Who Makes the Oil Price?
An Analysis of Oil Price Movements
1978 – 1982

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Oxford Institute for Energy Studies

WPM 4
1984
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Who Makes The Oil Price? 1978-82

A study of oil developments during 1978-82 may provide some important insights into the operation of the pricing mechanism for petroleum in international trade. First of all, this period enables us to study the behaviour of oil producers in both a rising and a falling market. In 1979/80 excess demand pushed prices up more than threefold. Two years later the position changed to one of unprecedented excess supply, with OPEC producing at less than 55 per cent of capacity. As we shall see the evidence suggests marked asymmetries in behaviour according to market conditions.

Secondly, 1978-82 is a period during which several non-OPEC countries emerged as significant exporters and began to play a major role in the world market. We would suggest that too often non-OPEC producers have been given little or no attention, being regarded merely as passive agents in a market in which the pricing decision is said to be beyond their control. The evidence of the post-1978 period paints a very different picture.

Thirdly, and for the very reasons mentioned above, the period 1978-82 provides a good testing ground for the issue of price leadership. Who led the oil price rise of 1979-80? How were prices determined in 1981-82 when excess supplies should normally have induced a rapid price collapse? As we outline in Section I, a number of characterizations of the oil pricing system can be developed, most of which postulate some form of leadership - either by OPEC or a subset of OPEC member countries acting as a 'cartel', or by a significant producer (Saudi Arabia) providing a free buffer stock to an informal commodity stabilization scheme.

Theorists have found it attractive to apply to the oil market an equilibrium concept due to von Stackelberg¹, which distinguishes a dominant producer (OPEC or Saudi Arabia) and a competitive fringe. The former makes the price, taking into account the effect of his actions

on the supply decisions of fringe producers. The latter have no influence on the market and just take the price as given by the dominant group.

Equilibrium concepts may provide useful norms. But the oil market has evidently been in a state of disequilibrium in the period considered here. A notion, first developed by Kenneth Arrow\(^2\), and not previously applied to the oil market, may be relevant. The idea is that in disequilibrium every producer faces a downwards sloping demand curve and thus has some discretion over his price. If everybody is a price maker what is then the role of the leader?

Oil experts within the industry have tended to look at the problem differently. Their interest focuses on the role played by Saudi Arabia as the linchpin of the pricing system, and on the interaction between this country and other OPEC producers. A conventional wisdom has developed in the industry; it defines Saudi Arabia as the 'swing supplier' which stabilizes prices by absorbing fluctuations in the demand for OPEC oil. Of course the 'swing supplier' cannot increase his production beyond installed capacity; and he is unlikely to remain indifferent if output declines below a certain limit. On this view Saudi Arabia's ability to stabilize prices, though significant, is nevertheless constrained.

We shall see that the evidence supports the Arrow notion as well as the idea of constrained Saudi leadership. Again, whether this corresponds to any view of price leadership as defined by the standard economic literature is questionable. We attempt in the concluding part of the paper (Section V) to suggest different theoretical characterizations of the oil pricing mechanism according to demand/supply conditions prevailing in the market. But there is a limit to the extent to which the behaviour of the oil producers can be explained in strictly economic terms. Politics are a factor of major importance, and economists forget this at their peril.

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This paper is structured around three distinct sub-periods:
(i) The period of rising prices from September 1978 to December 1980;
(ii) The price unification of 1981;
(iii) The slack market of 1982.

In each we seek first to describe the output and price changes which occurred, highlighting the differential size and timing of changes in official prices by each producer, and comparing these in turn with movements in spot crude and product prices. We seek throughout to draw out the implications of our findings for the oil pricing system, and these are brought together in the concluding section.
Some Theoretical Considerations

As suggested above, this paper seeks not merely to present a historical survey of the movements in crude oil prices since 1978, but also to examine the extent to which the facts lend support to some widely held views on the operation of the world petroleum market and in particular of the pricing system. It may be useful at the outset to outline some possible theoretical characterizations of the pricing mechanism in the oil market. We shall consider specifically three such approaches: first that which views the market as comprising a dominant, price-making cartel and a competitive, price-taking fringe; secondly that which concentrates on more standard price-leadership models; and thirdly that which views all producers, large and small, as price-makers when the market is in disequilibrium.

i. Cartel and Fringe

Much recent work on the pricing mechanism in the world petroleum market has focused on the notion of the existence of a dominant producer group or cartel which fixes prices to clear the market, currently and over all future periods, taking into account the optimal supply responses of a number of small, price-taking producers. See, for example the work of Salant, Ulph, and Dasgupta and Heal. Thus, Stephen Salant has developed a computerized Nash-Cournot model of the world oil market which explicitly uses a price-fixing producer and a competitive fringe. The latter seeks to maximize its profits at the price level dictated to it by the dominant supplier. Such work has come to the fore


in the mid-1970s with the emergence of a number of large producers outside OPEC. The basic notion and hence the explanation of the price mechanism is very straightforward. As suggested by Newbery\textsuperscript{6}, this can be construed as an equilibrium concept or, following Pindyck\textsuperscript{7} defended as a first approximation to the oil market. We shall seek in this paper to examine the extent of the approximation - an exercise which surprisingly has not yet been done.

\textbf{ii. Price Leadership}

Closely related to the cartel/fringe characterization of the world petroleum market, one may attempt to fit the pricing system to the textbook descriptions of price leadership. The literature on oligopoly gives us, among others, the following two models. 'Dominant firm' leadership is perhaps the most familiar. It envisages a large (usually low cost) producer which sets the industry price, taking into account the reaction of the smaller producers to that price, so as to maximize its profits. Such a leader would ensure that all other producers follow his price decisions by threatening to use aggressive pricing and production policies to drive them out of the market if they do not conform.

The price leader is not necessarily the producer which changes its price first; in the real world, any of the small producers may alter its price chronologically before the others - perhaps driven by short-term revenue requirements. A true price-leader, in this model, not only initiates the price change but is able to enforce it in the long run and have a direct influence on the decisions of other producers.

The second model of price leadership (due to Markham\textsuperscript{8}) is 'Barometric Leadership', in which all firms agree (formally or

\begin{flushleft}

\textsuperscript{7} R.S. Pindyck, 'Gains to Producers from Cartelization of Exhaustible Resources', Review of Economics and Statistics, 60, 1978.

\end{flushleft}
informally) to follow the price changes of a firm which they consider to have a good knowledge of the prevailing market conditions, and which has a good reputation for forecasting future market developments. This firm thus becomes the barometer of the industry, and to quote Stigler "... commands adherence of rivals to his price only because, and to the extent that, his price reflects market conditions with tolerable promptness." The literature outlines two further features of barometric leadership which may be important. First of all, the leader may change from time to time - though only if and when the reputation of a firm improves sufficiently to win the confidence of the rest of the industry. Changes are therefore unlikely to occur very frequently. Secondly, it is recognized that whilst upward price movements will almost invariably be led chronologically by the barometric leader, price cuts may be initiated by other firms in the form of unofficial discounts etc, with the barometric firm ultimately reducing official prices in line.

The recent literature on petroleum economics often singles out Saudi Arabia as the price leader within OPEC. This role has been characterized in many different ways. A purely 'economic' view, (which, paradoxically, is often propounded in the US for transparent political reasons) is that Saudi Arabia seeks to maximize its economic interests in the long run by pursuing a moderate pricing policy. The argument is that Saudi Arabia has huge hydrocarbon reserves and a very long time horizon for economic development. Its main objective is to protect a share of the world energy market for its own oil by erecting moderate pricing barriers against entry by substitute fuels.

As Saudi Arabia is unique in its ability to vary the rate of extraction with relative ease over a wide range, it has the power to exercise leadership within the councils of OPEC. This power is used to hold the agreed price line when excess supplies exert downward pressures and to dampen price rises when excess demand leads to price explosion. In one situation Saudi Arabia defends a price which is often close to its own preferences even if formally defined by OPEC. In the other situation it seeks to protect the long-term objective mentioned above.

iii. Arrow's Model of Disequilibrium Pricing

Kenneth Arrow first developed the notion that, in any market in disequilibrium in which there are a number of sellers, each one faces a sloping demand curve. Indeed Arrow argued that in such a situation, and even in the case of perfect competition, each small producer would price "... in accordance with the profit-maximising tactics of a monopolist." Hence, unlike the competitive fringe of the Salant-type model which takes price as given, in disequilibrium the Arrow approach sees every producer as a price maker. Each producer thus has the incentive to change its price unilaterally. When the disequilibrium is one of excess supply, the demand curve facing each producer is less than perfectly elastic and hence he can lower his price and increase sales and revenues. When there is excess demand in the market, the producer will face a demand curve which is shifting to the right. He can thus effectively sell at his supply price and operate along his supply curve, raising price until the excess demand is eliminated.

Such an approach has not, as yet, been applied directly to the oil market, although it is our belief that it may help to shed some light on the pricing behaviour of producers for at least some of the post-1978 period. To discover the relevance of all three models to the oil market, we must turn to examine the history of the 1978-1982 period.

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10 K.T. Arrow, op.cit., p.46.
II

The Second Oil Price Explosion

We have chosen September 1978 as the starting point for analysis as it marks the end of a period of relative price stability (of some two years since the 4th quarter of 1976). We shall assume that this period of relative stability in prices and in market shares in a marginally slack market produced, by September 1978, a structure of price differentials which was broadly in equilibrium. This means that the supply price of each crude in the world market more-or-less reflected the buyer's valuation of the differences in their quality, such that he would be indifferent between any two crudes of the same price. (This assumption is explored in more detail in Annex 2.)

We need first to outline the main changes in crude oil output over the whole period of September 1978 to December 1980, as it is only against such a backdrop that price movements can be understood fully.

Throughout the first three quarters of 1978, world output was fairly steady in the 60 mbd range, of which OPEC accounted for 28 to 30 mbd. September saw the usual increase in output as Western inventories were replenished before the winter. The customary pattern over the previous few years had been for output to continue to rise over the last quarter - perhaps to a December peak some 2.5 mbd (World) or 1.5 mbd (OPEC) higher than September. This pattern was disrupted in 1978 by the anti-Shah strikes in the Iranian oil fields, which pushed Iranian output down from a peak of 6 mbd in September to 3.5 mbd in November and 2.4 mbd in December. Despite a compensating increase in Saudi Arabian output of 2 mbd over the three months, total OPEC production in December was some 4.7% lower than its September level.  

11 World output was some 1.1% lower. 1977 had seen rises over these months of 4.2% (OPEC) and 3.8% (World).
The Iranian position worsened at the start of 1979; output fell to 500-700 thousand b/d in January and February and exports were suspended. They were not resumed until early March, soon after Ayatollah Khomeini's return, when production picked up to 2.3 mbd (March) and 3.6 mbd (April). It remained in the 3 to 4 mbd range for the rest of 1979. Total OPEC output followed very much this pattern, with low points of around 28.5 mbd in January and February, picking up thereafter to 30 to 31 mbd for the rest of the year.

What, then, of the price movements which these output changes invoked?

In many ways, the most revealing features of the 1978-80 price increases can be drawn from the initial movements before the OPEC meetings of December 1978 in Abu Dhabi and March 1979 in Geneva. We shall consider separately, therefore, three sub-periods: September 1978 to December 1978; December 1978 to March 1979; and the bulk of the period from March 1979 to December 1980.

(a) The Spot Price Movements to December 1978
The first price increases came in the spot product market. Spot prices of a number of light products were the first to show any marked increase, beginning as early as August 1978. Naphtha, and Premium and Regular Gasoline prices rose by 8-10% from July to August on the Rotterdam market and such increases were mirrored in the other main world spot product markets. These early movements in light products suggest some tightening of the market before the Iranian supply problems. They came three months before any substantial increase in the price of the largest traded product - high sulphur (3.5%) fuel oil - which began in November 1978. The first increases in spot crude prices came between these two phases of product price rises, beginning in October 1978 after a prolonged period in the $12 to $14 range (depending on the quality of the crude). As with spot product prices, November 1978 witnessed a particularly sharp spot crude price increase, as the effects of the first production cuts by Iran began to be felt. Supplies to the spot market fell as most oil companies withdrew, keeping their oil for contract customers. This, coupled with the
Figure 1

SPOT PRICES OF SELECTED CRUDES AND PRODUCTS
- April 1978 to March 1979 -

$\text{$/b}$

- **Premium Gasoline**
- **North Sea Crude** (Ekofisk 44)
- **Arabian Light Crude**
- **Heavy Fuel Oil 3.5%S**
- **Official Marker Price**
increasing unease in the oil market as a whole over the Iranian situation, pushed all spot prices up markedly in mid-November 1978.

Figure 1 graphs the initial movements in two spot crude prices along with the two product prices discussed, and highlights the very sharp and substantial nature of the increases.

These spot price rises provide us with a backdrop against which to assess the very first official price increases, which were announced by OPEC at the end of December 1978 at its Abu Dhabi meeting. By December, spot light product prices had risen by some 40%, spot crude prices by 18% and spot heavy product prices by some 9%. The official crude prices agreed at the OPEC meeting effected increases of between 2% and 6%, with the majority of crudes, including the Marker, rising by 5% (i.e. some 60-70 cents/b). This was very much less than required to match the spot price increases, and indeed it is not clear the extent to which the movements on the spot market affected the OPEC decision. All justifications of the price rise at the time were made in terms of the effect of inflation on real prices and the impact of dollar exchange rate movements on OPEC revenue, and it was even reported that Saudi Oil Minister Yamani was "not happy" with the outcome. To quote Petroleum Intelligence Weekly\(^\text{12}\) "....market forces, apparently headed by the Iranian supply shortfall, made it difficult to hold out for a smaller rise." Some evidence, then, of the movements in spot prices affecting the official price decision, but little evidence of OPEC achieving, or even attempting an official price rise of anything like the size needed to match spot price movements.

(b) December 1978 to March 1979

This period between the OPEC meetings of Abu Dhabi and Geneva witnessed very dramatic rises in both spot and official prices, and is also a period which reveals some interesting factors relevant to the price-leadership question. In order to understand the price movements over those four months it is worth reviewing, briefly, the sequence of effects which the Iranian production cuts had on the world market.

As we have seen, October 1978 to March 1979 saw some substantial cuts in output by Iran, which had affected total world and OPEC output. The Iranian loss amounted to some 5 mbd, compensated in part by a 2 mbd increase by Saudi Arabia. Whilst a net production cut of 3 mbd is substantial, it is at first sight surprising that a 5% fall in world output could cause, ultimately, a threefold price increase. To understand this we must examine exactly how the Iranian cuts affected the oil market.

The fall in Iranian production had a particularly large effect on BP (an estimated loss of 1.4 mbd), Exxon (loss of 400,000 bd), and Socal (loss of 300,000 bd), all of whom had to declare "force majeure" cuts on a number of their contract customers. BP, the most heavily affected, began the cuts as early as the second week of January 1979 with a huge 35% reduction. This was increased to 45% (1.4 mbd) in mid-February, at which time there were a spate of other force-majeure official supply cuts announced - Exxon's 10% (400,000 bd) being the second largest. This tightening of supplies to a few major companies caused a further shrinkage of supply to the spot market, and a sharp reduction in the flow of crude to the Third Party Market, of which BP and Exxon had been the chief suppliers. The 'Third Party Market' was the means by which major oil corporations fed crude oil to those companies which did not deal directly with an OPEC or a non-OPEC producer. Japan was by far the largest such country, and indeed it was Japan who was most hit by BP and Exxon's cuts.

The Japanese naturally responded to this new situation by turning directly to the producing nations, which, in turn, prompted producers both to increase their prices in the light of the perceived increased demand for their crude and further to restrict supplies to the majors, thus accentuating the problem. Indeed by the middle of
1979, many of the "force majeure" cuts had turned into long term reductions in the official commitments of most majors on the Third Party Market.

This chain of events resulting from the Iranian supply cuts, influenced both spot and official price movements in the early months of 1979.

(i) All spot prices - crude and products alike - increased very sharply in February 1979, as the majors and the oil producers curtailed supplies of crude to the spot markets. Light product prices rose to over $38/b, heavy products to over $17/b and the Marker crude spot price to $22.5/b (monthly average figures), reflecting increases of over 40% between the monthly averages of January and February 1979 (see Figure 1).

(ii) Following these early movements in spot prices, in both 1978 and early 1979, there began a series of official price increases, encouraged by the perceived increase in demand from Third Party Market customers. Figure 2 graphs the chronology of the early official price increases and several important points emerge:

- The first countries to raise official prices substantially were the UK ($1.50/b or 11%) and Norway ($1.65/b or 12%) on 15th January 1979. This was after the OPEC meeting of late December 1978 which had agreed slight upward adjustments to OPEC prices (in the region of 50-80 cents or 5%), but fully ten weeks before the meeting of late March which introduced the first large general price rise. Thus the first price increase was initiated by two non-OPEC producers - indeed two OECD countries.

- There then followed a number of slightly smaller official price increases by individual OPEC members. Ecuador was first to move in early February, followed some two weeks later by both Abu Dhabi and Qatar, with increases of 7.2% and 6.8% respectively. This early move by two countries commonly regarded as 'moderates' came on 15th February, two weeks before similar increases by Kuwait and Iraq, and nearly six weeks before the March OPEC meeting. Further moves in February/March by
**EARLY 1979 PRICE INCREASES**

- Increases in official prices between the OPEC meetings of December 1978 and March 1979 -

<table>
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<tr>
<th>DATE</th>
<th>SOURCE</th>
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<tr>
<td>22 Dec</td>
<td>OPEC</td>
<td>5% average</td>
</tr>
<tr>
<td>15 Jan</td>
<td>U.K., Norway</td>
<td>11%</td>
</tr>
<tr>
<td>1 Feb</td>
<td>Saudi Arabia, Ecuador</td>
<td>1% 7%</td>
</tr>
<tr>
<td>15 Feb</td>
<td>Sherah, Abu Dhabi, Qatar, Angola</td>
<td>7% 5%</td>
</tr>
<tr>
<td>21 Feb</td>
<td>Libya, Syria</td>
<td>11% 25%</td>
</tr>
<tr>
<td>28 Feb</td>
<td>Kuwait, Iraq</td>
<td>9% 34%</td>
</tr>
<tr>
<td>1 Mar</td>
<td>Oman, Dubai, Angola, Ecuador, Cameroon</td>
<td>4% 5% 7%</td>
</tr>
<tr>
<td>5 Mar</td>
<td>Libya, Malaysia</td>
<td>11% 8%</td>
</tr>
<tr>
<td>20 Mar</td>
<td>Brunei, Dubai</td>
<td>8% 22%</td>
</tr>
<tr>
<td>26 Mar</td>
<td>Egypt</td>
<td>4%</td>
</tr>
<tr>
<td>27 Mar</td>
<td>OPEC</td>
<td>Range 8% to 25%</td>
</tr>
</tbody>
</table>
Libya (along with Sharjah and Dubai) add to the list of unilateral actions which together belie any description of OPEC as a unified pricing cartel over this period.

- Much the largest increases in the first three months of 1979 came from two non-OPEC producers, Syria ($3.11/b increases on 21st February, giving a cumulative increase to that date of over 31%) and Egypt ($3.05/b increase on 25th March); and from the smallest OPEC producer, Ecuador ($4.60/b on 1st March). No sign here of the large producers dictating pricing policy to the small producers.

- Whilst the majority of the non-OPEC producers lagged the OPEC 'leaders' (Qatar, UAE, Iraq, Kuwait, Ecuador) in their first large price increase, they had all (with the exception of USSR, China and Mexico) introduced a substantial price rise (i.e. of $1.50 or more) before the March OPEC meeting. They all, therefore, preceded action by the majority of OPEC.

OPEC members entered their March 1979 Geneva conference with widely differing views on prices, and a reconciliation of those views was to prove impossible. Saudi Arabia's attempts to urge moderation were largely ignored, and it ultimately agreed to a Marker crude price increase of just over $1/b to $14.456/b. Other members, however, were left to add whatever premia or surcharges they wished to this 'minimum' marker price - the result being a wide range of price increases from Saudi's $1/b to up to $3.75/b by the African producers (Algeria, Libya and Nigeria). Even Gulf producers such as Abu Dhabi, Qatar, Iran and Kuwait set the surcharge at $1.80/b. The first OPEC conference at which large price rises were introduced, therefore, was one of disunity of aims and outcomes. Its effect was simply to keep pace with the large increases in spot and non-OPEC official prices which had already occurred.

Finally, note that all these price increases still left official prices substantially below spot crude prices - by an average of about $6/b at the end of March 1979.

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13 Sharjah and Dubai are both members of OPEC through their membership of the United Arab Emirates, although they do not act in unison with Abu Dhabi, the chief oil-producer and OPEC member in the UAE.
(c) March 1979 to December 1980

The bulk of 1979 and 1980 was a confused period of rapid, and generally uncoordinated, price increases, from which it is difficult to discern any clear pattern or any evidence of price-leadership on the part of a single group of producers. The main developments were as follows:

Spot crude prices (see Figure 3) increased very rapidly in 1979, particularly in April-June (Arabian Light spot price increased from $28/b to $35/b) and in September-November (from $35 to a peak of $41). This was both a much faster and greater absolute increase than was displayed in any official contract price in 1979. At the peak of November 1979, the Arabian Light spot price was fully $23/b above its official price. The factors behind these two spurs are again both of interest and importance. As noted above, March 1979 saw the resumption of Iranian exports, and by April spot prices began to weaken. Saudi Arabia therefore decided that it was again safe to return to its traditional output of 8.5 mbd, which it had raised to 9.5 mbd to counter the Iranian cuts. The effect of this cut, exaggerated further by Nigerian cuts of up to 100,000 bd to BP who inadvertently broke Nigeria's boycott of South Africa in May 1979, was to send crude-hungry majors heavily into the spot market, driving prices up towards $35/b by mid-May.

It is difficult to know the motives behind the Saudi cut. Some, notably Adelman14 have interpreted it as a deliberate attempt to push prices still higher, whilst others15 have seen it as a non-aggressive response to the return of Iranian exports to the world market. As we shall see, Saudi attempts to hold down the price throughout the rest of 1979 and 1980 would appear at odds with Adelman's interpretation. Indeed, the 1 mbd cut corresponded to an increase in Iranian output of some 3 mbd by April, leaving total OPEC output 2 mbd higher than in March. With spot prices weakening by March, it is perhaps not unreasonable for Saudi Arabia to have felt justified in returning to

SPOT CRUDE AND PRODUCT PRICES
1979 to 1982

$/b

Premium Gasoline

Official Marker Price

Arabian Light Crude

Heavy Fuel Oil 3.5%S

10

its lower output level to make way for Iran's resumption of exports. Whatever the motives of the Saudi cut, and despite the aggregate increase in OPEC output, the effect was again to cause unease in the world market and a further dramatic spurt in the crude spot price.

The second spot price spurt of November 1979 is, at first sight, something of a paradox, with seemingly adequate output to meet current demand. There was, however, substantial stockbuilding in the last two quarters of 1979 as the majors sought both to replenish depleted stocks and to guard against possible future political problems in Iran. To quote Seymour16, "Fear rather than shortage was, therefore, the dominant force behind the buoyant market in the second half of 1979."

Following the peak at the end of 1979, spot crude prices proceeded to fall during the first eight months of 1980 (Arabian Light fell from $41/b to $32/b by August 1980) before the onset of the Iran/Iraq War pushed them to a second peak (Arabian Light $41/b again) in November 1980. This second peak was above the level achieved by any official prices in 1980, but several producers had increased their official prices sufficiently by mid-1980 to have regained parity with spot crude prices before the second spot price jump.

Some understanding of the output movements behind the spot price spurt of late 1980 would again be useful. Iranian production, having recovered to 4 mbd in September 1979, fell steadily over the next year to just over 1.1 mbd in September 1980 at the outbreak of the Iran/Iraq War. Despite this, the year had seen no major aggregate supply shortages - indeed there was the usual pattern of inventory run-down in the first quarter of 1980 (less than usual if anything) and substantial build-up in the third quarter. This reflected sharply falling demand worldwide, as well as compensating increases in output by Saudi Arabia (back at around 10 mbd) and non-OPEC production some 1.5 mbd above 1978 levels. Iraq's output was steady at around 3.4 to 3.5 mbd. The war saw the combined output of Iran and Iraq fall from 4.5 mbd to under 1 mbd in October and November 1980. Saudi Arabia

16 I. Seymour, op.cit., p.189.
immediately sought to soften the impact of this cutback by increasing output to over 10.5 mbd but total OPEC output still fell by some 2 mbd.

Whilst this cut forced spot crude prices back up to $41/b, it did not have the same effect as the similar cut in 1978/9, which was followed by a threefold rise in spot prices in just eleven months. The reasons for this are well documented by Badger and Belgrave\(^\text{17}\) and need not concern us unduly here. We would perhaps place less emphasis than do Badger and Belgrave on the speedy and appropriate action by the IEA and Saudi Arabia, and point more to the fundamentally different market conditions in which the two production cuts occurred. In September 1980 the industry knew that world oil consumption had been on a declining trend for almost two years - a perception which, naturally, nobody had in 1979. Moreover inventory levels were very high, providing a secure cushion to both companies and governments.

**Official Prices.** As suggested above, the period saw a general melee of official price increases, with producers leapfrogging over each others' price rises. OPEC members, without exception, regularly increased prices outside OPEC meetings, and indeed acted in no different manner to the non-OPEC producers (with the sole exception of Saudi Arabia, as discussed below). At the extreme, Ecuador appeared to abandon any concept of a fixed official price for its crude, and varied its price with 'market conditions' almost on a cargo-by-cargo basis. No single country took a consistent 'lead' in the period - in terms of consistently increasing prices earlier than and/or by a greater margin than the rest. Tables 1 and 2 show a variety of countries to have increased prices more rapidly than the rest at one time or another. Several countries did emerge towards the top of the price league - notably Iran, Libya and Ecuador within OPEC, and Egypt and Syria outside OPEC - but there is no clear evidence of producers following any one country's price movements closely throughout the period.

Table 1: Official Price Indices for OPEC Producers, Dec.1978- Dec.1980
(Nov.1978=100)

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<th></th>
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<th>31.12.80</th>
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<tbody>
<tr>
<td></td>
<td>% Change</td>
<td>Index</td>
<td>% Change</td>
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<td>Index</td>
<td>% Change</td>
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</tr>
<tr>
<td>Saudi Arabia</td>
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<td>106.35</td>
<td>33.23</td>
<td>141.69</td>
<td>44.44</td>
<td>204.66</td>
<td>23.08</td>
<td>251.89</td>
</tr>
<tr>
<td>Iran</td>
<td>5.0</td>
<td>105.0</td>
<td>65.12</td>
<td>173.38</td>
<td>59.25</td>
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The manner in which official prices followed spot crude prices varied from country to country. At one extreme, Ecuador (within OPEC) and Egypt (non-OPEC) followed spot movements quite closely - particularly in the rapid rise of the first half of 1979 (see Figure 4). At the other extreme, Saudi Arabia lagged behind all other official price rises throughout the period and its official prices bore little or no relationship to movements in the spot price throughout 1979 and 1980.

The very volatile pricing of Ecuador and Egypt, among others, and their rapid response to spot price movements are interesting features of the 1979/80 price explosion. One may ask whether their policies provided some kind of leadership? We would suggest not. Ecuador and Egypt most certainly were not dominant producers, able to dictate pricing policy to the rest of the world's producers. Nor indeed were they always able to sustain price changes in the face of a reluctance by others to follow. (This was particularly so for Ecuador, whose pricing was especially volatile.) Equally, they were not the well-respected producers of the 'barometric leadership' model, inspiring the confidence of others in their judgements and forecasts. Such was the closeness of their pricing to the spot price that they gave other producers no more information than they were already receiving from the spot market. The pricing activity of such small countries is perhaps more simply explained by their relative lack of commitment to long-term supply contracts, allowing them effectively to trade on the spot.

Whilst the action of Ecuador and Egypt does not give evidence of price-leadership on their part, however, it is important in casting doubt on the notion of there having been any leader over the period. Just as Ecuador, Egypt and the like were not 'leaders', nor were they followers of some more dominant producer.

The role of Saudi Arabia, much the largest producer in OPEC, is worthy of particular attention. As the indices of Tables 1 and 2 show, Saudi Arabian prices lagged well behind those of all other OPEC and non-OPEC producers, such that by the end of April 1981 the Saudi Marker price of $26/b was up to $9 below those of comparable light crudes. It appears to have been a price follower throughout the two years of price increases, with much smaller price rises than others up to April 1980.
EGYPTIAN SUEZ BLEND 34 AND ECUADOR ORIENTE 30 OFFICIAL PRICE CHANGES

Figure 4

Spot Price

Oriente 30

Suez Blend 34

The history book shows Saudi Arabia to have been a voice of moderation throughout much of 1979 and 1980. As we have seen, it was uneasy about the March 1979 increases when it only raised the marker price by $1/b! This was the beginning of two years of 'multi-tiered' pricing within OPEC, with the Saudis keeping Arabian Light price increases to a minimum, and much of the rest of OPEC operating to a much higher de facto 'marker' price.\textsuperscript{18}

Indeed the Saudi motivation throughout the period appears to have been to prevent wide divergence of prices within OPEC - its price increases, when they came, attempting always to reestablish parity rather than push the whole system further up. The chronology of December 1979/January 1980 illustrates this point:

14 December 1979 - Saudi Arabia (along with the UAE, Qatar and Venezuela) increases its marker price by $6/b, in order to close the $5.5/b gap which has appeared between it and Iranian light, and to attempt to "clip the wings of the price hawks"\textsuperscript{19}.

16 December 1979 - Iran re-establishes the differential with a $5/b increase.

3 January 1980 - Iran further increases the differential by $2/b.

28 January 1980 - Saudi Arabia again tries to close the gap with its own $2/b increase.

1 February 1980 - Iran again re-establishes the differential with a further $2/b increase.

\textsuperscript{18} As early as the June 1979 Geneva meeting this pattern became clear - with the Saudi marker price at $18/b, but with the rest of the Gulf working to an effective marker of $20/b, and Iran employing its own $22 marker. Prices were not to regroup around the official marker until October 1981, despite frequent attempts by the Saudis to achieve such unity.

\textsuperscript{19} Dr. Humberto Calderon-Berti, Venezuelan Oil Minister.
Saudi Arabia's attempts to reunify OPEC prices throughout the period served only to allow further increases by the rest of OPEC. There would appear to be no evidence of conventional price-leadership by the dominant producer in the two years of rising prices.

None-the-less, a number of OPEC members did stick closely to the pricing pattern of Saudi Arabia. Indonesia and Venezuela increased official prices only slightly faster in 1979 and then remained in step, as did the UAE, Iraq, Qatar and Kuwait after their initial large increases in early 1979. Differentials had not been restored in any of these cases by the end of 1980, however. The motives of this group of relative 'moderates' are far from clear. They were reluctant to make full use of the headroom in prices created by the spot market and the more aggresive producers and yet their periodic large price increases, notably in early 1979, do not suggest any over-riding loyalty to the OPEC price-fixing machinery. There is, indeed, much evidence that these countries in particular added large unofficial premia on top of official prices for long-term contracts with companies who were desperate for oil. This effectively increased prices to nearer the spot price without affecting the "official" price.

The effect of producers' widely differing pricing policies was to widen price differentials substantially (both within and outside OPEC). Table 1 presents simple Standard Deviations for the index numbers at each date shown. They show a very clear and marked widening of differentials within OPEC to a peak in April 1980. The remainder of 1980 saw some limited narrowing of differentials, but the two year period of rising prices still ended with very substantial divergences of official prices from the differential structure of September 1978.

(d) Theoretical Implications of the 1979/80 Price Rises
What implications, then, does the evidence of the 1979-80 price increases have for the theoretical characterization of the world oil industry in a tight market? First of all, we would suggest that there is little or no evidence of OPEC acting as a unified cartel. We have described two years of widespread unilateral price setting by OPEC members, with the majority of pricing decisions being taken outside official OPEC meetings. The period was also one in which there was no
agreement on production within the Organisation. We would suggest that a group of producers who individually decide on both their output and prices do not constitute a cartel in any economically meaningful sense.

Secondly, we do not believe that the evidence of the tight demand/supply conditions of 1979/80 lends support to the notion that the oil market comprises a dominant producer group which sets prices and a competitive fringe of price-takers. As we have seen, there has been no group of producers which has consistently dictated prices to the rest of the industry, or indeed one which has consistently adopted the prices set by the others. Price changes have been initiated by almost every producer at some point over the two years - the smaller producers often reacting more swiftly to spot price movements. There has certainly been no large producer which has enforced its price changes - as in the "dominant-firm price leadership" model. The one country which could conceivably do so, Saudi Arabia, has lagged behind all other price movements throughout, and its attempts to set OPEC prices were unsuccessful. Equally, there has been no single "well-respected" producer which has acted as a "barometer" to the industry. The chronological leader changed too frequently for any credence to be placed on such a notion, and equally, early price moves were not always followed by the rest of the industry.

It has been suggested that, whilst the dominant price setter may not dictate all price movements, it does decide broadly the level around which prices will fluctuate. Hence, the dominant producer sets its price at, say, $30/b and allows the rest of the industry to compete around that level. Again, we would suggest that this does not consistently fit the facts in a tight market. There is no evidence of any country/group of countries determining the level to which the price was to rise over the two years.

The pattern of price movements in 1979/80 does not therefore conform to the notion of a price-taking fringe in the oil market. Rather, the pricing activity of the period suggests that even the smallest producer in the market had an incentive to change prices - i.e. every producer in the market, in times of excess demand, appears to face a sloping demand curve and not the horizontal demand curve postulated in models with a price-taking fringe. Every producer, in this case, is a price-maker. In a situation of excess demand, to quote
Arrow: "... any individual entrepreneur knows that he can raise the price, even if his competitors do not raise theirs, because they cannot satisfy any more of the demand than they do already. The entrepreneur is faced with a sloping demand curve and raises his price in accordance with the profit-maximizing tactics of a monopolist..." and indeed "...it is equally to the profit of all other entrepreneurs to raise their prices also..."  

In fact, in such a situation of excess demand, each producer finds the demand curve to be shifting to the right, such that he can effectively operate along his own supply curve. Such an explanation would appear to fit closely the pricing behaviour in the oil market of 1979/80. Small producers, both within and outside OPEC, had a rational economic incentive to raise their prices.

But producers did not always (and some never did) raise their prices as high as demand might have allowed. A variety of inhibitions were probably at work - fear of losing customers' goodwill should circumstances change, political caution, etc. It also seems that Saudi Arabia exercised an influence on pricing behaviour.

The role of Saudi Arabia during this period is difficult to define in terms of usual leadership models. As mentioned earlier, attempts by Saudi Arabia to set the price at its preferred level were not successful. In this sense, it was not a conventional price leader. Its contribution was rather different. Saudi Arabia's behaviour helped OPEC retain an identity and sense of purpose. By holding its prices down, well below market levels and in defiance of all market indicators, it defended the notion that the reference price of oil should remain an administered price. By so doing it helped prevent OPEC from abdicating its functions entirely to the market.

During this period, OPEC member countries found themselves moving between two poles: the spot market at one extreme and Saudi Arabia at the other. Their individual pricing behaviours reflect the relative attraction of these two poles, at different points in time, to each member country. As we have seen, Ecuador moved towards one pole

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20 K.T. Arrow, op.cit., p.46.
and allowed its prices to follow the market, in its ups and in its inevitable downs. Others, though strongly tempted to follow such an extreme course, found themselves more or less restrained by a commitment to price administration. They were not prepared to give up OPEC (the institutional form of this commitment) entirely. Saudi Arabia's pricing behaviour was a constant reminder of the need to administer prices. It also provided an anchorage to prices, an anchorage which did not stop them from rising but certainly increased the drag.

In short Saudi Arabia did not lead OPEC along a price path of its choice. Every oil producer was at times a 'price maker' à la Arrow. Without Saudi Arabia each would have taken full advantage of the slope in its demand curve. In the end, however, with the market reaching equilibrium every producer would have become a price taker - not of a price set by a dominant supplier, but of a price determined by the intersection of total demand and the aggregate supply curve.

Yet, because of Saudi Arabia's pricing policy, the outcome was different. Most OPEC producers followed a different price path to that traced by the market. The two paths went up in the same direction, but they rarely coincided. Curiously they intersected at a point where market prices were beginning to fall (having reached a peak which official prices never attained), while official prices were continuing to rise. The important point is that a distinction was preserved between OPEC's and the market's price behaviour when very powerful forces were attempting to abolish this distinction.
(a) 1981 Output
Again, a review of the output changes over 1981 is an important prerequisite to understanding the price movements over the year. As we noted earlier, Saudi Arabia increased its production to around 10.5 mbd in October 1980 in response to the Iran/Iraq war. It maintained this higher output ceiling (traditionally fixed at 8.5 mbd) until the end of August 1981 - a policy which had very important implications for the whole of the oil market in the first three quarters of the year. By the end of 1980, Saudi Arabian prices were some $8/b below the rest of OPEC and the decision to retain such a high "allowable output" imposed very marked cuts in sales on many other OPEC producers. Despite the fact that Iran and Iraq's combined output only recovered to some 2.4 mbd, the market slackened sufficiently for Libya and Kuwait to lose 1 mbd; Nigeria some 1.3 mbd; Venezuela 0.5 mbd; and Qatar, Algeria and the UAE some 200,000 bd in the eight months to August 1981. As we shall see, the pressure which such losses of output put on price differentials within OPEC were to prove sufficient to pull most prices down to the Saudi level. More flexible pricing in the first half of 1981 enabled most non-OPEC producers to maintain their output in the face of Saudi Arabia's 'flooding' of the market.

(b) 1981 Spot Prices
This emergence of an excess supply of oil was reflected most immediately in the spot markets. Having peaked in November 1980 (at $41/b for Arabian Light), spot crude prices fell by some $8 to $10 by mid-1981 to the then prevailing official marker price of $32/b. Spot product prices also began to decline in December 1980 (this time including 3.5% S fuel oil) and stabilised by June/July at prices not incompatible with the $32 Marker. The decline in product prices in the first half of 1981 was less than in spot crude prices, they having achieved a rather lower peak in 1980. All of this, coupled with the drop in sales outlined above, provided producers with a clear signal of the slackening of the market - a slackness which continued
throughout 1981, with only a weak recovery in spot prices in the winter quarter. Spot price movements over 1981 are graphed on Figure 3.

(c) Official Prices
Unlike the spot price decline in the first half of 1980, this time official prices followed the spot price down. Figure 5 illustrates the price cuts which took place before the OPEC meeting of late October 1981. Several interesting features emerge:

Almost without exception, non-OPEC producers cut their prices substantially between April and August 1981 - before any moves by the vast majority of OPEC. As we suggested above, these cuts were in response to the aggressive Saudi Arabian policy of selling 10.5 mbd at its relatively low price of $32/b. The non-OPEC producers' cuts in prices brought them all back to around the Saudi level (the resultant differentials are examined in (d) below), enabling them to compete and pushing still more of the burden of output adjustment onto the high-priced OPEC producers. Whilst still lagging spot price movements by around six months, the official price chronology shown in Fig. 5 again suggests a greater flexibility and sensitivity to spot price changes on the part of non-OPEC producers than OPEC countries.

The first three quarters of 1981 saw a prolonged series of disagreements within OPEC. As noted earlier, 1979/80 had seen the emergence of a two-tiered pricing system, with the official Marker at $32/b and a de facto Marker price of $36/b, around which much of OPEC was clustered. The Saudi policy of maintaining a very high output despite the weakening demand, and thereby inflicting very large cuts in sales on the rest of OPEC, was pursued with the sole aim of pulling the rest of OPEC back down to around its official Marker price. It was a clear attempt by Saudi Arabia to reassert its position in the Organisation and indeed in the whole world oil market.
By April

15 April

1 May

7 May

14 May

18 May

1 June

10 June

15 June

1 July

10 July

17 July

1 Aug

26 Aug

1 Oct

29 Oct

11% Ecuador

-6% Egypt

-2% China

-3% Malaysia

-3% Brunei

-4% USA

-10% Mexico

-3% USA

-8% Malaysia

-11% USSR

-3% U.K.

-11% Brunei

-3% Norway

-7% Mexico

-3% Libya

-5% Syria

-8% China

-4% Egypt

-7% Mexico

-5% Syria

-10% Nigeria

-3% USSR

-7% OPEC

+6%

Figure 5

EARLY 1981 OFFICIAL PRICE CUTS

Price cuts by all oil producers before the OPEC meeting of October 1981
The OPEC meeting in late May 1981 brought the conflict within OPEC into the open. Saudi Arabian attempts to pull the rest of the members' prices down from their $36/b "marker" were resisted and indeed the other twelve agreed production cuts (of some 1.25 mbd) in an attempt to defend their higher reference price. Much of the summer was then spent trying to urge production cuts on Saudi Arabia, as spot prices and output continued to tumble. A further meeting of OPEC in mid-August 1981 again failed to agree on a reunified price structure, and by this time, as we have seen, almost every non-OPEC producer had cut prices to the Saudi Arabian level, exerting still more pressure on the bulk of OPEC.

The failure of the August OPEC meeting was swiftly followed by one of the few unilateral price cuts by an OPEC member in 1981 - Nigeria cutting from $40/b to $36/b at the end of that month. As Fig. 5 shows, the only previous cuts had been by Ecuador who continued to be a law unto itself, and a small ($1.10/b) cut by Libya in July.

The battle by Saudi Arabia to re-impose itself as the 'leader' within OPEC, and to re-establish Arabian Light as "the" OPEC marker crude, was thus a long and difficult one. It was a battle which it finally won in late October 1981, when, at the meeting in Geneva, a new single Marker price of $34/b was finally agreed upon. All OPEC prices thus fell sharply to new levels around the $34/b Marker, while Saudi Arabia alone increased prices by $2/b to complete the reunification. (Further slight adjustments to prices were made at the December OPEC meeting.) It would thus appear that Saudi Arabia had ridden the storm of the previous few years, and had once again asserted itself as the leader of OPEC. That it had done this in a slackening market is of significance - a point which we pursue further in (e) below.

(d) How Good Was the Reunification of Prices?
As we pointed out in Section II above, the price movements of 1979/80 had the effect of dramatically widening price differentials between crudes of different quality and from different countries. The price changes of 1981 need to be viewed in a very different light - their effect, without exception, being to bring prices back together again. It is of interest to know how closely this was achieved. As we suggested earlier, the differentials of September 1978 had evolved over
two years of relatively weak prices, and are therefore a good benchmark against which to assess the price realignment of 1981. (See also Annex 2.) Table 3 compares the differential structure at the end of 1981 with that of 1978, on both a percentage and absolute basis.

For most crudes, the percentage differential over Arabian Light at the end of 1981 differed only marginally from that which had prevailed in 1978. Hence one gets an impression of a remarkably close return to the differential structure of 1978, following the relative chaos of 1979/80. This was brought about by what, on the surface, appeared to be a fairly arbitrary alignment within OPEC, and an unplanned and uncoordinated series of price cuts outside OPEC. Three important qualifications must be made to this picture, however. First of all, as we noted earlier, a correct differential is one which makes the buyer indifferent between two crudes. It should therefore reflect differences in transport costs, refining costs, product prices, etc., and need not necessarily be a set percentage of the crude price. If all costs, product yields and prices remained constant whilst crude prices rose, then the equilibrium differential would remain constant in absolute terms, and fall as a percentage of the crude price. An assessment of the 1981 reunification based purely on percentage differentials may not tell the whole story, therefore.

Secondly, it is important to note that, on a percentage basis, while the differences with the September 1978 positions are small, they are almost all in the same direction. There is a slight tendency to undercut Arabian Light which, given the previous reluctance of most producers to lower their prices, may appear rather surprising. This is, however, the perfectly rational behaviour of any producer in a slack market. The incentive is to price just below the major producer and take a larger share of the market. This reversal of policy by most producers - which, as we shall see, continued into 1982 - suggests that the earlier refusal to lower prices had little to do with short run profit maximization, and much more to do with the political desire to defend an independent marker price. Once the higher marker had been destroyed, most producers returned to revenue maximizing behaviour in the slackening market.
Table 3: Official Price Differentials against Saudi Arabian Light 34 crude

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Thirdly, and perhaps most importantly, for the next year or so there were a number of exceptions to the generally accurate return to the 1978 differential structure. Outside OPEC, Brunei, the UK and Norway were effectively undercutting the OPEC marker and, more significantly, there were a number of problems within OPEC. Nigeria and to some extent Indonesia, Algeria and Venezuela ended 1981 with more favourable differentials against Arabian Light than they had had in 1978, and, as we shall see below, these differentials were to cause problems within OPEC throughout 1982.

It is worth noting, finally, that the Arabian Light spot price for December 1981 was $34.26/b - only 26 cents above the official marker price. 1981 thus ended with spot and contract prices in remarkable harmony - with one or two important exceptions.

(e) Leadership in the Reunification of 1981

The question arises, whether Arrow's characterization of a market in disequilibrium, in which all producers faced sloping demand curves and hence were price-makers, held for the oil market in times of excess supply as well as it appears to in times of excess demand. 1981 can perhaps be termed a 'hinge' year between the tight market of 1979/80 and the slack market of 1982. It was a year of initially marginal but ever increasing excess supply. We would suggest that although there is evidence (as always in disequilibrium conditions) of Arrow-type behaviour, the most significant feature of oil developments in 1981 is Saudi Arabia seeking successfully to re-establish itself as the linchpin of the world oil market.

The Saudi tactics were clear - to allow buyers to lift as much oil as possible at its low price in order to bring the whole of the rest of the system to its level. It was, of course, aided by the general weakening of the market in 1981 which meant that it was seeking to pull the system in the same direction as the market. Equally, the Saudis were not dictated to by the market. They maintained prices well above any competitive level, whilst achieving a strengthening of their own position in the system. In this respect, the Saudi Arabian policies of 1981 fit well into a pure 'dominant producer' leadership model. By virtue of its position as the largest supplier, it was able to enforce its chosen price regime on the rest of the system. The final agreement
on the $34/b marker price was something of a political compromise by Saudi Arabia, its desire being as always to hold OPEC together. It had, however, made it clear from early 1981 that it would be happy to see the reunification at $34/b and hence ultimately achieved its aim. It is significant that it could do so when market conditions supported its policies, unlike during the previous two years when its attempts to resist market pressures were not very successful.

The policies of Saudi Arabia were thus relatively straightforward during 1981. What, then, of the role of the rest of the producers in that year? The non-OPEC producers continued to act in a revenue maximizing manner, given the policies of other agents. Having followed the market to its peak in November 1980, they sought to keep prices high for the first quarter of 1981 and so enjoy the enhanced revenue. When by the second quarter, the effects of the Saudi policy began to be felt on their output levels, they quickly followed the spot price down to levels close to Saudi Arabia's prices, and thus were able to maintain their output at the expense of the rest of OPEC. The non-OPEC producers were thus dictated to by Saudi Arabian production policies and the slackening market, and were quick to respond.

The behaviour of the bulk of OPEC is much more difficult to explain. As we have seen, their attempt to defend their higher 'marker' price cost them dearly in terms of lost output and revenue, and yet they resisted the pressures to cut prices for fully ten months. This clearly does not tie in with their 1979/80 policies except in so far as they wished to see high prices. Nor, indeed - as we examine in Section IV below - does it tie in with their behaviour in 1982, when again they appeared to seek to maximize their short term revenue. One can only conclude that their motives were political. That they resisted so long, and at such a high cost, indicates the strength of these non-economic factors. That they ultimately had to concede demonstrates the very significant power of the dominant producers in times of marginally slack markets.
The Slack Market of 1982

(a) 1982 Output Cuts
The pricing activity of 1982 cannot be understood without first recognising the very substantial excess supply which developed in the oil market. The situation of increasing slackness in the market in 1981 turned, in 1982, to one of major glut - presenting producers with very major problems which, in many ways, were of a totally different kind to those of the first half of 1981. The change was not merely one of degree.

At its peak in 1979, world oil production was over 65.7 mbd. This fell to a low point of just over 53 mbd in April 1982 and latest estimates, for October 1982, were just 56 mbd - fully 15% lower than the 1979 peak. OPEC production had fallen by a much larger percentage - 39%, from 31.8 mbd in July 1979 to 19.3 mbd in November 1982. Again, it hit a low point in April 1982 of 16.7 mbd - just 53% of OPEC's capacity. In rather stark contrast, non-OPEC output in October 1982 stood at 38 mbd (including Centrally Planned Economies), having grown steadily throughout the eighteen months since mid-1981. Whilst OPEC was operating at only half capacity, non-OPEC producers were at record levels of output, despite the very substantial downturn in total world demand.

(b) 1982 Spot Prices
This slackness was reflected in the spot market, where prices showed a fairly consistent downward trend following the modest recovery in the winter of 1981/82 (see Figure 3). Low points (of around $28/b for Arabian Light) were reached in March and again in November 1982. Indeed spot crude prices remained markedly below official contract prices throughout the year. Spot prices of expensive products again matched

21 Petroleum Intelligence Weekly, May 3rd, 1982, p.11, estimated total OPEC capacity at 31,185 thousand b/d.
the spot crude pattern very closely, with low points in March and November. The main product, 3.5% S fuel oil, was rather more stable, fluctuating between $24/b and $25.5/b throughout the year, except for a low point in August of $23.3/b.

(c) Official Price Undercutting
Such a situation of excess capacity and low spot prices places downward pressure on official prices which may manifest itself in two ways. Firstly, there is an incentive for a general, agreed, reduction in all official prices in an attempt to stimulate worldwide demand and allow a return nearer to capacity production for all producers (the efficacy of such a policy clearly depends on the price elasticity of demand for oil, the time lags involved, etc). Secondly, there is incentive for an individual producer to attempt to undercut his competitors' official prices, the reward being a larger share of the market and hence the potential for maintaining his production despite the contraction of worldwide production. He effectively can pass on the production cuts to his competitors.

First of all, it should be established that the pressure for a general reduction in all official prices was resisted throughout 1982, and for this attention must again focus on Saudi Arabia. Having succeeded, finally, in drawing down all of the rest of the world's producers to a $34 reference price by late 1981, Saudi Arabia chose to defend the newly agreed marker price in 1982 despite the sharply contracting demand. Possible explanations of the Saudi action are many. First of all, it may be a simple consequence of its long-term desire to smooth out fluctuations, both upward and downward, in the price of oil. Saudi Arabia may have felt that the long-term benefits, both economic and political, of such a policy outweigh the short-term costs of a loss in output. Such an explanation would of course also tie in with the Saudi pricing behaviour of the preceding three years.

To quote Dr Abdulhady Hassan Taher, Governor of Petromin and Saudi Minister of State in November 1982: "Saudi Arabia remains committed to its long-term goals of trying to maintain a reasonable equilibrium in the international oil market for the mutual benefit of both producers and consumers and for the common good of the world
economy as a whole." Moreover, as Dr Taher went on to argue, the Saudis saw the downturn in Western economic activity as a short run problem, recovery bringing about a renewed tightening of the market: ".... we believe that the oil market will return to a better balance in about six months from now (Nov 1982)." Long-term stability in oil prices was clearly considered to be worth any cost in terms of lost short-run revenue.

It is worth noting that it is unlikely that Saudi Arabia's attempts to hold prices high in 1982 will have won them many friends in the West - indeed statements coming out of the USA in the early months of 1983 suggested that the West would have preferred prices to fall, albeit in a reasonably controlled manner.

Some may equally argue that Saudi Arabia did not even view it as in their short-term interests to lower prices. There was a rational economic incentive to lower prices only if Saudi Arabia felt that it faced a positive marginal revenue over some future period of time. Marginal revenue is given by:

$$ MR = p(1-d) \frac{1}{z} $$

where p is price, d is the country's market share, and z the elasticity of world demand for oil.

Two factors may suggest that Saudi Arabia felt itself to be facing a negative marginal revenue in 1982. Firstly, it holds a large share of the market (40% of OPEC and 20% of Free World output in January 1982), i.e. its 'd' is large. Secondly, Saudi Arabia may well have perceived that it faced a very inelastic demand curve (i.e. a very low z), expecting any cut in its prices to be followed very quickly by other producers, and so resulting in little or no increase in Saudi sales. Chamberlin23 developed the notion of an oligopolistic firm


facing two demand curves - one assuming no reaction by rivals to a price change ("subjective" demand curve) and one assuming his rivals do react ("objective" demand curve). Rapid reaction to a Saudi price cut by other producers would imply that Saudi Arabia would slide down the more inelastic 'objective' demand curve and not along its own 'subjective' curve.

If other producers set prices always to undercut slightly the Saudi marker, as many did in 1982, price cuts by Saudi Arabia which are followed by everyone else may not have any impact on Saudi sales until all other producers are producing to capacity. The Saudi decision to hold prices in 1982 could then be related to a perception of negative marginal revenue, as little output growth would have been gained from a price cut. (If this were true, it would suggest a revenue maximizing behaviour by Saudi Arabia which was clearly absent during 1979/80.) There would thus appear to be political, and short and long run economic reasons why Saudi Arabia may have resisted the pressure to cut its prices in 1982.

By resisting the pressure to cut its official prices in 1982, Saudi Arabia effectively decided the level at which the "pricing game" was to be played. As we mentioned earlier, a slack market involves temptations for individual producers to undercut the formal price structure. 1982 did see several such moves. But competition took place just below the $34 reference level fixed by Saudi Arabia. Competition may have occurred in the same way at a lower price level had Saudi Arabia unilaterally cut the Marker price.

The price reductions of 1982 were very different in nature to those of 1981, which were aimed at a reunification of contract prices, achieved in October of that year. In 1982 the name of the game was competition, and one result of unilateral price cuts was to disturb the unified differential price structure.

Figure 6 graphs the chronology of the official price changes in 1982. It is perhaps best to consider the actions of OPEC and non-OPEC producers separately.
Figure 6

1982 Official Price Changes

Range -7 to +5%

Average -1%
Non-OPEC producers followed the 1981 reunification with a series of reductions in official prices in the first quarter of 1982 which undercut OPEC official prices, by substantial amounts in many cases. For example, the UK price-cut in early March put its Forties crude $3.5/b below comparable Nigerian Bonny; Mexico's price-cut in March put its Isthmus crude $2.5/b below Arabian Light; the Soviet Union's huge 17% cut in early March put its Export Blend fully $5/b below the Saudi Marker and successive cuts by Egypt put its Suez Blend $3/b below by mid-March.

Non-OPEC price changes since the OPEC meeting of late March 1982 have been relatively few, with most countries sticking throughout the year to prices just under the OPEC prices which they secured in the first three months. There have, indeed, been a number of non-OPEC price increases in the last three quarters of 1982 - notably from the UK, USSR, USA and Egypt, all of whom have brought official prices back up towards those of OPEC. Such moves would suggest that their earlier undercutting had been excessive in terms of that required to maintain output, and/or their earlier cuts had been made in anticipation of larger cuts from OPEC at their March meeting than actually occurred.

Table 3 presents the official price differentials of non-OPEC crudes against Arabian Light at the end of November 1982 and reveals a clear widening of differentials. Without exception, non-OPEC producers were pricing well below what was required to restore the differential structure of 1978. In order to achieve the same percentage differentials as 1978, non-OPEC prices would have needed to be increased by, for example, $3.97 (UK); $3.75 (Norway); $3.02 (USSR); $2.56 (Mexico); $2.53 (Egypt); $2.77 (Brunei). The effect of this undercutting by non-OPEC members was to allow them to maintain their output despite the fall in worldwide demand in 1982. Hence, whilst OPEC as a whole was operating at only 58% of its capacity, non-OPEC output had increased steadily over the year, and by September had reached its
highest ever total of over 20 million barrels/day. This was 6% higher than September 1981; OPEC output for the same month was 11% lower than the previous year.

OPEC producers made relatively fewer changes to official prices in 1982, as Figure 6 shows. The full OPEC meeting in March resisted pressure to cut the Marker crude price (and hence all OPEC prices) and settled instead for some further re-adjustments of differentials. These, in fact, had the effect of taking the structure somewhat away from the 'correct' 1978 structure - with the sole exception of Nigeria, whose $1/b increase restored part of the differential with Arabian Light though still leaving a large problem. In total, four OPEC countries cut their prices at the meeting (Abu Dhabi, Qatar, Libya and Algeria), and in each case the effect was to undercut the Saudi marker rather more than had been the case at the end of 1981.

Yet the policies of OPEC and non-OPEC producers in the slack market of 1982 caused problems and placed serious strains on the pricing system within OPEC. The main problems were:

1. Differentials between different quality crudes. This refers in particular to the differential between Middle Eastern Light crudes (especially Arabian Light) and African Light crudes of higher quality. As we have seen, whilst all of the African producers were pricing above Arabian Light, their percentage differentials were substantially lower than they had been in 1978 and indeed large increases in African crudes would have been required to restore these differentials: $1.46 (Libya); $2.24 (Algeria) and $2.27 (Nigeria). Saudi Arabia in particular demanded that these differentials be restored, to reduce the pressure on Saudi sales. However, whilst the official $35.52 charged for Nigerian Bonny, for example, was $2.27/b less than required to restore 1978 differentials, it was still $2.02/b more expensive than comparable UK Forties crude. With such competition from non-OPEC sources, the African OPEC members were unlikely to agree to any increase in their prices.
Other countries who reduced their differentials against lower quality Saudi Light were Venezuela and Indonesia - the latter's move having come at the end of November 1982. The extent of the narrowing was rather less than in Nigeria and Algeria's cases.

2. Official price differences for similar crudes. In three separate moves in February 1982, Iran unilaterally cut a total of $4/b from the official price of its crudes, thus severely undercutting all of the rest of OPEC. As Table 3 shows, Iranian Light was some 8% cheaper at the end of 1982 than Arabian Light, despite a $1/b increase by Iran in late June. In February, the Iranian cuts did not cause the uproar that they might have done as Iranian output was a mere 500,000 b/d. When output recovered to 2.3 million b/d, the undercutting of the OPEC price structure began to cause increasing alarm. Its effect, as witnessed by the rapid rise in Iranian output, like the squeezed differentials discussed above, was to place the majority of the burden of adjustment to the slack market on those countries who were holding the official OPEC price line.

3. Unofficial discounting. In addition to the two forms of reductions in official prices described above, 1982 also saw the emergence of discounting. Through a variety of techniques - offers of "improved terms" to equity holders, which spread to non-equity buyers in the form of straight discounts, processing deals etc. - producers sold contract crude well below official prices. Not surprisingly, price discounting enabled some countries to increase substantially the volume of their sales.

(d) Theoretical Characterizations of the 1982 Oil Market
We saw in Section II that most of the world's oil producers, with the exception of Saudi Arabia, acted as price makers in the disequilibrium market of 1979/80. In this, we argued, they conformed to Arrow's notion, that in disequilibrium all producers face a sloping demand curve. To what extent, then, did this hold for the 1982 oil market - again in disequilibrium, but this time one of substantial excess supply?
First of all, it is clear from the evidence above that the bulk of the world's producers, OPEC and non-OPEC alike, did not act as a passive price-taking fringe. They did not simply accept the price determined by either OPEC or Saudi Arabia. Rather, they acted to maximize their revenue by cutting prices individually in attempts to capture a larger share of the declining market. To use Chamberlin's terminology, they operated on their own downward sloping 'subjective' demand curves, whose elasticities were sufficiently large to give, at least in the short run, a perception of positive marginal revenues. In this, they acted as rational "Arrowian" sellers in a disequilibrium market, mirroring their behaviour in the tight market of 1979/80, but this time operating on negatively sloping demand curves.

There is, however, a very important difference between the experience in 1979/80 and that of 1982. As we have seen, in 1979/80 the influence of Saudi Arabia, the dominant supplier, on the so called 'fringe' oil producers was rather weak. This was not mirrored in the experience of 1982. The unilateral price setting of the 'fringe' producers was all done within sight of the marker price. Saudi Arabia effectively chose the level at which the pricing game was to be played, and to that extent retained a form of price-leadership. It was clear throughout the year that any movement down by the Saudis would be followed very quickly by all other producers.

This "leadership" by Saudi Arabia was achieved at substantial cost to itself in terms of lost output and hence revenue - costs which resulted from its unwillingness to prevent the competitive price undercutting by the rest of the world's producers. Being the lowest cost producer with the largest reserves gives Saudi Arabia the potential ultimate sanction, of being able to drive out any producer which undercuts its prices in a slack market. As we have seen, the nature and meaning of leadership is entirely different in a tight market.
Conclusions

Let us review briefly the main features of the post-1978 history of oil price movements which emerge from our study.

- **September 1978 to March 1979.** The first price rises came in the spot markets in the third quarter of 1978, all of which had shown substantial increases by the end of 1978. There is little to suggest that the small increases introduced by OPEC at their December 1978 meeting were in direct response to these spot price movements. In fact the first countries to respond to spot price rises were non-OPEC producers, beginning with the UK. They were followed by some of the smaller OPEC members in February 1979. OPEC as a whole did not introduce comparably large increases until their meeting in March 1979.

- **1979/1980** was a confused period of price-leapfrogging. Again, spot prices were the leading edge, with a mêlée of contract price rises following. Several of the smaller producers attempted to stay close to the spot price, whilst other, often larger producers lagged further behind. Saudi Arabia kept its prices below all others throughout the period - consequently price differentials against Arabian Light widened enormously.

- **1981.** In that year prices - spot, OPEC and non-OPEC official - finally tended to regroup around the reference set by the Marker crude. This was brought about by a combination of two factors: the slackening of world demand for OPEC oil, and the strong export advantage enjoyed by Saudi Arabia in this depressed market thanks to its low price policy. Non-OPEC producers adjusted to the situation by cutting their prices fairly swiftly; but most OPEC members held out through the first three quarters of 1981 against the Saudi attempts to reunify the oil price structure. The inevitable result was substantial losses of sales which ultimately encouraged everybody to agree a price realignment around a new Marker price of $34/b at the OPEC meeting of October 1981.
Demand continued to decline, but OPEC remained theoretically committed to the $34/b marker price despite declining spot crude and product prices. All major non-OPEC producers set contract prices below the Marker, and consequently managed to produce at near-capacity throughout the year. In mid-1982 several OPEC producers began to undercut the Marker price - either openly or through a variety of disguised means.

**In tight markets** Saudi Arabia was not able to exercise effective leadership: it could not lead other countries along the price path of its choice. It had however some influence on behaviour, providing an opposite pole to the spot market. The behaviour of individual OPEC producers was shaped by two factors - an almost irresistible lead from a nervous market and a long-standing habit of careful and rigid price administration. Nobody - except Saudi Arabia - followed the OPEC price-determination system; nobody - save Ecuador - followed blindly the price movements of spot markets.

The story was not as told by the 'dominant producer/competitive fringe' models. A large producer set a price but could not impose it on its peers. Very small producers took the spot market price and gave up all pretence at administration. All others made prices à la Arrow. In short, we observe that producers have some discretion over their own prices when excess demand obtains, and this discretion can be exercised despite the restraining actions of the dominant supplier. But the producers' freedom is not without bounds. They can make their own prices within a given range. As they move towards the upper end of the range they become takers of the competitive equilibrium price (as exemplified by the spot market). And those who remain close to the dominant supplier are indeed takers of an administered price. The stronger the influence of market forces, the more restricted is the price discretion enjoyed by producers. Hence, Mabro's view that the small OPEC members, in the tight market conditions of 1979, were 'apparent price makers'. "They appear as price makers because they keep on posting higher and higher prices (I am referring, to give one example, to what was witnessed throughout 1979), but their postings follow (usually with time lags and at a
distance), and never lead price determination on the market."24 It is thus possible to go one step beyond Arrow's characterization, and recognize that in this context price making is ultimately a succession of imperfect responses to market signals. It is price taking of sorts. When equilibrium is reached small producers have no other choice but to take unambiguously the ruling price.

In very slack markets, the small producers of the 'competitive/price-taking fringe' also enjoy discretion. They are always tempted to undercut the reference price set by the dominant supplier in order to maximize short-term revenues. Again, they are price makers of sorts, and the Arrow characterization becomes relevant. But the influence of the dominant producer is now very strong. The 'competitive/price-cutting'25 seller usually quotes its own prices just below the level set by the leader. In this sense the small producer is a price taker of sorts, since the price he makes is closely related to a given reference.

Price leadership obtains when the market is a little slack. Saudi Arabia was able to exercise price leadership of a conventional type in 1981 when producers just began to gain confidence in a turn-round in market conditions. They agreed to price realignment around the marker as they finally perceived that the market had ceased to be tight. In the very short period during which the market is just a little slack, no producer can benefit from raising his price above the level defined by the market, and no producer feels a strong urge to


25 Note the two different meanings of the term 'competitive'. In one sense, competitive refers to a market structure in which agents are too small or too numerous to be able to influence prices. Yet in common usage, competitive refers to the aggressive behaviour of those who seek to score better results than others. To compete in a market may involve direct action on prices, such as undercutting, in order to increase sales at the expense of somebody else. In some contexts, competition means that economic agents are price takers, and in other contexts it means just the opposite!
undercut the reference price. An equilibrium of sorts is then attained. This is not the conventional competitive equilibrium since the reference is determined by an administrative decision and need not relate to the relevant cost concept. As in the textbook model of the oil market, a dominant group of producers sets a price which the fringe producers take. But there is a difference. The price set by the dominant group may well clear the market from time to time; but it is doubtful whether prices set in this way could ever clear markets in successive periods over the long run.
ANNEXES
Annex 1

The discussion in this paper is based on official price data for the main world crudes, drawn chiefly from Petroleum Intelligence Weekly over the period since September 1978. For convenience, analysis of the behaviour of individual countries is founded on the movements in the price of a 'key' crude for each country i.e. that crude of which the country produces most. These are listed in the table below. We have ensured that all "premia" and "surcharges" which are sometimes applied to a country's price are included in the analysis and indeed that they are included in the database. Finally, in order to help identify any price-leadership, the data used in the paper presents all price changes on the date at which the decision was made and not necessarily on the date at which the price change became effective. Use of retro-active price changes has been common, particularly within OPEC, and can give the impression that prices are changed in unison when in fact several weeks may separate the decisions of individual producers.

Spot price data is taken largely from OPEC Bulletins and is expressed in the form of monthly averages throughout the paper unless otherwise stated. As all spot crude prices have moved together it is not unreasonable to talk in terms of "the" spot crude price. Spot product price movements have been rather less uniform.

Finally, all data on crude oil output used here is drawn from the regular tables of World Oil Production in Petroleum Economist. They are expressed in barrels-per-day throughout.
"Representative" crudes chosen for each country

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<th>Country</th>
<th>Crude</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEC:</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>Light 34</td>
</tr>
<tr>
<td>Iran</td>
<td>Light 34</td>
</tr>
<tr>
<td>Iraq</td>
<td>Basrah Light 35</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td>Murban 39</td>
</tr>
<tr>
<td>Qatar</td>
<td>Marine 36</td>
</tr>
<tr>
<td>Kuwait</td>
<td>Kuwait 31</td>
</tr>
<tr>
<td>Gabon</td>
<td>Mandji 30</td>
</tr>
<tr>
<td>Libya</td>
<td>Es Sider 37</td>
</tr>
<tr>
<td>Algeria</td>
<td>Saharan 44</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Bonny 37</td>
</tr>
<tr>
<td>Venezuela</td>
<td>Tia Juana 31</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Oriente 30</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Sumatran Light 34</td>
</tr>
<tr>
<td>Sharjah</td>
<td>Mubarak 38</td>
</tr>
<tr>
<td>Dubai</td>
<td>Fateh 32</td>
</tr>
<tr>
<td>Non-OPEC:</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>Forties 36.5</td>
</tr>
<tr>
<td>Norway</td>
<td>Ekofisk Blend 44</td>
</tr>
<tr>
<td>USSR</td>
<td>Export Blend (Mediterranean) 33</td>
</tr>
<tr>
<td>USA</td>
<td>Louisiana Light Sweet 37.5</td>
</tr>
<tr>
<td>Mexico</td>
<td>Isthmus 33</td>
</tr>
<tr>
<td>Oman</td>
<td>Oman 36</td>
</tr>
<tr>
<td>Syria</td>
<td>Suwaidiyah 24</td>
</tr>
<tr>
<td>Egypt</td>
<td>Suez Blend 34</td>
</tr>
<tr>
<td>China</td>
<td>Daqing 33</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Tapis Blend 43.5</td>
</tr>
<tr>
<td>Brunei</td>
<td>Seria 36</td>
</tr>
<tr>
<td>Angola</td>
<td>Cabinda 31.7</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Kole 33.5</td>
</tr>
</tbody>
</table>
Annex 2

September 1978 as the base date

As noted in Section II, we have chosen September 1978 as the base date for the analysis of official crude oil price movements. In so doing, we seek to identify a time at which we can view the structure of price differentials as being broadly in equilibrium. This we define as that structure of prices which more-or-less reflected the buyers' valuation of the different quality crudes, so as to make him indifferent between any two. We accept, of course, that in the real world we are unlikely to find the oil market in perfect equilibrium in this sense; we must seek rather to find a time at which the price structure appears to be "less imperfect" than at others.

The choice of date was influenced by two factors:

1. Price Stability.

September 1978 marked the end of a prolonged period of relative stability in contract prices. Table A, below, shows the last date prior to September 1978 at which OPEC members changed their official prices.
## Table A

<table>
<thead>
<tr>
<th>OPEC Member</th>
<th>Date of Last Price Change before September 1978</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iraq</td>
<td></td>
</tr>
<tr>
<td>Iran</td>
<td>December 1976</td>
</tr>
<tr>
<td>Qatar</td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
</tr>
<tr>
<td>Gabon</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>July 1977</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>January 1978</td>
</tr>
<tr>
<td>Algeria</td>
<td></td>
</tr>
<tr>
<td>Libya</td>
<td>April 1978</td>
</tr>
<tr>
<td>Nigeria</td>
<td></td>
</tr>
</tbody>
</table>

Only Kuwait and the three African producers altered their prices in the fifteen months prior to September 1978 - and then by only very small amounts, as they sought to adjust their differentials with the rest of OPEC.

Tables B and C compare the period from January 1977 to September 1978 with prior and subsequent periods of similar length. Together they show clearly both the relative infrequency and small size of price changes in the months approaching September 1978. Both tables present a picture of substantial disequilibrium in the 1973-74 oil market, followed by four years of increasing stability, ending in late 1978 with the start of the 1979/80 price explosion.

Outside OPEC, official price changes were rather more frequent, but again were not of any significant size over the two years from the end of 1976. North Sea prices, for example, drifted down by around 40 cents (2.8%) from January 1977 to April 1978, and then recovered around half of this fall over the next two quarters. Such movements were fairly typical of non-OPEC prices over the period - greater frequency of change than official OPEC prices, but still a period of relative stability.
Table B:
Number of Official Price Changes in key crude of main OPEC producers

<table>
<thead>
<tr>
<th></th>
<th>7/73-3/75</th>
<th>4/75-12/76</th>
<th>1/77-9/78</th>
<th>10/78-6/80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Iran</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Iraq</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Kuwait</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Qatar</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Libya</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Algeria</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Nigeria</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Venezuela</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Mean</td>
<td>7.45</td>
<td>2.91</td>
<td>1.09</td>
<td>9.36</td>
</tr>
</tbody>
</table>

Table C:
Percentage Changes in Official Prices of key crude of main OPEC producers

<table>
<thead>
<tr>
<th></th>
<th>7/73-3/75</th>
<th>4/75-12/76</th>
<th>6/77-9/78</th>
<th>10/78-6/80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>288</td>
<td>16</td>
<td>5</td>
<td>120</td>
</tr>
<tr>
<td>Iran</td>
<td>298</td>
<td>20</td>
<td>0</td>
<td>176</td>
</tr>
<tr>
<td>Iraq</td>
<td>293</td>
<td>20</td>
<td>0</td>
<td>138</td>
</tr>
<tr>
<td>Kuwait</td>
<td>301</td>
<td>19</td>
<td>-1</td>
<td>140</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td>312</td>
<td>10</td>
<td>6</td>
<td>138</td>
</tr>
<tr>
<td>Qatar</td>
<td>297</td>
<td>20</td>
<td>0</td>
<td>140</td>
</tr>
<tr>
<td>Libya</td>
<td>243</td>
<td>25</td>
<td>-0.5</td>
<td>167</td>
</tr>
<tr>
<td>Algeria</td>
<td>226</td>
<td>19</td>
<td>-1</td>
<td>171</td>
</tr>
<tr>
<td>Nigeria</td>
<td>191</td>
<td>32</td>
<td>-1</td>
<td>160</td>
</tr>
<tr>
<td>Venezuela</td>
<td>254</td>
<td>20</td>
<td>0</td>
<td>139</td>
</tr>
<tr>
<td>Indonesia</td>
<td>238</td>
<td>8</td>
<td>0</td>
<td>132</td>
</tr>
</tbody>
</table>
2. Stable Output Shares

Stable price differentials would not in themselves suggest equilibrium in the oil market, if at the same time there were wide fluctuations in the shares of the total market going to each producer. Table D shows the shares of eight major OPEC producers in total OPEC production over the year to September 1978.

Table D:
Shares in total OPEC output, Sep.1977 to Sep.1978

<table>
<thead>
<tr>
<th></th>
<th>Iran</th>
<th>Iraq</th>
<th>Saudi Arabia</th>
<th>Kuwait</th>
<th>Abu Dhabi</th>
<th>Libya</th>
<th>Nigeria</th>
<th>Venezuela</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>Sep</td>
<td>19.2</td>
<td>7.9</td>
<td>27.7</td>
<td>7.3</td>
<td>5.2</td>
<td>6.5</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Oct</td>
<td>18.2</td>
<td>8.1</td>
<td>28.2</td>
<td>6.1</td>
<td>5.5</td>
<td>6.9</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Nov</td>
<td>19.4</td>
<td>7.9</td>
<td>28.3</td>
<td>7.4</td>
<td>5.0</td>
<td>6.6</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td>Dec</td>
<td>19.6</td>
<td>7.6</td>
<td>29.4</td>
<td>8.2</td>
<td>5.0</td>
<td>6.0</td>
<td>5.7</td>
</tr>
<tr>
<td>1978</td>
<td>Jan</td>
<td>19.3</td>
<td>7.6</td>
<td>28.1</td>
<td>6.2</td>
<td>5.0</td>
<td>6.5</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>Feb</td>
<td>19.3</td>
<td>8.7</td>
<td>29.0</td>
<td>6.0</td>
<td>5.2</td>
<td>6.3</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>Mar</td>
<td>19.4</td>
<td>8.6</td>
<td>26.5</td>
<td>7.3</td>
<td>5.0</td>
<td>6.5</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>Apr</td>
<td>19.1</td>
<td>8.5</td>
<td>27.1</td>
<td>6.7</td>
<td>4.6</td>
<td>6.4</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>May</td>
<td>19.9</td>
<td>8.4</td>
<td>25.3</td>
<td>6.3</td>
<td>5.2</td>
<td>6.7</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>Jun</td>
<td>19.7</td>
<td>8.2</td>
<td>25.5</td>
<td>6.6</td>
<td>4.9</td>
<td>6.8</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Jul</td>
<td>19.9</td>
<td>8.2</td>
<td>25.2</td>
<td>6.6</td>
<td>4.9</td>
<td>6.8</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Aug</td>
<td>19.5</td>
<td>8.8</td>
<td>23.9</td>
<td>7.9</td>
<td>4.9</td>
<td>6.9</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>Sep</td>
<td>19.0</td>
<td>9.0</td>
<td>26.2</td>
<td>8.1</td>
<td>4.5</td>
<td>6.6</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Variations in a country's output may be caused by a number of factors other than price differentials with competing producers (for example, physical production problems, seasonal factors, changes in demand patterns for different crudes, etc.). With this important caveat, the evidence from Table D does suggest a high degree of stability in output shares among OPEC producers over the period.

It is again useful to compare this stability with other periods. Table E shows Standard Deviations of shares in total OPEC production - as a measure of their variability - for OPEC producers over three sub-periods from 1975 to 1980. It does not confirm very clearly the notion of increasingly stable shares up to September 1978; but it does certainly reveal the disequilibrium in the post-September 1978 market, highlighted by the very substantial increase in the S.D.s of the major OPEC countries.
Comparing 1975-76 with 1977-Sep.1978, we find that the S.D.s tend to be lower in our reference period for most countries except Saudi Arabia. In other cases where the S.D.s appear to be higher in the second period, the differences are not very significant.

Table E:
Standard Deviations of Country Shares in Total OPEC Output

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>1.67</td>
<td>1.74</td>
<td>2.09</td>
<td>4.08</td>
</tr>
<tr>
<td>Iran</td>
<td>1.05</td>
<td>1.07</td>
<td>1.14</td>
<td>4.04</td>
</tr>
<tr>
<td>Iraq</td>
<td>1.26</td>
<td>1.07</td>
<td>0.59</td>
<td>3.00</td>
</tr>
<tr>
<td>Kuwait</td>
<td>0.89</td>
<td>1.06</td>
<td>0.88</td>
<td>1.23</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td>0.94</td>
<td>0.84</td>
<td>0.30</td>
<td>0.28</td>
</tr>
<tr>
<td>Qatar</td>
<td>0.32</td>
<td>0.30</td>
<td>0.19</td>
<td>0.18</td>
</tr>
<tr>
<td>Libya</td>
<td>1.36</td>
<td>1.15</td>
<td>0.28</td>
<td>0.33</td>
</tr>
<tr>
<td>Algeria</td>
<td>0.27</td>
<td>0.27</td>
<td>0.36</td>
<td>0.35</td>
</tr>
<tr>
<td>Nigeria</td>
<td>0.63</td>
<td>0.50</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>Venezuela</td>
<td>0.90</td>
<td>1.02</td>
<td>0.66</td>
<td>0.61</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.31</td>
<td>0.29</td>
<td>0.27</td>
<td>0.53</td>
</tr>
</tbody>
</table>

Our analysis is that most producers enjoyed much greater stability in their monthly output shares in 1977-78 than in the preceding and subsequent periods, partly because the price structure was closer to equilibrium and partly because Saudi Arabia absorbed more readily OPEC random output fluctuation.

September 1978 would appear to separate a fairly prolonged period of stable prices and output shares from one of marked disequilibrium in both. As such it provides us with an appropriate starting point and base date for our analysis.