	3.9	4.2
Import	172.1	3.0	2.2
GDP	446.6	3.4	2.4
GDP, mainland	346.3	2.8	2.3

* Indicates that the variable is completely or mainly exogenous

1) Preliminary figures

2) Including inventories of platforms in progress



It is worth noticing that gross investments increase very slowly in the period as a whole. This is mainly due to our exogenous assumptions. As gross investments are an import oriented component of total demand, a change in composition of domestic demand - from investments to consumption - leads to a reduction in growth of imports. If the growth of domestic demand was more balanced with regard to investments and consumption, the growth of imports would have been higher than the growth of GDP for mainland Norway.

Wagerates are endogenously determined in the version of MODAG which is used in these calculations. As long as the unemploymentrate is around 2.5 per cent as in 1985, the growth of wagerates is assumed to equal the sum of the growth of import prices and productivity in manufacturing. From 1986 to 1989 the unemploymentrate is around 2.5 per cent (cf. figure 4.3), while in the 1990s the unemploymentrate is somewhat lower mainly due to demographic factors and thus wage growth is higher than what follows from import price growth and productivity growth.

Table 4.3. Unemployment, real wage-, employment- and productivity growth rates in per cent. HPS.

	1985-89	1990-93
Real wage	1.8	1.6
Productivity	1.5	1.3
Unemployment	2.4	2.1
Employment (man-years)...	0.9	1.0

Table 4.3. shows the development in some important variables related to the labour-market. We notice that the real wage growth is somewhat higher than the growth in productivity for mainland Norway during the period. Before 1990 this is mainly due to lower oil prices. The reason is that the growth of import prices that partly determines the growth of wages does not include oil prices. In the 1990s lower unemployment leads to higher growth rate for wage rates while higher oil prices reduce the growth in the real wage rate. Lower productivity growth in the 1990s compared to the latter half of the 1980s is a consequence of the weak development in gross investments.

Table 4.4. shows the components of the current account. Export revenues from oil and gas will be substantially reduced in spite of a growth in oil production by 8.5 per cent annually between 1985 and 1991, whereafter production is assumed constant. On the other hand, production of

gas is kept constant except for an increase of 12 per cent from 1987 to 1988. In spite of an increase in net foreign debt in the years 1986 to 1989 the deficit of net interest and transfers from abroad will not change compared to 1985 due to lower capital transfers abroad from the oil sector. In addition (mainly development aid) transfers will not increase much as long as nominal GDP increases slowly. In the 1990s the surplus on the current account will be large according our calculation. This is due to a doubling of the revenues from the export of oil and gas.

Table 4.4. Current balance in HPS. Annual averages in bill. NOK, current prices.

	1986-89	1990-93
Oil and gas exports	63	135
Other exports	165	219
Imports	222	286
Net interest and transfers abroad	-15	-17
Current balance account	-9	51

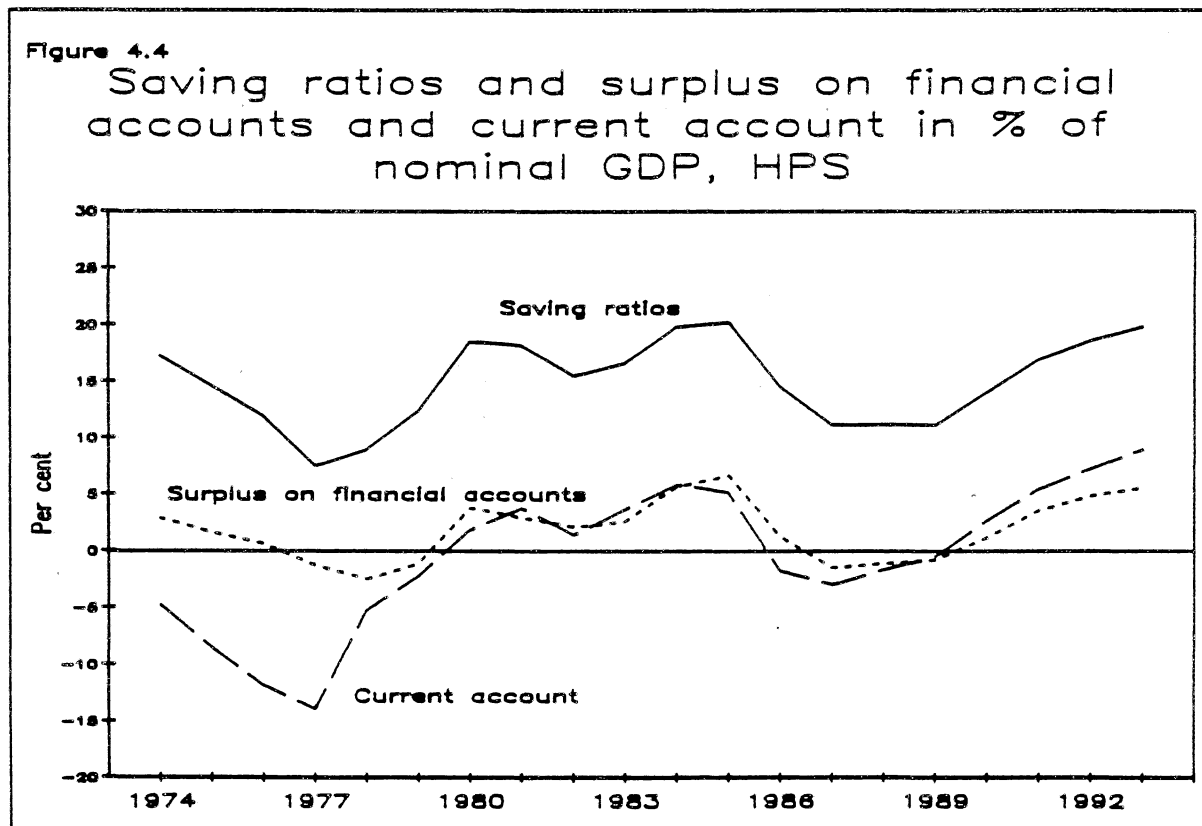


Figure 4.4. shows the development in total net savings as share of disposable income for Norway, and the current account and the surplus on government financial account as share of nominal GDP. We have included figures for these variables from 1974 to 1984 in order to be able to assess the numbers in a historical perspective. As is obvious from the figure, the net saving rate was very high in 1984 and 1985. In the years ahead our calculations based on the high price scenario indicate that the saving rate will be reduced by almost 50 per cent until increased oil prices in the 1990s again increase the surplus on the current account. However, the reduction in the saving rate in HPS is less dramatic than what it was in the latter part of the 1970s.

The surplus on government financial accounts, however, will deteriorate significantly even in the high price scenario. Excluding oil taxes and as share of nominal GDP the deficit on the government financial accounts will increase from 3.5 per cent from 1985 to almost 5 per cent in 1989 and is thereafter constant. On this background we have assumed that the nominal interest rate will stay at a high level. The real rate of interest before taxes is approximately 5 per cent around 1990. Even if this is lower than in 1985, when it was almost 8 per cent, it is high in a historical perspective and in view of an assumption of lower real interest rates on international financial markets.

Table 4.5. Disposable real income for Norway in HPS. Annual average growth rates in per cent.

	1985-1989	1989-1993
Disposable real income.....	-0.2	5.2
Contribution from:		
Net domestic product	3.1	2.8
Net interest and transfers abroad	0.0	0.3
Terms of trade	-3.2	2.4

Table 4.5 shows disposable real income for Norway in the two periods 1985-1989 and 1989-1993. Due to the development of oil prices, there is a small reduction in disposable real income for Norway from 1985 to 1989. The growth in net national product is not enough to compensate for the loss in terms of trade. In the period 1989 to 1993 there is a substantial growth in disposable real income for Norway both as a result of growth in output and an improvement in the terms of trade.

To summarize, HPS is based on policy assumptions that are generally in accordance with the government planning documents from 1985. Thus growth in GDP and employment is fairly moderate but much in line with the Norwegian experience from 1980. Unemployment is somewhat higher than in the 1970s but still very low by international standards. The drop in oil prices and the dollar exchange rate compared to 1984 and 1985 imply deficits both on the current account and in government budgets for the rest of this decade. These deficits are still fairly moderate particularly compared to those prevailing in the latter half of the 1970s. According to HPS the deficits will turn to huge surpluses in the early 1990s due to higher oil prices. This will have adverse effects on the world economy and traditional export industries in Norway. In addition low growth in labour supply will reduce unemployment in Norway, increase wage growth and reduce growth in GDP (mainland).

4.2. The low price scenario without policy adjustment

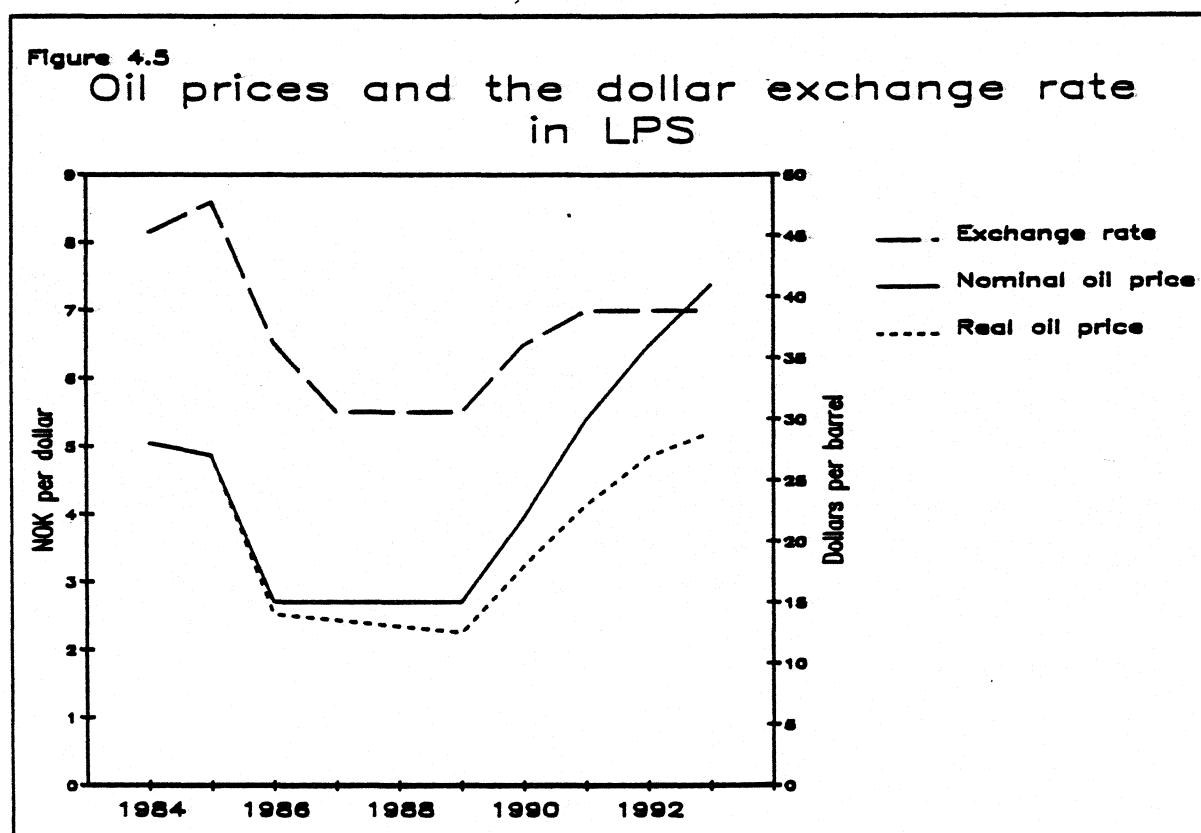
In section 3 we referred to some studies on how the international economy could be influenced by lower oil prices. The low price scenario (LPS) projects, as shown in section 2, a large increase in the crude oil price following a period of substantially lower oil prices around 1990. Thus, while world economic growth is likely to be stimulated in the years ahead due to lower oil prices, the reverse is likely to occur in LPS after 1990. The increase in oil prices, however, is not assumed to be large enough to eliminate all positive effects on the growth from the 1980s.

Table 4.6. Assumptions regarding international economic development and oil investment in LPS. Deviations from HPS.

	1986	1987	1988	1989	1990	1991	1992	1993
Deviations in per cent								
GDP trading partners	0.6	1.0	1.3	1.3	1.1	1.0	0.6	0.6
Import prices excl. oil	-0.5	-1.0	-1.5	-1.5	-1.0	-0.5	-0.5	0
Deviation in bill. NOK								
Oil investment	0	-7	-13	-12	-10	-10	-9	-7

Table 4.6. shows what assumptions we have made regarding the development of prices and market growth for Norway's main trading partners in LPS compared to HPS. In addition, we have assumed that investments in

the oil sector will be substantially reduced in the years ahead because the profitability of further oil exploration in the North Sea will be reduced, and the companies' cash flow from production will be considerably lower. Moreover, there are uncertainties with regard to future oil prices so that the high level of investment which is assumed in HPS may not be profitable. Lower investments will of course reduce future production possibilities, thus we have assumed that oil production is reduced by 7 per cent annually in 1992 and 1993. In order to estimate the full effect of lower investments, a more long term view than we have chosen would be necessary. Low investments during the next 10 years will mainly have consequences for production in the 1990s and in the next century.



In the LPS we have assumed no adjustment in economic policy except that tax rates, public expenditure on goods and services and transfers are adjusted in line with changes in inflation. As the public sector will have its income from oil taxes substantially reduced when the oil price falls, the assumption regarding economic policy implies that the public sector has

a marginal propensity to save equal to one. Alternatively one might say that the public sector regards the fall in oil prices only as temporary and the loss in income as transitory and thus does not adjust spending. This is of course not plausible, and we will return in the next section to possible effects of a restrictive policy.

Table 4.7. Effects on macroeconomic variables of a low oil price. Deviations in per cent from HPS.

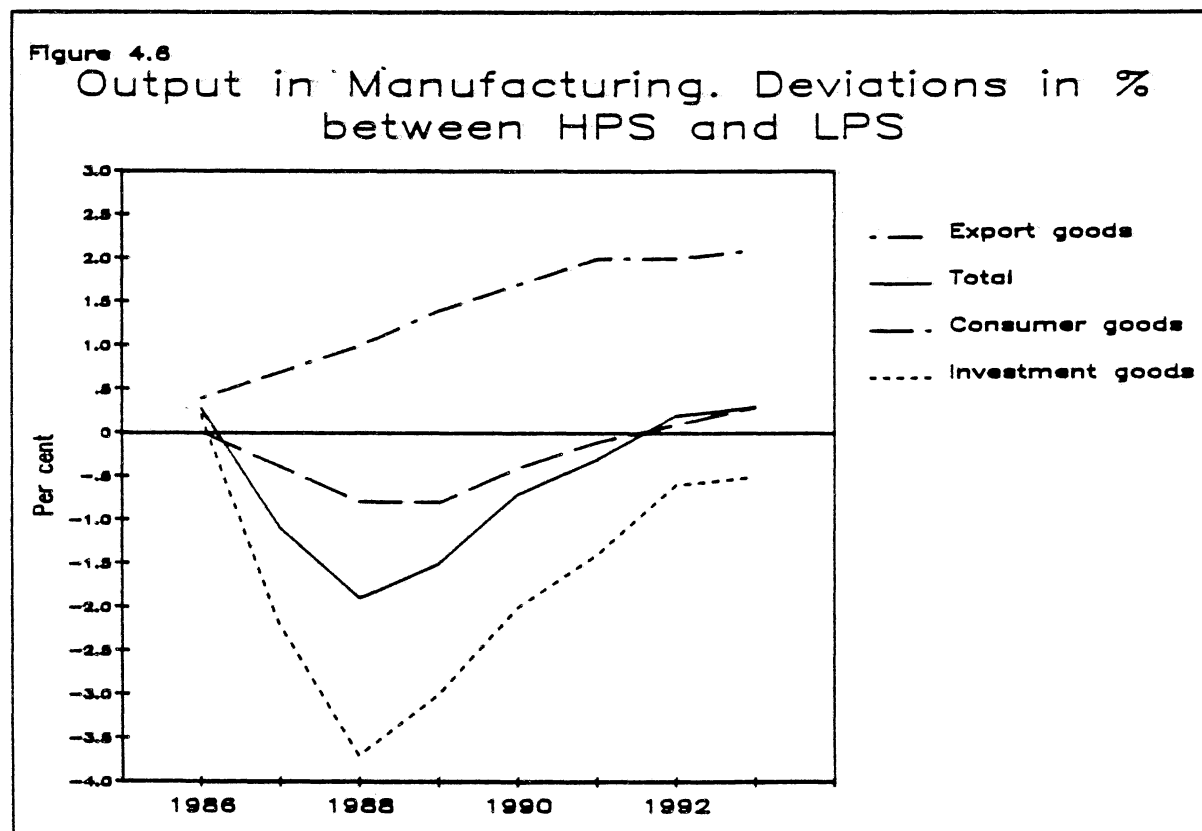
	Private consump- tion	Gross invest- ment	Trad. ex- ports	Im- ports	GDP main- land	Em- ploy- ment	Con- sumer prices	Wage rates	Un- employ- ment 1)
1986	0.6	0.1	0.6	0.6	0.2	0.1	-0.9	-0.1	-0.05
1987	0.5	-5.9	1.1	-1.3	-0.3	-0.2	-1.2	-0.3	0.2
1988	0.2	-11.4	1.8	-3.0	-0.9	-0.5	-1.6	-1.0	0.35
1989	0.1	-10.4	2.3	-2.6	-0.7	-0.5	-2.0	-1.8	0.30
1990	-0.1	-8.2	2.4	-2.1	-0.5	-0.4	-2.0	-2.2	0.25
1991	-0.4	-8.0	2.5	-2.3	-0.4	-0.4	-1.7	-2.3	0.20
1992	-0.3	-7.2	2.3	-2.5	-0.2	-0.3	-1.6	-2.3	0.10
1993	-0.2	-5.5	2.3	-0.5	-0.5	0.0	-0.2	-2.3	0.05

1) Percentage points.

In table 4.7. we show the development in some macroeconomic variables in LPS compared to the development in the high price scenario, HPS. An immediate effect of lower oil prices is lower inflation. The reduction in the Norwegian price level is somewhat stronger than abroad, cf. table 4.6. This is explained by the fact that lower oil prices increase economic growth abroad, while they depress the level of activity in Norway compared to HPS. This is in line with the experience after the oil price shock in 1979/80, where Norway experienced higher inflation rates than abroad. We assume that the growth of wages mainly follows changes in import prices albeit with a lag. Real wages increase during the first years after the fall in oil prices and this leads to increased private consumption. Increased activity for our trading partners will increase Norwegian exports excluding oil, in particular exports of goods. Increased domestic demand increases Norwegian output and imports. From 1987 this picture changes because lower oil investments give a significant negative effect on Norwegian production while at the same time imports are reduced. This leads to lower Norwegian production and employment, in particular in those parts of the economy that are closely linked to the oil sector. This development is partly counteracted by an increase in Norwegian exports, both following increased activity abroad and because lower domestic activity leads to higher

unemployment and therefore lower wage-growth and improved price competitiveness. In addition lower capacity utilization in Norway will reallocate resources towards export-oriented sectors due to the fact that export prices increase less. This further improves price competitiveness.

The development in the demand components is also reflected in different development for groups of manufacturing sectors. While production in sheltered manufacturing sectors changes very little due to the fact that these sectors mainly produces consumer goods, manufacturing sectors which mainly compete with imports on the domestic market, will experience a substantial reduction in output due to lower oil investments. Exposed industries which are mainly export oriented will, however, increase their output as shown on figure 4.6.



As unemployment increases, the growth in wages is further reduced and in the 1990s there is a moderate reduction in wages partly because employees will not be fully compensated for higher prices on oil-related goods when the crude oil price increases substantially. This is also in

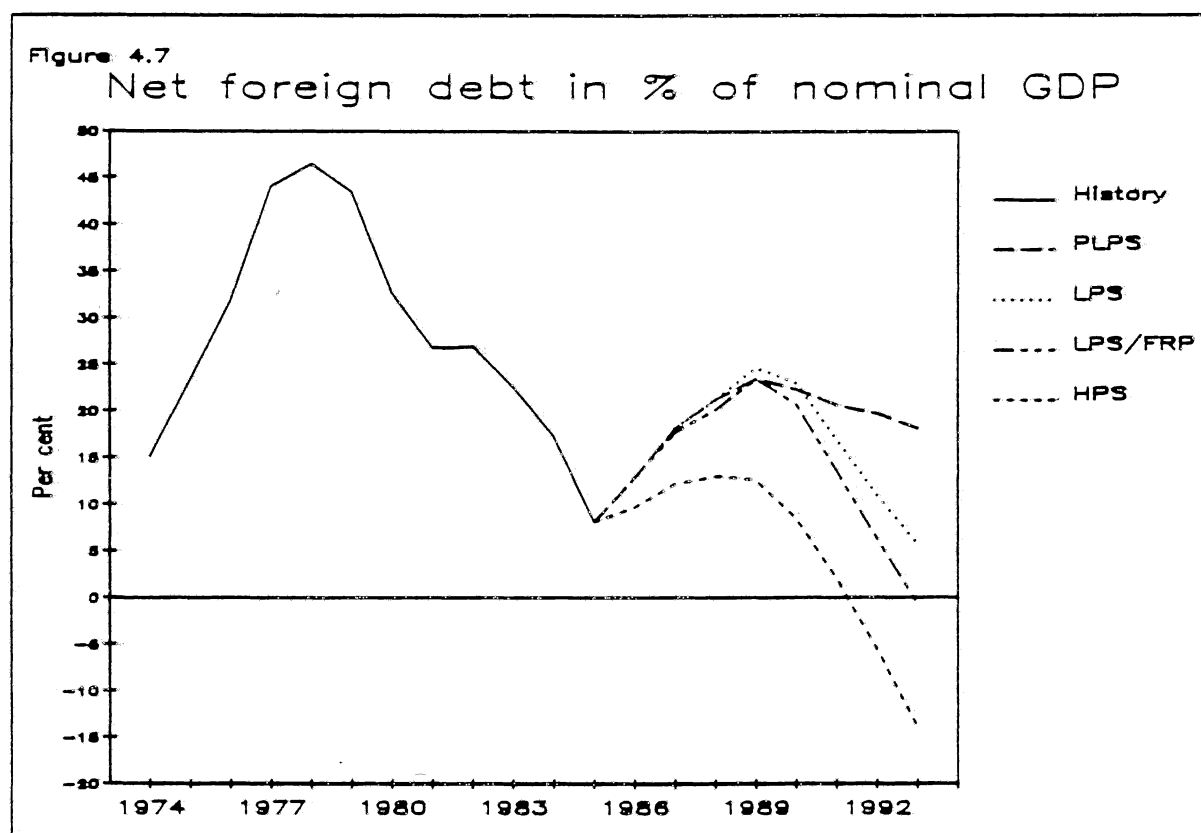
some ways parallel to the development after OPEC II.

In the last part of the period the growth in wages is again parallel to the development along HPS, but then on a lower level because unemployment in the years before has reduced wage-growth. The growth rate of consumer prices in the early 1990s is higher in LPS than in HPS due to stronger growth in oil prices and higher growth rates of import prices for traditional goods and services.

Table 4.8. Effects on the current account of a low oil price. Deviations in bill. NOK from HPS.

Total	Contribution from:				
	Exports of oil and gas	Other exports	Imports	Net interest and transfers abroad	
1986	-13	-15	0	2	0
1987	-13	-19	-1	7	0
1988	-13	-24	-1	13	-1
1989	-22	-34	-1	13	-2
1990	-24	-29	0	10	-5
1991	-17	-19	0	9	-7
1992	-26	-25	1	7	-9
1993	-42	-33	1	3	-13

Table 4.8. shows the development of the current balance in LPS. The reduction in export revenues of oil and natural gas is of course the main factor behind increased deficits on the current balance. As these deficits increase net foreign debt compared to HPS, there is also an increase in the negative contribution from net interest and transfers from abroad. The contribution from lower value of imports is significant during the latter part of the 1980s, mainly following lower oil investments, but also due to lower import prices. Exports other than oil and natural gas change very little compared to HPS. This is due to lower export prices (mainly in line with lower import prices), while the volume of exports increases. A factor that contributes to the weak development of export prices, is the price on refined oil products which is a part of other exports. In the calculations we have taken into account that Norway will be a net exporter of refined oil products in the late 1980s. The price on these products will change dramatically when the crude oil price changes. In LPS nominal net foreign debt in 1993 is calculated to be roughly as in 1985, cf. figure 4.7.



The increased deficits on the current balance is almost equal to increased deficits on the public sector financial accounts. In the next couple of years this deficit is increased by 15 billion NOK annually which increases to approximately 20 billion NOK around 1990. When oil production is reduced in 1992 and 1993, the deficit is increasing further to around 30 billion NOK. The deficit on the public sectors financial account excluding oil taxes calculated as a percentage of nominal GDP increases moderately until 1988 and is then approximately 5.5 per cent, that is half a percentage point above the level in HPS.

Lower oil prices will lead to a loss in terms of trade and a substantial reduction in disposable real income for Norway. In table 4.9. the reduction in disposable real income is decomposed into changes due to lower net national product, increased deficit on interest and transfers from abroad and loss in terms of trade. As is obvious from the table, the loss in terms of trade is the most important factor in the period as a whole. The contribution from increased deficit on net interest and transfers from abroad becomes more important in the 1990s due to the fact that net foreign

debt is then higher and that capital income for foreign oil companies is higher due to higher oil prices.

Table 4.9. Effects on disposable real income for Norway of lower oil prices. Deviations in per cent from HPS.

	Disposable real income	Contribution from:		
		Net domestic product	Net interest and transfers abroad	Terms of trade
1986	-3.9	-0.2	0.0	-3.7
1987	-5.6	-0.4	0.0	-5.2
1988	-7.6	-0.7	-0.1	-6.8
1989	-9.3	-0.3	-0.4	-8.6
1990	-7.6	-0.1	-0.9	-6.6
1991	-4.8	0.2	-1.3	-3.7
1992	-5.3	-0.7	-1.4	-3.2
1993	-6.0	-1.5	-1.8	-2.7

Our analysis in LPS is based on the assumption that oil prices during the latter half of the 1980s, will be approximately 40 per cent below levels in HPS and that a "third oil price shock" will take place around 1990 as OPEC capacity is almost fully utilized. The positive effect on the world economy that follows lower oil prices the years ahead will thus be reversed in the 1990s. Norwegian production of oil and gas will not be affected by low prices due to fairly low operating costs in the North Sea. Lower investments in the oil sector following low oil prices will only affect production capacity in the 1990s. However, in the 1980s lower investments lead to reduced imports and higher exports as resources are re-allocated. Increased economic activity in the OECD-area and reduced activity in Norway improve competitiveness for Norway's manufacturing sectors and reduce the deficits on the current account that follow the income loss due to the terms of trade effect. In spite of these effects Norway will experience substantial deficits on the current account which accumulate to a ratio of net foreign debt to nominal GDP of 25 per cent in 1989.

4.3. The low price scenario combined with a restrictive fiscal policy

As a consequence of large deficits on the current account and on public financial accounts, we shall now assume that a more restrictive fiscal policy is pursued. A restrictive fiscal policy may seem unnecessary

if one were certain that the oil price would increase considerably in the early 1990s. In that case the accumulated debt could have been repaid easily as shown on figure 4.7. However, it is not certain that we will experience such a sharp increase in the crude oil price at that time and one will therefore have to adjust public and private consumption to lower disposable income. In this scenario (LPS/FPR) we have assumed that the growth rate of public consumption is reduced from 3 to 1 per cent annually in the period 1987-90. The growth rate is increased to 2 per cent in 1991 and 3 per cent in 1992 and 1993 when Norway again experiences surpluses on the current account according to LPS. In addition it is assumed that average tax rates on personal income are increased by 1 percentage point in 1987-89 and half a percentage point in 1986 and 1991, compared to HPS. Such a policy will reduce the deficits on public financial accounts as share of nominal GDP by one percentage point compared to HPS. This tightening of fiscal policy is not very drastic, even though an annual growth rate of only one per cent in public consumption has not occurred in Norway for 30 years.

Table 4.10. Effects on macroeconomic variables of lower oil prices and restrictive fiscal policy. Deviations in per cent from HPS:

	Private consump- tion	Gross invest- ment	Trad. ex- ports	Im- ports	GDP main- land	Em- ploy- ment	Con- sumer prices	Wage rates	Un- employ- ment 1)
1986	0.1	0.0	0.7	0.3	0.1	0.0	-0.9	-0.1	0.0
1987	-0.9	-6.5	1.2	-2.2	-1.4	-0.9	-1.2	-0.4	0.9
1988	-2.1	-12.7	2.0	-4.6	-2.8	-1.8	-1.7	-1.8	1.3
1989	-3.0	-12.2	2.6	-4.9	-3.4	-2.6	-2.2	-3.1	1.8
1990	-4.0	-10.3	2.9	-5.2	-3.8	-3.1	-2.5	-4.3	2.1
1991	-4.4	-10.1	3.3	-5.4	-3.9	-3.4	-2.6	-5.3	2.1
1992	-4.5	-8.9	3.3	-4.8	-3.7	-3.3	-3.0	-6.6	2.0
1993	-4.9	-7.0	3.6	-3.9	-3.5	-3.2	-3.3	-8.1	2.0

1) Percentage points.

The substantial reduction in domestic demand in LPS/FPR will lead to a significant increase in unemployment, at least by Norwegian standards. The growth of wages (and by assumption also government transfers) will therefore be reduced. Table 4.10. shows how the development will be compared to HPS for some main macroeconomic variables.

A more restrictive fiscal policy will strengthen effects that were apparent already in the low price scenario without changes in the fiscal policy. Domestic demand is now considerably reduced. In particular the

further reduction in private consumption is substantial while the reduction in gross investments is more moderate compared to LPS. Imports will be lower for two reasons: lower domestic demand and lower import shares following improved price competitiveness for Norwegian producers. Lower wage growth also leads to increased exports excluding oil and natural gas. In the short run this effect is small due to the fact that the capacity utilization in most export oriented manufacturing sectors, is quite high in the outset, so that they are not able to increase exports much even if their price competitiveness is improved. In the 1990s, however, exports continue to grow as opposed to developments of exports in LPS. Thus, a more restrictive fiscal policy will reduce deficits on the current account and the main reason for this is lower imports due to lower demand and improved price competitiveness. The value of exports is almost the same as in the previous section. In addition to the capacity factor already mentioned this is a result of fairly low export price elasticities in the model in addition to the fact that part of exports are assumed constant in volume (mainly net receipt from shipping services). As it takes some time before the effects of lower domestic demand will materialize in changes in price competitiveness the changes in exports compared to the figures in table 4.7. are moderate.

Table 4.11. Effects on the current balance of lower oil price and restrictive fiscal policy. Deviations in bill. NOK from HPS.

	Contribution from:			
	Total	Exports	Imports	Net interest and transfers abroad
1986	-13	-15	2	0
1987	-11	-20	9	0
1988	-10	-25	16	-1
1989	-19	-35	18	-2
1990	-17	-30	17	-5
1991	-8	-19	17	-6
1992	-14	-24	17	-7
1993	-28	-32	14	-19

From table 4.10. we see that the simulation with a restrictive fiscal policy (LPS/FPR) will result in a substantial reduction in the wage rate due to higher unemployment. In 1990, unemployment will reach 4.5 per cent, corresponding to 100 000 persons before decreasing to just below 4 per cent in 1993 due to our assumption of increased public consumption and

lower taxes in the 1990s. This is also the reason why we have somewhat higher GDP growth than in HPS, but from a significantly lower level.

What have we then gained in terms of external balance? This is shown in table 4.11. The improvement in the external balance is only moderate in the 1980s. In 1990, for example the net foreign debt is reduced by only 20 billion NOK compared to the alternative without fiscal policy restraint. In 1993, however, the difference is almost 50 billion NOK and Norway will become a creditor nation in 1993. Net foreign debt as a percentage of nominal GDP is shown on figure 4.7.

The reduction in the deficits on the public sector financial account is only a few billion NOK the first years increasing to nearly 10 billion NOK from 1990 to 1993. This implies that the deficit on the financial account excluding oil taxes as a percentage of nominal GDP is virtually constant during the entire period 1986-93 in LPS/FPR.

Due to inertia in the movements of wages and prices, a restrictive fiscal policy will only have small effects on the current account deficits as long as the policy changes are of the order we have assumed in LPS/FPR. It is, of course, a problem with this kind of policy that it takes considerable time before the desired results become significant while the costs in terms of higher unemployment etc. appear earlier. However, the main reason why a restrictive fiscal policy may be necessary, is the uncertainty with regard to the development of future oil prices, and particularly with respect to whether a substantial increase in oil prices will take place in the early 1990s or not. One possible conclusion is that due to the sluggish behaviour of the economy, such measures may have to be taken now if a further accumulation of foreign debt is to be avoided in the 1990s if oil prices do not increase as in LPS and LPS/FPR. This is part of the subject for the following section.

4.4. A permanent low price scenario

In the chapter on future crude oil prices, we argued that the crude oil price must be expected to increase substantially in real terms in the early 1990s. This is in particular the case in the low price scenario. However, we cannot exclude the possibility that a low real price on crude oil will persist at least until 1993, the last year of our calculations. The permanent low price scenario (PLPS) is based on an assumption of a real

crude oil price of \$15 from 1990 to 1993 implying a real price increase of 20 per cent from 1989 to 1990 instead of more than 40 per cent in the low price scenarios described in section 4.2 and 4.4.

As a consequence of the permanent lower oil price, we assume that the positive effects on GDP growth and inflation rates in the OECD-area following the fall in oil prices in 1986, are also permanent. Thus the change in GDP and import prices are assumed to remain at the levels reached in 1988/89 (cf. table 4.6) compared to the high price scenario (HPS). The other important change in assumptions compared to the low price scenario is that investments in the oil sector are assumed to be further reduced when the real oil price remains low. Compared to the figures in table 4.6, investments in the oil sector are reduced gradually until 1991 when it is 28 billion NOK less than in HPS. We have, however, not changed oil and gas production compared to LPS because it is reasonable to assume that lower investments from 1989 and onwards will only affect output after 1993.

Table 4.12 shows the effect on some macroeconomic variables of a permanently low oil price compared to the development in HPS. The figures prior to 1989 are the same as in table 4.7.

Table 4.12. Effects on macroeconomic variables of a permanent low oil price. Deviations in per cent from HPS.

	Private consump- tion	Gross invest- ment	Trad. ex- ports	Im- ports	GDP main- land	Em- ploy- ment	Con- sumer prices	Wage rates	Un- employ- ment 1)
1988	0.2	-11.4	1.8	-3.0	-0.9	-0.5	-1.6	-1.0	0.35
1989	0.0	-16.1	2.3	-4.5	-1.9	-0.8	-2.1	-1.8	0.55
1990	-0.4	-20.5	2.9	-5.8	-2.5	-1.0	-2.6	-2.7	0.70
1991	-0.5	-23.7	3.9	-6.3	-3.0	-1.3	-3.4	-3.7	0.90
1992	-0.4	-22.3	5.0	-5.6	-2.6	-1.3	-4.4	-5.2	0.80
1993	-0.3	-20.8	6.1	-4.7	-2.3	-1.2	-5.5	-6.8	0.80

1) Percentage points.

The most dramatic change takes place in the development of investment due to the reduced offshore activity. Lower import prices and higher unemployment due to lower domestic demand reduce the inflation rate by almost one percentage point after 1990 in PLPS compared to HPS. The real wage, however, is not much reduced compared to LPS in spite of higher unemployment. The main reason for this is that in PLPS consumer prices increase less rapidly in the 1990s due to little increase in oil prices as opposed to LPS. This is also reflected in the figures for private consump-

tion which is only slightly lower than in LPS. This somewhat surprising result is, however, mainly explained by the fact that tax rates and transfers are not fully adjusted in line with lower inflation in this scenario.

Exports of traditional goods mainly from manufacturing increase more rapidly in PLPS than in LPS. The growth rates from 1990 are one per cent higher due to higher market growth and improved competitiveness due to lower domestic cost increases. This also explains part of the reduction in imports in addition to the effects of lower growth in domestic demand.

The effect of a permanently low oil price on the current balance is shown in table 4.13. Instead of showing large surpluses as in all previous scenarios, the current balance in PLPS is just in balance in the 1990s. Thus the net foreign debt accumulated in the latter part of the 1980s remains constant, but as share of nominal GDP it decreases slowly as shown in figure 4.7.

Table 4.13. Effects on the current account of a permanently low oil price. Deviations in bill. NOK from HPS.

	Total	Contribution from:			
		Exports of oil and gas	Other exports	Imports	Net interest and transfers abroad
1988	-13	-24	-1	13	-1
1989	-16	-34	-1	18	0
1990	-23	-42	-1	23	-3
1991	-40	-63	-2	28	-3
1992	-62	-86	-1	30	-5
1993	-78	-105	4	32	-9

Compared to the figures in table 4.8 there is a dramatic change in the current balance in the 1990s if oil prices stay at a low level. The difference in export revenues from oil and gas is more than 10 per cent of nominal GDP (PLPS) in 1993. One third of this is compensated by lower imports, while again exports excluding oil and gas change very little due to lower prices and assumptions of no volume change for some export items. Net interests and transfers abroad increase less in PLPS than in LPS due to lower capital income for foreign oil companies and transfers because nominal GDP increase less in PLPS.

The deficits on the public sector financial accounts increase somewhat, in particular when we deduct oil taxes. This is partly a consequence of not fully adjusting transfers and tax-rates in line with lower

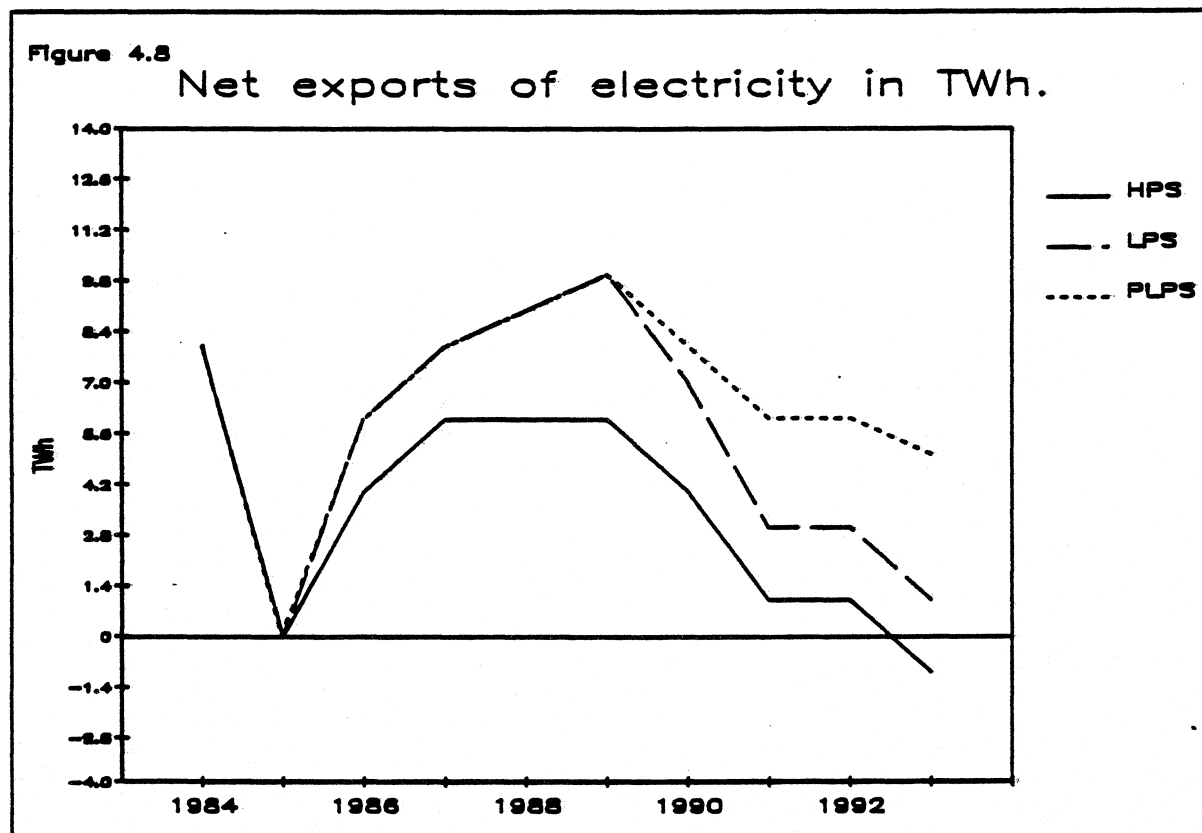
inflation. The increased budget deficits are assumed to result in a somewhat higher real rate of interest.

The main conclusion we can draw from the permanently low price scenario with regard to the economic development in the early 1990s is that the rapid accumulation of foreign debt that takes place in the LPS will not continue. The current account will be approximately in balance from 1990 to 1993 even in case of a permanently low oil price. This result does, however, to a large extent depend on our assumption regarding oil investments. If offshore investments do not change very much from the levels in LPS and LPS/FPR in order to keep oil related industries going or because oil prices are expected to increase in the last half of the 1990s, both output, imports and employment will increase compared to PLPS. In that case the current account will continue to be in deficit in the period 1990-1993 and the kind of policy changes discussed in the previous section may be appropriate.

The implication for production in some oil related industries is quite dramatic following the large reduction in oil investments. Output in oil well drilling in the early 1990s is reduced to only 10 per cent of the level in HPS. Production of machinery is reduced by 15 per cent and shipbuilding by 7 per cent. Even if the macroeconomic picture - disregarding the large loss in terms of trade - does not look all that bleak with an unemployment rate of 2,5 per cent in PLPS in 1993 as opposed to 1,8 per cent in HPS, there will, however, be some serious structural problems in the labour market.

4.5. Consequences for electricity consumption

A significant part of total energy output in Norway is supplied by hydroelectric power plants. All electricity consumed is produced by these plants. The consumers of energy goods are able to substitute electricity for oil when the oil price falls. Households may use more oil based products for heating their houses, and producers may also substitute different energy commodities. In MODAG W total energy use in each production sector is related to gross output in fixed proportions, but the use of electricity versus oil products depends on relative prices between the two. The same is the case for households. Thus, changes in the relative price of different energy commodities will lead to substitution.



The production of electricity is exogenous in MODAG A. Our assumptions regarding output is based on the last report from the government to the Storting and implies a growth rate of output of 2,3 per cent annually until 1990 and only 1,1 per cent thereafter. The output assumption is the same in all scenarios. Since domestic demand is endogenous this implies that the net exports are endogenous in MODAG A. In figure 4.8 we show net exports of electricity measured in TWh. In HPS low oil prices implies substantial net exports in the years ahead (equivalent to 5 per cent of the production in TWh), while the oil price increase in the 1990s reduces net exports and a small net import may be necessary in 1993. Lower oil prices will lead to more net exports in particular in the case of permanently low oil prices. This is the case even if the energy intensive export industries increase their energy consumption substantially due to higher output growth as world market demand increases.

5. CONCLUSION

Based on our analyses of the oil market, the crude oil price is not likely to remain at a very low real level the rest of this century. The positive impact on the world economy of a lower crude oil price, will therefore probably be of a temporary nature. If the crude oil price should increase in the early 1990s, the world distribution of income will again change to the advantage of the oil producing countries. For the Norwegian economy, the implication is that the substantial deficits which are likely both on the current account and on the public sector financial account will turn to surpluses in the 1990s.

However, one cannot completely disregard the possibility of a more permanently low crude oil price, perhaps lasting at least 10 years from now. The possibility for this development should to a reasonable extent be taken into consideration in the design of the economic policy in the years ahead and may lead to a certain moderation in domestic use of goods and services. However, even if the crude oil price should stay at a permanently low level, the deficits on the current account will be more or less eliminated in the early 1990s if investments in the sector is heavily reduced.

In our analysis we have assumed that investments in the oil sector will be substantially reduced following a lower oil price. To what extent the government should try to counteract such a development, depends among other things on its belief in an increase in the crude oil price in the early 1990s from today's low level. As central government income already is highly dependent on tax revenues from the oil sector, it is not obvious that a sensible policy is to increase the central governments engagement in the oil sector more than what is the case already. The choice here, however, will have effects on future production capacity for oil in Norway, and this is taken into account in our low price scenarios by lower oil production after 1991. Had our analysis been extended further until year 2000, the consequences of low investments for future production capacity would have become more clear.

The impact for the Norwegian economy of lower oil prices is first of all a loss in terms of trade. Even in the scenario labelled the high price scenario, disposable real income for Norway will be lower in 1989 than in 1985 as a consequence of a loss in terms of trade. In the low price scenario, disposable real income for Norway will be approximately 10 per cent lower in 1989 than in 1985. If we as an alternative imagine no change

in the terms of trade from 1985 to 1989 we may say that the low price scenario implies a loss of 7 years of normal economic growth by 1989.

Table 5.1. Impacts on the Norwegian economy of lower oil prices. Average deviations from HPS.

	LPS		LPS/FPR		PLPS
	1986-89	1990-93	1986-89	1990-93	1990-93
Deviation in per cent:					
Disposable real income .	-6.5	-6.0	-6.8	-9.3	-13.3
GDP	-0.3	-1.4	-1.6	-4.0	-2.0
GDP-mainland	-0.4	-0.3	-1.9	-3.7	-2.6
Unemployment	0.2	0.1	1.0	2.0	0.8
Real wage rate	0.6	-0.6	0.1	-3.2	-0.6
Deviations in bill. NOK:					
Current balance	-15	-27	-13	-17	-50
Public sector borrowing	-15	-25	-12	-16	-60

Table 5.1 summarizes some main effects of lower oil prices with and without changes in the fiscal policy. Changes in the terms of trade leads to deficits on the current account and approximately similar loss in net public incomes. The question is therefore to what extent one should meet the loss of income by lower consumption or lower savings. In the low price scenario without policy change, savings are reduced in line with lower income in the sense that both private and public consumption in 1989 is the same as in the high price scenario while the deficit on the current account increase in line with loss of oil revenues.

According to our calculations, increased unemployment will lead to lower wage growth and thus a slight improvement in price competitiveness. Together with lower capacity utilization following a more restrictive fiscal policy and lower oil investments, this will also improve competitiveness. Thus import shares are reduced and exports increased. Increased profitability in the manufacturing sector will increase the production capacity and therefore potentially export growth. The effects on the current account, economic growth and employment is therefore more positive than the reduction in public consumption and private consumption will indicate in isolation. The supply side mechanism that comes about through increased profitability as sketched above, are represented in the model we have used, but maybe underestimated. The redistribution of resources from public and private consumption to import and export oriented activity which is an important goal of a more restrictive policy may therefore be too

pessimistically estimated in our calculations. The extent of the problems the economy may face given the assumption we have made may therefore be somewhat smaller than in our analysis.

We have with some support in empirical studies, cf. Stølen (1985) based our analysis on the existence of a close negative relationship between nominal wage growth and unemployment. If this Phillips-type equation could be broken either by some kind of income policy or shifted by selective labour market policies or tax policies, it will be possible to reduce deficits on the current account without resorting to restrictive fiscal policies. Whether this can be achieved or not is, however, uncertain.

APPENDIX

OIL PRICES AND EXCHANGE RATES

In this appendix we will explore in some detail possible feedback mechanisms from the crude oil market to markets for major currencies, particularly U.S. dollar.

In theory, interconnections between these markets take three different forms:

- Crude oil, as the major internationally traded good, is presently nearly completely denominated and traded in dollar. Changes in the price of this good obviously change the volume of dollar needed to carry out these transactions.
- Because of its importance in international trade and as an important input in production of most goods and services, a change in its price implies a redistribution of income between countries. Balance of payments are improved in countries which are net importers of crude oil and petroleum products when prices are reduced. Net exporters at the same time experience a deterioration on their balance of payment. The balance of payment effect can be decomposed to a terms of trade and a volume part.
- Transfers of income between net exporters and net importers represent a shift in wealth. If gainers and losers do have different portfolio preferences with regard to their portfolio of assets abroad, net currency demand shifts between currencies. Hence, exchange rates are affected.

In addition to the three arguments mentioned so far, changes in oil prices with its implied transfers of income between and within nations (between energy producing sectors and other sectors, between governments and the private sector) are likely to influence government stances on fiscal and monetary policy. This of course raises the question of what is a neutral policy response to external shocks such as the one focused in this report. We have chosen only to touch upon these questions in this context.

Before going more deeply into these arguments, it is probably worthwhile to give a brief overview of the history of exchange rate developments over the last 15 years. Doing so immediately brings us to a point where clarification of our definitions is necessary. By a bilateral exchange rate we refer to a comparison of the exchange rates of two countries, e.g. the value of US dollar relative to Deutschmark. More interesting is probably the term effective exchange rates. This term

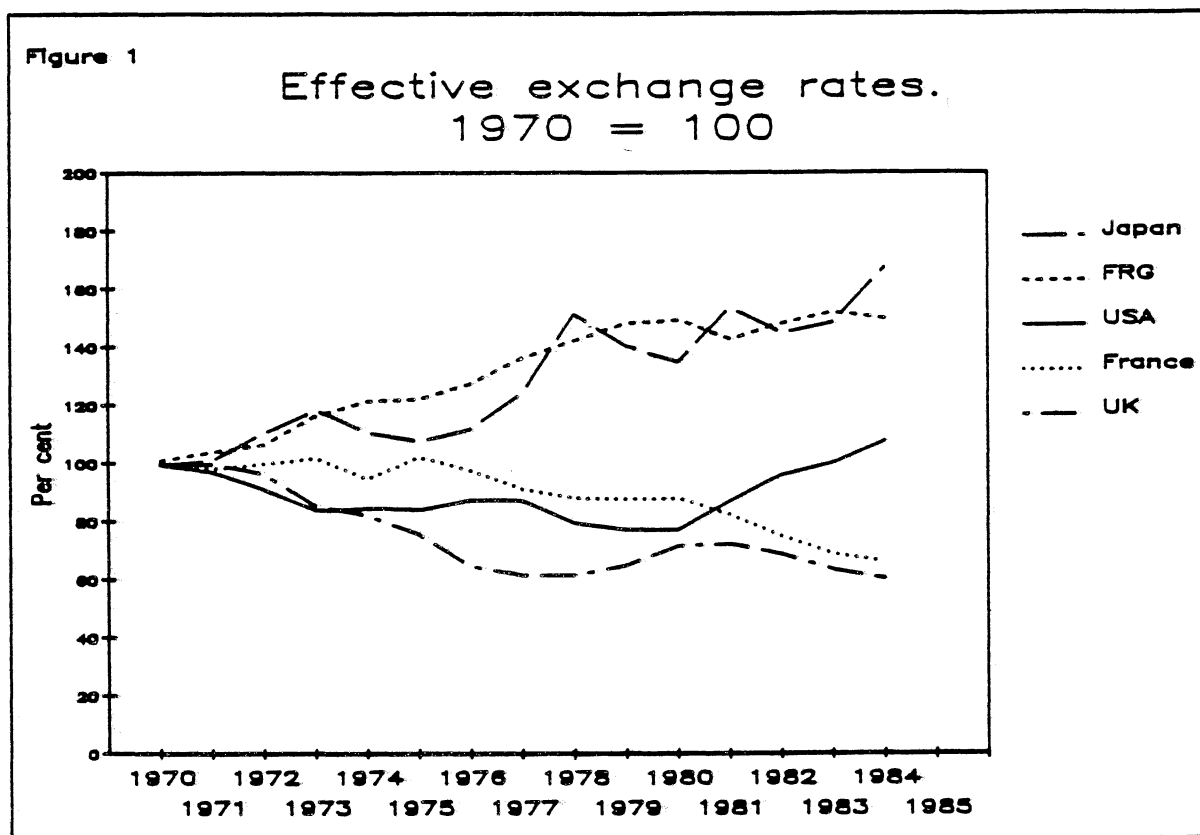
refers to the value of a currency relative to a basket of important currencies, the importance being measured by their importance in trade relative to the country studied. Finally, if added that the effective exchange rate is a real one, this indicates that each nominal exchange rate is corrected for differences in inflation rates in all countries embodied in the currency basket considered. It is the real, effective exchange rate which gives the best indication of one currency's strength or value.

Table A1. Effective exchange rates. Indexes.

	US	Japan	Germany	UK	France
1970	99.2	99.6	100.9	99.5	100.1
1971	96.7	101.0	104.1	99.6	97.9
1972	90.8	110.6	106.6	96.1	99.9
1973	83.6	118.5	116.4	85.2	101.8
1974	84.6	110.4	121.6	81.8	94.4
1975	84.0	107.5	122.3	75.4	102.3
1976	87.6	112.0	127.6	64.4	97.3
1977	87.0	124.1	136.4	61.3	91.0
1978	79.2	151.3	142.2	61.4	87.8
1979	77.0	140.3	148.3	65.1	87.5
1980	77.1	134.7	149.3	71.7	87.8
1981	87.0	153.5	142.7	72.2	82.2
1982	96.0	144.7	148.2	68.6	74.9
1983	100.2	148.5	152.1	63.2	68.8
1984	107.8	167.4	149.7	60.1	65.9
1985					

Source: OECD Economic Outlook, december 1985

In table A1 effective exchange rates are shown for the five largest OECD-countries. A visual picture is given in figure 1. As indicated in the table, the depreciation of the dollar which started after abolition of the Bretton Woods fixed exchange rate system in 1971 stopped after OPEC I. Later, the dollar appreciated over the next few years and peaked again in 1976, after which time it depreciated strongly until oilprices skyrocketed again in 1979. In the following five years, the dollar exchange rate increased considerably against all currencies, in fact the effective rate increased by 40 per cent. Only quite recently, in the spring of 1985, was this process reversed.



After the gold standard was abolished in 1971, the currency system within the OECD area has been one of freely moving exchange rates. This tradition may have been modified after the economic summit between US, Japan, FRG, UK and France in September of 1985. The ministers decided to pursue a policy of depreciating the US dollar through market operations. This fact makes it somewhat dubious whether to predict exchange rate movements in the years ahead on a presumption of the international monetary system being one of freely floating exchange rates, some sort of dirty floating rates or if a return to fixed exchange rates are to be expected.

Overall, US dollar has been the one of the major currencies fluctuating most wildly in the period of market determined exchange rates. Looking again at table 1A, we can observe that the value of the dollar in 1985 was roughly in line with its 1970-value, Yen has been appreciated by close to 70 per cent, D-mark by 50 per cent while UK Sterling and French franc are depreciated by 40 and 34 per cent, respectively.

Let us now proceed with the more theoretical discussion of how oil prices and currencies are related. Before OPEC I, a minor share of transactions of crude oil in international markets were paid for in Sterling, but even then dollar very much dominated as the currency in which international oil trade was settled (Golub (1985)). After 1977, hardly any oil trade is

settled in other currencies except for barter agreements with a few Eastern European CPE's. Consequently, demand for dollar varies almost proportionally with demand for currency to pay for international oil trade. The value of this trade is determined by its volume and the dollar-price paid. Considering the fact that the value of international trade in crude oil in 1984 was approximately 250 billion dollars, this demand for dollar motivated by the need to carry out transactions is of no insignificant importance.

We then conclude that demand for dollar motivated by transaction needs is strongly positively correlated with the dollar price on oil in the short run. After some time, the effect more or less cancels out if the long term own price elasticity of demand for internationally traded crude oil is in the vicinity of minus one. In that case an increase in volumes of crude traded compensate for a somewhat lower price.

A reduction of the price of oil changes the balance of payment for several reasons. The immediate effect is an improvement in net importing and a deterioration of net exporting countries terms of trade simply due to the lower price on oil. This immediate change in terms of trade are somewhat reduced by the fact that the rate of change in both domestic and export prices in the OECD-area (the major net importing countries) are reduced because of lower oil prices. The magnitude of this terms of trade improvement relative to GDP is most significant in Japan. This country do have an insignificant domestic energy production and imports crude oil in the same quantities as US, while GDP is only half as big. But even US gain considerably due to its huge net import of more than 4,5 mbd in 1984. In table A2 we have shown the value of net oil imports for the largest OECD countries.

Table A2. Net oil imports in billion US dollar.

	US	Japan	Germany	France	UK	Italy	OECD
1973	7.0	6.6	5.1	3.3	3.3	2.4	33.8
1976	30.7	23.2	13.1	11.2	7.8	8.1	116.2
1979	57.6	37.9	24.5	16.3	2.2	20.6	186.8
1981	74.8	58.4	28.9	26.8	-5.2	22.2	256.0
1983	49.8	45.6	22.7	18.1	-10.3	17.4	176.8

Source: OECD Economic Outlook, December 1985.

Compared to other large OECD countries except the UK, US is less dependent on crude oil imports. This is due to its huge domestic energy production. Thus, the terms of trade effect is greatest in magnitude in

countries heavily dependent on net import of crude oil or petroleum products to service their domestic needs. In net exporting countries like UK and Norway (and of course OPEC), we are on the other hand looking at significant terms of trade losses.

Looking again at the US position, one uncertain element when judging the effect of lower crude oil prices on the US economy is the fact that a significant part of the domestic crude oil production has high marginal costs. A considerable reduction in prices could induce a number of producers to go out of business, thus stimulating imports. This points to the second important effect on the balance of payment situation: not only prices but also volumes change as response to a reduced oil price. A decline in prices on petroleum products of course stimulates consumption. In most countries outside OPEC, domestic producers, if any, produce at or close to maximum capacity. Increased consumption in these countries has to be met by increased net imports.

Reduced crude oil prices reduces OPEC member countries export revenues. Important here is how OPEC's spending pattern is adjusted.

Table A3. OECD countries exports to OPEC. Nominal shares.

	OPEC exports share			Share of OPEC imports		
	1972-73	1975-82	1983-84	1972-73	1975-82	1983-84
US	5.3	10.1	7.5	22.9	20.5	17.5
Japan	7.0	14.5	11.1	16.4	18.1	19.5
Germany	3.3	8.0	6.5	13.2	14.3	12.3
France	4.8	9.3	9.6	10.6	9.4	10.0
UK	5.8	10.4	8.0	11.5	9.8	8.2
Italy	5.3	12.8	12.7	7.8	9.2	10.2
Norway	1.0	2.1	1.1	0.3	0.3	0.3
OECD total ...	4.1	8.8	7.6	100.0	100.0	100.0

Source: OECD Economic Outlook, December 1985

In table A3 we show OECD countries exports to OPEC as a share of their total exports and as a share of OPEC total imports. Equally important is the responding pattern in net importing countries. It has been estimated that both OPEC I and II represented a redistribution of income from OECD to OPEC of magnitude equal to 2 per cent of GDP in the whole of OECD. Observers seem to disagree to how fast expenditures in OPEC were adjusted and increased income absorbed. Larsen and Llewellyn (1983) indicate that at both occasions, expenditure patterns were adjusted within 3 to 4 years. Contrary to this, Fabritius and Petersen (1981) take the opinion that it

did take at least five years for OPEC to develop and implement domestic spending plans which absorbed increased income after the 1973-74 price hike. Their investigation indicates that respending after the second price hike in 1979 was rather insignificant over the first two years. In both cases, the responses differed considerably between high and low absorbers.

In this report, we study the consequences of reduced, not increased income to OPEC. A priori it is not necessarily appropriate to assume symmetry in response to increasing and decreasing revenues respectively. It is probably easier in a technical sense, though not necessarily in a political sense, to cancel development programmes faster than to initiate new ones. Most OPEC countries already have reduced or terminated a number of development programmes and reduced imports of consumption goods considerably over the last few years.

Looking at the OECD countries, experience from the past is even more confusing. After OPEC I, fiscal and monetary policy was adjusted so as to compensate the 2 per cent cut in effective domestic demand, the objective being to avoid an increase in employment. After OPEC II, focus of attention had shifted towards fighting inflation. To facilitate this goal, economies were deflated and the magnitude of fiscal and monetary response was similar but of opposite sign of the 1973/74 response.

We now turn to the third channel through which changes in oil prices may influence exchange rates; countries' differing portfolio preferences. The huge current account surpluses of oil exporting countries post 1973 have led to considerable financial accumulations and holdings. In addition to current account surpluses, some oil-exporting countries (OEC) have borrowed funds in OECD-countries. Total financial investments consist of cumulated current account surpluses plus gross external borrowing. Table A4 shows current accounts, gross external borrowing and deployment of OEC's funds. Accumulated over the period 1974-84, the oil-exporting countries have increased their external holdings by almost 390 billion dollars. By the end of 1973, the stock of financial holdings was only less than 14 billion, while at the end of 1984, total holdings amounted to more than 400 billion dollars. As usual when comparing the current account and the capital account, we end up with a considerable discrepancy. Over the period these discrepancies cumulate to about 50 billion dollars. While surpluses on the current account over the years 1974-84 amount to 350 billion, registered increase in net assets is only 300 billion. Discrepancies of this type is due to the fact that not all financial transactions

Table A4. OEC balance of payments, gross borrowing and deployment of funds.
Billion US dollar.

	Current account	Gross borrowing	Deployment	Discrepancy
1974	67	2	52	-17
1975	32	3	38	3
1976	26	9	37	-8
1977	25	11	40	4
1978	-3	11	18	10
1979	59	2	55	-6
1980	110	3	91	-23
1981	49	8	54	-3
1982	-15	20	8	3
1983	-15	18	4	1
1984	5	2	-8	-15
Total	350	90	390	50

Source: Bank of England Quarterly Bulletin, March and June 1985.

have been registered, and that valuation of the assets varies.

The distribution of the financial holdings on different financial objects has differed considerably over time. The immediate reaction after oil prices skyrocketed and current account surpluses surged, was to increase deposits in banks. Later, a more diversified allocation of the

Table A5. OEC portfolio structure. Billion US dollar.

	Total	Bank deposits	Government bonds, etc.	Gold, SDR etc.	Stocks, real estate, etc.
1973	13	9	1	2	1
1979	257	131	18	10	98
1983	410	159	38	36	177
1984	402	159	33	32	178

Source: Bank of England Quarterly Bulletin, March and June 1985.

portfolio has evolved. The development since the end of 1973 is shown in table A5.

We note that in the first four years following OPEC II there was a tremendous increase in the oil-exporting countries' holdings of less liquid assets (stocks, real estate). The share of bank deposits in the total has decreased, though in 1984 still constituting 40 pct. of total holdings.

Table A6 shows the distribution of total holdings on different countries. The table does not show distribution on currencies, where US

Table A6. OEC countries holdings grouped on countries. Shares in per cent.

	UK	US	Germany	Other industrial countries	LDC	Others 1)
1973	54	26	-	4	-	16
1979	22	19	6	31	15	7
1983	14	21	6	25	14	20
1984	13	21	6	26	15	19

Source: Bank of England Quarterly Bulletin, March and June 1985.

1) Contains IMF and OEC bank credit to non-banks.

dollars dominate to a larger extent than what is indicated by the table. According to Bank of England, dollar holdings presently constitute almost 70 pct. of the total. This is a higher share than around 1980, see Golub (1983). According to Golub, the dollar's share of total holdings fell from 65 pct. in 1976 to less than 57 pct. in 1979. Later the share has increased. By the end of 1973, oil-exporting countries financial holdings were concentrated to UK, USA and IMF-deposits. The immediate impact of OPEC I was that the oil-exporting countries mainly increased their holdings in UK and USA. Gradually holdings were increased in other industrial countries and in some developing countries. These holdings became more important over time.

By 1979, as compared to 1973, the UK share of OEC's deposits had dropped from 54 to 22 per cent (and continued to decline through 1984). The US share dropped from 26 to 19 per cent, while deposits in other industrialized countries increased from 4 to 37 per cent. However, from table 6 we see that a relatively larger share of holdings is located in US in 1983/84 than in 1979, looking only at industrial countries. This probably indicate trends in and out of dollar in correspondance with the development of the dollar exchange rate. In the years before 1979/80, oil-exporting countries were moving out of the US dollar because its value was declining, while the opposite development has been the case from 1980 on.

In this appendix, a number of qualitative arguments regarding feedback mechanisms from the crude oil market to markets for major currencies have been developed. Some tentative conclusions are indicated in table A7.

Transaction demand for currency to carry on the world crude oil trade is assumed to affect the dollar, but leave other currencies unchanged. Transaction demand and the dollar price of oil obviously are positively correlated at least in the short run. As a net importer, the

direct terms of trade effect through oil prices is positive for US while the direct volume effect is negative because demand is stimulated and domestic production reduced. The price effect is likely to outweigh the volume effect in the short run but this is not obvious after some years. A priori, we are not aware of strong arguments to how terms of trade on other prices or volumes of these goods and services may be affected of an oil price decrease. Differences of portfolio preferences of net importing countries relative to net exporting countries are assumed to put a downward pressure on the dollar. This conclusion is mainly derived from the fact that foreign assets among OECD countries are believed to be more evenly distributed over currencies than are OPEC deposits. Obviously, dollar is the dominating currency even in the OECD-countries holdings, but less so

Table A7. Tentative effects on four major currencies of a considerable decrease in the dollar price of crude oil 1).

	Exchange rates			
	Dollar	D-mark	Sterling	Yen
Oil trade transaction demand	-	0	0	0
Balance of payment effects				
Terms of trade				
Oil prices	+	+	-	+
Other prices	?			
Volume effect				
Oil trade	-	-	-	-
Other goods	?			
Portfolio preferences	-	+	?	+
Overall effect of lower oil price	-	+	-	+

1) If a partial effect of a crude oil price decline is judged to depreciate a currency, minus is imputed in the table. Opposite, a plus sign is used if it works to appreciate the currency studied.

than in the OPEC portfolios. Thus, a shift of wealth from OPEC to the OECD region implies a reduction in demand for dollar relative to other currencies.

Our very tentative conclusion is that the value of the dollar and the dollar price of oil is positively correlated at least in the short run. In the short run, portfolio preferences are believed to dominate over balance of payments effects.

A similar overall conclusion is reached when looking at the value of Sterling. A consensus estimate seems to be that the effective Sterling exchange rate will decline by 3 per cent as a response to a 10 per cent reduction in the dollar price of oil (see Powell and Horton (1985)). As a net oil exporter, UK terms of trade deteriorate. In a longer perspective, even net exports of crude could possibly be reduced because fewer fields become economic to develop at lower prices.

Other major OECD currencies are expected to appreciate if oil prices decrease. The balance of payment improves because the terms of trade effects dominates over increased imports of crude oil and other products. In addition, portfolio preferences stimulate demand for these currencies.

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