The Role and Behaviour of Oil Inventories

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1. Introduction and Executive Summary

The purposes of this paper are to explain the economics of inventory behaviour, to describe and analyse the changes in oil inventories since the beginning of the Gulf crisis, and to discuss issues of public policies relating to stocks. In Section 2 we emphasize the different economic function performed by inventories in times of crisis, when increased uncertainty and larger variance of expectations tend to increase desired inventory levels. Section 3 describes the evolution of petroleum inventories over the course of the 1980s, arguing that the drive to reduce product holdings especially over the decade has reduced their buffer role and therefore increased the vulnerability of the supply system when refining capacity is stretched. Section 4 evaluates the available evidence on stockholding behaviour since last August, focusing on the different patterns that emerged in three major areas: the USA, Europe and Japan. Finally, Section 5 addresses the issue of public policies and discusses the motivations and performance of the major institutional players (EC, IEA, DOE) in the context of the current crisis.

The key issue in any oil crisis is the behaviour of stockholders. Their behaviour, however, is not immediately reflected in observed stock levels. Actual changes in stock levels only reflect the *ex-post* demand for stocks, but in times of crisis it is the *ex-ante* demand which has an impact on the market. If inventory holdings remain constant or decline, this cannot be interpreted as conclusive evidence that the market is in equilibrium. A decline in inventories might simply be exposing the fact that there has been a supply shortfall, and the gap has to be made up somewhere. It cannot be taken to prove that demand for stocks has not risen.

In a crisis, *ex-ante* demand for stocks will certainly be higher than in normal times, because the increased variance of expectations will emphasize the precautionary function of stocks. This extra demand (which is not directly observable) might however be frustrated and actual stock levels may remain constant or even decline. But this does not imply that the inability to attain the desired stock level has no effect on the market. The adjustment cannot occur without an impact on prices, which will rise even if volumes purchased do not, or do only to a small extent.

Preliminary data suggest that actual stock levels for crude oil and products have increased slightly over the course of the crisis in Europe and to a greater extent in Japan, while they have fallen in the USA. This suggests that the production shortfall from the Gulf has been somewhat aggravated by increased demand for stocks in Japan and in Europe, and has been accommodated by a drop in US stocks (and presumably in developing countries.) This adjustment on the physical side has been accompanied by a price rise, part of which is undoubtedly of a speculative nature, but which reflects for the major part the imbalance between desired inventory levels and and *ex-post* holdings.

The critical issue at this stage appears to be for how much longer the USA will be able to accommodate the pressures which have emerged in Japan and in Europe, and which have driven product prices in these areas so much above US prices. Since the beginning of the crisis, the net drawdown in US commercial stocks of crude and products combined has been about 200,000 b/d. The rate of depletion in October was much higher than this average, being almost 700,000 b/d in the first three weeks. With domestic crude oil production declining and imports falling, unless refinery runs are cut drastically it could not be long before the USA reaches a hard floor in its crude oil holdings.

A drawdown of strategic stocks, which has been substituted so far by a large drawdown in US commercial stocks, might then become unavoidable even if war does not break out in the Gulf. If on the other hand refinery runs are cut, products coverage might become too thin and increase the pressure on product prices. In either case, the balance appears to be very delicate.

2. The Economic Function of Stocks

In the oil industry large volumes of stocks are held in the transportation system (pipelines, tankers, terminals) and at refineries for operational reasons. Crude oil and products that continually fill these vessels are construed as stocks and form a substantial part of the total commercial inventories. There is therefore a minimum volume of stocks below which holdings cannot fall without hampering the transport, processing and sales of oil.

For supply security reasons, several countries also impose a minimum level for commercial stocks, which is obviously higher than the operating minimum and which must be maintained by law.

Above these levels, the oil firm will naturally try to optimize its stock levels. It will need additional stocks to smooth production in the face of fluctuating demand, both for seasonal and conjunctural reasons. A stock buffer is also needed to cope with technological constraints in refining: depending on the complexity of the refinery, there is only a limited combination of products slates obtainable from any given type of crude oil. Taking the USA as an example, the ratio of gasoline-to-distillates demand can vary from 1.8 at the height of the heating season to over 3 during the driving season, while the ratio of gasoline-to-distillates refinery production normally moves in the narrower range between 2.2 in the winter and 2.8 in the summer.

The ultimate rationale for holding some stocks to cope with seasonal and some unexpected variations in demand is that of avoiding stock-outs, and thus lost sales, particularly in circumstances where demand cannot be backlogged. This is a crucial feature for the oil industry, where products are bulky and slow to move from one location to the other, and where the interruption of supplies to customers has particularly unpleasant consequences.

Finally, the speculative motive may play a role in varying stock levels held around the optimum, when large price changes are expected.

Cost considerations play an important role in the determination of inventory optima. The cost of holding oil inventories is greater than in other manufacturing industries, especially as a large proportion of these inventories is tied in the system as minimum operating requirements and is not immediately or not at all usable. Where applicable, legal requirements also limit the volumes of usable stockholding. Further, petroleum inventories are themselves subject to much greater changes in value than in any other sectors. In normal times, these cost concerns tend to prevail and exert a downward pressure on petroleum stocks. As Section 3 details, the 1980s have witnessed a clear tendency for firms to restrict them to a minimum above operating or legal requirements.

In a crisis, the stock-out avoidance (or precautionary) motive for holding inventories tends however to acquire a predominant importance. In times of heightened uncertainty and political instability, fears of actual disruptions deeply affect stockholding behaviour and desired inventory levels tend to increase both for genuine precautionary

reasons (i.e. to reduce the probability of being caught in a stock-out) and because of expectations of future price increases. In such circumstances, demand for stocks becomes almost exclusively related to attitudes towards risk.

This is what happened after the Iranian crisis, when demand for stocks soared on fears of supply shortages and rocketing prices, and added to demand pressures. Spot prices continued to rise even after it became clear that there was no supply shortfall: increased production in other OPEC countries more than compensated for the loss of Iranian production. OECD consumption in 1979, in contrast, was only moderately higher than in 1978. The difference was a substantial buildup in stocks, which exerted strong pressures on prices.

Very little of this increase in desired or actual stock levels need be necessarily of a speculative nature: past experience suggests that in periods of uncertainty stocks have tended to fall only *after* the effects of the shock to the system have gone, and it is difficult to believe that all speculators would have collectively missed the right moment to sell.

The fundamental problem is that in times of uncertainty over future supplies the desired inventory levels will tend to increase *regardless* of what their initial level was. This is why the reassuring statements we heard from governments and companies at the start of the Gulf crisis, namely that stock levels were at historical highs, did not entirely convince. Even if commercial stocks were high, this may have few stabilizing effect because after an oil shortfall a private stock drawdown is likely to occur only when the price is known to have fully adjusted to the shortfall, and the shortfall is known to be temporary.

This does not mean that over the past few weeks companies have been actively stockpiling crude oil, or that they will do so in future. After the experience of 1980-81, companies are all too aware of the consequences such a behaviour would produce in the relationship with their governments, and are determined to do all they can to avoid accusations of "stockhoarding" in future. But the fact that they are not holding more stocks does not imply that they *would not like* to hold more. This unsatisfied desire to hold even higher stocks is then reflected in the immediate *replacement* of stocks which in normal circumstances would have been allowed to run down, and this can push prices up in the market even though an actual stockbuild does not take place. In other words, the mere replacement of a barrel of crude oil run through a refinery or product sold to the final consumer with a purchase on the market (rather than taking that barrel from stocks) can add significantly to price pressures.

3. Evolution of Oil Inventories in the 1980s

After their disproportionate rise in 1979-81, commercial stocks of crude oil and products worldwide began to decline rapidly. The decline was steepest in the first half of the 1980s, when a combination of high carrying costs, weakening prices, and declining demand provided a strong justification for inventory cuts. But the drive to streamline operations, reduce working capital and maximize inventory turnovers kept the pressure on product stocks even in the second part of the decade, in spite of rising demand and reduced spare capacity in refining. At the start of the new decade, the supply system appears to many to have become far more vulnerable to disruptions, without the buffer once provided by stocks.

The dramatic reduction in stocks which took place after the exceptional buildup of 1980-81 was determined by a number of causes, the most immediate of which was the heavy financial burden placed by high inventory levels on refiners and operators. Although the cost of commercial storage space did not increase significantly after 1978, the rise in interest rates meant that financial carrying costs rose by a factor of five from 1978 to 1981 and were still three times as high in 1983 compared with 1978. Taking as an example gasoline storage in the USA, the National Petroleum Council estimated that annual tankage costs increased from $2.50 per barrel in 1978 to $2.95/b in 1983, while carrying costs soared from $1.70 per barrel per year in 1978 to nearly $8.40/b in 1981, and were still around $6/b in 1983.

The decline in demand levels and the reduction in seasonal demand swings was the other obvious incentive for reducing inventory levels. Between 1979 and 1984, OECD demand for oil dropped by almost 20 per cent, while the seasonal swings flattened due to reduced use of oil for heating and increased transport demand for middle distillates as a proportion of the total. Before 1979, total OECD consumption in the two winter quarters was 5 mb/d higher than in the summer quarters, with middle distillates used for home heating accounting for 3.5 mb/d. In 1984, the seasonal swing in consumption had dropped to only 2 mb/d, with heating oils representing 1.8 mb/d. There was clearly less need for a seasonal increase in stock levels.

In addition, the emergence of surplus refining capacity made it economical for refiners to meet winter peak demand by increasing refinery utilization rates instead of drawing down seasonal inventories. The industry evolved a deliberate strategy of cutting product inventories and holding just enough crude to meet specific demand hikes. Changes in crude and products inventory levels between 1980 and 1985 clearly show how refiners implemented this strategy. Taking the USA as an example (but the story is very much the same for other countries) total product inventories declined by 29 per cent between the September 1980 peak and the end of 1985, while crude oil inventories only declined by 14 per cent over the same period.

With plenty of spare refining capacity to meet demand surges, and imports continuing to fill much demand, stock drawdowns were not intended to contribute as much to total supply as they had done in the past. Historically, US heating seasons had begun with distillates stocks as high as 258 mb (1977) and 70.2 days' supply (1980). At the beginning of the 1984 heating season, distillate stocks totalled 47 days' supply, and

in 1985 they had declined further to 37 days' supply at the expected demand level. The seasonal swing between the October-November peak and the April-May low, which had been historically of the order of 45 per cent, also declined between 1982 and 1985 to around 35 per cent. In the winter season of 1985-86, distillate stocks contributed only to about 5 per cent of total supply, down from an average of over 10 per cent in the past.

A similar story holds for gasoline. Measured in days' supply, US gasoline inventories at the start of the 1986 summer driving season fell to their lowest level in ten years, only three days above the minimum operating inventories as calculated by the National Petroleum Council.

As mentioned above, this pattern was not peculiar to the USA. Commercial stocks in the OECD countries fell dramatically between 1981 and 1985, and the amplitude of seasonal fluctuations also declined. The average first-quarter draw dropped from 2.7 mb/d in 1975-78 to 1.8 mb/d in 1982-85, while third-quarter stockbuilds fell from 2.1 mb/d on average in 1975-78 to 700,000 b/d in 1982-85. Second and fourth quarters' figures show comparable reductions.

The situation was of course tighter in the USA, where companies are not committed by law to maintain their inventories above a minimum floor. However, in Europe and in Japan stocks moved very close to the mandatory inventory minima laid down by governments, as refiners tried to minimize holdings of individual products. Indeed, the Japanese refiners put pressure on their government to lower the private sector's emergency stockpile obligation from 90 days' supply to 60 days (15 days above the minimum operating requirements, estimated for Japan as around 45 days). And stocks in Europe were very close to the estimated minimum of some 950 mb, or about 80 days' supply (after taking full account of the different statutory requirements in each country).

The shift in international oil trading in 1982-85 away from long-haul to short-haul shipments (i.e. the growth in the relative importance of Latin America to USA, North Sea to Europe, and North Africa to Europe transactions as compared to long-haul trips from the Middle East to the USA), meant a shorter transit time between production sources and refineries. Use of domestic crudes instead of imported crude also cut this time lag and eliminated the risk of one tanker being delayed, allowing refiners to carry less inventory. A wide-ranging rationalization strategy was implemented, with reduction of supply lines and development of trades and exchanges among refiners.

Finally, a crucial incentive for reducing stock levels in the early 1980s was the growing volume of crude and product traded on the spot market, and the greater price volatility which increased companies' vulnerability on inventories.

In 1986 the oil price crash encouraged some rebuilding of depleted inventories, but most of the rise in primary stocks was unintentional, simply reflecting supplies outrunning demand. Feeling that there was still too much downside risk for both crude and products to rebuild stocks, oil companies brought to perfection their ability to operate on smaller product stock levels.

Refiners succeeded in further streamlining operations, with the objective of maximizing inventory turnover and minimizing tankage and inventory levels. To some extent physical stocks were replaced by information, as the adoption of computer-based systems made available nearly instant data on volumes and locations. In addition, acquisitions and divestitures also contributed to lower stock levels. By withdrawing from areas with poor market share, many refiners (especially in the USA) were able to close redundant terminals. Refinery closures also translated in lower inventories.

More importantly, the spectacular rise of futures markets undoubtedly undermined the use of physical storage in hedging price risk. As more and more companies became involved in futures trading and new instruments were introduced in the market, physical stocks partly lost their hedging function against price uncertainty.

The recovery in products demand over the second part of the decade did not spark a comparable increase in product inventories in most areas, as shown in Table 3.1.

Table 3.1 Percentage Changes in Product Demand and in Product Stocks between 1985 and 1989

	Product Demand (1)	Product Stocks (2)
USA	+ 8.4 %	- 9.6 %
Japan	+ 14.9	+ 10.5
UK	+ 2.8	- 8.9
France	+ 7.5	+ 4.9
Germany	- 4.2	+ 12.4
Italy	+ 12.0	+ 14.9

(1) Average demand over the year
(2) Stock level at year-end

Source: IEA

Only in a few countries does the growth in product demand appear to have been tracked by increased products inventories. In some countries, like the USA and the UK, the increase in demand has not prevented a decline in total product stocks, and in others product inventories have remained close to the levels achieved in 1985-86 (i.e. around the minima established by their respective laws).

Table 3.2 below details the evolution of crude and products stocks in the USA by location: it is apparent that while the volumes of crude oil held at refineries have actually increased since 1985, product inventories at refineries and bulk terminals have declined significantly even after 1985.

Table 3.2 US Crude Oil and Major Product Stocks at Year-end, by Location (mb)

	Crude Oil		Major Products		
	Refinery	Tank farms & pipelines	Refinery	Bulk Terminals	Pipelines
1980	124	213	160	288	98
1985	90	183	124	198	96
1989	100	199	113	158	90
% changes					
1980-89	- 19.3	- 6.7	- 29.5	- 45.0	- 8.5
1985-89	+ 10.6	+ 9.0	- 8.7	- 20.2	- 6.6

Source: EIA, *Petroleum Supply Annual*, various issues

A very similar trend is to be found in other areas. In France, for example, there has been an equally impressive drop in the volumes of products held at refineries, while the volumes held in the distribution system have increased or remained stable. Whereas the stocks in the distribution system have only fallen by 5 per cent between end-1981 and end-1989, stocks held at refineries have dropped by more than 50 per cent.

The decline in the level of stocks throughout the decade in turn had implications for prices, as stocks levels became a major determinant of spot price changes. Lower stock levels, while clearly reducing the industry's financial exposure, also tend to reduce the ability to absorb any short-term demand shock: a cold spell or a sudden surge in gasoline demand during a long weekend requires the price to rise sharply to clear the market.

In addition, with the growth of futures markets and other trading instruments information about changes in stock levels has become important *per se*. Short-term news about changes in stock levels affects perceptions and stimulates oil price movement, and this volatility is indeed the lifeblood of a speculative market. Week-to-week (or month-to-month) fluctuations in stock levels undoubtedly provide the kind of news the market needs to operate, and they have become able to instantly turn market sentiments from "bullish" to "bearish" or vice versa. The level of stocks in the ARA system, in Le Havre or in the Caribbean has become closely watched, although the volumes involved are comparatively small. (The ARA storage system has held on average, between 1986 and the present time, 5.5 mb of gasoline stocks, less than one mb of naphtha, 8 mb of gasoil and 3.5 mb of fuel oil, of which a large proportion is made up of Dutch compulsory stocks controlled by the Dutch stock-owning body ICOVA. The independent storage in Le Havre holds on average around 5 mb of products, and about the same volume of crude).

The emphasis placed by petroleum spot and futures markets on short-term factors, stemming from the very nature and objectives of its main participants, has clearly contributed to a narrow interpretation of stocks changes as the mere *ex-post* balance between supply and demand. Petroleum markets greet any weekly increase in stocks in an essentially "bearish" fashion, with prices immediately slipping back on the news, but with little or no relationship with longer-term underlying trends. With refinery closures and rise in oil product demand gradually putting refining capacity at a premium in many areas, any reliance on higher crude stocks and flexibility in refining cannot be stretched too far. Focussing attention solely on short-term changes can be short-sighted.

To conclude, since the mid-1980s the degrees of freedom of the physical supply system appear to have been reduced in many areas, as the drive to cut costs maintaining inventory levels on a fine edge has set in deeper. However, occasionally an unexpected event (such as the cold snap which swept the US Gulf and East Coasts in December 1989) uncovers the inherent rigidities in the system and exposes the lower actual level of stocks. Then the markets discount it all at once, in the form of a spectacular price spike. These spikes are in nobody's long-term interest, yet current trends imply that - regardless of political crises and embargoes - they may become longer, more widespread and more frequent.

4. Oil Inventories and the Gulf crisis

At the beginning of the Gulf crisis, all parties concerned (oil companies, IEA, governments) stated that petroleum stocks were plentiful, in fact at historical highs and that with OECD total stocks on land at 471.5 million tonnes (99 days of OECD forward consumption, or 152 days of net imports) the world could comfortably shoulder the disruption of Iraqi and Kuwaiti oil exports for an unspecified period.

Shortly afterwards, however, the idea began to percolate through that the optimism on stocks was the outcome of a misleading aggregation process. The "fallacy of aggregation" was thus exposed, and a different angle on the situation began to appear. It became clear that crude oil and petroleum products could not be treated as an homogenous commodity, and that there were large differences in regional situations. Crude oil stocks were higher than in previous years, the increase being due entirely to a positive decision to stockpile crude in the first half of 1990 taking advantage of oil price weakness. However, as shown in Table 4.1, the bulk of the buildup had taken place in North America. And for petroleum products the situation appeared to be far less comfortable.

Table 4.1 OECD Commercial Stock Changes in the First Half of 1990 (mb/d)

	First Quarter			Second Quarter		
	Crude	Products	Total	Crude	Products	Total
N.America	+ 0.4	+ 0.4	+ 0.8	+ 0.2	0.0	+ 0.2
Europe	+ 0.3	- 0.4	0.0	+ 0.3	+ 0.2	+ 0.5
Pacific	+ 0.1	- 0.1	0.0	- 0.1	+ 0.2	+ 0.1
OECD	+ 0.8	0.0	+ 0.8	+ 0.4	+ 0.4	+ 0.8

Source: *IEA Oil Market Report*

The perception gradually grew that product inventories were not in fact as high as many had initially thought. In spite of the IEA's original position that there were no grounds for concern as stocks levels were perfectly adequate, oil product stocks were very much the weak link in the supply chain. As discussed in Section 3, many refiners had pared their products to the bone during the course of the 1980s. And when the crisis began refinery utilization rates were near maximum, which when combined with the loss of Kuwait's sophisticated hydrocrackers, put spare capacity at a premium.

Paradoxically, the same oil companies which at the start of the crisis told the world that their own stocks were plentiful and more than adequate to make up for any shortfall, found themselves in an embarrassing spot when they had to justify to the public the immediate transfer of increases in spot gasoline prices to the pump. The result was a complete volte face, and with nonchalance companies abandoned the thesis of high stocks and adopted that of low stocks. This had the advantage of supporting the

replacement cost argument in explaining price increases at the pump.

As the crisis progressed, oil companies have become more and more careful to avoid any possible future accusation of stock hoarding, and have repeated on every possible occasion that their inventory levels are not increasing, that they have learnt from past experience, and that in fact they are down to the bare minimum requirements. In early October, when crude oil prices were oscillating around $40 per barrel, authoritative oil company sources declared that companies were unable to do much to help moderate the price rise because they had few available stocks that could be released onto the market. They were working on a minimum stock basis in order to co-operate with IEA calls and to avoid exposure to unpredictable market developments. Indeed, they claimed to have taken a strictly commercial decision not to build up their stocks above normal seasonal levels. They also pointed out that while global commercial oil stocks were broadly adequate, they are held by many companies throughout the supply chain and not just by a few big companies. This implicitly diverted any blame onto small independent refiners, final consumers and of course the pernicious speculators.

Hence governments have invited the oil companies to show restraint and to draw down their stocks first; the IEA has blamed market psychology; and the oil companies have blamed the small operators (refiners and retailers) for building up their stocks. The overall impression is inevitably that not much is being done to clarify the issue, and indeed one might argue that this would be in nobody's interests. After all it is hard to see who among the important players has been directly worried about prices. Oil companies do not suffer overall losses from high prices, at least not in the short term, and OECD governments are keen to emphasize their belief that the effects on the macroeconomy are strictly limited. Those who suffer most are of course developing countries, but their interests have been under-represented in the debate.

It is difficult even for independent researchers to clarify the issue, because of the lack of any timely and reliable data on stocks outside the USA and the impenetrable secrecy surrounding the holding of stocks. While in the USA information on stock levels is readily supplied on a weekly basis by the American Petroleum Institute, data for Europe are not publicly available on an instant weekly basis, and official data published by government agencies on a monthly basis tend to appear with lags of at least two months. This lack of transparency in European inventory levels is a quite deliberate policy of the European oil industry, as there are no technical reasons to explain the difference in the availability of information. The US industry is open and accessible in a way that the European counterparts seem rather keen to avoid. In these circumstances, all sorts of unsatisfactory explanations and inaccurate definitions can be put forward, certainly not to the advantage of completeness of information and transparency, and therefore not to the advantage of market stability. This veil of secrecy is unnecessary, destabilizing and in the longer term could even bring the threat of regulation much closer.

Given the bashfulness of the Europeans in supplying regular data, markets are forced to extrapolate from the US situation. To the extent that there is any interplay between inventory levels and market prices, this interplay therefore only involves US inventories.

4.1 The USA

On 27 July, on the eve of the crisis, US crude oil stocks stood at 386 mb, the highest level recorded since 1981, some 86 mb above minimum operating requirements of 300 mb, or about 6 days of forward cover. For gasoline, the stock position was most precarious. As is shown in Table 4.2, there have been three distinct periods following this.

Table 4.2 : US Commercial Stocks 27 July 1990 to 19 October 1990 (mb)

	Crude oil	Mogas	Jet Fuel	Distillates	HFO
27 July	386.6	215.6	44.6	118.6	44.7
3 Aug	379.7	218.5	44.8	119.2	45.2
10 Aug	375.9	212.4	43.9	119.3	46.2
17 Aug	375.7	214.0	42.0	121.5	47.4
24 Aug	376.8	210.9	43.2	119.2	48.3
31 Aug	372.2	210.5	42.0	126.7	49.2
7 Sep	374.3	211.1	41.7	131.7	50.2
14 Sep	369.8	217.0	42.6	133.3	49.3
21 Sep	364.0	222.3	42.3	136.5	52.2
28 Sep	354.6	223.9	42.1	134.8	51.5
5 Oct	350.4	225.7	43.1	133.3	50.5
12 Oct	343.3	225.9	43.5	135.9	50.8
19 Oct	340.4	222.6	44.5	136.1	49.6
Minimum Operating Requirement	300.0	205.0	30.0	85.0	30.0

Sources: API and NPC

In August, the pressure was on gasoline with demand high as distributors and motorists topped up their tanks. The pressure was so severe that in spite of near maximum capacity crude runs, usable gasoline stocks for the entire USA had fallen below a day's consumption by the end of August. Indeed, at the end of August the US

EIA gave a warning that gasoline stocks needed "continued surveillance", since they had dropped by 5.6 mb in only one week and were only 6.2 mb (less than one day's consumption) above the minimum operating inventory. In the meantime, record refinery runs allowed gasoil stocks to build up and led to crude inventories falling by 14 mb over August.

In the first three weeks of September, companies were finally able to realize an increase in gasoline stocks. This was facilitated by a combination of the seasonal decline in demand and lower demand induced by higher retail prices, together with the switch from summer to winter gasoline standards allowing more gasoline to be produced per barrel of crude oil input. Gasoline inventories increased by over 11 mb, as refineries maintained near maximum capacity operation and crude oil stocks were depleted by a further 10 mb. Stocks of gasoil continued to rise, as the crisis reinforced previous fears of a rerun of the winter 1989.

Over the next four weeks up to mid-October, the fall in crude oil inventories became precipitous. A further 24 mb were depleted, whereas the rise in product stocks stalled. At this rate of crude oil stock depletion, crude oil stocks above minimum operating requirements as estimated by the NPC (300 mb) would be entirely used up by the beginning of December. As margins for simple distillation became increasingly negative, crude runs begun to fall and refiners took the opportunity to begin maintenance programmes some of which had been postponed during the previous two months.

What the US figures clearly show is that since August there has been a trend to convert crude oil stocks into product stocks. Table 4.3 presents the total changes from end-July to mid-October 1990, showing a 46 mb reduction in crude oil stocks accompanied by a 30 mb increase in the major products stocks. Contrast this with the pattern of 1989, when over the same period crude oil stocks rose by 6.5 mb, and product stocks rose by only 3 mb. Having started August 1990 with a record level of crude oil stocks (56.6 mb higher than the previous year), by mid-October the cushion had been almost completely used up, standing at only 4 mb higher than the previous year.

Gasoline stocks have recovered from their August lows to stand roughly at the same level as last year, and distillates and heavy fuel oil stocks are considerably healthier than they were last year. Some worries still remain for kerosene, as increased demand for military requirements and from the Far East may continue to stress the world kerosene markets.

The net drawdown in US commercial stocks since August has therefore been about 200,000 b/d. In the fourth quarter, to date, the net drawdown has been almost 700,000 b/d. Within this picture, as we have seen, there has been a considerable shift in the composition of stocks from crude oil to products.

Table 4.3 US Commercial Stocks in 1990 and 1989 (mb)

		1990	
	27 July	19 October	Change
Crude Oil	386.6	340.4	- 46.2
Gasoline	215.6	222.6	+ 7.0
Kerojet	44.6	44.5	- 0.1
Distillates	118.6	136.1	+ 17.5
HFO	44.4	49.6	+ 5.2
		1989	
	28 July	20 October	Change
Crude Oil	330.0	336.5	+ 6.5
Gasoline	226.0	223.2	- 2.8
Kerojet	47.6	43.7	- 3.9
Distillates	115.5	120.0	+ 4.5
HFO	42.2	47.5	+ 5.3
		1990-1989	
	end-July	October	
Crude Oil	+ 56.6	+ 3.9	
Gasoline	- 10.4	- 0.6	
Kerojet	- 3.0	+ 0.8	
Distillates	+ 3.1	+ 16.1	
HFO	+ 2.2	+ 2.1	

The desire to convert the overhang of crude oil inventories into products is perfectly understandable and constitutes the only hope to avoid a rerun of last year's disastrous US heating oil season, this time of an even greater magnitude. Indeed, there is a suspicion that the US crude oil stockdraw may have been accelerated by polite suggestions from the DOE that this would represent a helpful measure. The transparency of the US market means that in the light of such suggestions any uncooperative behaviour would soon be noticed.

A drawdown of US strategic stocks (prevented by a number of factors which will be discussed in Section 5) has therefore been substituted by a large commercial

drawdown. What is slightly worrying at this stage is that while the crude oil stocks overhang of end-July has been entirely absorbed, a significant part of the shortfall still has to work its way through the system. Simple arithmetic shows that with domestic crude oil production down by about half a million b/d from last year, to 7.182 mb/d in August and 7.004 mb/d in September, crude imports at 6.552 and 6.020 mb/d, and crude runs to refineries up to 14.228 and 14.207 mb/d respectively, the actual gap in the US supply/demand balance for crude has been 0.494 mb/d in August and 1.183 mb/d in September. The cumulative stock changes implied are 15.3 mb in August (0.494 x 31 days) and 35.5 mb (1.183 x 30 days) in September, for a total of 50.8 mb. The actual recorded fall in crude oil stocks between end-July and end-September has been around 32 mb. This suggests that even assuming no further worsening in the US supply/demand balance (which is unlikely, given that preliminary October data show US crude oil imports sharply down from September), there is still almost 20 mb of crude oil to be "found" for the figures to tally. A number of questions then come to mind: how long can the USA sustain such a rate of depletion in its crude oil inventories, and is the rise in crude oil prices in the USA still to begin?

4.2 Europe

The European situation is very different. As shown in Table 4.4, current estimates for the EC show crude oil stocks at the end of September at 402 mb, still about 24 mb higher than in September 1989. Gasoline stocks were 135 mb, 3 mb higher than 1989, and distillates were 263 mb, 1.5 mb lower than 1989.

Table 4.4 EC-12 Commercial Stock (mb)

	Crude Oil	Gasoline	Distillates	HFO
July 1990	408.5	130.3	252.0	145.9
Aug. 1990	404.6	132.3	258.9	153.4
Sept. 1990	402.1	135.5	259.7	153.0
Sept. 1989	378.3	132.6	261.2	149.9
change July/Sept. 1990	- 6.4	+ 5.2	+ 7.7	+ 7.1

Source: Euroilstock

Compared with the beginning of August, EC crude oil stocks at end-September appeared to have fallen by just over 6 mb, while gasoline stocks had risen by about 5 mb, distillates by almost 8 mb and fuel oil by 7 mb. Hence, while in the first two months of

the crisis the USA has drawn down almost 10 per cent of its commercial crude oil stocks, the EC as a whole has only drawn down 1.5 per cent over the same period. Furthermore, once products are brought into the picture the US net drawdown of crude and products combined over August and September, at around 100,000 b/d, contrasts with the net increase in European stocks of 225,000 b/d over the same period. This means that for every barrel of stock reduction in the USA, the Europeans have increased their stocks by more than two barrels. Therefore on the one hand American stock reductions, being visible on a weekly basis, have unsettled markets and contributed to the price increases. On the other hand the less visible increase in European stocks has manifested itself in the market as increased demand, and also forced the general level of prices upwards.

In September alone, while US commercial crude oil stocks fell by 20 mb, European stocks only fell by 2.5 mb. This cannot be due to the European industry hitting minimum legal or operating requirements. Neither of these have increased by 24 mb compared with last year, but the level of crude oil stocks has.

Of course, when the aggregate figure for the total EC-12 is disaggregated by country, a number of differences in individual countries' behaviour appear. For example, the crude drawdown of Greece, France and Holland contrasts with the buildup (in descending order) of Spain, the UK, Germany and Italy. However, for the EC as a whole the apparent rule of thumb based on September evidence is that for every eight barrels of crude oil the Americans depleted, the Europeans depleted one. Given that one of the worries the US DOE has about unilateral strategic stock drawdowns is that Europe may free-ride, it is slightly ironic that this appears to be precisely what Europe has done in response to US commercial stock drawdowns. US drawdowns had the effect of forcing US prices down relative to Europe, thus effecting partial satisfaction of the European thirst for stocks through a reduction in European exports to the USA (indeed, the large price differential has also attracted some cargos of products from the US to Europe, thus reversing the normal direction of the flow.) This could not be sustained for ever, and will probably be instrumental in the gradual reassertion of US prices.

4.3 Japan

To analyse the situation of Japan we consider first crude oil import patterns. In July 1990, Iraqi and Kuwaiti supplies represented about 10 per cent of total Japanese crude oil imports, compared with 15 per cent of US imports. The immediate response of Japan to the cutoff of these supplies has been to seek immediate replacement from whatever sources were possible. In particular, the loss of crude oil lifted on term contracts in Iraq and Kuwait was swiftly replaced by Iranian oil. In addition to 250,000 b/d term volumes, Japan bought 7 mb of spot Iranian crude for August, and 7 mb for September, while MITI agreed to increase the (unofficial) ceiling on Iranian oil imports from about 300,000 b/d to 550-580,000 b/d. By September, the first of these additional supplies began to arrive, while increased deliveries in the fourth quarter have been guaranteed by Saudi Arabia to term contract holders, and purchases of Iranian oil for the same period have jumped to 750,000 b/d. By comparison, the USA began to feel the effect of the cutoff of their Iraqi imports (1.1 mb/d in July) together with the diversion of other

imports caused by the differentially higher level of prices in Europe.
Table 4.5 shows the different impact of the embargo on US and Japan crude oil import figures.

Table 4.5 USA and Japan 1990 Crude Oil Import Changes (per cent)

		from July 1990	from previous year
USA	August	- 3.3	+ 1.0
	September	-11.5	- 4.0
Japan	August	+16.3	+10.9
	September	+ 7.9	+12.7

Sources : API, MITI

It is apparent that while US crude oil supplies began to feel a severe squeeze in September (and an even worst one in October), which was covered by a net rundown in stocks, Japan was able to maintain and even increase its crude oil supplies. Hence Japan's loss of crude oil has been replaced on a greater than one to one basis, and the relief of Japanese buyers manifested itself in a decline in spot crude purchases in September.

On the petroleum products front, Japan had to compensate for the loss of about 225,000 b/d of light product imports from Kuwait (70 per cent of Kuwait product exports were delivered to Japan), as well as complete its seasonal stockbuilds. Kerosene and naphtha supplies are the greatest worries, given their political sensitivity (as a shortage of kerosene in Japan would be as much a political disaster as a shortage of gasoline in the USA). Hence in Japan, as in the USA, the desire has been to convert crude oil into products as fast as possible. Crude oil runs to refineries increased by 16 per cent (to 3.45 mb/d) in August compared to July, as some of the constraints placed by MITI on Japanese refiners were lifted.

Japanese fears of product shortages in the winter were fuelled by the fact that at the start of the Gulf crisis product inventories were not high by historical standards, as detailed in Table 4.6.

Table 4.6 Japanese Commercial Product Inventories on 1 August (mb)

	Gasoline	Naphtha	Kerosene	Gasoil	Fuel Oil
1987	11.1	12.1	25.0	10.2	25.2
1988	11.1	10.6	29.1	13.0	30.1
1989	11.7	10.7	25.0	12.4	27.5
1990	9.2	10.7	25.5	9.5	25.7

Source : PAJ

When Table 4.6 is converted into days of forward fourth quarter sales (using the previous year's fourth quarter demand) a better picture of Japanese perceptions about their stock levels at the start of the crisis emerges. This is shown in Table 4.7.

Table 4.7 Japanese Product Inventories on 1 August in days of fourth quarter sales

	Gasoline	Naphtha	Kerosene	Gasoil	Fuel Oil
1987	17.2	27.9	43.8	19.9	20.5
1988	17.0	21.9	51.4	23.3	26.9
1989	17.1	20.5	38.4	20.8	22.0
1990	12.6	19.1	42.8	14.4	20.6

Hence the Japanese perception of their products inventories at the start of the crisis would have been that they were very insecure compared to 1989 for most products. In August, the situation worsened. Provisional PAJ figures show a surge in the demand for gasoline (presumably into secondary and tertiary stocks), of 13.6 per cent from July and 10.7 per cent from August 1989. This reduced gasoline stock cover to 11.5 days of fourth quarter consumption, and 9.6 days for demand at August levels. There also appears to have been a buildup in secondary and tertiary kerosene stocks, as demand increased in August by 12.2 per cent from July, and by almost 20 per cent from August 1989. However a rise in domestic production was enough to increase primary stocks of kerosene by 18.8 per cent from July, bringing forward coverage up to almost 51 days of fourth quarter demand. The normal seasonal pattern is that kerosene stocks reach a maximum in October of about 40 mb, from which point they decline to between 15 and 20 mb the following March. To maintain this pattern, a further stockbuild of 4 mb was needed in October. Naphtha stocks fell by 22.3 per cent from July, leaving only 15 days of fourth quarter coverage.

By the end of August, therefore, the primary stock coverage for a number of products would not have been considered satisfactory. Note that the embargo had not yet bitten at this point. This lies behind the headlong rush of the Japanese into the world product markets. It also constitutes the major reason why Japanese prices for all products, except heavy fuel oil, could move so far ahead of US prices and maintain such large differentials for extended periods.

5. Public Policies

The strategic importance of oil supplies and the potential economic and political damage that may be caused by disruptions have long been recognized by the governments of the consuming/importing nations. Over the last twenty-five years they have attempted to put in place some form of buffer or safety net and to devise a system of co-ordinated responses to the occurrence of such crises. The following pages briefly review the history and performance of these agreements as regards stock drawdowns, and discusses the behaviour of the major institutional players in the context of the current crisis. Finally, this Section examines the test drawdown of the US Strategic Petroleum Reserve in October and its value as a "laboratory experiment" for larger scale depletions of government stocks.

5.1 European Community Regulations

The first step towards the introduction of minimum legal inventory levels beyond those which would be commercially justified was taken by the EC in 1968. Directive 68/414 instructed Member States "to adopt such laws, regulations and administrative provisions as appropriate to maintain their stocks of products at a level corresponding, for each of the categories of petroleum products (or their crude oil equivalent), to at least 65 days' average daily internal consumption in the preceding calendar year". The three categories of products concerned are gasoline (including motor spirit and aviation gasoline); middle distillates (gas oil, diesel oil, kerosene and kerojet); and heavy distillates (fuel oils).

The 1968 directive was followed in 1972 by Directive 72/425, which in recognition of the substantial growth in the oil requirements of the Community and therefore of the increasing dependence on imported supplies, increased the EC obligation to maintain minimum stocks of crude oil and/or petroleum products to 90 days (76 1/2 for the UK in recognition of its indigenous crude oil production). Save in case of particular urgency or in order to meet minor local needs, member states should refrain, prior to consultation between member states, from drawing on their own stocks to below this compulsory minimum level.

The concept of "minimum legal stock requirements" is distinct from that of "minimum operating inventories". The former is a minimum level established for precautionary purposes, while the latter (as discussed in Section 2) is essentially of a technical nature. The EC Directives establish explicitly that the notion of "compulsory stocks" excludes, among other items, supplies held in the refining plant and in the distribution system (pipelines, road tankers and rail tank-wagons, storage tanks of distributing stations), and those held by small consumers. It includes supplies held in ports of discharge; in refinery tanks; supplies held in storage by refiners and by importing, storage or wholesale distribution firms; supplies held in storage by large-scale consumers in compliance with the provisions of national laws. In short, minimum legal requirements in Europe include part of the minimum operating requirements (namely, tank bottoms and working inventories), but they do exclude pipeline and refinery fill.

The actual implementation of the EC directive in different countries is described below:

	Obligatory Stockholding	Obligation Placement	Independent Stockholding Organization	Financial Aid from Government
Belgium	90 days	All traders	No	No *
Denmark	90 days	All traders	Yes	Yes *
France	91 1/4 days	All traders	No	Yes *
Germany	90 days	All traders	Yes	No
Italy	90 days	All traders	No	Yes *
Netherlands	90 days 70 days	Refiners Non-refin.	Yes	No *
UK	76 1/2 days 66 days	Refiners Non-refin.	No	No

* controlled prices

Source : UK House of Commons Energy Committee

To deal with their stockholding obligations, some EC governments have provided for the creation of separate stockholding bodies. In Denmark, for example, an independent body (FDO) managed by oil companies but with a government representative on its board, holds 50 per cent of petrol stocks and 60 per cent of other main products. The stocks held by this body may be drawn down only with government approval. Similarly, in the Netherlands the stocks-owning independent body ICOVA holds 65 days' stocks, which are not available to individual companies without government approval. In West Germany, all refiners and traders are obliged by law to be members of the public co-operative EBV.

In 1973 the EC adopted Directive 73/238, which defined (in very general terms) the possible areas of response of its Member States "in the event of difficulties arising in the supply of crude oil and petroleum products which might appreciably reduce the supply of these products and cause severe disruption". These were:

- to draw on emergency stocks and distribute these stocks to users;
- to impose specific or broad restrictions on consumption, depending on the estimated shortages, and to give priority of supplies to certain groups of users;
- to regulate prices in order to prevent abnormal price rises.

The latter is an important factor in explaining the very understated and cautious attitude of the European oil industry since the start of the Gulf crisis. The mere prospect of any government ever trespassing into the area of oil price formation is enough to give European oil companies a very real incentive to apply all their talents to projecting a soothing view of the future. Indeed, it is believed that the European Commission itself is actually *in favour* of some release of mandatory stocks in order to reduce pressure on prices. At the time of writing, it is understood that the Commission

would be about to submit to member states a new directive aimed at allowing stock releases not only in the occurrence of physical shortages, but also to dampen excessive price rises.

Of course, the oil industry knows that the EC Commission and its member states are very different entities, and that this directive stands only a very slim chance of being approved by governments. Indeed, some even argue that they have perhaps been put forward by the EC Commission because energy is one of the few key areas where it has little power, but is very unlikely that EC governments will give their approval to a directive empowering the Commission to call for a unilateral European drawdown. No European government will agree to a stock release unless there are specific guarantees that Japan and the USA will do the same. However, this comforting assessment of the situation is not enough to reassure the oil industry. Although some companies might agree privately that a 5-10 days' reduction in compulsory minimum inventory levels might be of some help in the current situation, fears exist that this might open the door to an active role being taken by the EC bureaucracy in the process of price formation. These fears would in themselves be enough to provide the rationale for companies to state the view that all upward price movements are mere speculation, and all downward movements are the reassertion of supply and demand fundamentals. If this view were not maintained the chances of a hydra being released from Brussels increases, and it could be very difficult to extirpate once unleashed.

5.2 The IEA

The International Energy Agency (IEA) was created in November 1974 by the governments of sixteen OECD countries (today twenty-one) as the designated body for the implementation of the International Energy Programme. The initial motivation for its formation was to a degree political: the creation of a juxtaposed body to OPEC, the neutralization of the producers' cartel by a consumers' cartel. Indeed France saw the creation of the IEA as being an essentially political (and anti-Arab) action, and refused to join. It did not begin to seriously reconsider this decision until 1990.

The IEA programme requested that all the participating countries should establish a buffer of oil supplies, by maintaining emergency reserves sufficient to sustain consumption for at least 60 days (raised to 90 days in 1980) with no net oil imports (at the average daily level of the preceding calendar year). It also required all participating countries to devise a programme of contingent oil demand restraint measures, enabling it to reduce its rate of final consumption in the event of a crisis. Longer-term tasks included the development of an information system on the international oil market, providing a framework for consultation with oil companies, for long-term co-operation on energy, and for improving the relations with producer countries.

During the Gulf crisis, the role of the IEA has several times come under fire. In the face of rapidly rising prices on world oil markets, the persistent refusal of the IEA to draw down government-held or government-controlled stocks has appeared incomprehensible to many.

Since the start of August, IEA press releases have reiterated that:

- there has been no physical shortfall of crude oil or refined products in the marketplace, and the oil market remains well (or adequately) supplied;

- the shortfall of Iraqi and Kuwaiti oil can be largely covered by increased production by OPEC and other producing countries, company stocks and demand restraint;

- recent oil price fluctuations are in large measure driven by the extreme political uncertainty and war fears, exacerbated by each new development in the region and imperfect information flows. "So long as the Gulf crisis remains unresolved, uncertainty will continue to play a significant role in price determination".

Recognition has been given by the IEA to the likelihood that the European and North American winter could bring tighter markets, because of increased demand, reduced surplus production capacity among OPEC and other oil producers, and the full capacity demands on world refining facilities. However, while recommending a continued commercial drawdown to "reduce uncertainty and volatility in the world oil market", the IEA has made no commitment on the use of government-owned and controlled stocks for the same purposes. In its 28 September press release, the IEA Governing Board *recommended* (but IEA recommendations are not binding) that each member country "complete preparation and take all decisions necessary, on a standby basis, to implement stockdraws and/or demand restraint or surge capacity measure at the outset of any further significant oil supply shortfall"; but no indications were given as to the actual ordering of preferences and on the actual events which would trigger IEA action. Certainly the loss of over 7 per cent of world consumption would formally activate IEA mechanisms, but the position is still unclear for smaller losses and for the timing of action.

Here lies the major bone of contention. Since the outset of the Gulf crisis, the IEA has been keen to blame "market psychology" and "market sentiments" for the oil price rises. The official IEA line has been that as the physical market is well supplied, any price increase is entirely due to uncertainty and speculative behaviour. And the IEA role is not to dampen "speculation", but rather to deal with *actual oil supply shortfalls*.

This has attracted much criticism because it appeared to set back by a whole decade the debate on the role of the IEA in a crisis, wiping out the lesson learned in 1979 and the considerable evolution of the IEA's emergency response programmes in the 1980s. Indeed, in 1984 a sea change in IEA thinking appeared to have taken place. The Governing Board decided that during a disruption, *whether or not* the 7 per cent of world consumption shortfall barrier had been breached, governments should meet quickly to consider a co-ordinated stock drawdown. For the first time, stocks were being seen as a pre-emptive mechanism, not just as the last resort. The trigger was still there, but the tacit admission was that it could be pulled before anyone else fired a gun. Yet there are very few signs today that the July 1984 decision has had any practical implication. The IEA appears still totally averse to the idea of using government-owned or controlled

stocks unless an actual shortfall sets in the oil market.

There is an echo in this of the 1978-80 crisis. The major contribution of the IEA over the period was after all a decision to increase the emergency requirement stock levels by 30 days. Requests by countries suffering severe shortfalls went unheeded. When Turkey asked for assistance it was offered inappropriate grades of crude oil at ludicrous prices. Turkey turned to the spot market in pure exasperation. Yet other factors are very different from the second oil shock. Open markets have greater power, new markets have emerged, and oil markets in general move far faster than in the past. The economic dislocations caused by market reactions to uncertainty are greater than ever before. Waiting for a physical shortage to arrive is fine in a world of controlled prices when you only need to fill in quantity shortfalls at the point when they arise. Such a policy would have worked much better in 1973 and even 1979. The oil markets of 1990 are however very different and more ethereal creatures.

In addition, there is another significant difference between the structure of oil stockholdings today and that of the 1970s. The amount of oil now in government-mandated and government-held stockpiles is much larger in both absolute and relative terms, and could be used effectively to mitigate the sudden price increases. The idea that this might panic the market is rather peculiar, it seems to imply that those trading oil do not read newspapers. What is far more likely to panic markets is the perception that co-ordinated and swift action is not credible. Total government-mandated and government-held stocks in OECD countries amount today to about 1500 mb of oil, making the potential value of co-ordinated stockpile releases considerable. As oil consumption in these countries is approximately 38 mb/d, a 10 per cent interruption in supply could be completely replaced by stocks releases for over 400 days. If governments are really holding back reserves because they are thinking of circumstances in which 1500 mb could be used up, then we should all first panic, panic again, and then ask governments why they have not stockpiled enough oil.

Over the years many have argued that, if handled correctly, the use of strategic reserves could reduce the direct economic effects of a crisis by deflating not only prices but also price expectations. As expectations of future price increases tend to inhibit private stock drawdowns, some of the economic literature has actually advocated the need to change such expectations by using changes in the spot price of oil rather than changes in oil availability as a trigger mechanism for the release of strategic stocks. The spot price is easy to measure, monitor, and agree upon; and because sudden price increases are really the major problem caused by reduced oil supplies, focusing on them attacks that problem more directly. The simplest method would be to trigger the co-operative drawdown plan any time the spot price of oil rises more than a given percentage above its average value in the most recently completed quarter. Prices may still rise, but in a less dramatic fashion, and thus the stock releases could actually achieve the goal of buying time for consumers to adjust to higher prices - while demand will fall in the medium term in response to higher prices. An alternative method - and in economic terms also far more elegant - could be to link stock drawdowns to the degree of backwardation in forward (but not futures) crude oil markets. This would encapsulate the degree of the desire to hold immediate supplies, generated either by a direct supply shortfall, or more importantly in current circumstances, due to an increase in the

perceived value of stocks in anticipation of a supply shortfall.

But whatever the actual mechanism, there can be little doubt that during a disruption releases from stockpiles are an alternative source of supply, which could limit both the increase in petroleum prices and the economic losses and transfers of wealth suffered by oil-importing countries. We should not overlook also the fact that those who draw down would actually realize pure capital gains, since all money already invested in strategic stockpiling programmes constitutes an economic bygone, and hence a fixed cost. The only real cost of a drawdown is the increase in the chances of developments leading to a total depletion of stocks. As noted above it would be distressing if that were a factor.

Let us now turn to examining the rationale behind the IEA's reluctancy to take any concrete action in the course of the current crisis.

One possible explanation is that unlike the more formal sharing agreement, there is no pre-established formula for determining the size of a stockdraw or its allocation among countries when the actual supply shortfall is smaller than the 7 per cent threshold. Whereas very detailed rules have been laid down for such an occurrence, for sub-trigger situations like the current one there is actually no agreement on how much should be used and who should do the drawdown. Indeed, the lack of any common pricing policy for the sale of this oil has also raised some fears that this vacuum could worsen the chaotic situation of prices. The USA has an outright auction. In Germany, it is established that in an emergency, participants to the EBV scheme would get supplies on the basis of an unpublished formula based on import volumes and retail sales. There is however no formula for pricing crude or products in case of a drawdown. An EBV supervisory board to be established in a crisis has only general guidelines to sell stocks at "medium prices, which do not encourage price increases in the market". Likewise in Japan: in case of crisis, refiners and distributors would receive supplies up to an estimated drawdown capacity of 1 mb/d. Pricing is to take account of the "current market situation", but no set procedure is known.

Another factor is of course related to the traditional differences in the preferred course of action of different IEA members. Some have indeed suggested that while all the IEA countries appear to agree on the importance of co-operation, they do not agree on how this aim is to be achieved other than by continuing participation in the existing IEA programme. While the USA has insisted on expanded and co-ordinated stockpiling and has opposed the use of demand restraints, other IEA members clearly prefer demand restraints and tend to regard public stockpiling as either a last resort or not worthwhile. Germany and Japan, the other two countries with significant strategic stocks, are particularly inclined to save their reserves as a last line of defence. The official IEA position is that stock drawdowns and demand restraint are substitutes for each other, and this decision provides the most concrete evidence of the preference of other IEA members for demand restraint, in contrast to the US position.

There is no doubt that many European governments do not share the US ideological objections to the introduction of non-market demand restraint measures, and in a system governed by a majority rule it is rather easy to stall any US pressures in the

opposite direction. When the actual voting weights of the IEA countries are considered (see Table 5.1), it is obvious that the opposition of Germany and Japan is enough represent a formidable basis for the forging of a blocking vote.

Table 5.1 IEA Member Countries' Voting Weights

	General	Oil consumption	Combined
Australia	3	1	4
Austria	3	1	4
Belgium	3	2	5
Canada	3	5	8
Denmark	3	1	4
Germany	3	8	11
Greece	3	1	4
Ireland	3	0	3
Italy	3	5	8
Japan	3	15	18
Luxembourg	3	0	3
Netherlands	3	2	5
N. Zealand	3	0	3
Portugal	3	0	3
Spain	3	2	5
Sweden	3	2	5
Switzerland	3	1	4
Turkey	3	1	4
UK	3	6	9
USA	3	47	50
Total	60	100	160

The stern opposition of Germany and Japan to any release of strategic stocks appears rather difficult to justify when considering the scale of these stocks. As shown in Table 5.2, the coverage provided by purely strategic stocks in Germany and Japan in terms of inland demand is actually higher than that of the US Strategic Petroleum Reserve. Measured against fourth-quarter 1989 demand, strategic stocks of crude and products in West Germany amount to around 99 days' consumption, while Japan's crude stocks would cover 59 days of refinery input, and the US SPR 44 days. The picture is obviously different when the days' coverage is measured in terms of import, given the substantial domestic crude oil production of the USA. In the event of a total cutoff in imports, the US SPR would be enough to make up for the loss to US refineries for 98 days. (Note that figures for Japan also exclude mandatory company inventories which are controlled by refiners but not differentiated from normal commercial inventories and therefore not technically counted as strategic stocks).

Table 5.2 Strategic Stocks in the USA, Germany and Japan

	Volume and composition (mb)		in days' inland consumption (1)		in days' of net crude imports (2)
USA (SPR)	crude	590		44	98
Germany (EBV)	crude	75	crude	48	52
	prod.	115	prod.	51	51
	total	190	total	99	103
Japan (JNOC)	crude	205		59	52

(1) assuming inland consumption as in fourth quarter 1989
(2) assuming a total block on crude imports

A realistic appraisal of the IEA attitude would also have to mention the fact that the majority of IEA members (including the USA) believe that oil prices never really reached a pain level. Prices are not yet hurting enough, and no vocal lobbying is known to have taken place in Washington in favour of concrete action. Undoubtedly the IEA includes among its members some of the richest countries in the world. These can well afford to pay current prices and are willing to do so instead of depleting their strategic stocks, because of fears that the situation might worsen. Some are aware of the very heavy burden today's prices are placing on many developing countries, whose share of oil in total energy demand has *risen* since the second oil shock. But they also believe that it is not for the IEA to concern itself with these types of dislocations, which are better dealt with by financial institutions like the IMF and the World Bank.

To conclude, the IEA is unlikely to take any action unless very dramatic events develop in the Gulf. So far, the situation has been helped by a muddled substitution of commercial stock drawdowns for public stock drawdowns, and a substitution that to date has been almost totally confined to US crude oil stocks. If now the choice has become one of running down the remaining cushion of private stocks, or topping them up with strategic stocks, it seems less than obvious that the correct choice has been made.

5.3 The SPR Test Drawdown: A Rehearsal?

The US Strategic Petroleum Reserve (SPR), consists of six sites in Louisiana and Texas divided into three groups. These are named after the crude oil pipelines they originally had access to, namely Seaway, Texoma and Capline, although Seaway and Texoma were converted to natural gas use in 1987.

The SPR has been built at a considerable cost. The average price paid for crude oil has been $27.26 per barrel. Once capital, maintenance and forgone interest returns on outlays are included the cost rises to over $70 per barrel. It can currently be drawn

down at the rate of 3.5 mb/d, and distributed at the lower rate of 3 mb/d due to pipeline limitations. While below the planned 1992 level of 4.5 mb/d, the logistics of the SPR are at least a little less problematic than they were. In 1983 the maximum drawdown rate was 1.7 mb/d and in 1986 it was still only 2.3 mb/d. The mechanics of the drawdown are essentially very simple. Water is pumped into the bottom of a cavern, forcing the oil up to the extraction pumps.

In the context of the current crisis there are four sites of any real importance as detailed below, for a combined actual usable capacity of 562 mb.

	Caverns	Storage (mb)
Seaway Group		
Bryan Mound	20	223
Texoma Group		
West Hackberry	22	212
Capline Group		
Bayou Choctaw	6	54
Weeks Island	salt mine	73

The first intimation that a SPR drawdown was likely came on 15 September 1990, with the enaction of a law permitting the president to order a test drawdown of 5 million barrels without a declaration of an energy emergency. This neatly sidestepped the provisions of the Energy Policy and Conservation Act which allows the use of the SPR if the president rules that it is necessary to counteract a "severe energy supply interruption". The provisions for the use of the SPR then proved so vague that it was thought better not to attempt a definition of what the Energy Policy and Conservation Act provisions actually mean. In reality the wording was vague enough to give the president absolute carte blanche. The order for a 5 mb drawdown came on 26 September, and the formal notice of sale was issued two days later.

The sale received strong support from the oil industry and from the House of Representatives. There was less dissent than scepticism about the working of the system, but given the history and delays in the programme a knee-jerk scepticism about its efficiency seemed rather understandable. Indeed this also was one of the major reasons for the drawdown: without a successful operation the credibility of the SPR may have become suspect.

The 28 September notice announced the sale of 2.2 million barrels of sweet crude oil, and 2.8 mb of sour crude oil. The minimum bids for SPR oil were set at 40,000 barrels for delivery to a barge, 75,000 barrels for pipeline transmission and 200,000 barrels for delivery to a tanker. Pricing proved to be a problem. The DOE had originally intended a fixed price bidding system, but refiners were obviously unhappy about fixed prices during a time of price instability when the lag from bidding to delivery was to be well over a month. Hence an indexing system was adopted as follows. For

both sweet and sour crude oil a reference price was to be set reflecting a five-day index of the price of a composite basket of US domestic crudes, the bid deadline (i.e. 2 October), being the middle day of the five. For both sweet and sour this consisted of Alaskan North Slope and Light Louisiana Sweet, with the addition of West Texas Sour for the sour reference price and West Texas Intermediate for the sweet. The final price paid by successful bidders is the index recalculated for a five-day period, with the delivery date being the third day, plus the differential of the original bid from the bid deadline reference price.

The bids received for the six grades offered, together with assays of these grades, are detailed in the Appendix. While SPR crude is delimited by sulphur content, it is not delimited by the individual original crude oils. There is then "layering" in each cavern, such that the published proportions of each crude oil in each SPR blend need not bear too close a resemblance to that in any quantity an individual refiner receives, hence adding an extra element of uncertainty for potential bidders.

The most immediately striking feature of the bids, as detailed in the Appendix, is that only 3.95 mb were actually sold. The 800,000 barrels of Weeks Island Sour received no offers at all, and 300,000 barrels of West Hackberry Sour received offers that were adjudged too low to be acceptable. The failure of the Weeks Island offer is due to both crude quality and location. Weeks Island sour is considerably heavier than the other two sours offered (by 4.5 and 5.1 API), and hence considerably less attractive. Also, unlike Bryan Mound Sour and West Hackberry Sour, it is most easily accessible by refiners who are in the largest part refiners of sweet crude oil. It has been suggested that the lack of bids for Weeks Island Sour reflects perceptions of sour crude oil availability in November when deliveries of the SPR offer are likely to be made. However this would only be an explanation of a lack of acceptable offers, not a lack of any offers at all, and does not explain why the Bryan Mound Sour offer was sold out.

The auction was dominated by the larger refiners, indeed most of the large refiners who did not bid have no refineries either on the Gulf Coast or easily accessible via the Capline pipeline. However, judging from the quantities and prices involved, for one of the big six refiners the auction was a rather half-hearted flag waving exercise. The lion's share went to Amoco (1.12 mb), and Phibro Energy (0.6 mb) who own four US Gulf Coast refineries. The smaller refiners were largely absent from the bidding. The uncertainties over quality and delivery, combined with a residual amount of price risk and the apparent widespread lack of understanding of the procedures, was enough to scare the smaller refiners well away. If larger drawdowns are attempted, entry to the bidding procedure will clearly need to be made easier for smaller refiners.

The question is then whether the drawdown has been a success. The answer really depends on one's view of its motivations. If the motivation was to show that the fears about its operation were unfounded, it will be considered a success if all the 3.95 mb awarded arrive on time without any problems with pipeline schedules, tanker and barge availability or the physical mechanics of the drawdown, and then prove acceptable to refiners.

However, the real question remains in our view that of the purpose of strategic stocks. The most widely held view is that the SPR was designed to lessen the economic effects of oil crises, and that strategic reserves should not be used to affect prices in the market. We believe that to define a crisis rigidly in terms of physical shortfalls is to miss the point. Prices provide the first clue that there are physical imbalances, as graphically proved by the fact that the drawdown in US commercial crude oil stocks has in just eleven weeks halved the buffer remaining above the minimum operating requirements. In addition, it should be remembered that the most vulnerable point of the oil supply system (also in terms of political sensitivity) is still products. The best place to hold crude oil inventories during a crisis is with oil companies, not in salt domes. If a spell of cold weather boosts gasoil demand, holding crude oil stocks in the ground is useless. It would take two months to complete the process that leads from bayou to refinery stocks of finished products.

As noted above, the drawdown in commercial crude oil stocks in the USA has been used as a substitute for an SPR drawdown. It is inconceivable that if US crude oil stocks in August had been the same as they were in 1989 there would not have been a large transfer from the SPR into oil company stocks. However the cushion has now gone, crude oil stocks have fallen to last year's level. It is hard to see the logic of those who believe that a 50 mb rundown of the SPR would have been undesirable, when in its absence commercial stocks have fallen by the same amount. US product stocks still need to be increased. This process has begun to stall as a combination of poor margins for simple distillation capacity and refineries' turnarounds has led to refinery runs beginning to tail off. This is not a hopeful sign. The major difference between this crisis and previous crises has been the presence of a refining constraint, i.e. holding crude oil is no longer tantamount to holding oil products. This time all the bottlenecks and constraints on the oil supply system could be tested, and in such circumstances it is desirable for refineries to keep working.

To place the blame for price rises solely on speculation is wrong. President Bush has a fixation about futures markets. In announcing the drawdown on 26 September he said, "There is no justification for the intensive, unwarranted speculation in oil futures." If markets were not calmed by the drawdown order he was "prepared to take additional steps, if necessary, to ensure that America remains strong". He was not alone in this attitude. As it was put most succinctly by Representative Billy Tauzin, "Nobody in the oil business believes these phoney prices being paid by oil traders in New York City."

However, as shown in the previous paper in this series (*Oil Price Differentials: Markets in Disarray*, by P. Horsnell), the price behaviour of futures markets has been unremarkable compared to the physical markets. Brent futures have lagged behind Brent physicals, and NYMEX has remained close to WTI which in proportionate terms rose less than any other major crude oil. Speculation may have caused upwards movements but it has also caused sharp downward movements. The underlying trend in prices was not the result of speculation but the presence of imbalances in the oil market. A further angle to the role of futures markets is added by the stock situation. It is no accident that US crude oil stocks began the crisis 46 mb higher than in 1989. A switch in early 1990 in oil futures from backwardation to contango (i.e. a position where more distant months trade at a premium to more immediate months), made

stockholding economic. The first quarter of 1990 saw an increase in OECD stocks which was entirely due to the USA. The major reason behind the increase was NYMEX. Hence the USA was able to delay any meaningful use of the SPR because of the originally high level of commercial stocks, and for this it should be grateful to the futures markets. The result of NYMEX's period of contango was to allow the US government to substitute a private stock drawdown for a public stock drawdown.

To conclude: given the scale of the rundown in commercial crude oil stocks (both those manifested in API figures and those implied by US crude oil balances as detailed in Section 4) the SPR drawdown order was too late and involved one-tenth of the oil it should have. In a situation where Germany and Japan have shown little inclination to use their strategic reserves, it does fall on the USA to take a lead and lobby the other parties involved, while making a note that when the crisis is over, and preferably before, two major issues need to be addressed as a matter of extreme urgency.

First, the current state of international public stockpiling policy really does need to be sorted out. Secondly, it is time to reopen the debate of the 1970s and question whether the holding of strategic reserves purely in crude oil rather than in oil products is wise. Oil products, not only crude oil, are in the final analysis the crux of the issue.

APPENDIX

The SPR Bidding Round

(bid volumes in thousand barrels, bid prices in $/b)

Bayou Choctaw Sweet

35.6 API, 0.41% Sulphur
39% Ninian, 27% Es Sider, 15% Forties, 8% Brent, 11% Zarzaitine, Kole, Sirtica

600,000 barrels offered, 625,000 awarded.

Successful Bids

BP	150	38.8951
Amoco	200	38.6796
Amoco	200	38.5106
Marathon	75	38.4950

Unsuccessful Bids

BP	150	38.4651
Amoco	200	38.2606
Ashland	150	36.1250
Clarendon Ltd.	250	36.0300
Clarendon Ltd.	250	36.0300
Clark Oil	200	35.3290
Mapco Petroleum	100	34.9200
Indiana Farm Bureau	100	32.1300
PRI International	75	32.0390
US Oil and Refining Co.	360	27.8500

Bryan Mound Sweet

35.8 API, 0.34% Sulphur
47% Forties, 21% Ninian, 17% Es Sider, 15% Bonny Light, Sirtica, Forcados

600,000 barrels offered, all awarded.

Successful Bids

Amoco	200	39.0606
Amoco	200	38.8106
Amoco	200	38.4106

Unsuccessful Bids

Phillips 66 Co.	320	37.1290
Nat. Coop. Refinery Ass.	150	36.4790
Crown Central Petroleum	200	36.4290
Phibro Energy Inc.	600	35.7890
Diamond Shamrock	400	35.5000
Diamond Shamrock	400	35.5000
Farmland Industries	200	34.2820

West Hackberry Sweet

37.1 API, 0.3% Sulphur
32% Forties,21% Brent,20% Ninian, 27% Ekofisk,Bonny Light,Es Sider,Escravos

1 million barrels offered, all awarded.

Successful Bids

Amoco	40	38.3996
Amoco	40	38.3996
Amoco	40	38.3996
Marathon	40	38.3300
BP	100	38.1451
BP	100	37.9451
BP	100	37.7451
Sun Refining (received 540000)	600	37.2590

Unsuccessful Bids

Marathon	40	38.3300
Marathon	40	38.3300
Union Oil of Ca.	100	37.1700
Chevron	100	37.0790
Exxon	50	36.7890
Exxon	50	36.7890
Exxon	50	36.7890
Koch Refining	40	36.6000
Koch Refining	40	36.6000
Koch Refining	40	36.6000
Chevron	200	36.5790
Kerr McGee Refining	80	36.2500
Conoco	40	36.2211
Chevron	300	36.0790
Phibro Energy Inc	100	35.7890
Murphy Oil	40	35.5005
Texaco	40	34.5300
Texaco	40	34.2800

West Hackberry Sour

34.0 API, 1.43% Sulphur
72% Isthmus, 11% Arab Light, 17% Iran Light, Dubai, Oman

1 million barrels offered, 700,000 awarded.

Successful Bids

Phibro Energy Inc.	250	34.5107
Mobil	300	34.4907
Citgo Petroleum	75	32.9700
Fina	75	32.6407

Unsuccessful Bids

Texaco	75	32.0000
Hunt Refining	40	30.2905

Bryan Mound Sour

33.4 API, 1.46% Sulphur
80% Isthmus, 20% Arab Light, Dubai, Oman

1 million barrels offered, all awarded.

Successful Bids

Ultramar	75	35.8409
Phibro Energy Inc.	350	34.5107
Transworld Oil	480	34.5007
Shell (received 95000)	500	34.1107

Unsuccessful Bids

Shell	500	33.6607
Coastal States Trading	400	33.1407
Coastal States Trading	400	33.1407
Transworld Oil	360	32.4607

Weeks Island Sour

28.9 API, 1.41% Sulphur
43% ANS, 21% Isthmus, 5% Suez Blend, 5% Maya, 5% Dubai, 5% Arab Light, 5% Oman, Iran Light

800,000 barrels offered, none awarded.

No bids were offered.

Source: Compiled by OIES on data published in *Platt's Oilgram News* and *Platt's Oilgram Price Report*

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