

# Surrey Energy Economics Centre

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OIL PRICES IN 1990 AND BEYOND

by

D Hawdon, I Himona  
and J Nasmyth

SEEDS 52

July 1990

## Discussion Paper Series

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## THE PROSPECT FOR OIL PRICES

by Jan Nasmyth, Petroleum Argus, London

The view that oil prices will fluctuate between a maximum of \$20/bl and a minimum of \$10/bl was put forward first by Martin Orlean<sup>1</sup> in a talk to the International Energy Agency in September 1988. Since then it has stood the test of time and has been endorsed by some important figures in the oil industry. It is based on an interpretation of Opec's actions. This Organisation may be relied upon to control production only when the market is seriously weak, near \$10/bl. When that happens production will be restrained and the price will recover. But as soon as it recovers, the discipline is lost. Those producers who have the capacity to do so will produce more than their quotas if the demand is there. Above \$10, Opec automatically meets the demand and quotas are irrelevant.

Refiners, for their part, are cautious. They keep their stocks at the minimum working level. Supply is always equal to what the refiners think demand is going to be. If they guess it right there is no stock build and the market is stable. Trouble starts if the refiners get their estimate wrong. If they underestimate demand, prices will rise. If prices approach \$20/bl, the big producers of the Arab Gulf will become alarmed for the long term future of the market for oil and they will increase production and put cargoes on the water that have not been sold. This is the effective \$20 ceiling.

If the refiners overestimate demand, they will find their stocks building. They will become nervous, pull out of the prompt market which will immediately fall. There is no one else there to steady it. Opec will have to be summoned, discipline will be restored and the market will bounce off the \$10 floor.

The theory accords with market behaviour since the middle of 1986, when Opec responded to the first \$10 danger signal. It responded again in November 1988 and since then we have been comfortably up in the cruising range.

I see no reason why this range should not continue to be valid. The limits will be changed only if Opec changes its perceptions, if it thinks that oil can be sold above \$20/bl without doing long term harm to the market, or if it should think that the \$10 floor can no longer be held. Assuming that the price of oil remains in the \$10-20 range, what will the effect be on demand and supply?

### SUPPLY

First let me consider supply. With a bit of luck the answer will be so clear that I shall not have to spend much time on demand. The broadest measure of future potential to supply is the figure for published proved reserves. For the world these rose from 640 billion

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<sup>1</sup>Joe Roeber Associates, see MEES 17 October 1988

barrels in 1980 to 900 billion in 1989, an increase of 40pc. The increase was achieved after producing and consuming some 200 billion barrels of the 1980 reserves. The increase of world consumption over the same period was below 1pc. Using this broad indicator there is no reason to suppose that the price of oil in recent years has been insufficient. We have been flooded with new reserves. More up to date figures for the current year show the trend continuing.

Much of the increase in reserves has been due to increasing the recovery factor of reserves which were known in 1980 and not due to finding new reserves. Expenditure on new technology in the upstream sector has helped.

The justification of the current level of prices is not to be found in the world picture. It has to be sought in the reserve picture outside Opec and especially in the USA. If we subtract the Middle East reserves from the world we find that reserves rose by a more modest but still adequate 17pc. And in the USA the reserves fell by 3pc.

The inference seems to be that the current level of crude price is sufficient to maintain exploration at an adequate level except in the case of the USA, and that is a very important exception.

These findings accord with what we have been told about costs of exploration and production. New technology has led to a significant fall in the costs in the high cost fields. Between 1986 and 1988 operating costs in established fields in the British North Sea fell 17pc. For new fields the production costs are now estimated at 25pc less than they were in 1986. These really dramatic reductions have led to a surge of development expenditure. The UK Minister of Energy has forecast that expenditures next year will be up 75pc on 1989.

Operating costs on existing fields in the British North Sea are now estimated at \$4.2-5.8/bl. Production costs on new fields are estimated at \$9-13/bl, compared to estimates of \$12-18 in 1986. The new fields would be in trouble if the price of crude fell and remained on its \$10 floor. But as long as crude remains above the middle of the \$10-20 range, the British North Sea is assured not only of profitable production from its developed fields, but also of further development.

The same cannot be said of the USA. Domestic production is falling and now accounts for only some fifty percent of the domestic demand. What, if anything, the US authorities will do about this is an open question. At the moment they seem inclined to do nothing. The vote of the consumer counts for more than the pressure from the domestic oil industry and the warnings of the Defence Department. But if they do decide to do anything by way of protecting the domestic producers, the effect will be to lower price outside the USA. We have had plenty of experience of US protection in the years of the quota from 1959-70. The effect of such measures is to raise prices in the domestic USA, but not to the full extent of the protection. The difference is made up by a fall in price outside the USA. It is widely believed that there is an understanding between the Saudis and the US administration. The Saudis have been warned that if they let the price

fall too low, the US will respond with protection. This reinforces the urgency of the case for quota discipline whenever price falls toward the \$10 bottom limit.

Finally it must be mentioned that the cost of producing oil in the big fields of the Middle East is very low. Nothing has been said about this recently, but the cost in the days of the majors was 10-20¢/bl. There is no reason why it should have gone up in real terms.

From this brief survey of reserves, it is clear that the price will have to go over \$20 to maintain production in the USA. At \$15 it will be sufficient to sustain exploration and to maintain production in the North Sea, and that at this level the reserves in the Middle East will continue to mount.

There is of course a distinction between proved reserves and producible reserves, but it does not seem to me to matter much. If the need for production arises the comparatively modest expenditures that are needed to convert proven into producible will be made, and present plans to increase production in the Middle East look more than adequate. Plans have been published to increase Opec's production capacity by 4 to 6mn/bd in the next five years. The producible reserve is expected to rise.

I have defined three categories of oil reserves, those in the USA, those in non-Opec of which I have chose the British North Sea as an illustration, and those in the Arabian Peninsular. The costs of production in these categories are of differing orders. The most immediately relevant are those of the USA. Prices in the \$10-20 range are not sufficient to maintain reserves in the USA but, for the time being, they appear to be adequate to keep the run down of these reserves politically tolerable. The big producers are aware of this consideration and it is one of the reasons, perhaps the main reason, why they can be relied upon to support the \$10 floor.

In the event of a change in policy in the USA, either because they have opted for protection or because they have opted for some other method of assuring security that will cost less than maintaining domestic production, the next stop becomes the cost of non-Opec oil. I cited an estimate of the cost of developing new North Sea production at \$9-13/bl.

Until recently one could rely on the oil industry to pay a premium for non-Opec reserves. I suspect that will not be reliable for much longer. Perestroika is an idea that is not confined to Russia. Events there have been dramatic, but there has been an equally dramatic breaking down of the barriers that separated the commercial oil industry from the state-owned oil industry. The chasm that opened with the nationalisation of production assets in 1972-4 is being bridged and major oil companies are now being invited back into territories from which they were expropriated.

To keep 10¢ oil shut in while spending money on developing \$13 oil requires an immense wall of mutual distrust. That wall is crumbling. The strongest inhibition on developing Opec oil today is not security, it is quota. The big Arabs can be relied upon to continue to restrict production at some point, currently \$10. The non-Opec states can

be relied upon not to restrict production, because if they do their potential reserves will not be developed. With the security factor dwindling freedom to produce has to be offered to offset the low costs in the Middle East.

If we are talking in terms of reserves, quota is circumventable. The proposal that the US stockpile hire, instead of purchasing Saudi crude, may have wider application. The cheapest way of acquiring oil reserves today is not looking for them or even buying them on Wall Street. It is hiring them and putting them in a convenient salt cavern.

To sum up these thoughts on the availability of oil supply, one may say there is plenty of oil at a price. At what price depends in the immediate future on the policy of the USA. For the time being US policy requires a \$10 floor. Looking further ahead, perhaps five years, perhaps less, one must assume that the USA will resolve its policy dilemma in one way or another and cease to rely for its security on the restraint of the Gulf Arabs. The Arabs will then have to decide their policy in the new circumstances. They may or may not decide that it is in their interest to maintain the price at the level which is necessary to sustain non-Opec production, a price which in the case of the British North Sea is estimated at \$13. Their decision is likely to be determined by what happens to demand.

## DEMAND

We are today still within the most prolonged period of expansion in the history of the world. Yet we have to acknowledge that the demand for oil is growing more slowly. A forecast on the basis of recent trends suggests something between one and two percent for future years, the higher figure if economic activity continues at a high level, the lower figure if it does not.

But we do not have to be limited by what we have seen in the past. We can see things that are happening now which will make the future pattern different. Most notably, there is pressure from environmentalists and there is competition from natural gas. The two together may lead to gas taking the growth that has been postulated for oil.

Proven gas reserves are almost equal to those of oil. Two years ago they were equal, but the proving of new reserves has put oil ahead. Consumption of gas is only one half of the consumption of oil, so the reserve production ratio is higher. It seems a reasonable assumption that in the future the owners will wish to see these reserves produced and brought to the market and that their policy in respect to pricing will be competitive.

This has not been the case in the past. The pioneer in moving gas by sea was Algeria and Algeria's French trained officials took the view that gas at the well-head should be priced at the calorific equivalent of oil at the well-head. They were able to persuade only one of their customers that this was an acceptable formula and that was France and it took the personal intervention of the French president to get the contract signed. In due course even the French decided that the Algerian gas was too expensive

and it is now understood by both parties that gas has to compete with other fuels delivered to the consumer. The normal practice in Europe now is for gas to be indexed to oil.

The Algerians had an ally in the national monopolies or near monopolies that marketed gas in Europe. These took the view that gas was a premium fuel and should command a premium price. Dependent for their revenue on small scale sales to householders they were and mostly still are reluctant to quote competitive prices for bulk sales to industry.

There are signs that this restraint on the part of the marketers may be breaking down. British Gas has widened the range of customers to which it will supply interruptible gas. Shell and Esso are to compete with British Gas in the UK. In Italy the electricity authority, ENEL, has made its own arrangements to import Russian gas and intends to make its own arrangements to import LPG. And in Germany, Wintershall is proposing to build a pipeline from Rysum, near Emden, where the Norwegian gas comes ashore, to Ludwigshaven. Faced with the refusal of the established gas marketers to agree common carrier rights, industrial consumers are building their own pipelines.

Gas is now being priced in a manner competitive with oil in parts of the world where this has not been the case in the past. It also has advantages for the customer which are being emphasised by the environmental movement. At the light end of the barrel, oxygenates are being blended into gasoline to replace lead and oxygenates are made from gas. Some blenders have put as much as 10pc of MTBE into their premium grade. Further developments may carry the gas substitution further. It is now clear that the elimination of lead and the limit on vapour pressure have not sufficed to make the quality of the air acceptable to the inhabitants of Los Angeles. President Bush has suggested that methanol be substituted for gasoline. Los Angeles is happily an extreme case, but it tends to be a precedent for the rest of the world.

At the heavy end, gas has advantages for electricity generation. A combined cycle gas turbine achieves 60pc efficiency, as compared to the 40pc which is the best that steam raising can achieve. The turbines are efficient in small units, which makes possible the use of waste heat for local heating, thereby increasing the efficiency still further. If governments continue to worry about carbon dioxide, the quickest way to get the emissions down is by using natural gas to generate electricity.

Gas also competes directly with the middle of the barrel for domestic heating.

In the US gas is the favoured fuel for new electricity plants because it requires less capital and the industry is short of capital. In the UK, gas is the fuel selected by the new units that are planning to supply electricity when the industry is denationalised. Gas is everybody's favoured fuel just now, but this has been so in the past, and past experience suggests that the development of gas takes longer than is expected. To some extent that is due to the higher capital expenditure required for transportation, whether it be by pipeline or by liquid gas carriers. But to some extent it has been due to



institutional drag. The gas monopolies of Europe have not been in favour of expanding their markets too fast. At Nova especially they have not been in favour of developing the bulk market at the expense of the household market. Those monopolies now find themselves outflanked and perhaps things will move faster from now on.

To sum up the demand situation, oil growth is growing more slowly and it is likely that the growth will slow further as a result of the competition from natural gas. Let me illustrate the point with two assumptions, using Western Europe as a test case. The first assumption is that the growth of demand for oil and gas will be at 1.5pc a year for the next ten years. The second is that the proportion of gas in the total will in ten years rise from its current 25pc to the 37pc which is what it is in the USA now. The effect is to reduce Western Europe's consumption of oil from 596Mt in 1988 to 580Mt in 1999. Gas takes all the growth.

### CONCLUSION

When talking about the pricing policy of the big Arabs, I suggested that the bottom limit today was \$10 because below that they feared a reaction from Washington. I also suggested that in a few years the US would have resolved its security dilemma in one way or another, either by protecting its domestic industry or by seeking security in some other way, and that then fear as to what Washington might do would no longer be a force in Arab decision making.

The Arabs will then have to decide on whether they want to effect a decline in non-Opec production, or whether the demand is big enough to accommodate both non-Opec at somewhere around the present level and what they think they need for themselves.

I believe that if they find that world demand is actually falling, they will quote a price calculated to stop the development of non-Opec crude. In the British North Sea the development of new production facilities is estimated to cost \$9-13.

From all the facts available to us now, we therefore have no reason to change our view that crude oil prices will continue to fluctuate between \$10 and \$20 per barrel.

## PROSPECTS FOR OIL PRICES

by Irene Himona, Hoare Govett

### INTRODUCTION

I must admit a certain degree of embarrassment standing in front of this audience today, about the fact that my oil price forecast of last year (\$13 a barrel) was completely wrong. Fortunately, I was by no means in a minority of one, and if I remember correctly, in last year's SEEC oil price seminar three of the four speakers were also worried about weak and volatile oil prices. As it turned out prices were not only strong, but also exceptionally stable by historical standards. I suppose it goes to prove that consensus are almost always wrong.

Last year I emphasised uncertainty as a key feature in the market, and if anything 1989 proved the point. Furthermore, looking out into the future, the uncertainties seem to be multiplying by the day. I have to say that although we now know exactly why we were wrong last year, given the same set of data, we would make exactly the same, pessimistic forecast.

Unfortunately, as stockmarket analysts we are not exactly in the business of scenario planning. The conventional stockmarket indicators used in assessing whether an oil company's shares are over or undervalued, require one oil price assumption. Although we have to use sensitivities, at the end of the day we can only have a single investment recommendation, buy or sell, but not both. Therefore, we have to produce what is, essentially, a single point forecast by forward projection of demand and supply trends, on the basis of the information available. In theory, this approach suffers obvious drawbacks. However, the unpredictability of the past 12 months was such that even scenario planning would be extremely hard pushed to produce the goods.

In addition, I think it would be fair to say that what is a lot more important with any forecast is not simply the actual prediction, but the analysis and interpretation that goes with it. All that a forecast is attempting to achieve is reduce uncertainty by identifying the key driving forces in the system. As I will be discussing, the medium and longer term outlook for oil prices is extremely clouded by a number of conflicting developments: the environmental issue in the West and its likely impact on oil consumption but also on the whole future of industrialisation within the LDCs, as well as the revolution currently under way in the Eastern Block, provide a sample of the uncertainties faced. These particular factors are largely political in nature, and it would take a very brave forecaster indeed to try and predict their outcome, let alone quantify their impact on the oil market and oil prices.

## **THE PAST TWELVE MONTHS**

During the fourth quarter 1988, OPEC was producing 22.5 mbd of crude oil and the average Brent spot price was \$13.50 /bbl, whilst a crude like Dubai fell to below \$10 a barrel temporarily. Speaking on this forum in December 1988, I was predicting continuing weak oil prices in the face of what appeared to be an evolving OPEC struggle for market share, with planned capacity expansions and overproduction creating a bearish outlook. A year later and OPEC production is approaching 23.5 mbd whilst Brent is standing at \$19.20 a barrel. Very few observers, whether in industry, academia, the City or the press, would have believed this possible last year. It is a reality today, and the reasons are to be found in exceptional developments on both the supply and demand sides of the market, as well as in the notorious nature of the data available in the oil industry.

## **SUPPLY DISRUPTIONS**

The first reason for the oil price strength experienced is to be found in the non OPEC supply side disruptions. First were the numerous accidents that occurred in the North Sea. Such accidents started in July 1988 and continued until the summer of 1989. The result was that UK output was down to a 10 year low of 1.35 mbd in June 1989. The 10 month average to October 1989 was only 1.74 mbd, compared with 2.3 mbd in the equivalent 1988 period. In other words, a loss of over 0.5 mbd from the North Sea alone.

Then there was the Exxon Valdez incident of course, which led to a temporary disruption in Alaskan output, over and above the natural decline experienced in the area. It also turned out that the decline of the mature areas was much sharper than even the field operators were anticipating. The combined effect appears to have been a fall of around 460,000 bd in average US oil output for 1989, the largest annual decline experienced since 1974.

Taken together, the supply side problems in the form of North Sea disruptions and a steep decline in the US, were responsible for the loss of some 1 mbd in non-OPEC production. Almost half of this loss was compensated for by increasing output in Norway (up 0.34 mbd for the first 10 months of the year) and certain LDCs, so that the 1989 decline in non-OPEC output will probably average around 0.4 - 0.5 mbd.

## **DEMAND STRENGTH**

The second reason for the oil price strength of 1989 was the exceptional demand strength, which goes back to the fourth quarter 1988. Nuclear plant problems in Japan, coupled with shortages of hydroelectric power in Europe and stockbuilding in Germany in advance of tax changes, led to Free World oil consumption rising by over 4.5% in Q4 88 over its year ago level. The result of such exceptional strength in Q4 88 was to boost the 1988 average demand growth to 3.3%, compared with a consensus forecast for growth of around 2.5% to, at most, 3%.

For forecasters at the low end of that range - and we were certainly in that camp - the difference amounted to some 400,000 bd, which is significant. In other words, demand turned out 0.8% higher than anticipated. The extent of the shortage, of course, was not actually known until well into 1989; the poor quality of the data - which more often than not verges on misinformation - has always been a severe problem in the industry. This led to a lot of talk a year ago about the "missing barrels", as it was presumed that what appeared to be surplus oil produced by OPEC, was moving into storage, to be released at some later stage. The consequence was that demand projections for 1989 were based on a very low starting point, leading to the expectation of a surplus.

The combined effect of the demand and supply side disruptions was a "shortage" of some 900,000 mbd for 1989. This amount was excluded from conventional demand/supply/stock models at the beginning of 1989. It is not therefore surprising that the surplus we were anticipating last year never materialised and that, what was at that stage regarded as heavy OPEC overproduction, was quite comfortably absorbed. In fact, were it not for such increased OPEC output, oil prices would be well above current levels.

Unpredictability has been an integral part of the oil industry's evolution over the past twenty years or so and the past twelve months simply served to reinforce that unpleasant truth. In retrospect, it is always easy to explain what has happened. The main question we are faced with, however, as to what is going to happen in the short and medium term is, as usual, a much more interesting and difficult one.

## **THE SHORT TERM**

### The OPEC Meeting

The outcome of the November conference in Vienna was greeted with an initial oil price fall of around 40 cents a barrel, as the new quota of 22 mbd exceeds most people's demand projections for the first half 1990. Furthermore, it was recognised that continuing overproduction by the UAE will mean that the 22 mbd ceiling will be exceeded by at least 0.5 mbd if not more. These are the negatives which caused the initial price weakness.

On the positive side, however, Kuwait agreed to cut output in return for an increased share in the group total. This has been widely seen as a welcome moderation in the country's stance and a success for the OPEC. Additionally, the market was encouraged by what it saw as a sign of maturity within OPEC, with a gentlemen's agreement not to use overproduction by the UAE as an excuse for quota violation by other members.

### Oil Traders

In the short term, the oil price outlook will be, as always, a function of perceptions and expectations in the oil market, by contrast to the longer term prospects which become a function of demand/supply fundamentals. The oil traders who were pessimistic on prices

a year ago and cut their positions by selling the oil, were badly caught out and lost money when the unpredictable disruptions started setting in. This experience will, in itself, be adequate to prevent them from going short of crude again, especially as we are just entering what appears to be a cold winter. So the downside will be limited for the next 2-3 months.

#### The Fundamentals - Short Term

Moreover, on the fundamental side the "one off" factors of 1989 have not disappeared. France is currently experiencing problems with almost half of its nuclear power plants and so is Spain, whilst the dry summer has led to a cut in European hydroelectric output of around 20%. On the US side, the latest cold snap in the eastern part of the country has apparently contributed to space heating energy use rising some 20% above normal levels. Such developments will most likely lead to demand strength over and above conventional forecasts, though the precise magnitude cannot be predicted.

There is also a lot of uncertainty on the supply front. The well publicised production problems in the Soviet Union have already led to net exports to the West running some 0.5 mbd below normal, and the trend is expected to continue next year. Additionally, maintenance periods in the North Sea will be twice as long as the average - six weeks rather than three - due to the need for the installation of safety valves in certain fields in the spring 1990.

Taken together, the above factors mean that the call on OPEC as the residual supplier may, yet again, prove to be higher than a ceteris paribus forecast would indicate.

Even if the worse happens, however, and the much feared surplus does develop due to OPEC overproduction and seasonally lower demand, given the traders' attitudes, any oil price weakness would only materialise after a time lag, and only after the surplus became well documented. Additionally, looking at the demand-supply-stocks balance, any such weakness should only be minimal, as current stock levels do not appear to be excessive.

For 1990 as a whole our forecast for the average Brent spot price is standing at \$19 a barrel, which does not exclude some weakness in the first half of the year. We expect growth in the demand for OPEC oil to slow down, with a projected increase of 0.7 mbd, to a total of 21.3 mbd for the year as a whole. For the crucial first half, we anticipate a first quarter call on OPEC of around 22 mbd, falling to 19.8 mbd in the second quarter 1990.

The 0.7 mbd expected rise in the 1990 demand for OPEC crude compares with a rise of around 1.65 mbd in 1989. So the room for manoeuvre is still quite limited. The Gulf countries' demand for a substantially higher market share cannot, as yet, be fully satisfied.

At the same time, however, current stock levels do not appear to be much above levels in 1988 and given the uncertainties mentioned above on both the demand and

supply sides of the equation, we are assuming that, once again, OPEC will manage to sail through 1990 largely unharmed.

### **THE MEDIUM/LONGER TERM OUTLOOK**

So far I have looked at the short term - the previous 12 months and 1990. As far as investment decisions in the oil industry are concerned, however, the medium/longer term outlook is what really matters, since time lags usually cover periods of 5-10 years. Indeed, it is precisely because of the long time lags that we never know exactly what the physical state of the industry is, and on which side of the equilibrium the market lies. Time lags mean that new trends on the demand or supply sides, or the evolution of existing trends, are not immediately obvious and their impact will only become known much later. Thus, unfortunately, we are always a few steps behind the evolution of the market, a problem compounded by the notorious nature of the available data.

#### The Conventional Wisdom

The evolving conventional wisdom today is a simple, positive view of the future, which goes as follows : oil consumption is set on a gently rising trend, of around 1- 2% per annum with certain LDCs providing the main engine of growth. At the same time, non-OPEC supplies, excluding the unlikely discovery of a new major oil province, will at best remain constant, and most likely they will start declining at some stage during the next decade. Thus, the demand for OPEC oil will rise over time to a level which will provide adequate comfort, as far as OPEC revenue requirements go.

Oil prices within this scenario are set to remain stable at around \$18/bbl for a couple of years. By then demand will be approaching OPEC production capacity, and when the two curves meet - in fact before then due to the expectation of the event - we may very well experience a price hike, particularly if the planned capacity expansions within the group have not materialised by that time (if Iraq's experience is any guide). The "race" between demand growth and capacity expansion is, in fact, becoming quite a common topic of discussion; what this expression basically says is that price is a function of demand and supply. Optimism in the industry is such that OPEC is already being encouraged by some commentators to "remember the lessons of the 1980s" and avoid the temptation of keeping prices at a high level.

#### Uncertainties

So what's wrong with this forecast and should there be something wrong with it? It seems that, although rational and feasible, this vision of the future is too good to be true. The world used to be a lot simpler and predictable once upon a time, which meant that in the 1950s and 1960s forecasters in the oil industry had an easy life. Nowadays, the industry is a much more complicated place than the above view would have us believe.

I mentioned in the introduction the very hot topic of the environment. Irrespective of the contradictory scientific evidence as to whether the problem exists or not, the fact that the majority of people believe it does, will be enough to necessitate political action. The Alaskan experience, with the local tax increase and the indefinite closure to exploration of the ANWR, both of which followed the Exxon Valdez accident, were politically motivated actions which are not necessarily economically rational, but they do definitely point to a plausible direction of policy in the future: against the oil industry, against the energy industry in general and indeed, against the very lifestyles we, in the West, are used to, and those in the LDCs aspire to.

Developments in the Communist world have got to be looked at as well, as it appears that they may turn out to be of far greater significance than the environment, placing the whole of the developed world into a very turbulent period, with consequences we have not even started to appreciate. The Communist countries will be a market whose sheer size creates the potential for massive increases in energy consumption, as it enters the industrialisation process. On the other hand, given the tremendous inefficiencies of the system, there is also potential for increased energy conservation and efficiencies. Which one of these conflicting forces will prove overwhelming is anyone's guess - assuming, that is, that the changes under way are allowed to reach their natural conclusion.

Due to the increasing number of unknown and thus uncertain topics, we find ourselves in an environment of variables, with absolutely no constant on which to base future predictions and plans. Hence, I think there are very few conclusions to be drawn regarding the longer term outlook for oil prices.

First, it is reasonable to say that any long range forecast is more or less guaranteed to be wrong, if past history is any guide; forecasters at large have proved to be quite unimaginative in the past, with a lack of vision and there are not many grounds for assuming a change in their nature. What vision there is, will be extremely weak due to the above mentioned developments.

Second, and because of the above point, it could be argued that long term price forecasting is irrelevant anyway. The oil industry, oil producing and consuming countries have survived by getting it completely wrong in the past - with a lot of pain, but nevertheless they did survive. It is necessary to be aware of pressures developing in the industry so that for planning purposes, the business retains the speed, flexibility and adaptability required in a constantly changing market for its survival, but that is probably as far as one would want to go.

Given freedom of choice, no-one would engage in oil price forecasting, short or longer term. Scenario planning, which avoids specific predictions, would be a much more convenient approach. Nevertheless, whenever there is demand for a specific product, suppliers are bound to exist.

## **OIL PRICES AND OPEC STABILITY**

by David Hawdon, University of Surrey

### **INTRODUCTION**

The aim of this paper is to examine the contribution of OPEC stability to an understanding of oil price movements. In an oligopolistic industry like crude oil it is uncontroversial that the output behaviour of the major suppliers will affect prices. However, contrary to the usual predictions of price stickiness in such markets crude oil prices are notorious for their volatility. The precipitation of price movements is explained in terms of changes in the degree of frustration or dissatisfaction with previously agreed quota limits.

### **STABILITY OF OPEC**

In the oil market, as in any market with a significant oligopolistic structure, stability in the behaviour of the dominant grouping of producers is the key to price variations. The interactions of market demand and total supply will explain the general drift of prices but sudden variations in prices whether explosively upwards or downwards depend on the behaviour of the principal producers.

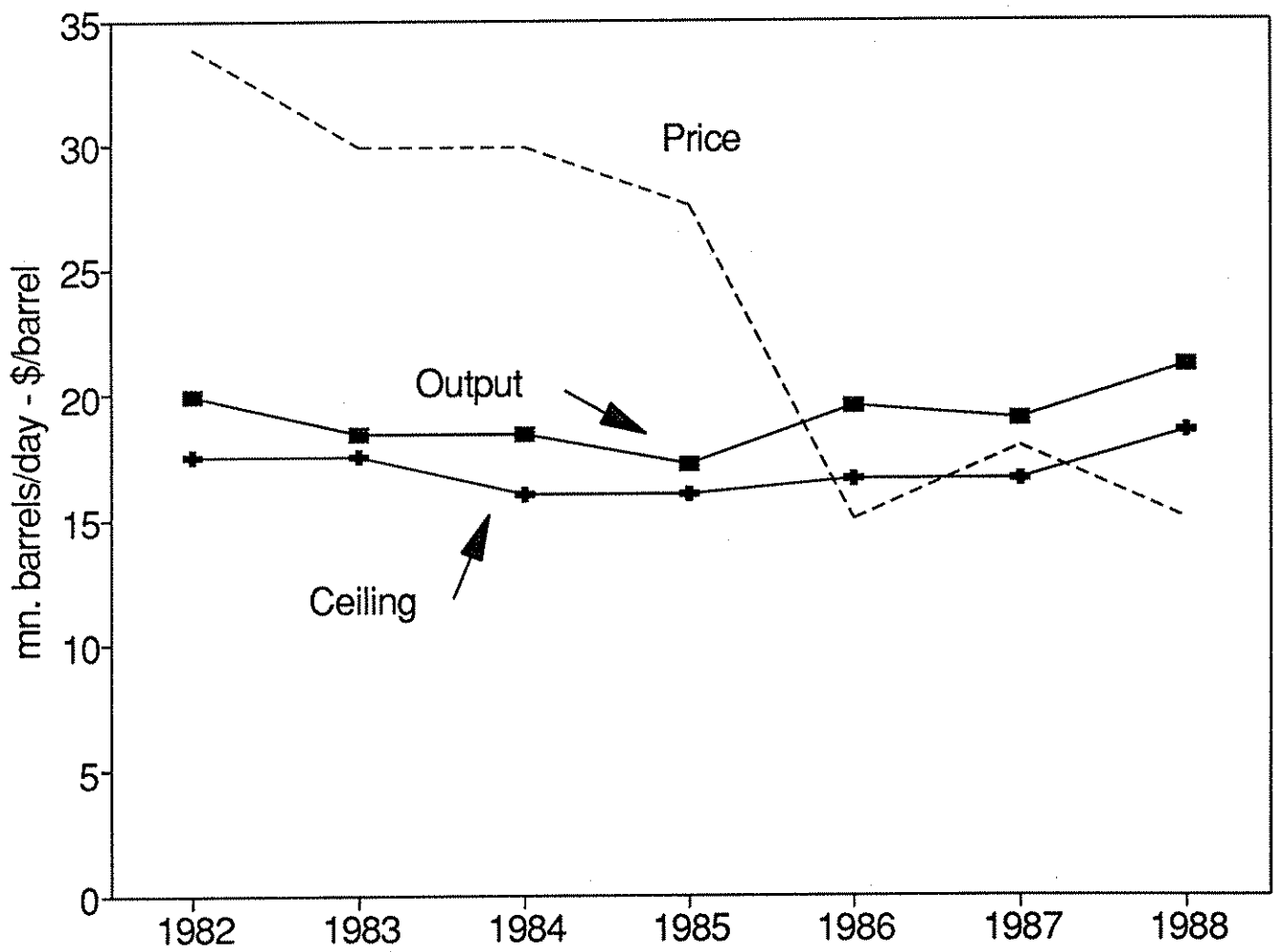
Since its inception OPEC has attempted to control oil prices and production levels. Early efforts to control both variables simultaneously were, as might be expected, futile and by 1982 emphasis centred on the regulation of the market by a system of supply quotas. CHART 1 shows the relationship between total OPEC output, agreed quotas and the course of prices. The expansion in Saudi Arabian production in 1986 showed the impact of deviation from quota by a major producer on total OPEC output and thence on the price level. Towards the end of the period the effect of such deviations has become modified by growth in energy demand.

Total OPEC output is not however the only channel through which prices are affected. In addition, as Robert Mabro has pointed out (Mabro, 1989), even in a period of zero overall change in production, competitive movements in shares can generate price movements where demand is inelastic. Thus in 1986 even without the overall increase in supply the efforts by Saudi Arabia and Kuwait to increase their market shares are likely to have exerted a significant influence on prices.

OPEC quota arrangements were intended to prevent such behaviour. Why then have they generally broken down? If we can answer this question we can hopefully model price changes more accurately. The conventional explanation of cartel instability is that whenever the marginal revenue to a cartel member from cheating is greater than



### CHART 1. OPEC OUTPUT AND CEILINGS



the marginal cost there exists an incentive to expand output. For any member, except the largest, the marginal revenue is relatively constant at fixed output, is approximately equal to the price and is greater than marginal cost. Thus economic theory would predict cheating as the norm and enhanced cheating when the price minus marginal cost difference is high.

This explanation suffers from two defects. At a general level it is not clear why any cartel would ever be formed if the prospects for its survival are poor. In the specific context of the oil market, it does not seem consistent with the occurrence of the single most blatant example of "cheating" at a time when prices were weak.

The benefits of production sharing in the oil industry are well known. Where the market elasticity of demand is low supernormal profits are to be made by a group controlling output. In addition the persistent tendency towards vertical integration in the industry indicates the economic attractiveness of establishing some control mechanism for regulating prices. It is these benefits of cooperation which provide the motivation towards production agreements within OPEC.

The problem for all cartels is to agree on the quota allocation. In a market where the producers differ in fundamental operational and socio economic characteristics it is not surprising that dissatisfaction arises out of any given set of allocations. In its various attempts to devise a method of establishing the quota levels, OPEC discovered a wide range of factors about whose importance the members disagreed. As many as 23 separate factors were put forward for consideration at the 1986 OPEC conference, eventually being reduced by a voting procedure to 8 (see MEES, 1989), which were subsequently used to form quotas for the period from 1986 to 1988. Although the members disagreed on the weights to be allotted to each factor, they provide an insight into the underlying concerns of the principal producers. Three factors - reserves, capacity and historical production - were given the greatest weight, followed by socio economic/development factors such as population, economic dependence, domestic consumption, production costs and external indebtedness. Although these factors were never formally used in constructing quota allocations they provide us with the components of an OPEC preference function for quotas.

$$U = f(\text{reserves, production capacity, historic shares, population, dependence, costs and debt})$$

The existence of such preferences in regard to quota allocations suggests the construction of an index of dissatisfaction which might help explain adherence to or collapse of agreements. Previous work on OPEC stability suggests that members'

willingness to sacrifice output increases with GDP levels but falls with population growth. This can be used to assess general preference for cooperation over competition. However, it says nothing about the degree to which members are dissatisfied with existing commitments and enables no inference to be drawn regarding their willingness to violate agreements.

The approach adopted here is to construct an index of dissatisfaction measuring the difference between actual and 'ideal' quotas at a point in time. The 'ideal' quota is the quota that an individual producer would choose given information only on factors in the producer's preference function. One method would be to use the weights revealed by the 1989 OPEC study as being preferred by each producer. The problem with such an approach is that the choice of weights is likely to have been influenced by the then current state of the market and is unlikely to represent an equilibrium position. An alternative method is to estimate the producers' preference function using actual production levels during a period of market stability. Inevitably the choice of any year will seem to be somewhat arbitrary. However, by 1988 the oil market appeared to have settled down following the unusual events of 1986 and so 1988 was chosen for estimation purposes. Preferences (U) were measured by actual production levels in that year. The alternative of using quotas was rejected on grounds that there could be no assurance that quotas were acceptable to all producers. A simple linear model of the relationship between production and three major explanatory factors - reserves (Res), productive capacity (Cap) and population (Pop) - was estimated and found to explain approximately 96% of the sample variation.

$$\text{Prod (U)} = 0.150 + 0.006 \text{ Res} + 0.477 \text{ Cap} + 0.003 \text{ Pop.}$$

Estimation of a more general function was not possible given the limited sample size. The addition of other factors made no significant difference to the explanatory power of the equation.

Comparison of U with the quota allocation for any country provides a measure of dissatisfaction (1). Interestingly Kuwait and the UAE appear to experience the greatest deviation between desired and quota output levels in 1988 so that the method correctly pinpoints countries most likely to break with quotas. Saudi Arabian dissatisfaction on this measure reached a peak in 1986 (see CHART 2 ) which also conforms to our expectations. An aggregate measure of dissatisfaction, allowing for capacity availability but excluding Iran and Iraq, and focusing on positive values only (2), reached peak values during the period 1985 to 1986 suggesting that this period was one of intense pressure on the quota system. (see CHART 3)

CHART 2. SAUDI ARABIA DISSATISFACTION  
1982 TO 1988

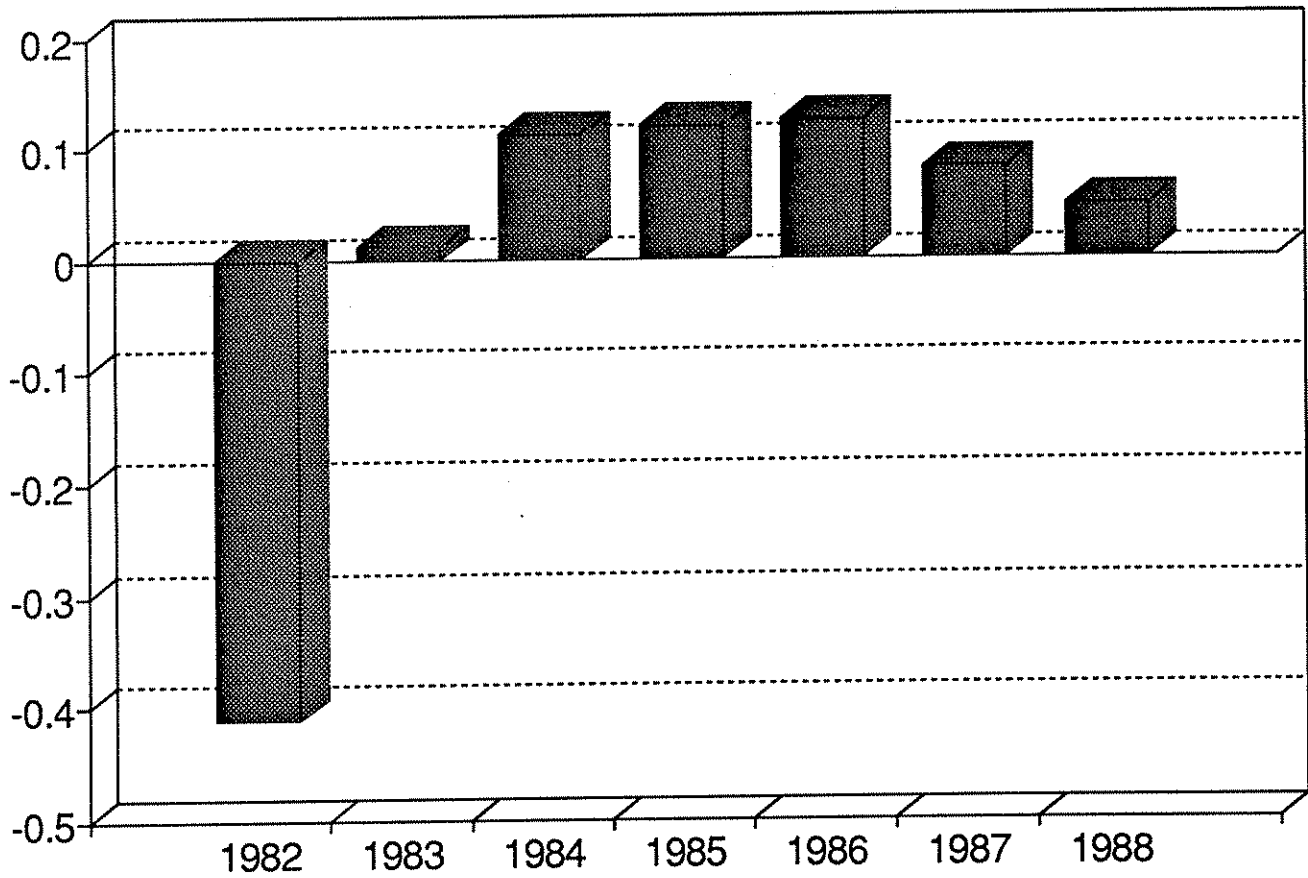
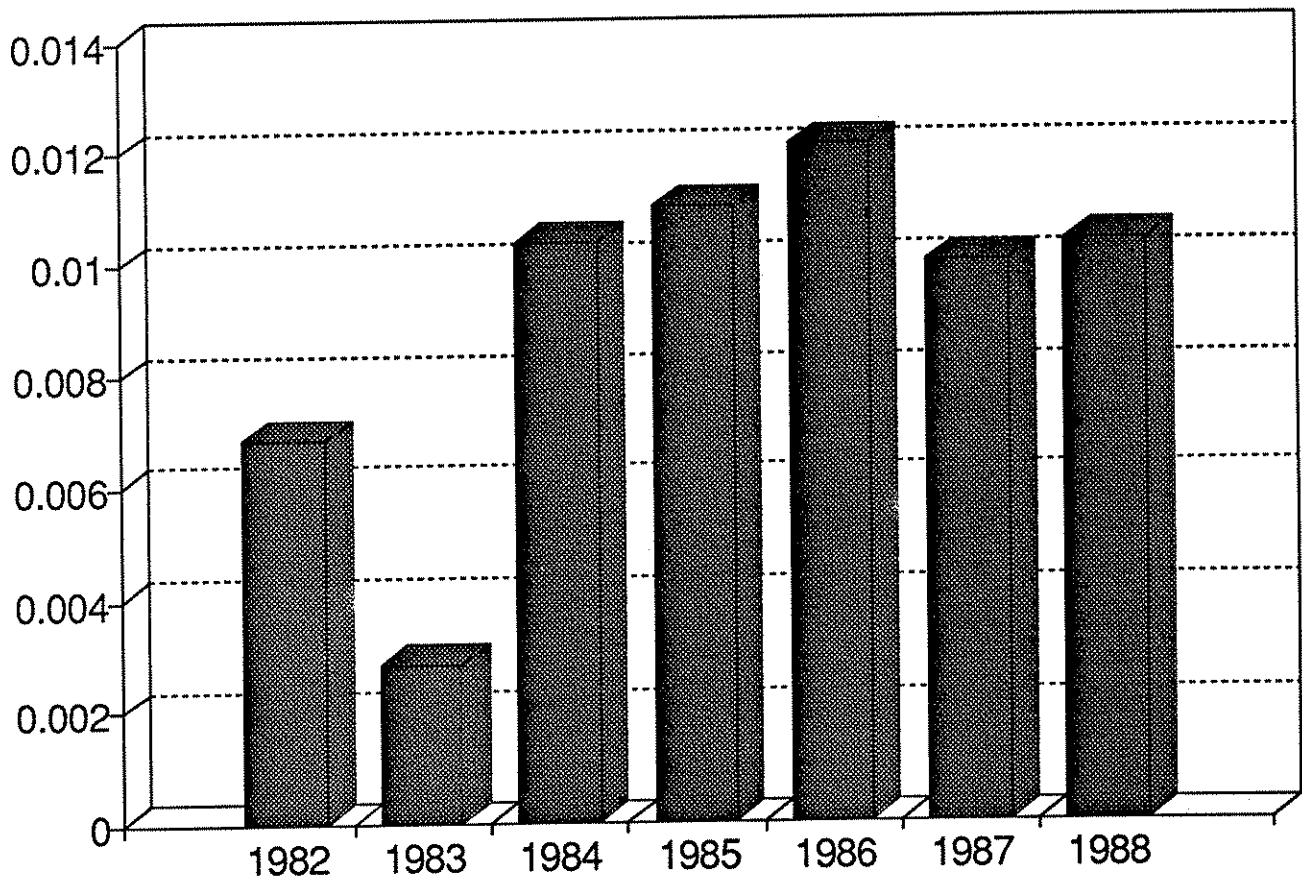


CHART 3. OPEC WEIGHTED DISSATISFACTION  
Iran and Iraq omitted



### Including Dissatisfaction within a Price Model

The dissatisfaction index can be used in assessing short run price prospects in combination with other factors. It may be thought of as a trigger mechanism for setting off retaliatory behaviour by disaffected members of the cartel. The model assumes basically that prices are demand driven. Suppose that OPEC was able to set quotas within a ceiling level of production which was satisfactory to its members. Then it would look to demand growth to yield higher prices. At times however member dissatisfaction with quota allocations will set off episodes of high production rates until quotas are revised to accommodate the causes of dissatisfaction. In this process we would expect lags to play an important role. These factors are incorporated in the following price equation which was estimated over the period 1974 1988.

$$P = 0.97 \text{ GDP} - 35.20 \text{ DISS} + 0.92 \text{ P}(-1) - 0.5 \text{ DUM} - 3.92$$

(1.18)                      (-1.73)                      (6.84)                      (-2.42)                      (-1.09)

R2 = 0.87, F = 14.48. T ratios in brackets. Estimation method OLS

where P is log of price, GDP is log of OECD area gdp, DISS is the dissatisfaction measure and DUM is a shift parameter for 1986. These results are consistent with the existence of strong lagged effects; they imply a proportionate link between GDP and prices, and a (negative) dissatisfaction effect as expected. The effect of non-OPEC supplies on the market is to some extent allowed for in the negative constant term. The peculiar conditions of the market in 1986 are accommodated by a shift parameter DUM. Price is basically demand driven but OPEC can exercise some degree of control by bringing its quota arrangements into line with members preferences and hence reduce dissatisfaction and hence the propensity to cheat. Although few of the individual coefficients are significant, the whole picture is reasonably in line with expectations.

### **PROSPECTS FOR 1990**

We can assess prospects for oil prices in 1990 in two ways - at the level of dissatisfaction with existing quotas and then at the overall impact this is likely to have on prices. We need to make assumptions about reserves, capacity and population for 1990. Production capacity is derived from estimates given in MEES (1989), population is assumed to grow at historic growth rates, and reserves are held constant at 1989 levels. Excluding Iran and Iraq from consideration the quota arrangements agreed during 1989 produce a lower dissatisfaction measure suggesting a greater willingness to adhere to quotas during 1990. On the demand side, rather than provide my own forecast, I adapt the NIESR projection of 2.6% GNP growth for the major 7 industrial countries to the whole of the OECD area. These assumptions imply a price in the region of \$22 per barrel for the coming year. A prudent forecaster will always qualify any prediction by noting that a lower price is

possible under a wide variety of not unlikely circumstance such as lower world demand, higher OPEC productive capacity, or efforts by Iran or Iraq designed to restore market shares.

#### Notes

1. Dissatisfaction is measured as the difference between the desired share of country *i* in desired ceiling production levels and the share actually allocated by the current quota arrangement. 'Desired' shares are calculated from the first equation.
2. Weighted dissatisfaction for OPEC as a group is the average of the individual country dissatisfaction levels multiplied by productive capacity less quota production allocation. Only positive dissatisfaction values are included. It measures both the willingness and the ability to threaten quota output arrangements.

## REFERENCES

MEES (1989). Middle East Economic Survey, 33:1, 9 October 1989, OPEC Secretariat Proposal pD1 - D2.

MABRO (1989). Robert Mabro. OPEC's Production Policies. How do they work? Why do they work? Oxford Institute for Energy Studies. WPM12. April 1989.



