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Emergency Oil Stocks in the European Union

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Introduction

Note on the content and background

In November 2008, the European Commission introduced a proposal for a Council Directive imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products (COM(2008) 775 final). The proposal aims to improve the existing regime of emergency oil stocks management in the EU. Against this background, this present compilation of three briefing papers evaluates the emergency oil stock regime of the European Union from different perspectives. The briefings analyze the situation on oil markets from various perspectives, and look at the working of the present emergency oil stocks regime in the EU in general, as well as give an assessment of the proposal, and/or on how it should be changed.

The first paper is written by **Lutz Kilian**, Professor of Economics at University of Michigan. The questions tackled in this paper include whether emergency oil stocks can function as stabilizers of prices in case of market disruptions of a more general nature, or whether they are only suitable for unexpected shortages in oil supply. In this empirical contribution, Kilian analyses a great deal of data series on oil prices to support his arguments.

In the second paper, Professor **Paul Stevens**, Senior Fellow at Chatham House and Professor Emeritus of Petroleum Policy, Dundee University, discusses the role of oil stocks in the general picture of the 'oil challenge'. The briefing discusses the role of emergency oil stocks in safeguarding the security of supply as well as the pros and cons diverse stockholding systems (govt. owned, commercial). Other questions include: what are the pros and cons of holding emergency oil stocks in physical form vs. in tickets? Is there a need to refine the rules and harmonize these areas? How can the effectiveness and clarity of rules be enhanced in a real case in the EU? How to best mainstream/clarify the role of EU-EOS rules vis-à-vis the IEA and its own regime?

In the third and final paper, **William Ramsay**, Senior Fellow and Director of European Governance and Geopolitics of Energy at Institut Français des Relations Internationales gives his assessment on the latest Commission proposal, followed by his insights on 35 years of international collaboration of oil crisis management. In discussing this, William Ramsay also addresses many of the questions and issues raised above in the second paper.

All three papers include a 1-page executive summary which answers the above questions and findings in a nutshell.

The Potential Role of Oil Stocks in Countering Oil Price Volatility

Lutz Kilian

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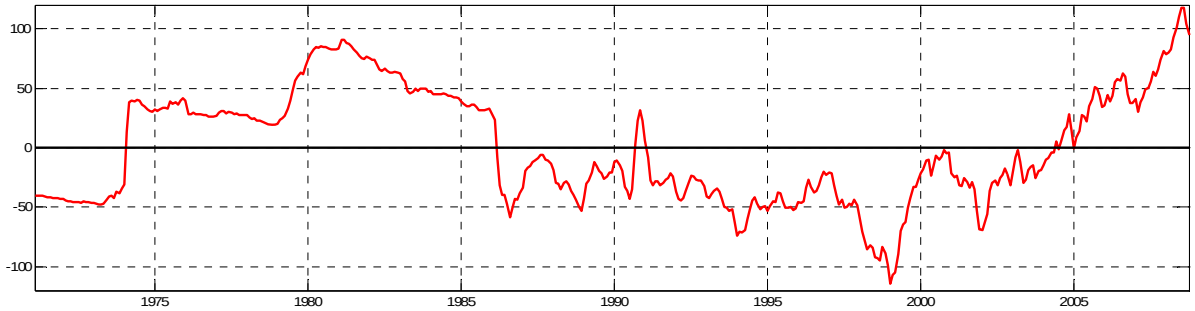
EXECUTIVE SUMMARY

The proposal of using the EU's reserves of crude oil in combating swings in the price of oil relies on governments selling off their oil stocks when the price of oil is high (and replenishing these stocks when the price is low). Estimates of economic models of the global crude oil market suggest that releasing these stocks would lower the price of oil only temporarily and only by a small percentage, if at all. Intuitively, this result makes sense. The recent surge in the price of oil was caused by rising demand for industrial commodities such as crude oil from emerging Asia, combined with strong, but stable demand from OECD economies, resulting in a persistent increase in the global demand for crude oil; thus a one-time release of crude oil will do little to quench the world's thirst for crude oil, beyond the very short run. It would be possible, of course, to spread out the release of oil stocks over several years, but in that case the amount of oil available for release in any given month would be negligible. Either way, the effect on the real price of oil would be small. Moreover, the use of government oil stocks in a futile effort to lower the price of oil would leave the EU unprotected against the real danger of temporary oil supply disruptions in the Middle East. Similar comments apply to the use of emergency stocks of refined products. Finally, there are a number of potential pitfalls in implementing this proposal in practice. It is recommended instead that these reserves be used to deal with unexpected oil supply disruptions only, as originally intended.

A REVIEW OF THE DATA

Headline reports of the price of oil tend to focus on the spot price of crude oil. Since all prices tend to trend upward over time, a more informative measure of the price of oil is the real (or inflation-adjusted) price of crude oil, which captures how much oil-importers have to give up in terms of consumer goods when purchasing a barrel of crude oil. This real price of oil is plotted in Figure 1 and expressed in percent deviations relative to its long-run average. Figure 1 shows that the latest surge in the real price of crude oil started in 1999, following a brief period of unusually low oil prices. While the initial increase of 1999-2001 simply restored the level of the real price prevailing throughout most of the 1990s, the surge resumed in mid-2003 and accelerated in 2007. By 2005, the real price of oil imported by the United States had reached levels comparable to 1974 or 1985. As of March of 2008, it reached a new all-time high, exceeding the previous all-time high in 1981. The real price of oil peaked in July of 2008, followed by a sharp decline.

Figure 1: The Inflation-Adjusted Dollar Price of Imported Crude Oil Relative to its Average for 1971.1-2008.9



Source: Computations by the author based on data from the Monthly Energy Review, EIA, November 2008. The oil price is the refiners' acquisition cost of imported crude oil and has been extended backwards in time as in Barsky and Kilian (2002). The inflation-adjustment is based on the seasonally adjusted U.S. consumer price index for all urban consumers. See: http://research.stlouisfed.org/fred2/.

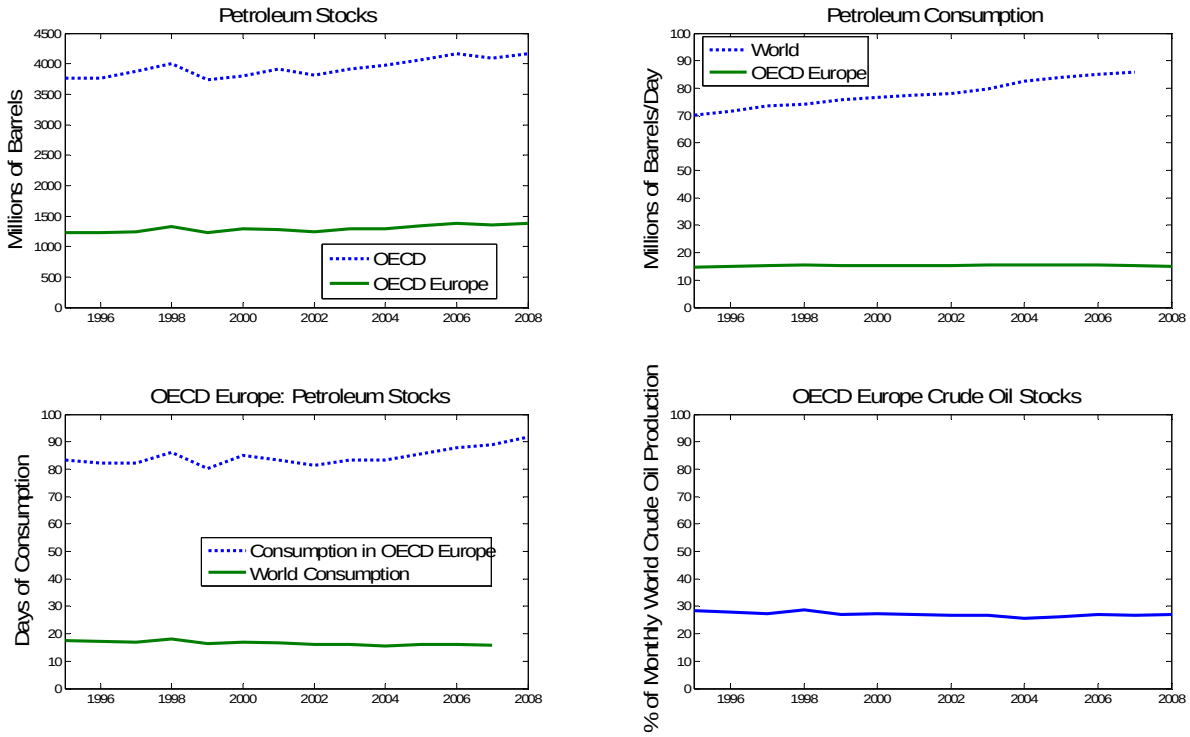
While it makes sense to focus on dollar prices since crude oil is traded in dollars, qualitatively similar, if less pronounced, fluctuations would be observed if we expressed the inflation-adjusted price of crude oil in Euros. Large fluctuations in the price of oil are associated with microeconomic and macroeconomic adjustments in oil importing economies. The question posed in this report is whether EU oil stocks should be used in countering the apparent price volatility in global crude oil markets.

A useful starting point is a review of the data on petroleum stocks in Europe and more generally in the OECD. There are no publicly available data for the EU, but the Energy Information Administration (EIA) provides detailed data for European members of the OECD. *OECD Europe* in EIA publications refers to Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. While this list does not match the list of EU countries exactly, it comes close enough for our purposes.

Petroleum stocks are measured at the end of each period. Ideally, we would like a measure of crude oil stocks. Petroleum stocks as defined by the EIA include stocks of crude oil (including strategic reserves) as well as unfinished oils, natural gas plant liquids, and refined products.

Hence, these stocks overstate available reserves of crude oil. Especially, the inclusion of refined products is troublesome, since refined products play a very different role from crude oil in the production chain, as discussed further below. Nevertheless, the EIA figures provide some indication of the level of reserves.

Figure 2: Petroleum Stocks in Perspective



Source: Computations by the author based on data from the Monthly Energy Review, EIA, November 2008.

The upper left panel of Figure 2 shows that OECD petroleum inventories in general and petroleum inventories in *OECD Europe* in particular have grown somewhat since 1995, by 11 percent and by 13 percent respectively. The data for 2008 are preliminary estimates as of November 2008 based on data up to July of 2008. These petroleum stocks include inventories owned by market participants as well as governments. Thus, not all of these stocks would be available for government intervention. Nevertheless, it is instructive to evaluate the magnitude of these inventories relative to measures of oil consumption and oil production.

The upper right panel of Figure 2 shows that petroleum consumption in *OECD Europe* has remained virtually flat since 1995, whereas world petroleum consumption has grown by 22 percent. No global oil consumption data are available for 2008 at this point. The lower left panel shows that petroleum stocks in *OECD Europe* on average have amounted to less than 90 days worth of *OECD Europe* petroleum consumption and less than 20 days worth of world consumption. Whereas the former indicator has been increasing in recent years, the latter has been declining, reflecting the growth in world oil consumption. Of course, the focus on petroleum stocks is misleading in that these stocks contain refined products as well as crude oil. For example, 56 percent of European emergency stocks are held in the form of finished products (see European Commission 2008). The lower right panel suggests that European crude oil stocks, on the basis of these data, amount to perhaps 10 days of global crude oil production. This is, of course, only an educated guess, and the actual share may very well be lower.

The proposal of using crude oil stocks in combating swings in the price of oil relies on governments selling off their oil stocks when the price of oil is high (and replenishing these stocks when the price is low). In the absence of detailed data about the composition of European oil stocks, it is difficult to say what fraction of the OECD Europe oil stocks may be available for such a policy intervention and what fraction is owned by market participants.

More detailed data for the United States from the EIA suggests that in the U.S. about two thirds of all petroleum stocks in October of 2008 were held in the Strategic Petroleum Reserve (SPR), with the remainder accounted for by oil market participants. Hence, the working assumption in this report will be that a similar breakdown applies in the EU. Leaving aside the problem of coordinating the use of oil reserves, this suggests that policymakers have at their disposal crude oil reserves amounting to perhaps 20 percent of monthly world crude oil production.

AN ECONOMIC PERSPECTIVE ON THE RECENT SURGE IN THE PRICE OF CRUDE OIL

Before we can assess the prospects of a policy intervention involving the sale of petroleum stocks, we must analyze the determinants underlying the recent surge in the price of crude oil.

1. The Role of Global Demand Shocks

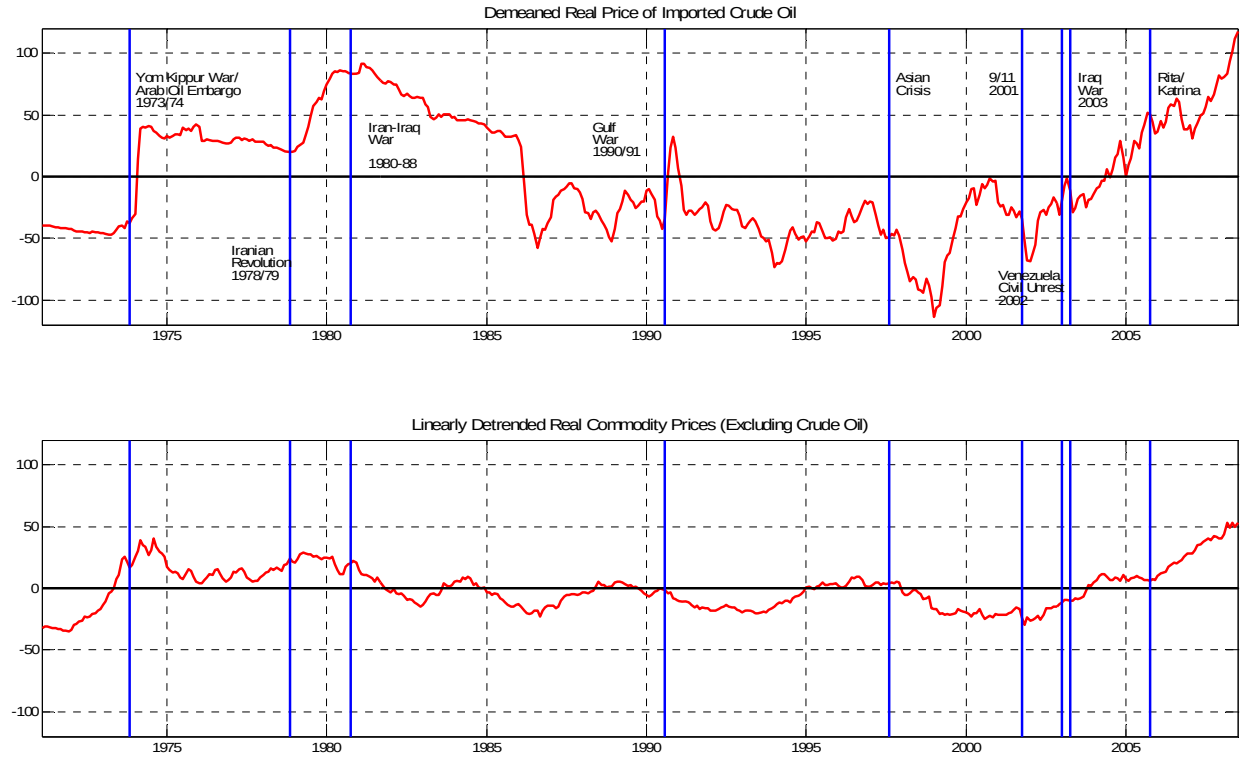
It is widely accepted at this point that much of the recent increase in the real price of crude oil has been driven by shifts in the global demand for industrial commodities, reflecting increased growth in emerging Asia in particular (see Kilian 2008b). One indication of such broad-based global aggregate demand pressures is a parallel shift in other industrial commodity prices. In fact, shifts in global demand for industrial commodities have been an important feature of the oil price data as far back as the 1970s (see Barsky and Kilian 2002, 2004).

Figure 3 presents the real price of crude oil expressed in percent deviations from the mean and an index of real commodity prices expressed in percent deviations from a linear time trend, highlighting the cyclical fluctuations in global commodity prices. Key historical events have been marked by vertical bars. The lower panel shows that there have been three episodes since the 1970s, during which commodity prices have risen persistently above trend: 1971-1974, 1977-1980, and 2001-2008. In all three cases, the underlying cause of the broad-based increases in commodity prices has been strong global demand for industrial commodities, driven by a booming world economy.

The upper panel of Figure 3 shows that these periods were characterized by large increases in the real price of oil as well, although the increases in the real price of oil in the 1970s lagged the increase in commodity prices. For example, commodity prices began to take off in late 1971, whereas oil prices only began to surge in late 1973. Likewise, the boom in other industrial commodity prices in 1977 predated that in oil prices in 1979. The reason is that commodity prices always have been spot prices of freely traded commodities, whereas crude oil was mainly traded in the form of long-term contracts at negotiated prices until about 1980. Since then oil has been trading in spot markets as well.

Table 1 compares the growth rates of real commodity prices during the three periods of high global demand for industrial commodities. The first column shows that during 1971.11-1974.2, other industrial commodity prices increased across the board at rates quite similar to the rate at which the price of oil increased. In fact, considering the secular decline in most non-oil commodity prices the rates are remarkably similar. Since we know that there were no cartel activities or other major supply shocks in industrial commodity markets in the early 1970s, this evidence suggests that all of these price increases were driven by excessive demand for industrial commodities relative to supply. There really is little need for additional explanations of the increase in the price of oil in particular, and recent research has debunked the popular myth that the 1973/74 oil price shock was driven primarily by the Yom Kippur War in October of 1973 or the subsequent Arab oil embargo (see Kilian 2008a,c).

Figure 3: Cycles in Inflation-Adjusted Prices of Crude Oil and Commodities for 1971.1-2008.6



Source: See Figure 1. The CRB index of commodity prices has been linearly detrended to highlight cyclical fluctuations. There is no apparent trend in the real price of oil. The dates of selected historical events are indicated by vertical bars.

Table 1: Growth Rates of Inflation-Adjusted Industrial Commodity Prices in Percent

	1971.11-1974.2	1977.8-1980.2	2001.6-2008.6
Crude Oil	125.3	70.7	327.5
Industrial Raw Materials	92.6	24.2	66.7
Metals	95.9	27.6	234.6
Textiles	81.5	17.0	-2.9

Source: Computed by the author from data provided by the EIA and the Commodity Research Bureau. The non-oil commodity prices are not detrended, so their growth relative to trend will be higher than the raw numbers shown here.

Turning to the 1977.8-1980.2, we again see parallel shifts in oil and other industrial commodity prices, suggestive of a global demand expansion. The increase in industrial commodity prices, however, was at most one third of the increase in crude oil prices, suggesting that there must be additional explanations of the surge in crude oil prices. As we will discuss below, an important factor behind the surge in the real price of oil in 1979, beyond high levels of global real economic activity, was a sharp increase in uncertainty about future oil supply shortfalls associated with the Iranian Revolution, the Iranian hostage crisis, and the Soviet invasion of Afghanistan.

Likewise for the 2001.6-2008.6 period, Table 1 shows massive price increases in some industrial commodities (such as metals prices which have more than tripled since 2001.6) and substantial, but much lower price increases in many other industrial commodities. However, none of these increases rivals that in the real price of crude oil, which has more than quadrupled over this period. The observed differences in the rate of price increases reflect differences in the responsiveness of the supply of these commodities, a point to which we shall return below, when we discuss the evolution of global oil supplies.

Why does global demand for industrial commodities fluctuate so much during these three historical episodes? It has been shown that the two demand expansions in the 1970s were caused by parallel monetary expansions in many industrialized countries including the United States (see Barsky and Kilian 2002, 2004). These monetary expansions caused a temporary boom in the global demand for industrial commodities. In contrast, the global demand expansion since 2001 was not driven primarily by economic growth in industrialized economies (although solid growth in Japan, Europe and the United States has contributed to strong overall global demand), but rather by additional demand form industrializing economies in emerging Asia. Thus, this latest demand boom reflects as much a structural transformation of the world economy, as it is a global business cycle phenomenon.

2. The Role of Oil Supply Disruptions and of Precautionary Demand

A complementary explanation of rising oil prices is that wars cause oil supply disruptions, which in turn drive up the real price of oil. There is not much empirical evidence supporting that view. One reason is that many wars in the Middle East did not cause damage to oil fields. A case in point is the Yom Kippur War of 1973. No hostilities took place on OPEC territory during this war and OPEC oil production was unaffected. A second reason is that historically unanticipated war-related oil supply disruptions over time have tended to induce increased oil production. Increased production took place not only in other oil producing countries with spare capacity, but, as the example of the Iran-Iraq War demonstrates, oil producers at war need the foreign exchange earnings from oil exports to sustain their war effort, creating an incentive for additional oil production. Hence, the overall effect on the real price of oil has tended to be much smaller than a shock that would permanently wipe out oil production (such as a Iranian nuclear attack on Saudi oil fields) or an oil supply disruption taking place in an environment in which oil supplies are constrained. This is not to say that war-induced oil supply disruptions could not cause substantial increases in the real price of oil, but that historically they have not. Figure 3 helps make that point. It is useful to focus on events that did not coincide with major shifts in the demand for oil such as the outbreak of the Iran-Iraq War in late 1980. The outbreak of that war caused only a minor increase in the price of oil. Nor was the 2003 Iraq War associated with a large oil price increase, although it coincided with a major supply cut in Venezuela in late 2002 such that the combined reduction in oil production in Iraq and Venezuela was comparable to the oil supply shocks of the 1970s.

This does not mean that events in the Middle East cannot be important for the real price of oil. To the extent that there is no spare capacity in oil production, the mere threat of future oil supply shortfalls can cause the price of oil to jump. This type of phenomenon is illustrated by the invasion of Kuwait in August of 1990. The reason for the sharp spike in the real price of oil seen in Figure 3 was not the reduction in Kuwaiti and Iraqi oil exports, although there was a supply disruption, but the uncertainty about whether Iraq would invade Saudi Arabia as well and seize Saudi oil fields, creating a tremendous oil supply shortfall. Uncertainty of this type causes so-called precautionary demand for oil. In essence, traders drive up the price by buying oil as insurance in anticipation of possible shortages. Unlike other oil market shocks, precautionary demand shocks may cause immediate and large jumps in the real price of oil, as expectations may shift in an instant. The sharp increase in the real price of oil in mid-1990 shown in Figure 3 illustrates this point. As soon as the U.S. had moved enough troops to Saudi Arabia to forestall an invasion of Saudi Arabia, however, the uncertainty dissipated and the real price of oil fell sharply (notwithstanding the fact that Iraqi and Kuwaiti oil supplies remained off the market and that in fact many Kuwaiti oil facilities were damaged or destroyed during the war in 1991).

For precautionary demand to arise it is essential that there is no excess supply of crude oil. A case in point is the Tanker War in the Persian Gulf in the 1980s. Despite the fact that at times up to 30 oil tankers were attacked per month, the price of oil steadily fell during this period because oil supplies far outstripped demand for oil. In contrast, in 1979 precautionary demand played a central role in driving up the price of oil beyond what the state of the global economy would have justified. Interestingly, it can be shown that precautionary demand has not played an important role since 2001.

Figure 3 also illustrates that negative shocks to the demand for oil and other commodities such as the Asian crisis or 9/11 (which induced a U.S. recession) tend to be followed by declines in the price of crude oil. The same is true of the global slowdown since mid-2008.

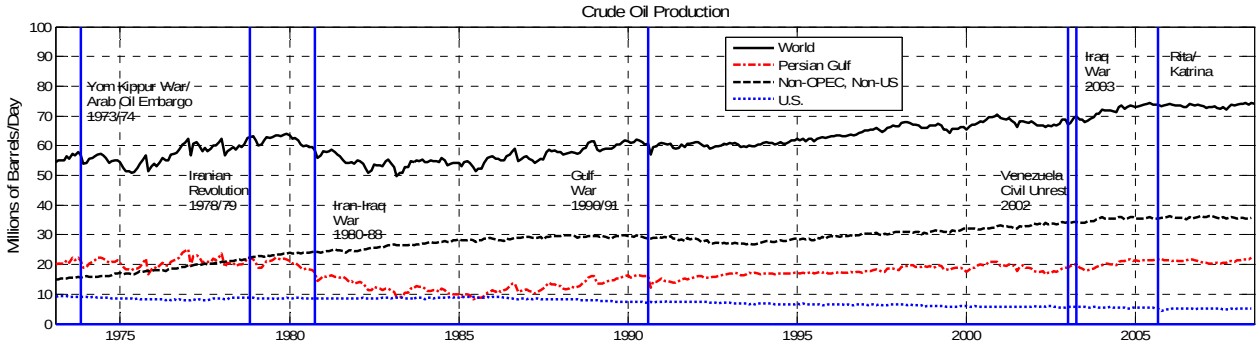
3. The Evolution of Global Oil Production

Since the effects of rising global demand for crude oil on the real price of oil depend on the global supply of crude oil, it is useful to review the trends in global crude oil production. Figure 4 shows that global oil production has steadily increased since the early 1980s. The current overall level of production is at an all-time high. The temporary decline in 1980-1986 owes much to Saudi Arabia's unsuccessful attempt to reduce its production to stem declines in the price of oil as well as to the global economic decline of the early 1980s (which reduced demand for oil). U.S. oil production has steadily declined since the 1970s, notwithstanding the development of Alaskan oil resources. Production in the rest of the world has been increasing.

One clearly would expect oil supplies to expand over time in response to higher oil prices, provided that oil producers believe that oil prices will remain sufficiently high to make the investment in new capacity worthwhile. For example, the 1973/74 oil shock triggered increased exploration and drilling activities across the globe, which led to a substantial increase in oil production with a delay of about five years. Since the most recent surge in oil prices started more than five years ago, it makes sense to compare the growth rates of oil production during 1974.1-1979.12 and 2001.6-2008.5.

Table 2 shows that contrary to prevailing wisdom there already has been a substantial oil supply response in recent years of roughly similar magnitude to the response following the 1974 oil price shock. Oil production since 2001.6 increased by 12.5 percent compared with 14.5 percent in the six years following 1974.1.

Figure 4: Crude Oil Production for 1973.1-2008.5



Source: Computations of the author based on data from the Monthly Energy Review, EIA.

Table 2: Growth Rates of Crude Oil Production in Percent: Selected Periods

	1974.1-1979.12	2001.6-2008.5	2005.6-2008.5
World	14.5	12.5	0.8
Persian Gulf	4.0	23.7	3.1
OPEC	0.6	19.0	2.4
Not OPEC or U.S.	51.6	11.0	0.3
U.S.	-3.6	-10.4	-5.4

Source: Computations of the author based on data from the EIA.

Nevertheless, there are interesting contrasts. After 1974, Persian Gulf oil producers (and even more so other OPEC oil producers) were reluctant to increase their oil production or to invest in new capacity, reflected in growth rates of 0.6 percent for OPEC as a whole. U.S. oil production even fell at a rate of 3.6 percent, as U.S. oil fields had already peaked. At the same time, non-OPEC, non-U.S. production grew at an astounding rate of 51.6 percent, accounting for the bulk of the response of world oil supply.

Since 2001.6, oil production in the Persian Gulf has increased at a rate of 23.7 percent, suggesting that these oil producers have delivered on promises of increasing oil production substantially. The same is true to a lesser extent for OPEC as a whole, which includes countries with declining oil resources. In contrast, non- OPEC, non-U.S. oil producers have expanded oil production only by 11 percent. A likely explanation of this pattern is not so much that the world is running out of oil in the foreseeable future, but that the threat of expropriation in many oil producing countries prevents the flow of much needed investments. Two prominent examples are Russia and Venezuela.

There is reason for concern in that much of the observed increase took place prior to mid-2005. Since 2005.6, world production of oil has essentially stagnated. Whereas Persian Gulf oil producers still expanded by 3.1 percent, oil production in non-OPEC, non-U.S. countries grew at 0.3 percent only. These data help explain the disproportionate increase in the real price of oil since 2005 relative to other industrial commodity prices.

They also suggest that the real price of crude oil in the foreseeable future is likely to be determined by demand conditions in the global oil market. In the absence of precautionary demand shocks, this means that only reduced demand from industrialized economies and/or reduced demand from emerging Asia will cause the real price of oil to fall.

As of mid-2008, there were indications that a slide in the price of oil may had begun, as Europe and the U.S. economy were slowing down, as was China. The slide has accelerated since September of 2008, with the onset of the credit crisis. In particular, the economic and financial crisis of the OECD economies, which had contributed little to the increased demand for oil in recent years, became a major factor in the erosion of demand pressures. In fact, the price of oil since July of 2008 has fallen about as fast as it rose in the first half of the year. How long this development will continue, depends on the ability of the world economy to avoid a prolonged recession or even depression. All else equal, one would expect to see the real price of oil rebound, as soon as the world economy recovers.

4. The Response of the Price of Oil to Oil Demand and Supply Shocks

The informal analysis of the global oil market in the preceding sections is consistent with estimates obtained from formal econometric models. Recent work by Kilian (2008b) suggests that each of the three types of shocks discussed above has a very different impact on the real price of oil. Figure 5 shows that an oil supply disruption ("oil supply shock") temporarily raises the real price of oil; an unanticipated increase in global demand for all industrial commodities ("aggregate demand shock") causes a persistent increase in the real price of oil that peaks after one year; and a positive demand shock that is specific to the crude oil market ("oil-specific demand shock") - such as an increase in precautionary demand following the threat of war in the Middle East - causes an immediate jump in the real price of oil. In addition to these response estimates, Figure 5 includes error bands to convey the extent of the estimation uncertainty. In particular, the price responses to the two demand shocks are fairly precisely estimated and statistically significant.

Of particular interest is the question of how much of the recent surge in oil prices can be attributed to each shock. Figure 6 shows that each oil price shock episode is different. For example, the 1990/91 episode was driven primarily by shifts in precautionary demand; the 1979/80 episode reflected primarily a combination of strong global aggregate demand and increased precautionary demand in 1979; in contrast, the surge in the real price of oil since 2002 can be attributed almost entirely to increased aggregate demand for industrial commodities. Put differently, the real price of oil rose because the world economy was booming (and more recently has fallen, as the world economy slid into recession).[1]

This analysis will help us assess the likely impact of selling off oil stocks on the real price of oil in the next section. Before turning to this question, it is useful to debunk an alternative explanation of recent oil price movements that has gained popularity in the press. In particular, it has been suggested that speculation in oil futures markets has been the driving force behind the surge in the real price of oil since 2002.

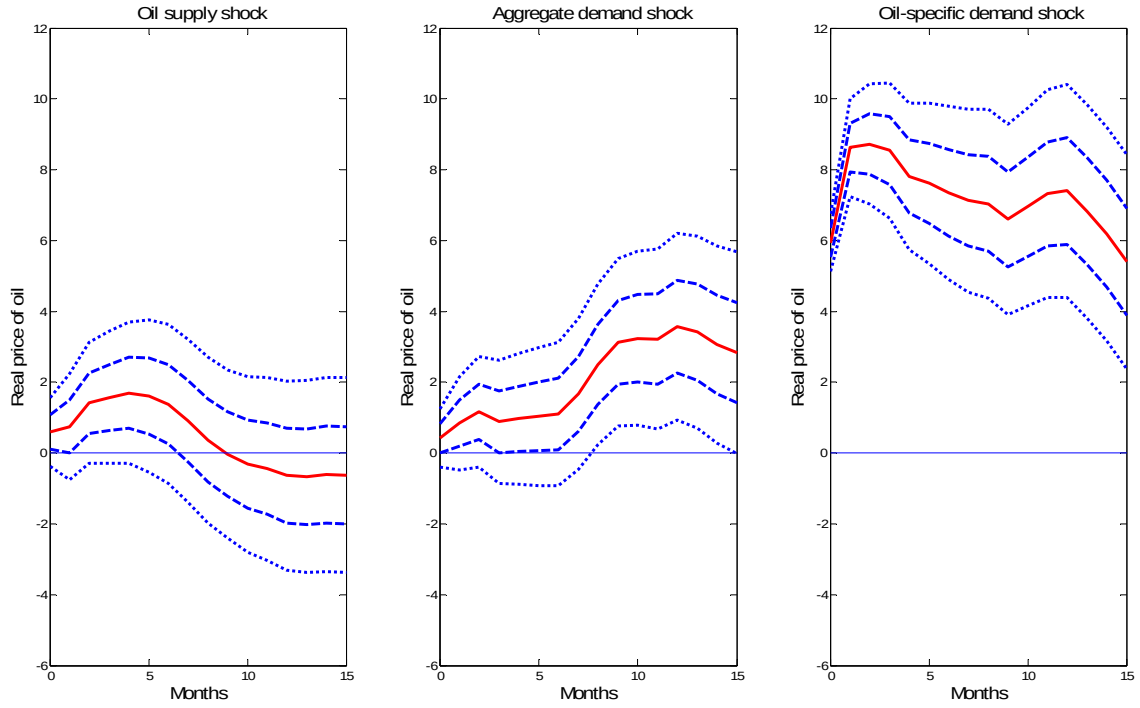
[1] This distinction has important implications for the effect of these shocks on oil importing economies. See Kilian (2008b,c), Kilian and Park (2008), and Kilian, Rebucci and Spatafora (2008) for further analysis.

5. The Role for Speculators

Based on data compiled by the Commodity Futures Trading Commission, Alquist and Kilian (2008) have documented that there indeed appears to have been an influx of speculators (defined as buyers and sellers not customarily in the oil business) in NYMEX oil futures markets after 2003. This evidence is consistent with anecdotal evidence of hedge funds entering the oil futures market. It raises the concern that possibly these speculators might have been responsible for the increase in the spot price of oil at about the same time.

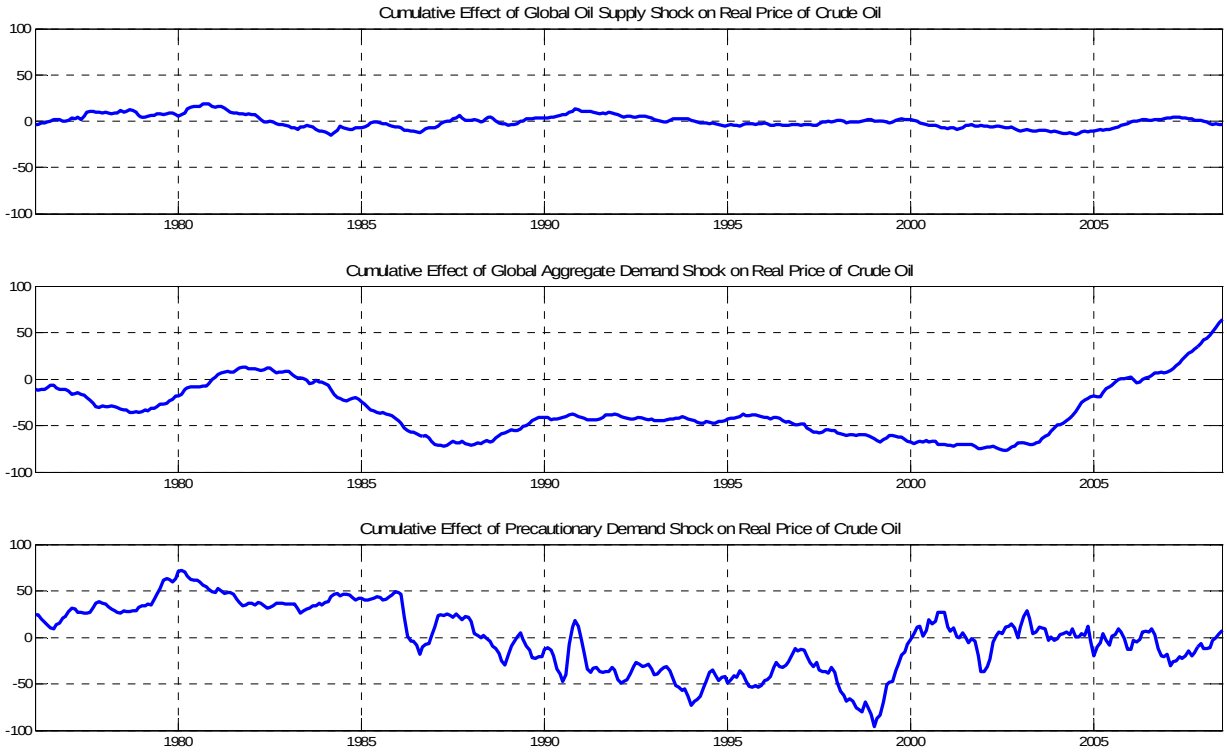
Figure 6 shows that such speculation could not have been oil-market specific or the econometric model underlying Figures 5 and 6 would have picked up the additional speculative demand as an oil-market specific (precautionary) demand shock. This leaves the possibility of futures-market driven speculation in many industrial commodity markets. One problem with that explanation is that industrial commodity prices rose as fast or even faster in commodity markets for which no futures contracts exist (see Bini Smaghi 2008). Another problem is that speculators in oil futures markets appear to have played both sides of the futures markets rather than consistently betting on higher prices. A third problem is that it is not clear how exactly speculators in oil futures markets drive up the price of oil in the spot market. The implicit argument is that traders in the spot market interpret higher oil futures prices as a prediction of higher spot prices; thus spot traders will buy a barrel of oil and store it with the intention of selling it a year later at a higher price and making a profit.

Figure 5: Responses of the Price of Crude Oil to Oil Demand and Oil Supply Shocks



Source: Kilian (2008b). All shocks have been normalized such that they tend increase the real price of oil. In particular, the oil supply shock represents an oil supply disruption and the demand shocks a demand expansion.

Figure 6: The Contribution of Each Shock to the Evolution of the Real Price of Oil during 1976.1-2008.6



*Source: Kilian (2008*b).

There are several problems with that interpretation. First, Alquist and Kilian (2008) have shown that oil futures prices are no more accurate predictors of the spot price than the current spot price, raising the question of why traders would rely on predictions from oil futures prices. Second, according to standard economic models, one would expect oil inventories to have increased sharply relative to trend since 2003, if spot traders had responded to higher oil futures prices. That did not occur in the U.S. and OECD data (see Kilian 2008d). On the other hand, if, for technological reasons, the stock of oil in inventories had been fixed, increased speculation in the spot market would have implied that traditional buyers must have received less crude oil. Those traditional buyers are refineries, so their output in the form of gasoline, heating oil, etc. should have fallen. This implication again is inconsistent with the data. Thus, there is no real evidence for the view that speculation is behind the recent surge in the price of oil (or that diminished speculation explains the subsequent fall of the real price of oil). Thus, there is no reason to believe that additional regulation of oil futures markets would have brought down the price of oil. The next section will evaluate the alternative policy proposal of releasing government-held crude oil stocks in an effort to ameliorate the shortfall of oil supplies.

ANALYSIS OF THE POLICY PROPOSAL

1. The Need for a Global Approach

The preceding analysis illustrated that the root cause of the recent surge in the price of oil was that demand for crude oil grew faster than its supply. A fallacy in discussions of this problem is to view any increase in the domestic availability of oil relative to domestic needs rather than the global demand for oil. For example, during the U.S. election campaign, a popular proposal involved increased domestic drilling for crude oil. The implicit premise was that this oil would become available domestically, making it unnecessary to purchase expensive oil from abroad. In reality, the price of crude oil is determined in global markets. Unless the increase in domestic production is truly large (which seems unlikely given the continued decline in U.S. oil production since the 1970s, even as Alaskan oil was discovered), its effect on the world price of oil will be negligible. Any additional oil produced domestically will simply be valued at the same high global price.

This would be true, even if sales of domestic oil were restricted, as oil supplies are fungible. History has taught us that attempts to steer oil supplies in any one direction are futile. For example, in 1973/74 Arab oil producers attempted in vain to punish the Netherlands for its pro-Israeli stance by restricting oil deliveries to the Netherlands. The market responded by simply substituting other crude oil supplies for those from Arab oil producers, undermining the embargo. Likewise, if the U.S. substituted domestically produced oil for imported oil, this would simply free up oil for consumption elsewhere. Either way, the market for crude oil is truly global. The implication is that we must judge the impact of releasing crude oil stocks on the price of oil not relative to the level of domestic consumption, but relative to world-wide levels of oil consumption and oil production, as illustrated in Figure 2.

2. The Best-Case Scenario

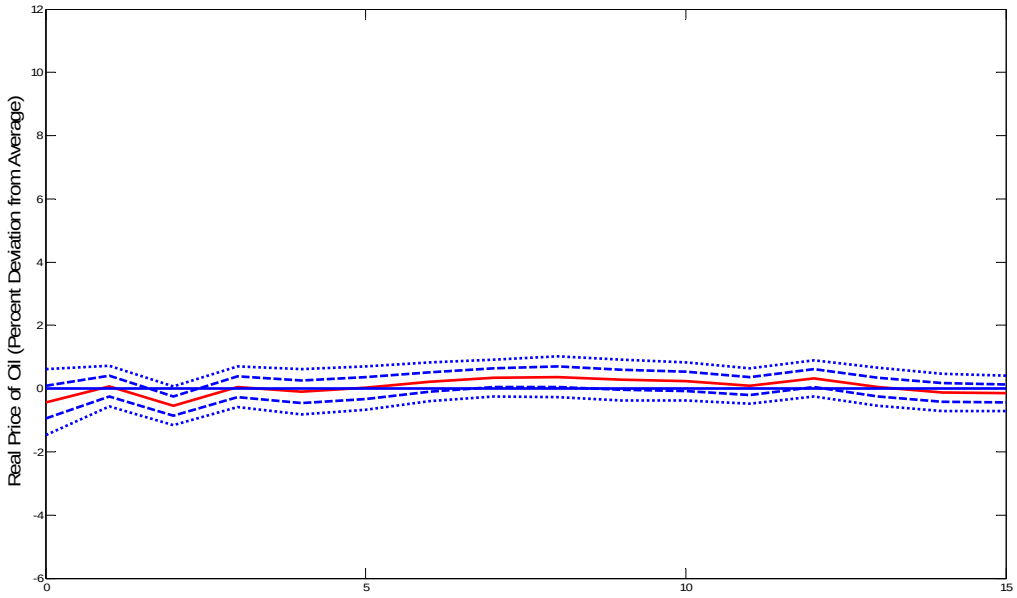
One interpretation of a release of oil stocks is as a surprise increase in world oil supplies. In the context of the model discussed earlier we can easily ask what the effect of an increase in crude oil supplies of a magnitude corresponding to the current EU government oil reserves would be. This interpretation is likely to be too optimistic. Unlike other shocks to world crude oil production (such as opening a new oil field) that tend to raise the level of production persistently over time, a release of petroleum reserves would tend to be short-lived. Once the petroleum stock is spent, no new stocks will be forthcoming. This suggests that such a policy intervention would actually be less effective than an unexpected expansion of oil production, which as we have shown has at best moderate price-dampening effects (see Figure 5).

One way of mimicking this situation in the model underlying the results in the preceding section is to allow for a positive oil supply shock in a given month, followed by a negative shock of the same magnitude in the following month. Below we assume that EU crude oil stocks amount to 20 percent of the monthly global production of crude oil. The release of a different quantity of crude oil would simply result in a scaled version of the same plot. The response has been plotted on the same scale as the response to an oil supply disruption in Figure 5 to facilitate a direct comparison. Figure 8 shows a minor reduction in the real price of oil two months after the release of the oil inventories, but the overall effect is very small and so imprecisely estimated that one would be hard-pressed to justify any policy actions on this basis.

As discussed earlier, it is difficult to know what the actual level of EU crude oil inventories is, but Figure 8 indicates that regardless of the quantity of crude oil stocks released to the market, there will be no statistically significant reduction in the real price of oil. Ignoring estimation uncertainty, the model implies that the real price of oil would temporarily drop by 0.5 percentage points, although accounting for estimation uncertainty the effect may very well be much smaller. Although this best-case scenario postulates that all crude oil stocks are released, few proponents of the use of strategic oil reserves would advocate such a radical course of action (see Emerson 2006). It seems prudent to keep some stocks in reserve, in which case the response of the real price of oil will fall proportionately. Moreover, the premise that the EU has at its disposal stocks amounting to 20 percent of monthly world crude oil production may be overly optimistic; any reduction in this stock would further reduce the estimated response proportionately. Even a coordinated multilateral release of oil reserves beyond the EU would not change the results in Figure 8 materially.

The evidence in Figure 8 suggests that the idea of countering global demand pressures based on the release of crude oil stocks is not feasible. The effects of such a policy would be too short-lived and too small to make a difference. Intuitively, this result makes sense. If the problem is rising demand from emerging Asia combined with strong, but stable demand from OECD economies, resulting in increased demand for crude oil not just this month, but in every month for the foreseeable future, then a one-time release of oil will do little to quench the world's thirst for crude oil. It would be possible, of course, to spread out the release of oil stocks over several years, but in that case the amount of oil available for release in any given month would be negligible. Either way, the effect on the real price of oil would be small.

Figure 8: The Effect of an Unanticipated Release of All *OECD Europe* Oil Stocks on the Real Price of Crude Oil



Source: Computations by the author based on the model in Kilian (2008b). Results shown assume that current EU crude oil stocks amount to 20 percent of monthly world crude oil production. The thought experiment is an unanticipated release of this stock in period 0, followed by a reversal of that increase in period 1.

3. Unintended Consequences of a Policy Intervention

The preceding analysis has focused on the best-case scenario for policy intervention. Even for that scenario, the case for selling off crude oil stocks is very weak. There are additional reasons to be very cautious about such a strategy. One reason is that the level of oil inventories held by market participants such as refineries depends on their perception of the risk of an oil supply shortfall. Government oil inventories act as an insurance against possible oil supply shortfalls. An obvious concern is that the private sector may choose to increase its inventory holdings in response to a meltdown of government-held inventories, which would counteract the policy intervention.

More importantly, a sell-off of crude oil stocks would leave the oil-importing country vulnerable to unanticipated political events in the Middle East such as the threat of war or terrorist attacks. Historically, such events have been responsible for sharp spikes in the price of oil. The most prominent example has been the invasion of Kuwait in 1990 (see Figure 3). As Figure 5 shows, such shocks tend to cause sharp swings in the price of oil as well as in domestic economic activity, as shown in Kilian (2008b).

This observation suggests that it would be imprudent to sell off all government-held petroleum stocks. A likely political disturbance in the foreseeable future would be a shipping accident, terrorist attack or war resulting in the closure of the Straits of Hormuz, through which most oil exports from the Persian Gulf must pass. If a supertanker were sunk in the Straits, for example, merely clearing the obstructed shipping lanes would likely take months. The effect on the price of oil would be dramatic. If the existing petroleum stocks had been sold off, there would be no cushion left to deal with this emergency. There are many other scenarios involving military conflict or political upheaval in the Persian Gulf region with qualitatively similar outcomes.

A case can be made that the primary function of government-held oil stocks is to provide insurance against such events. Selling of oil stocks to combat an increase in the price of oil driven by shifts in global demand is akin to a homeowner cancelling his fire insurance to make ends meet in tough times. That additional cash may come in handy, but the consequences could be catastrophic in the event of a house fire.

This line of reasoning suggests that the level of petroleum stocks available for policy interventions aimed at stabilizing the price of oil is actually somewhere between nil and negligible, measured relative to the likely risk of an oil supply disruption. Moreover, strategic reserves seem more suited to coping with the temporary shortfalls associated with political disturbances in the Middle East such as a closure of the Straits of Hormuz than with persistent changes in the structure of the world economy or the global business cycle.

4. Further Caveats

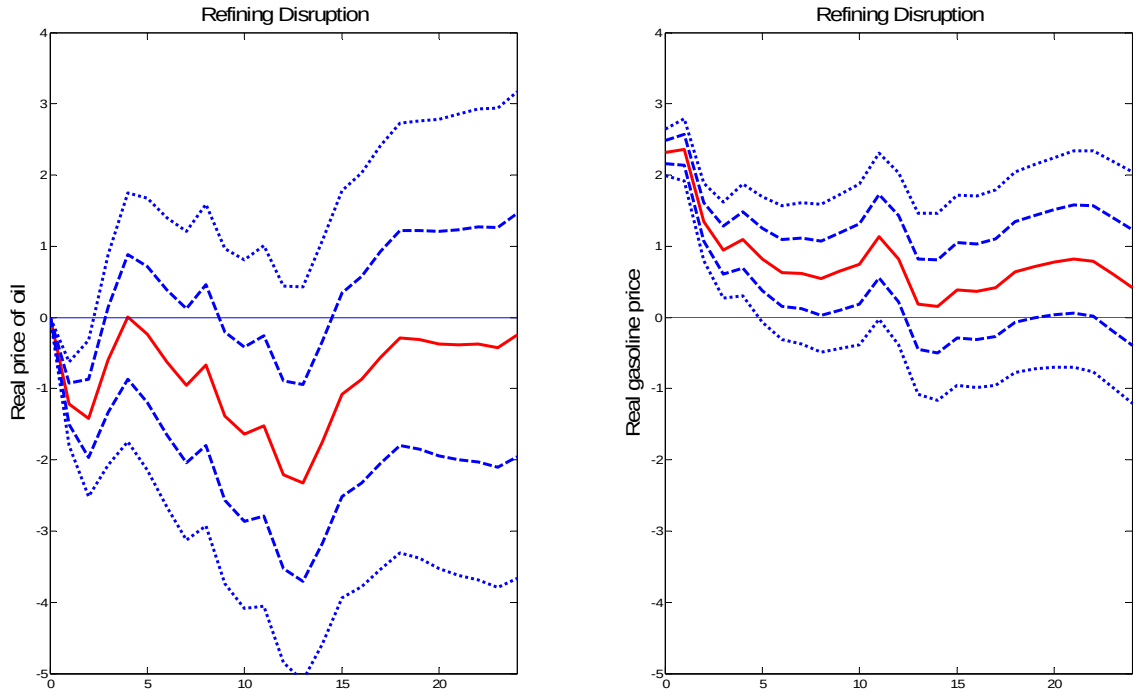
Calls for the use of strategic petroleum reserves have been voiced in response to events outside of the Middle East as well. For example, it is common for U.S. policymakers (and, more generally, the media) to call for a release of crude oil from the SPR in anticipation of hurricanes making landfall in the Gulf of Mexico. The premise of such calls to action is that hurricanes are likely to disrupt drilling on off-shore oil platforms, causing an oil supply shortfall and higher crude oil prices. Historically, this analysis has proved incorrect. Not only were the disruptions of oil production in the Gulf negligible on a global scale (see Figure 4), but, more importantly, these hurricanes have tended to disrupt refining activities in Texas and Louisiana.

Since refiners produce refined products such as gasoline from crude oil, rather than representing a crude oil supply disruption, the shutdown of Gulf refineries represented a disruption of gasoline supplies and an unexpected reduction in the demand for crude oil. This observation explains the fact that crude oil prices actually fell slightly following these hurricanes (contrary to the predictions of the media), while U.S. retail gasoline prices skyrocketed. This phenomenon is captured by estimates of an economic model of the global crude oil market and the U.S. gasoline market in Kilian (2008d), shown in Figure 9.

The ultimate aim of the proposal of releasing strategic reserves is not to reduce the price of crude oil, but to reduce the prices of gasoline, heating oil and other refined products faced by domestic consumers and firms. As the example of the hurricanes Rita and Katrina illustrates, releasing crude oil reserves will have the effect of lowering retail energy prices only if refiners have sufficient spare capacity to process the additional crude oil. This was not the case in the United States following the devastation caused by these hurricanes. All remaining refineries were already operating at full capacity, and a release of oil from the SPR, while politically expedient, would have done nothing to keep gasoline prices in check. Similarly, any release of EU oil reserves would require careful analysis.

In addition, one must take into account that there are different grades of crude oil differentiated by their sulphur content. Crude oil is not a homogenous product. For example, Venezuelan oil is quite different from Libyan oil. Not all refineries are capable of processing all types of crude oil. Again, it is quite likely that a given refinery may not be able to process oil from strategic reserves, if the grades available do not correspond to those the refinery is set up to process.

Figure 9: Price Responses to an Unanticipated Disruption of U.S. Refining Activities



Source: Kilian (2008d).

The relative demand for different grades of crude oil also depends on the desired mix of refined products. The demand for crude oil is derived from the demand for diesel fuel, gasoline, heating oil, and other refined products, and a shortage of one of these final products may have differential effects on the demand for crude oil of different types.

Finally, there is an active trade in refined products such as gasoline. For example, following Rita and Katrina gasoline was shipped from Europe to the United States, in response to the price differential. If the EU, for example, had decided unilaterally to increase gasoline production by releasing its crude oil reserves, it is likely that European gasoline would have been sold to the highest bidder abroad until the price of gasoline (adjusted for transportation costs) is equalized.

While this study has focused on the effect of releasing crude oil emergency stocks, similar comments would apply if the EU chose to release its stocks of finished and intermediate products. While releasing EU stocks of gasoline, for example, would bypass the refining bottlenecks discussed above and may allow policymakers to lower gasoline prices more directly, the relatively small size of EU gasoline stocks and the fact that gasoline is traded globally would limit the reduction in the domestic price of gasoline. Given the lack of detailed data on the availability of EU gasoline stocks, it is more difficult to assess these effects quantitatively, but the underlying mechanisms (and the dangers posed by such a strategy) are essentially the same as in the case of crude oil.

CONCLUSION

The latest oil price boom ensued when countries in emerging Asia increased their demand for industrial commodities during a period of already strong growth in OECD economies. Asia's increasing appetite for industrial commodities including crude oil reflected the growing industrialization of that region. Global oil supply increased substantially in response, but not enough, and in the last three years the growth of world oil supplies has all but ceased. This supply-demand imbalance in oil markets explains the bulk of the recent surge in oil prices. There is no evidence of that increase being fueled by speculation in oil futures markets, by oil supply disruptions in the Middle East, or by market concerns about future oil supply shortfalls.

Given the state of oil supplies, the price of crude oil for the foreseeable future is likely to depend primarily on the evolution of the global demand for oil. This point is confirmed by the decline in the price of crude oil since July of 2008. The initial decline coincided with evidence of a cooling world economy with recession fears looming large in Europe, the United States and China. Indicators of global demand pressures such as international shipping rates suggest that global demand peaked in June of 2008, right before the price of oil began to decline. The fall in global demand for oil and hence in oil prices accelerated with the onset of the current financial and economic crisis, which has led to a sharp contraction in world real activity and consequently in the demand for industrial commodities including crude oil. In fact, the decline in common indicators of global demand (such as the Baltic Dry Cargo Index) since June of 2008 has been at least as dramatic as its increase earlier this year.

The fact that recent oil price fluctuations have reflected shifts in global demand rather than short-term supply disruptions has important implications for the use of strategic oil reserves. The analysis in this report suggests unequivocally that the use of strategic reserves of crude oil or other petroleum products would have been futile in the recent economic environment. Such reserves were created to combat temporary shortfalls of oil supplies such as closure of the Straits of Hormuz. They are ill-suited to offsetting persistent shifts in the global demand for oil that are associated with long-term changes in the structure of the world economy (such as the rise of Asia as an economic power) or with fluctuations in the global business cycle. Moreover, the use of oil reserves in an effort to stabilize the price of oil would make the EU economy even more vulnerable to oil supply disruptions in the Middle East. It is recommended instead that these reserves be used for genuine emergencies only, as originally intended.

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How Emergency Oil Stocks Fit the General Oil Challenge

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EXECUTIVE SUMMARY

The challenge in today's oil market has three dimensions – volatility, the end of cheap oil and growing environmental pressures. It is the issue of volatility where oil stocks might play a role. Volatility has two aspects – immediate physical availability and price volatility, both clearly linked. The key for the EU is that price volatility has increased and security of supply has moved up the policy agenda. Oil stocks can be categorized as primary, secondary and tertiary. They are held to ensure security of supply and – more controversially - as a possible mechanism of price management. In general the quality and accuracy of stock data are poor.

The usage of stocks held by the IEA, the US and the EU has been mixed but generally poor. Furthermore, they have yet to be tested in a real emergency. There is a debate whether stock release should be ruled based or discretionary.

Stocks can be held by private companies or governments (or both). Private stocks are held for operational reasons although the volumes for this have been reduced. Private stocks are also held for speculative motives although in recent years this motive has weakened as companies are less able to benefit. Governments hold stocks for strategic reasons to be able to run the military and emergency services. They may also hold them to influence prices although the record has been extremely poor.

There is clearly a need to refine, clarify and harmonize the rules by which stocks can be used. However, excessive reliance on rules is dangerous since crises can vary enormously in their nature and flexibility is required.

The issue of an optimal size for reserves and the issue of coordinated release is dominated by the presence of market failure, in particular the fact that stocks involve strong elements of a "public good". The problem is that any stock release by one country benefits all because of the fungible nature of international oil markets. Thus there is a strong incentive for governments to "free ride" i.e. let others bear the cost of storage. What is clear is that cooperation in creating stocks among a large group of countries increases the optimal size of reserves compared to the optimal size for individual countries. The argument that self interest would create a coordinated stock release without intervention is flawed.

There are measures to improve the effectiveness of rules, not least to ensure existing rules are actually observed. Two other issues concern increasing the coverage of the IEA's scheme to include OPEC and other large consumers currently not IEA members and the need for credibility and coherence in managing stocks. Finally the report argues that the EU stock holding system would be far better and more effective if merged into the IEA's system. Arguments for maintaining a separate EU system of stock holding can easily be refuted.

1. INTRODUCTION

The starting point for analysis is to try and define what is meant by the "oil challenge". The challenge in today's oil a market has three dimensions – volatility, entering the era of an end to cheap/easy oil and growing environmental pressures.

Environmental pressures relate not only to greenhouse gas emissions and climate change but also increasingly to problems of urban air pollution arising from the growing use of liquid fuels in the transportation sector, especially in developing countries. The end of the era of cheap oil has two dimensions[2]. The first relates to geological or "below ground" constraints. This links to ideas associated with "Peak Oil" and the general depletion of conventional oil resources[3]. The second concerns "above ground" constraints which relate to oil inaccessible for political reasons ranging from sanctions to the spread of "resource nationalism" and supply shortages arising from a lack of investment both by international oil companies (IOCs) and national oil companies (NOCs)[4].

Both these challenges are important and require serious policy attention aimed at encouraging substitution to cleaner fuels including squeezing more out of conventional oil sources since the unconventionals, for the most part, are a disaster in terms of CO2 emissions and generally improving energy efficiency. However, there is little role for oil stocks in the agenda for solution[5].

It is the first challenge – volatility – where oil stocks can play a role. Oil market volatility has two dimensions, both obviously linked. The first is immediate physical availability of oil products. Sudden physical shortages create problems in terms of an impact on economic output in terms of "outage costs" and, in its more extreme form, an inability to operate the military, police and emergency services. The second dimension is crude and product price volatility. This creates macro economic problems and potentially problems of fuel poverty[6].

These two elements of volatility – availability and price - are linked by virtue of the two markets for oil. The wet barrel market is where producers sell and refiners (or distributors) buy physical barrels of crude oil (or products)[7]. The paper barrel or futures markets are where promises to deliver and take delivery are made. The links between the two markets are complex but can be simplified to the following. The wet barrel market looks to the paper markets to signal what prices might be while the paper markets look to the wet barrel market to indicate surplus or shortage and on that basis drive futures prices.

[2] A good exposition of some of these issues is provided by Shell, 2008. These scenarios discuss three "hard truths" which set the context for the future – 1. A step change in energy use as countries such as China and India take off in development terms. 2. Supply will struggle to keep pace as large mature fields face accelerating natural decline rates. 3. Environmental stresses are increasing especially in the context of climate change.

[3] The term conventional is used to distinguish from other sources of liquid fuels such as those from tar sands and shales; heavy bitumen; coal and gas to liquids; and biofuels.

[4] For example see Stevens, 2008.

[5] Interestingly, as will be developed below, part of the IEA's International Energy Programme (IEP) requires governments to have contingency plans to address all three – squeezing more from conventionals; increasing fuel substitution and demand reduction; as well as stockpiling as part of the plans for dealing with emergency supply disruptions.

[6] Fuel poverty is commonly defined as a situation where households spend more that 10 percent of the income on fuel.

[7] This is sometimes referred to as the "fundamentals". However, this is misleading since it implies that physical supply and demand are the only things which matter. This is not the case.

These two elements of volatility also provide a definition of security of supply. While this means many different things to many different people it is usually defined as ensuring adequate physical supply at affordable prices. Thus the threat is a short term physical or supply discontinuity.

The latter can be the result of a geo-political event such as the Arab oil embargo of 1973 or Iraq's invasion of Kuwait in 1990; an accident such as the Pipe Alpha disaster in the North Sea in 1988; or some form of weather disruption such as Hurricanes Katrina and Rita in 2005[8].

An important question is how far, from the EU point of view, this sort of volatility is increasing in recent years and as a result how far security of oil supply has moved up the agenda of concerns. Several reasons support the view that this is indeed the case. First, EU oil import dependency is rising as the North Sea oil production plateau declines. In 2006, 85 percent of EU oil consumed was imported from third countries. By 2030 this is expected to rise to 93 percent (EC, 2008). Second over the last few years there has been periods when there has been a serious disconnect between wet and paper barrel markets such that the "money managers"[9] who operate in the paper barrel markets misunderstand the wet barrel market with the result that oil prices over or undershoot. Thirdly, all forecasts imply that there will be growing dependence upon the Middle East for oil supplies simply as a result of the location of proven conventional reserves[10]. All the signs are that this region (at best) is unlikely to become less politically unstable than in recent years.

It is in this context of the challenge of justified growing concerns about security of supply that the issue of oil stocks becomes highly relevant. The economics of oil stockpiling relates to the motives for holding stocks coupled with the costs, benefits and risks of doing so. Much of the discussion also revolves around the need for governments to intervene in stockpiling for reasons of market failure. It is these issues which form the basis for rest of this paper.

[8] It might be argued that an OPEC decision to cut production to defend prices also constitutes a discontinuity

[9] Players in the paper barrel markets are conventionally divided into commercial and non-commercial players. Commercial players are interested in wet barrels but normally the non-commercials have no interest in physical barrels. However, there is a further division within the non-commercials between "speculators" and "money managers". "Speculators" move in an out of the markets on a daily and weekly data and are interested in and benefit from short term (i.e. daily or weekly) price fluctuations. "Money managers" by contrast are seeking an investment class to invest part of their portfolios and tend to invest for the longer term. Whether this also classes as "speculation" is essentially an exercise in semantics.

[10] For example see the IEA, 2008; DOE, 2007 and OPEC 2008.

2. WHAT IS THE ROLE OF OIL STOCKS IN SAFEGUARDING SECURITY OF SUPPLY?

Security of supply has already been defined in Section 1. However, it is also important to understand exactly what oil stocks are and what their role is seen to be. There are three kinds of oil stocks –Primary, Secondary and Tertiary.

Primary stocks are those (crude and products) held by governments or oil companies (usually in large-scale storage facilities). In the case of the IEA members these are the stocks requirement by the International Energy Programme (IEP) detailed below. In addition to the stocks held by consuming countries, many producer governments also hold primary stocks either in storage depots or at sea (en route to market or slow steaming). However, the level of these producer stocks is sensitive, since they can represent a form of overproduction by OPEC members. Data on them are thus extremely uncertain. Producer stocks are also highly volatile since their purpose is to be located close to the market to take advantage of price fluctuations.

Secondary stocks are product stocks held by wholesalers in gasoline stations and small fuel depots.

Tertiary stocks are those held by the final consumer and they can range from a household's winter heating oil supplies to the gasoline motorists carry in their tanks.

There are no comprehensive data on secondary and tertiary stocks[11], but the volume of inventories held at this level can be quite significant. Also they can be volatile. Fears of impending shortages trumpeted in the media will cause consumers to increase tertiary stocks. This in turn draws down secondary stocks which also draws from primary stocks. Thus since primary stocks are the only ones formally measured by governments, often it can appear stocks are falling while all that has changed in reality is the property rights to stocks. This can sometimes mislead the "money managers" in the paper market to believe there to be a "shortages" of oil.

C**onsuming countries hold strategic stocks for two main reasons:**

1. Security of supply. Stocks provide an important cushion against unanticipated interruptions of supply.

Part of stocks are often termed **strategic stocks**. All governments need strategic stocks to ensure they can run police, emergency and military services in the event of a national crisis. Such national strategic security motives for storage of oil products have been long standing. For example, in the UK they were introduced in 1917[12] and in France in 1925 (Emerson, 2006). During the Cold War, Western Europe within the context of NATO developed a whole network of product pipelines specifically for military use. However, their very nature tends to restrict information on both their level and indeed their whereabouts.

In less dramatic mode, maintaining adequate stocks helps limit the price spike in the event of a temporary supply disruption and contain the resulting damage from "outage costs" to the macro-economy.

[11] There are estimates made in a few cases. For example,for household heating oil stocks in Germany but such data are rare.

[12] Arguably an even earlier example was the British Governments purchases of 51 percent of the Anglo-Persian Oil Company (later BP) in 1914 when the Royal Navy switched its battle fleet from coal to oil.

2. Price management. More controversially as will be discussed below, inventories can be used to manage prices in non-emergency situations. For example, following Iraq's invasion of Kuwait in August 1990 oil prices rose sharply, and the IEA came under intense pressure to use its inventories to stabilise the market. Proponents argued that the IEA should announce a price ceiling and stand ready to make crude available to prevent prices breaching this level. The IEA initially refused, stating that this type of active market management was not within its remit[13]. In the event, stocks were released on the first day of Operation Desert Storm (in January 1991), following Saudi pressure on the United States. However, the stocks were actually released into a market which was already falling, and aggravated the subsequent price collapse creating a negative precedent for future use of stocks to manipulate prices. Nevertheless, the pressure to use official holdings to manage the market and prevent prices breaching a "reasonable" upper limit remains very strong.

Stock uncertainties. The IEA in its Monthly Oil Market Report calculates stock levels as a residual from changes in supply and demand (other organisations use a similar approach). Problems arise because both supply and demand data are themselves estimated and generally of poor reliability[14]. The implied stock level is thus the difference between two very large numbers, both of which are inexact. The stock data are therefore subject to a considerable degree of uncertainty. Despite this, they play an important role in moving the oil markets. Oil traders wait and respond to the weekly release of stock estimates by the American Petroleum Institute (API) and oil prices move as a result[15]. This is despite the fact that weekly releases are notoriously unreliable because of the very short time frame for collecting the data.

There is clearly a case for developing much better data on stock holding at primary, secondary and tertiary levels. This will be discussed below.

[13] In mitigation, the IEA's Charter explicitly excludes the IEA from interfering with prices. Thus the only valid "emergency" is a physical shortage. However, it was also believed (Emerson, 2006) that the failure to release was the fear that the crisis might get worse and stocks should be held back for a "real emergency". As will be developed below this is a major problem with the release of strategic stocks.

[14] One only has to see the constant revision of demand and supply data to realize the truth of this observation.

[15] This is known as the "Thursday Effect".

3. USAGE OF OIL STOCKS TO DATE

The International Energy Agency (IEA). The IEA was formed in November 1974 as a direct response by Secretary of State Kissinger to the Arab Oil Embargo of 1973. One of its first acts was to create the IEP intended to create a multilateral response system to deal with any future supply disruptions.

The basis of the IEP was a collective response of which strategic stocks was only a part and indeed effectively a last resort. It would be triggered for any member by a reduction in oil supplies (effectively imports) of at least 7 percent. The first line of defence was a programme created by each government to reduce oil demand, switch fuel away from oil and where feasible produce a surge in production. There was a supply allocation plan for members to step in and assist any country facing a shortfall[16]. The IEA set a level of stocks in 1974 of an amount to sustain at least 60 days of consumption with no net imports. In 1975-6 this was raised to 90 days with a producer of crude oil allowed to reduce this by up to 25 percent (76.5 days). As the Second Oil Shock crisis developed the 7 percent for a member effectively morphed into a collective 7 percent.

The IEP had been developed in an oil market where the global oil flows were managed by a few major oil companies operating essentially on a bilateral basis. However, by the 1980s the oil markets had changed and the number of players in creased enormously as indeed did spot trade in the wet barrel market and paper transactions in the futures markets. At the same time, the threat began to be seen as a pricing rather than a volume problem because the new oil markets meant that supply and demand imbalances quickly translated into a price response, often over or under shooting. This rather invalidated the original command and control reaction which was embodied in the IEP to respond to a supply disruption by simply replacing volume.

In this new context in 1984, Coordinated Emergency Response Measures (CERM) were created which effectively converted the response mechanisms into a

> *"consultation process rather than a set of guidelines" (Emerson, 2006, page 3377).*

This change reflected the clear fact that there was no agreement amongst Member Countries over how collectively to deploy the reserves and maximize their role in a global market. Unlike IEP, the CERM trigger had no clearly defined trigger[17]. The stock level was also retained at a minimum of 90 days. In practise, the actual stock levels held by IEA members exceed this and in 2005, the IEA collectively held 118 days of the previous year's net imports and when stocks held by net exporting members are counted the figure rose to 152 days (Emerson, 2006). However this represents the average and the numbers of each country vary considerably.

Subsequently, CERM contingency plans were created four times. In 1991, in anticipation of the military action to liberate Kuwait a stock release was announced. In 2005, CERM released stocks in the aftermath of Hurricanes Katrina and Rita although again the release of 20 million barrels did little that was not achieved by increasing product imports and the US government relaxing the obligations under the 1990 Clean air Act (Victor & Eskreis-Winkler, 2008). On two other occasions – in anticipation of the Y2K computer problem and the imminent invasion of Iraq in 2003 - CERM contingency plans were drawn up but they were not implemented.

[16] In this context it is important to remember that the whole system was created by the US who had been the prime target of the Arab Oil Embargo in 1973. It was clearly designed with that eventuality in mind.

[17] It is worth emphasising –see section 10 – that CERM did not replaces the IEP. Rather it was seen as a supplement to allow greater flexibility in the absence of a full scale global supply disruption.

The Strategic Petroleum Reserve This was created by US President Gerald Ford in December 1975 and began filling in July 1977.

The Energy Policy and Conservation Act (EPCA) of 1975 gave the President broad discretion to withdraw oil from the reserve in the event of a "severe energy supply interruption" which included one that "may cause major adverse impact on the national safety or the national economy". This has been interpreted to include an oil price spike. In the event of a major interruption, the administration would authorise an early draw down "in coordination with IEA allies". Oil drawn from the reserve would be auctioned on a commercial basis to the highest bidders. There is also the option to release the SPR on an exchange basis whereby companies promise to replace the oil at some future date. There are three categories of drawdown available to the President - Full Drawdown; Limited Drawdown (up to 30 million barrels); and Test Sales (up to 5 Million barrels).

Use of the SPR has been extremely erratic. At the time of the Iranian Revolution it was not used, allegedly because there was no pumping capacity to recover the stocks. In general Republican Administrations have been reluctant to use the stocks in response to high oil prices. The only release under a Republican Administration was in 2005 at the time of the Hurricanes but this was actually under the auspices of an IEA CERM release. By contrast President Clinton was more willing to use the SPR when faced with higher prices and between 1992 and 2000 there were several releases of which at least two were intended to try and reduce prices, most notoriously just before the Presidential Election of 2000. The release was intended to ease higher heating oil prices in the North East USA as a result of severe weather. However, while it did lower the New York Harbour heating oil prices this led to a narrowing of the spread between those prices and heating oil prices in Rotterdam and so inhibited greater European imports to relieves the shortages. Also the spread between New York and the US Gulf Coast did not widen enough to invoke Jones Act tankers to move crude into New York (Emerson, 2006). Thus the release actually worsened the shortage of heating oil since physical volumes did not respond to the changes in price. The cynics might argue that since the SPR release was designed only to allow the politicians to be “seen to be doing something” then it did actually achieve its objectives. Also in 1996, in order to raise revenue to reduce the Federal Budget deficit, stocks were also sold off. During the Clinton Presidency a heating oil reserve was created to try and mute prices in the North East USA during severe winters.

In 2002, the Bush Administration began filling the SPR to reach a target of 700 million barrels. The process continued despite the increasing oil prices. In President Bush’s January 2007 State of the Union Address, he called for the capacity to be increased to 1.5 billion in the “near future” (by mid 2008 it was 728 million barrels).

The EU

In 1968, the European Economic Community’s six members agreed (68/414/EEC) to maintain a minimum level of stocks of crude and products amounting to 65 days of domestic consumption. In 1972, this was increased to 90 days (72/425/EEC). This stock holding system was strengthened and clarified in 1998 (98/93/EC). It was also allowed for members to hold stocks on behalf of others.

There had been an attempt in 2002 to adopt a proposal to overhaul the EU’s energy security policies. This had several specific suggestions. To increase strategic reserves from 90 to 120 days and at the same time to give central control of them to the European Commission. To segregate a larger proportion of stocks from those held by private companies. To develop specific intervention criteria to allow stock release which would also include price triggers.

In reality, member government were simply not prepared to cede control over their strategic oil stocks and the result was that there was "little chance of this happening" (Emerson, 2006 page 3382) as indeed proved the case and the proposal was dropped.

In 2006 after much negotiation, 98/93/EC was superseded by 2006/67/EC which laid out more or less the same terms, similar to the IEA although the EU stock requirements are expressed in terms of product – gasoline, middle distillates or fuel oil or their equivalent in crude before refining. The IEA requirement does not specify the form of stocks. A key change in 2006/67/EC was that members could no longer make a withdrawal from stocks which would reduce their coverage below the minimum before a "consultation" between member states except in a "particularly urgent situation" although what this might be was left undefined.

In March 2007 the issue again came back onto the agenda and the European Council underlined the need to enhance energy security of supply for EU and members states by developing a more effective crisis response mechanism and argued that an analysis of the current system revealed flaws and a tendency among some members to free ride, an issue developed below.

Others

In recent years, others consuming countries outside of the EU or IEA context have been developing strategic stockpiles although data are sparse. China has begun to develop a strategic stocks reserve aimed at protecting refiners from volatile global crude prices. While it has certainly been building the capacity it is not at all clear that in the period of high oil prices they have actually been filling it. It seems likely that India has also been pursuing such a route. At the start of 2004 they announced the creation of a strategic reserve amounting to 15 days consumption with the ultimate target being 45 days.

In 2003, the Asia-Pacific Economic Cooperation Organization (APEC) endorsed its Energy Security Initiative (ESI) which encouraged members to develop emergency preparedness plans which might include strategic stocks although this was left as a voluntary option. The "ASEAN plus Three" grouping has also been discussion the option of strategic oil stocks.

4. IS THERE ROOM FOR IMPROVEMENT?

The first point to make is that strategic oil stock systems around the world have never been tested in anything approximating to a real emergency. The only times such emergencies have occurred was been the consequent shortages following the Iranian Revolution and the immediate aftermath of the Iraqi invasion of Kuwait. On both occasions the system was not invoked.

However, there is a sense that in general the usage and management of oil stocks has been poorly handled.

"In practise, however, strategic stocks can only boost energy security when they are handled properly. And on that front the track record of most states with large holdings is discouraging." (Victor & Eskreis-Winkler, 2008 page 1)[18]

Arguably this unfortunate since the very large stocks which have been accumulated in the OECD either under the IEA or the EU system –

"Deserve a credible deployment policy"(Emerson, 2006 page 3383)

To date this has been conspicuously absent. Two issues are paramount – whether release should be rule based or discretionary and the relationship of IEA/EU stocks to OPEC.

In most cases, the basis for a stock holding strategy is far from clear –

"Most countries have opaque and unreliable procedures governing when their governments can fill the stocks and when they can release oil." (Victor & Eskreis-Winkler, 2008 page 1)

The argument for a rule base system is that it avoids the accusation of the strategic reserves being "politicized" and used for narrow political interests rather than the greater good. However, the problem with any rule based system as that it lacks flexibility to adjust to specific circumstances. One obvious solution which has been called for (Victor & Eskreis-Winkler, 2008) is the creation of an "independent reserve board" drawn from experts who will then make the decisions although this could still be done within a range of rule based options[19]. While this clearly makes sense at a national level, for example for the SPR, at a regional level it may prove more problematic since governments tend to see such strategic oil reserves as a key national interest. This clearly underlies the reluctance of the EU members to delegate responsibility for oil reserves to the Commission following the 2002 proposals.

It is tempting to leave security of supply issues to the market and there is a general view within the oil industry itself that:-

"Energy security comes above all from well-functioning markets" (Victor & Eskreis-Winkler, 2008 page7)

This view was strongly reinforced by the loss of Iraq and Kuwait in 1990. The "doomsday scenario"[20] was a major disruption to supplies coming out of the Straits of Hormuz. However, this was perceived to be managed perfectly well by leaving it to the market. This led to considerable complacency over oil security issues.

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[18] A key source of criticism was that stocks should be bought while prices are low and released while they are high whereas for the SPR since 2000 the opposite has been the case.

[19] A similar argument has been applied to the operation of monetary policy.

[20] In scenario building methodology, the "doomsday scenario" is the event with a low probability of occurrence but a very major impact if it does happen.

However, such complacency misses two key points. The first is the public good/market failure dimensions of oil stocks which will be developed in detail in Section 8 below. The other is the fact that previous disruptions occurred at a time when there was considerable spare capacity to produce crude within OPEC, notably in Saudi Arabia and the UAE which could be brought to market very quickly. OPEC spare capacity is an important part of the stocks story.

It has also been suggested (Emerson, 2006) that the nature of the stock release and possibly the criteria used for the release could be linked into the estimated spare capacity within OPEC based upon a specific numerical rule. It has also been suggested (Stevens, 2008) that a deal between the IEA/EU and OPEC is needed such that OPEC will develop and maintain a degree of spare capacity and if there is an outage, OPEC's spare capacity will be given first option to fill the gap. Informally is has been suggested this is already the case. At the time of the Venezuelan oil workers strike at the end of 2002 and the impending attack on Iraq, the IEA indicated that OPEC's spare capacity

> *"…would officially be the first line of defence in an emergency"* (Emerson, 2006 page 3382

A final important question on improving stock holding policies relates to holding crude rather than products. For example, Iraq's invasion of Kuwait caused few problems in terms of the availability of basic crude, but the loss of Kuwait's refinery capacity with its specialised configurations caused a major shortage of middle distillates. Of particular concern is that often the global spare capacity to produce crude oil is heavy sour crude which given the current shortages of upgrading capacity is a serious problem. While it may seem obvious to solve the problem by holding stocks of oil products rather than crude this neglects the fact that oil products have a definite shelf life and, unlike crude oil, would need to experience a regular turnover which might complicate the stock holding. Although the EU system encourages stock holding of products, it is allowed to hold the equivalent in crude. Thus the EU system does not really address the refinery constraint problem.

5. WHAT ARE THE PROS AND CONS OF DIFFERENT STOCKHOLDING SYSTEMS?

GOVERNMENT VERSUS PRIVATE

Oil stocks can be held privately and/or by governments. Private stocks are defined as those held voluntarily for commercial reasons. However, since the IEA's Treaty requirements, many stocks are held in private hands on behalf of the government as a result of a requirement imposed by government regulation. Such stocks are effectively excluded from a discussion of private stocks since they are (de jure) government held stocks although in many cases they are effectively also needed for operational purposes (see below). As such they are not strictly emergency stockpiles since they could not be used without compromising the effectiveness of industry operations.

Privately held stocks

Voluntary private oil stocks are held for two commercial reasons. First, oil operations require a certain minimum level of stocks to fill the pipes and the tanks. This is for technical reasons to allow pipelines to operate effectively, distillation processes to refine, tankers to load efficiently etc. However, such stocks are also required for economic reasons. Because of the very high capital intensity of all stages of oil operations, full capacity operation of capital equipment is crucial to profitability. Operating equipment below capacity spreads these very high fixed costs over a lower throughput. This raises average fixed costs exponentially and seriously damages profitability. Thus security of supply in the various stages of the industry is crucial. One way of ensuring this continuous reliable supply is to feed the equipment from storage rather than from direct flow. Thus most refineries and loading terminals have considerable storage capacity[21].

What the "correct" level for operational stocks should be is much debated. Prior to the first oil shock of 1973, virtually all stocks held privately were for such operational reasons. Real prices were falling which would discourage stockholding for speculative purposes (see below) since a falling price trend implies negative profit from holding stocks. Thus private stock levels before 1973 could be taken as indicative of what the industry regarded as necessary for operational purposes. In the United States which is a reasonable benchmark, the industry held declining relative levels as the industry got better at managing its logistics in part as a result of the growing use of linear programming and computing in the industry (Bamberg, 2000 Chapter 13). In 1960, the US industry held the equivalent of 80 days of domestic consumption; in 1965 the figure was 72 days and in 1970 66 days[22] (Horwich & Weimer, 1987). Today, in part in response to financial pressure to reduce working capital (see below) such operational levels would be regarded as extremely high and much lower numbers would be the norm.

There is a further observation relevant to stock holding today. In the 1960s and 1970s the international oil business was dominated by a small number of major IOCs[23]. These companies were all "operationally vertically integrated"[24].

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[21] This is why most export pipelines are much less vulnerable to interruption by military action than is generally understood. This is because the pipeline does not feed directly into the export tankers (VLCCs and ULCCs) but into storage. The tankers are then loaded from this storage. So unless the authorities cannot get access to the pipeline to effect repairs terrorist would find it very difficult to halt the export flow (Stevens, 2000)

[22] In fact this still represented an increase in the total number of barrels held – 830 million barrels in 1965 and 971 in 1970.

[23] These were usually called the Seven Sisters". They were Exxon, Mobil, Chevron, Gulf, Texaco, Shell and BP. Often CFP was added to make what became known as the "majors".

[24] For a more detailed discussion of what this actually meant see Stevens, 2003.

Thus it was their own equity crude oil which was transported in their own chartered tankers to be processed in their own refineries and the products distributed via their own marketing and distribution networks[25]. Thus despite this physical chain with no paper contracts, oil companies still felt it made sense to maintain real physical stocks. This is important when the issue of physical stocks versus "tickets" is discussed below.

The second commercial motive for holding private oil stocks would be for speculative gain. This would require buying oil cheaply now to store, selling it at higher prices in the future. This makes sense if the difference between the expected future price and the current price covers the transactions costs of buying the oil plus the storage costs. However, holding stocks by private companies for speculative motives carries several risks. The most obvious is that the future price falls, leaving the stock holder facing a lower value to the stock assets. A variation is if price fails to rise leaving the stock holder to cover the costs of stock holding. Another major risk is that in the event of a disruption and higher oil prices, governments introduce price regulation to prevent the stock holder taking advantage of the higher prices by "profiteering" and hence benefiting from their "foresight" in holding stocks. A variation on this theme is not actual price regulation but "moral pressure" from consumers and governments. This results in damage to the corporate reputation if companies are seen to be "profiteering" from supply disruptions. This has been a relatively common reaction in the OECD and over the last 20 years has been a major inhibitor to private stock holding[26].

There are several important questions with respect to private stock holding. Since the oil price collapse of 1986, the industry has had a growing struggle to increase shareholder value by reducing working capital. Holding oil stocks is an important element of working capital for companies. In recent years, there has been a growing tendency to reduce operational stock levels and move closer to a "just-in-time" system of inventory management. Thus the trend of private oil stocks has been for them to be progressively lower although it is far from clear how far lower stocks (compared to history) can be attributed precisely to this trend.

Another question concerns the impact of the development of futures markets for oil and oil products. In theory, both operational and speculative motives can be met by buying paper barrels rather than buying wet barrels and storing them, providing the paper barrel requires physical delivery. For operational purposes it makes absolute sense to buy paper barrels rather than wet for "storage" if the futures market is in backwardation. When the prompt price is higher than the futures price it makes no sense to secure a barrel for use in three months by paying a high price today and paying to store it when the barrel can be bought at a lower price than today with the only storage involving a piece of paper[27]. Even if the market is in contango i.e. the future price is above the prompt price, the difference between the prompt and future price may be large enough to offset the cost of storage encouraging paper barrels to be purchased for "stocks". The rise of paper markets for oil in the last 10 years is another major explanation of why privately held oil stocks are generally, allowing for regulation, much lower than they used to be given that "backwardation tends to be viewed as the normal state of nature in paper commodity markets. The paper markets also discourage holding physical stocks for speculative purposes. It is much cheaper to hold a piece of paper rather than a barrel of oil.

[25] Of course the relative capacities were in many case unbalanced. Some companies such as BP were "crude long" and had access to more equity oil than refineries. Some such as Shell were "crude short" and had more refinery capacity than equity crude.

[26] As will be developed below, the rise of the future markets has also complicated the issues of oil stocks held by private companies

[27] This of course neglects an issue to be developed below that if you put a piece of paper promising delivery of oil into a car tank, it will not get very far!

Government held stocks

Governments hold oil stocks for a number of reasons[28]. There is the requirement for strategic stocks to run the military and emergency services already alluded to. Governments might also hold stocks to limit the economic damage arising from physical shortage of oil into the economic system. These economic costs are effectively the "outage costs" if the economic system is forced to operate below capacity because of a physical shortage of oil products.

More formally is the IEA (or indeed EU) member countries Treaty requirement to hold stocks – minimum 90 days consumption - to meet their legal obligations under the Emergency Sharing scheme of the IEA.

There may also be political motives for holding stocks. These might range from political or foreign policy considerations to fulfilling some sort of "leadership role". For example, such considerations are central to Saudi Arabia's stock holding policy, much of which involves overseas storage or slow steaming to provide an instant mechanism to supply markets to mute price rises without the usual lag imposed by travel time[29].

Governments might also be tempted to hold stocks in an attempt to stabilize oil prices. Price spikes also carry a cost to the economy in terms of their macro-economic impact on GDP, balance of payments etc. However, using stocks to stabilize oil prices is controversial since it involves government intervention in the market place which many would regard as dangerous and undesirable. As already outlined, in the aftermath of Iraq's invasion of Kuwait in 1990, the IEA attracted a huge amount of criticism for not using the stocks to try and mute what was seen as a very short term mini-price spike. In both Japan and South Korea the government has in the past swapped strategic reserves with commercial oil companies to try and insulate companies from short term price spikes (Emerson, 2006) [30]. In general, attempts by governments to control commodity prices have proved to be largely ineffective[31] and oil appears to be no exception to this rule[32].

[28] APEC, 2004 lists six advantages to government held oil stocks. However, it noticeably fails to discuss the disadvantages arising from politicization which will be discussed below.

[29] A central part of this policy is the decision since 1985 to carry a significant amount of excess capacity to produce crude oil. An issue discussed later.

[30] South Korea also had an oil stabilization fund which was used to protect the government administered crude price from extremes of volatility. Thus when crude prices were low the fund was filled, when high depleted and the administered price held constant.

[31] For a comprehensive examination of the costs and benefits of various commodity stabilization schemes (which have a very long history) see Greenaway & Morgan (1999), especially Part III.

[32] This is a view strongly reinforced by Kilian, 2008 in the context of EU stock control.

6. PHYSICAL STOCKS VERSUS "TICKETS"

The EU system allows a country to hold stocks on another member's territory provided a bilateral intergovernmental agreement exists. For example, in 2007, Denmark, Ireland and Sweden all held some of their stocks in the UK under a series of bilateral deals. Across the EU there are 40 such agreements in place with 10 under discussion (EC, 2008).

It is also estimated that around 11 percent of emergency stocks are held through "ticket" arrangements where by the stocks are owned and physically stored by another country (EC, 2008). These tickets entitle the holder to buy the stock in a crisis situation at the price stated in the agreement. Such agreements tend to be done on a three month basis. The advantage is that it removes the cost of storage from the ticket holder although this would be implicit in the agreed price. It also helps to get round the problem mentioned earlier that oil products have only a limited shelf life so "ticketing" allows a regular turnover of the product. However, the obvious problem is that with the best will in the world, a "ticket" as a piece of paper will not power a vehicle or an aircraft. In other words such a system is vulnerable to the view which has wide currency in the context of the IEA's schemes that in the event of a major global emergency affecting oil supplies, it is unlikely that agreements will be kept in a context of a scramble for oil supplies (Horwich & Weimer, 1987). This also appears to be the view of some in the Commission. Thus "… there is practically no experience with these of "tickets" in a supply disruption. Critics may assume that, depending on the specific supply disruption, it will be very difficult or even impossible to purchase the reserved oil" (EC, 2008 page 13).

7. NEED TO REFINE, CLARIFY AND HARMONIZE THE RULES

The EU system of stockholding has huge variations in the way in which the relevant Directives have been transposed by individual countries. Some have created government owned stocks, others have created government supervised agencies to hold the stocks, some delegate the responsibility entirely to private companies and some have a mixed system of government and privately held stocks (EC, 2008). Thus management and ownership of the stocks are often separate. The balance between crude and products also varies with the share of products in total stocks ranging from 20 to 100 percent (Ibid.).

In terms of rules for release, the IEA's IEP has a clear trigger of 7 percent reduction but the CERM system has no defined trigger and there have been a number of occasions when the IEA has taken informal actions rather than invoking explicit measures (Emerson, 2006). The decision process in the IEA is also quite clear. There is Standing Group on Emergency Questions (SEQ)[33] which is assisted by an Industry Advisory Board. SEQ makes recommendations to the IEA's Governing Board[34] which then decides on action. By contrast, the EU has no clear rules for release nor indeed is there any clear decision process at an EU level. In effect the decision remains with national governments and in the event of an emergency, the Commission's role via its Oil Supply Group is

"*confined to consultation*" (EC, 2008 page 11).

There is inevitably the problem that having rules and invoking them is trying to "buck the market". This returns to the issue of a "rules versus discretion" based stock system. However, "making the stocks available" is not the same thing as necessarily interfering with a market process. Although the authorities may indicate that stocks are available, it is up to the market whether or not this offer is taken up. For example, in 1991, of the IEA's release only around half came to market (Emerson). A similar story of refiners not taking up the option of greater supply can be told for the stock release after Hurricanes Rita and Katrina (Victor & Eskreis-Winkler, 2008).

On balance it is difficult to argue the case for clear cut rules of operation of the strategic oil stocks. By the nature of any major supply disruption conditions will vary depending upon the magnitude and the nature of the disruption. Creating "rules" for all eventualities becomes pointless[35]. Rather it requires judgement and an ability to be flexible. This is precisely why practical experience persuaded to IEA to move away from the IEP system (although technically it is still in place) and instead adopt CERM which allows flexibility. As indicated earlier, this was also an acknowledgment that Member Countries of the IEA could not agree on the basis for any stock release. The only obvious point is that the decision making should be insulated from the dangers of politicization. This implies that control of the stocks should be vested in some sort of independent but expert body which arguably is what SEQ actually is since it would be difficult for the Governing Board to go against clear advice from the SEQ.

[33] This group has an EU representative as an observer.

[34] This consists of the energy ministers of the member countries and their advisers

[35] In economics methodology there is something called "The Law of Parsimonious Explanation". This simply requires that any economic "law" should be simple. If there are too many qualifications and exceptions then the "law" becomes inoperable. A similar concept needs to be applied to rules in this context.

8. RELEASE COORDINATION ARGUMENTS FOR AND AGAINST A COORDINATED RELEASE

To understand the optimal size of a strategic oil reserves and the issue of whether a stock release is better coordinated or left to individual governments it is necessary understand the "public good" dimension of oil stocks[36].

In the context of an oil price spike as a result of physical shortage, the release of stocks will mute the higher price. Obviously the impact on price will be a function of the magnitude of the stock release in relation to the loss of supply driving the price spike. However, it is also a function of the impact of stock release on market perceptions[37]. Thus it is quite plausible for a small stock release to have a very disproportionate impact on prices.

However, while a stock release will mute prices nationally, they will also mute prices internationally since the international oil market is fungible. Thus the benefit of the stock release from lower prices extends beyond national boundaries. Everyone benefits from the lower price and no one can be excluded from that benefit – hence the public good dimension. This considerably complicates the analysis when considering the role of stocks.

Holding stocks costs, not least in investing in the required infrastructure. Thus governments spend "hundreds of millions of dollars per year maintaining them" (Emerson, 2006 page 3377). More specifically, in the US it has been estimated that the SPR held in salt caverns, requires an investment cost in infrastructure of some $6 per barrel. Also there is evidence that the expected individual direct benefits for most countries are less than the costs those economies would bear if they developed an oil stockpile on their own. Indeed, a study by Leiby et al, 2002 concluded that apart from the United States, in no case would the expected economic benefits from stockpiling justify any unilateral expansion of such stocks. Thus –

> *"… the cost of building, filling and operating expanded reserves, in most circumstances, far exceeds the benefits to the individual countries. …. Only through cost sharing arrangements with other countries can any one country other than the US, expect to come out ahead, since measured economic benefits are largely proportional to the GNP of the owning group, while costs of developing and managing a reserve are largely independent of ownership." (Leiby et al., 2002 page 8)*[38]

There is another consequence to cooperation. Thus

> *"… When sufficiently large regions or groups of economies coordinate their efforts, and recognize joint benefits, the jointly optimal reserve is often substantially larger than the sum of the individually optimal reserves." (Leiby et. al., 2002 page 9).*

[36] In economics, a public good has two characteristics. Consumption is non-rival and it is not possible to exclude consumers from enjoying the good. The former characteristic means the marginal cots of supply is zero. The second characteristic means consumers do not have to express any preference for price. As a result there can be neither a supply nor a demand curve. Thus allocation by any market mechanism –which requires price determined by supply and demand - is impossible.

[37] Given the relationship between wet and paper barrel markets discussed earlier, this is a crucial issue.

[38] It should be stressed that the only "benefit" being measured in the study is what happens to GDP and imports. Also the outcome is the result of the way in which the economic model measuring relations between oil prices and macro-economic variables is configured and estimated.

The logic is simple. For an individual country, if the cost of an individual stock programme exceeds the individual benefits, little or no stocks would be held. However, collectively paying for the same level of reserve reduces the costs for each country but does not reduce the benefit. Thus higher levels of collective stocks can be justified. Arguably, this is an important lesson for the EU.

However, all this analysis neglects the problem of free-riding. If one country decided not to contribute, it would still gain the benefit. Thus there is no reason why that country should pay for a benefit which it will get anyway. Of course they may wish to hold stocks to avoid the consequence of some form of sanctions or military blockade. In these circumstances a country's willingness and ability to buy oil, even at high prices, will not help.

There is yet a further dimension arising from this public good aspect of oil stocks. The theory argues there is little need to coordinate any stock release. The logic is as follows. If there is a crisis, once the disruption occurs, it is argued that the benefit is for individual stock holders to release stocks because it is assumed the probability is that once one disruption has occurred, another disruption in the near future is less likely. Thus economic self interest will encourage a general stock release with wider benefits in terms of lower prices without the need for formal coordination.

> *"Conditional on the occurrence of a significant disruption, the hedging benefits of holding oil in the reserve are modest compared to the own-country benefits of drawing down the reserves." (Leiby et. al., 2002 page 2).*

This is a positive outcome since the public good dimension outlined above means that multilateral stock release is more effective than unilateral stock release and that self interest would promote a multilateral release. This is the attraction mentioned earlier in Section 4 of bringing OPEC into CERM to formally act as a first line of defence. Equally other major consumers (such as Brazil, China and India) and producers (such as Russia) should also be incorporated into the system.

However, there is a serious flaw in this logic regarding a coordinated release driven by self interest which has two dimensions. First it assumes that disruptions can be modelled on a probabilistic basis but arguably crises have no memory[39]. Thus it is not obvious why the occurrence of a crisis inducing a shortage should reduce the probability of another immediate crisis. Indeed the exact opposite case can be made in the context of an interlocking region such as the Middle East. Put simply, free riding could seriously undermine a coordinated release effort. Few observers believe that if there were a major supply crisis which looked like removing substantial oil supplies for a long period, the IEA Emergency Sharing System would survive (Horwich & Weiner, 1987).

Another reason to doubt an automatic coordinated stock release is that there is a logic within government that sees oil stocks as strategic to be used only in the event of an "emergency". The danger is that an emergency occurs, but a view is taken that the stocks should be held in case there is a "real emergency". Thus they never get used as the government awaits ever further disruptions.

Finally, a key question is whether privately held stocks – operational and speculative- will be at an optimum level in terms of national interest or whether there exist elements of market failure? As indicated, the buying and releasing of stocks will obviously affect current prices in the national and international market place.

[39] This is similar to the argument that cards or a roulette wheel or tossing a coin have no memory. Probability argues that tossing an unbiased coin 100 times should provide 50 heads and 50 tails. However, once the coin comes down heads, it does not remember that, and the next time, the odds remain even. Thus 100 tosses could produce 100 heads or 100 tales.

The argument is that such price effects are rightly ignored by private stock holders. This will understate the social costs and benefits of storage to oil importing countries. Thus storage could be too high since its costs are understated or too low if the benefits are understated. It is this failure to take account of the externalities of stock building and release which creates an argument for government intervention. A variant on this theme arises because as discussed earlier, there are strong elements of a "public good" about stock releases in a crisis. Releasing stocks by an individual at a time of crisis will help mitigate the consequent price rise and these benefits are shared in a non-rivalrous way by all oil importers. Private behaviour and motivations would fail to take account of such benefits[40].

[40] Arguably in a crisis a private stock holder would hold back stocks in the expectation (hope) that things will get worse and prices go even higher thereby increasing their speculative profit.

9. HOW TO IMPROVE THE EFFECTIVENESS OF RULES

An important if rather obvious dimension of the effectiveness of the rules is that they be followed by member countries. This of itself is a problem. Thus

> *"One of the problems of the current system is that not all Member States may be implementing all the provisions of the existing legislation as required" (EC, 2008 page 12)*

Furthermore it appears to be impossible to determine whether this is as a result of them simply ignoring the rules or the result of their interpretation of subsidiarity. A particular issue is whether countries are actually holding the minimum required level of stocks. There are serious data problems. This has two dimensions. First the data reporting is

> "*infrequent and has long reporting lags"* (EC, 2008 page 17).

At the same time there are serious doubts as to how much of the "reported" stocks are actually available for use in an emergency and how many would be required for operational purposes for the system and therefore not available for consumption, a point examined in Section 5.

A further problem is that "effectiveness" can only be judged in the light of experience when systems are used either for real or even if only in simulations. This has not happened at an EU level whereas the IEA has on many occasions carried out simulations with the help of the Industry Advisory Committee. In 2004, the IEA carried out an Emergency Response Exercise which for the first time included participation by China, India, ASEAN, Brazil and the new EU member countries.

There are a number of other issues relating to effectiveness although for reasons developed below in Section 10 these are aimed largely at the IEA.

There is the question of the actual size of the stocks held. The level of 90 days appears to have become the accepted norm. However, careful analysis of the literature suggests that this number has simply been plucked out of the air with no analytical basis (Emerson, 2006). It would therefore be of value carefully to analyse what optimal levels of stocks might be.

There is also the issue of credibility. If it is accepted that a major consequence of any supply disruption relates to the price reactions, then these will be in large part initially determined by how far the stock response is seen to be credible and coherent. Quite obviously any indecisiveness or lack of clarity in action could well unnecessarily aggravate the price reasons with negative consequences.

10. CONFORMITY WITH IEA RULES - HOW TO CLARIFY RESPECTIVE ROLES?

The EU and IEA strategic stock systems are very different. They are independent of each other and use different methodologies when identifying what the obligations with respect to stock levels and content should be. However, in effect the IEA official stocks and the EU official stocks cover both systems although some products are in one system and not in another[41]. The administrative burden of this fact is significant and

> *"Member States sometimes complain about the administrative burden of complying with these two distinct obligations" (EC, 2008 page 15)*

This inevitably raises the question as to why the two systems should struggle together side by side. This is reinforced if there are plans to tighten the EU requirements not least in terms of Member State compliance with the existing rules, let alone any new rules which may emerge.

Two arguments are put forward (European Commission, 2008) as to why the EU should retain its own system alongside that of the IEA. The first is that a number of members of the EU are not members of the IEA. The second is that there could be local small scale disruptions in the EU which would fall outside the remit of the IEA's scheme. Neither argument is compelling.

It is true that eight members of the EU are not part of the IEA[42]. But the IEA is in the process of considering widening CERM coverage as indicated in Section 9. To be able to do this, membership of the IEA's CERM would require dropping the requirement to be a member of the OECD. This would make involvement in CERM much less burdensome administratively than full blown membership of the OECD. It is not clear why the administrative burden of joining a revised IEA's CERM system for what are (for the most part) relatively small countries would be any less than the current struggle to meet the EU requirements, especially if these are reinforced and indeed strengthened.

As for small scale disruptions falling short of securing an IEA response, there is no reason at all why this should be the case. It was precisely the need to allow for small scale local responses which led the IEA to develop the CERM system for emergency stock management. A recent classic example of this in action was the IEA stock release[43] associated with a highly localised impact from Hurricanes Rita and Katrina. If this can be done for the Gulf of Mexico there is no obvious reason why it could not be done for a -

> *"… disruption of supplies through an oil pipeline … [causing]… serious problems to the country concerned …[even if] … such a disruption had no significant effect of the global market …" (EC, 2008 page 7 brackets my additions)*

Section 8 explains at length the public good dimension of oil stocks and the general benefits of a coordinated series of decisions to share the costs of developing strategic oil stocks[44]. The wider that cooperation is and the more countries involved the better. It would seem therefore a better option to merge the EU emergency sharing mechanisms into an IEA CERM mechanism which itself needs to expand membership rather than trying to reform the EU system in isolation.

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[41] For example, LPG and bitumen can be included in the IEA's definition of stocks but not in the EU which allows only gasoline, middle distillates, fuel oil or crude oil.

[42] Bulgaria, Cyprus, Estonia, Latvia, Lithuania, Malta, Romania, Slovenia

[43] Effectively an SPR release

[44] As indicated the necessity of a general coordinated stock release is more controversial.

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An Assessment of the main features of the proposed Council Directive on Emergency Oil Stock Holding - COM(2008) 775 and a review of lessons learned in 35 years of international collaboration in oil crisis management

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EXECUTIVE SUMMARY

Since the 1973 oil embargo, countries of the International Energy Agency and members of the European Union have been co-operating in building a series of institutions and procedures to prepare for the next disruption in oil supplies. There have been multiple occasions to test these mechanisms that provide both a means to respond in markets with real oil and a reminder to markets that incremental oil is available is times of stress. There is a constant tension to turn to these strategic inventories when prices are high. Citizens ask why they should not benefit from the tax Euros they have invested in oil stocks. Policy makers protect against this pressure by limiting strategic stock use to physical supply disruptions. Really, what policymakers are doing is seeking to limit economic damage from supply disruptions that translate into price spikes that damage consumers. How policy makers structure the response mechanisms and procedures will determine whether markets are receptive to the comforting messages of governments, or whether the market discounts the credibility of those assurances and passes the risk on to consumers as higher prices.

The draft Commission Directive is a very good effort to put in place a viable, harmonious structure that will conform with IEA mechanisms. Carefully negotiated, it should do just that. This paper is intended to identify some of the strengths and weaknesses of the proposed Commission directive and to identify some of the key lessons drawn from 35 years of oil crisis management in the IEA. The author has participated in every IEA crisis management incident over those years and has seen a clear convergence of crisis management procedures with the expectations of the market. The Commission is in a good position to benefit from all those lessons as a point of departure.

This paper is divided into two major parts. Part 1 addresses the general tenor and major features of the current Commission draft that differentiate it from the status quo. Part 2 looks back over time at the experiences of oil crisis management, how it has changed, how and why it works and how it has to evolve in the future – and consider moving beyond oil.

1. AN ASSESSMENT OF COM(2008) 775 FINAL

Practitioners in the business of oil crisis management need only read the first page of the Commission draft document to see the reflection of years of collaboration between the world's two institutions best suited to deploying a coherent, effective response to oil supply disruptions – the International Energy Agency and the European Union. Together, those institutions' Members are responsible for 50% of world oil consumption and their potential outreach to engage other major consumers in oil crisis management co-operation, i.e. China, takes them well beyond that. The language on the first page of the draft identifies three key objectives:

- "…stressing *complementarity* with the crisis mechanism of the International Energy Agency (IEA)."
- "…guarantee that the stocks held for emergencies would be fully *available*."
- "Better *adaptation* of the internationally accepted rules of the IEA…"

The mere tone of the language of these undertakings is encouraging, but of course the details will not always be so easy. We will expand on these initial aspirations as a point of departure:

Complementarity

A constructive dialogue among the crisis management staffs of the Commission and the IEA has been ongoing for years. It comes of a common awareness that for a strategic stock program to be convincing to the market, the major players need to be in the game. That means Europe, Japan and the US at a minimum, but producer Canada and Pacific Basin consumers Australia, Korea and New Zealand provide important globality to the participation. For the Directive to promote seeking complementariy with the IEA reflects the Commission's desire to ensure the maximum impact of Europe's own strategic stocks in any collective decisions to deploy these stocks in times of supply disruptions.

Article 21 para 3 of [COM(2008) 775 final] establishes a mechanism for those EU Members also Member of the IEA to allow them to fulfill their international obligations under the International Energy Programme which established the IEA. Paragraph 5 appears to provide for a broader application of an IEA decision to the EU Members not yet Members of the IEA. That would be a welcome reinforcing message of solidarity. In fact, EU Members non member if the IEA but who were in the IEA accession process have voluntarily taken on commitments in IEA joint actions in the past. There are other aspects of Article 21 that will be raised at a later stage.

The most important principle to respect in improving the complementarity with the IEA is in preserving the rapidity and clarity of decision-making the IEA has been able to achieve in its Co-ordinated Emergency Response Mechanism. Markets trade in real time, hence any assurances of stock availability must be authoritatively announced as available in as close to the same time frame as the disruption or the market will react such that everything that follows takes place at higher economic cost. Article 21 para3 of the proposed Directive is a welcome acknowledgement of this principle.

Fully Available

Policy makers need to be precise about what this phrase means. It needs to be clear that *fully available* is best defined as "clearly additional strategic stocks commercially available to operators."

Over the years the words used to describe oil crisis intervention have evolved. At the beginning of the IEA, the emergency sharing system established national *rights and obligations*.

Calculating on a national-level base period of oil consumption and available supplies, each country would be obliged to make oil available to other IEA Members or be eligible to receive oil. Companies participating in the crisis management scheme would make voluntary offers to buy and sell within these rights or obligations. The system undertook to monitor the flows of crude to ensure an equitable distribution of the shortfall. Over time, crisis managers concluded that markets would do this anyway and governments should focus their attention on providing the additionality of strategic volumes of oil rather than seeking to rearrange and fine tune commerce.

Policy attention shifted to structuring the collective *releases* of oil to bridge the global supply gap with the understanding that it was impossible to address only that oil lost to IEA Members in recognition of the fact the global system could not be segmented. This was the beginning of the recognition of the principle that "a crisis anywhere is a crisis everywhere".

The experience in dealing with the devastation of hurricanes Katrina and Rita raised attention to the importance of the *availability* of incremental strategic barrels. It was found that systemic flexibilities in oil markets and broad economic adjustments were such that all lost oil volumes didn't need to be replaced. The market was reassured by the knowledge that the volumes were *available* if needed. In other words, IEA countries strategic stocks were not being pumped or force-fed into the market, they were being *made available*. There did not have to be a one to one correspondence between the oil supply disruption and the drawdown of strategic stocks for the collective action to have the desired stabilizing effect.

But the same experience led to other observations about *availability*.

When the holder of strategic stocks is a commercial operator with an integrated system – how does he perceive his interests? The national authority has authorized drawing stocks below the 90 day stock-holding obligation in order to respond to a supply disruption. But the value of the oil in the operators' tanks is likely to increase in value if it stays there in a tight market. Does the operator have an incentive to make that oil really *available* to the market?

Furthermore, the operator knows he will need to reconstitute his inventories to above 90 days sometime after the crisis, but he doesn't know when. Paragraph 6 of Article 21of the proposed Directive recognizes this tension and should go some way in relieving it. National administrations are aware of the disincentive the need to restock has to making strategic stocks available and they have no interest in forcing their companies to reconstitute strategic stocks in a high market. But that needs to be clear to operators who will otherwise hesitate to make the barrels truly available.

If the same holder of stocks is a wholesaler to other operators and refiners, how does he price the incremental barrels of strategic stocks to his customers? No one can expect him to take a loss. But at what point is the price he sets a disincentive to stock *availability* for his customers? Looking back at the experiences of the twin spinster hurricanes, company performance in making strategic stocks truly *available,* has shown room for improvement.

A final point on how National Agencies make available holdings of government owned stocks. The most effective mechanism here has proven to be the open bidding process used by some agencies where public tendering permits the market and the national authorities to judge the commercial availability of strategic barrels to operators. If the market doesn't believe the barrels are truly *commercially available*, it will reflect that judgment in higher prices.

Adaptation of internationally accepted rules

If this objective is read more broadly to imply both rules *and procedures* there are many challenges in finding the desired complementarity. This gets to the nature of national stock holding agencies, the nature of their holdings as real physical stocks in country, versus stocks elsewhere or even stocks held in the form of tickets. Everyone seeks the most cost effective or cost avoidance method possible in these matters because holding strategic stocks (that withstand the market test of commercially available) is not cheap. The consumer will ultimately bear all those costs, but do they reach the consumer via corporate costs or national level taxation? The Commission draft puts strong preference on nationally owned and operated stocks. That is the proper approach as the credibility of the IEA system hinges too much in a global context on US, Japanese and Korean government owned and controlled stocks. All other forms of strategic stocks are marginally less compelling to the market albeit their very existence, well-distributed across Europe contributes to quieting nervous markets.

An unofficial Commission staff working document assessing the proposed Directive, examines policy options 0, 1, 2 and 3 for implementation of Council Directive 739 of 2008. The third policy basically recognizes that no crisis encountered over the past decades has required a massive mobilization of strategic stocks over a long period. It doesn't mean that such scenarios are not out there with a positive probability, but it does address the need for a practicable approach to the problem. The amount of stocks held in a thirty day government owned and controlled national authority would provide ample credible volumes of clearly incremental oil and product for any foreseeable circumstance. Under unforeseeable circumstances, the 30 days provides time for the holders of the remaining 60 days to make preparations.

The next challenge Commission negotiators will face is the problem of definitions. Definitions of every single data base, each product, the moment when feedstock becomes fuel, what is a stock-holding ticket and be what definition is it a valid proxy for "commercially available" strategic stocks?

None of these discussions will be new as parties have long since identified where their interests are and how best to keep the cost burdens on someone else's balance sheet. These discussions will take time, but have to be kept from eroding the two most important principles of complementarity and real availability.

The IEA and Commission are already consulting on many of the definitional issues, especially as the EU shifts its focus to net imports – in the direction of IEA methodology.

Other noteworthy aspects of the proposed Commission Directive

Article 2 para (d) of the proposed Directive gives the Commission the authority to find a "major supply disruption" in terms of an event at Community or Member level. That is probably necessary flexibility, but it leaves a lot of ambiguity in deciding what can constitute a major supply disruption and may make some Members anxious. Presumably, to take a not-too-far-fetched example, some EU Member out at the end of the Southern Druzhba could experience a drop in supplies along that line that would constitute a "major supply disruption" for that Member. Not everybody else might see it that way, but if that pipeline is the biggest or only source of imported crude – it is certainly a major problem locally. The Commission needs to be able to respond to that Member. The question becomes whether the EU needs the full authority of a major disruption finding to deal with the problem, or whether a sub-regional relaxation on the need to hold 90 days would be sufficient.

The language would also appear to leave policy prerogative to the EU to declare and implement a full scale EU-wide strategic stock response absent the IEA. That may be politically desirable policy autonomy, but practically, a full scale stock mobilization without the other major global players would simply put the EU into the position of supplying the incremental barrel of crude to world markets as supplies that would otherwise have flowed to the EU get rerouted elsewhere.

Article 7 of the proposed Directive is possibly too complex. Recourse to policy option 3 might simplify substantially the need to define the national entity if the principle of "government-owned, government controlled commercially available incremental barrels" is respected.

Article 15 of the proposed Directive calls for weekly reporting on commercial stocks. This will be a very welcome development for oil markets. Stock levels worldwide are one of the most important determinants of the health of the oil market, yet data are sorely lacking. Only North America reports monthly (M-1) data. The International Energy Forum now houses an initiative – the Joint Oil Data Initiative (JODI) that OPEC and IEA developed with four other agencies. The JODI is collecting and perfecting a limited data set for M-1 oil date that is improving over time, but does not show good results on stocks.

Market sentiment is constantly buffeted by stock data from North America because there are no other data available. A weekly submission of European data would considerably complement the North American data and surely take some of the volatility out of oil markets. It is sufficient for two or three oil tankers to experience a delay in their entry into the US Customs Union, for US stocks to show a sudden 4-5 million barrel drop in a month. There have been times when such a drop would add many dollars to the NYMEX near month contract for WTI. More stock reporting from more places in the world will reduce market vulnerability to single source data.

The proposed Directive establishes a "co-ordinating group". To oversee implementation of this Directive, the Union will need such a group which needs to meet frequently enough to be fully operational should the need arise. There is little doubt that the people who will sit in this group will be the same individuals sent by their countries to sit on IEA emergency preparedness committees. This is ultimately desirable if complementarity is to be achieved, but the practicalities may prove tricky as the Commission seeks the views of these people to be informed as the IEA is convening the same people to emergency sessions to evaluate the market.

2. EXPERIENCES FROM INTERNATIONAL COLLABORATION ON OIL CRISIS MANAGEMENT

The Current Market Context

This assessment is being undertaken at a time when oil prices have fallen to around $40 per barrel from their July 2008 high of $147 per barrel. There are forecasts of collapsing demand worldwide and OPEC is encouraging Russia to join its efforts to restrain production. This assessment would be the same at either extreme in prices. It will no doubt be read in yet a different price context. Policy makers discussing strategic stocks must maintain a longer term perspective of the issues – stepping back from the day's headlines. Public pressure may build in the next year or two to diminish costly strategic stocks if OPEC producers' surplus capacity approaches 5 million barrels per day (mb/d) as currently forecast. The decision to build strategic stocks addresses a long term vulnerability of our economies which might one day be reduced. But for the foreseeable future, holding strategic stocks is good policy.

At the same time, because of the likely accumulation of "spare production capacity", major producers will be in a position to incrementally increase production on a fairly rapid basis – depending on how deeply they mothball their spare capacity. This surge ability has proven useful in the past, especially on the occasion of Iraq's invasion of Kuwait. Producers are generally predisposed to draw on their geologic stocks of crude rather than having consumers collectively tap into their strategic stocks.

This willingness on the part of producers is vulnerable to the nature of the short-fall. If the disruption is due to actions taken by consumers (or with the acquiescence of major producers for actions taken by a third party) that cause a break in supply from a major producer, producers may have their own reasons to withhold their geologic potential from the market. It doesn't take too much imagination to identify a plausible scenario.

In any case, the accumulation of surplus capacity over the next two (plus) years is likely to be only temporary. As economies return to a more normal growth path, energy demand will resume its growth path as well. It will likely be a shift in the demand schedule reflecting this period of reduced economic activity. Of concern during this interim is whether production and other energy infrastructure capacity are being added at a sufficient pace. This paper is not intended to explore that uncertainty, but needs to flag it as well worth watching.

About strategic stocks

It is not about whether there will be another crisis in energy markets. It is about not knowing when the next crisis will be or what form it will take. Just as no two disruptions are the same, mechanisms for dealing with oil disruptions cannot remain static.

Strategic stocks are nothing more than an insurance policy. The existence of strategic stocks beyond commercially required stocks reduces the risk of economic disruption should something go wrong in the market. Both IEA and the EU have multilateral arrangements for stock actions in times of crisis, but the IEA co-ordinates formally beyond Europe including major stock holders in the US, Japan and Korea. To date, communication between the IEA and EU has facilitated timely decision making in the IEA on the preparation of a coordinated stock release or of the actual release of stocks into the market.

The most recent stock release co-ordinated by the IEA was in response to the 2005 hurricanes Katrina and Rita that tore through US oil, gas and refining capacity in the Gulf of Mexico.

There, a price spike of $7.00 a barrel was reversed in a few days by an immediate decision by the IEA. If nothing else, the IEA action saved consumers $560 million per day.

In the course of 2008, rhetoric between Iran and a number of other countries was harsh. Some countries have talked of the need to strike Iran's nuclear capability and Iranian spokesmen have on occasion threatened to take Iranian oil off the market. Even if this is just rhetorical hyperbole, the IEA has been able to remind the market that government-held strategic stocks alone are sufficient to replace Iranian exports for nearly two years – probably longer than Iran would want to go without oil revenues. The market awareness of the existence of the stocks provides not only comfort to the market, it gives a greater degree of freedom for policy makers confronting threatening rhetoric. How much is a degree of policy freedom worth?

The existence of physical stocks considerably limits the temptation of consumers (or commercial operators) to hoard. Operators or speculators taking long positions in the market or consumers topping up the tanks of several hundred million vehicles can create shortages where there are none. Shortages have high welfare costs first and political costs later.

In the case of hurricanes Katrina and Rita, the greatest damage done to global systems was to refining capacity on the Gulf Coast. The amount of oil lost was not insurmountable and the US gas market managed to absorb a 12% loss of supply through the time honored effect of the price mechanism. The lost refinery product was however a tougher nut to crack. Yet the availability of 2 mb/d of oil and products from strategic storage around the world, provided time for refineries to realign crudes and reset product slates reflecting a remarkable flexibility to adjust to the Gulf Coast refinery losses. The availability of strategic stocks provided the time necessary for systems to readjust, for cargoes steaming for the US Gulf to be redirected to other refineries and markets.

The availability of strategic stocks also gives policy makers the necessary political space within which to propose and implement difficult demand-restraint measures. Consumers and voters do not want to hear about measures intended to change their patterns of living, but that is what demand restraint must ultimately do. For those countries relying first on such demand restraint measures, the political space provided by quickly mobilized strategic stocks is extremely valuable. For the more traditional interruptible contracts, more typical of gas and electricity, time is important to firming up procedures and alternatives to withstand the interruptions.

Who is involved?

Inviting more parties to the table is a good idea. Already the fact that IEA decision-making reaches around the world is quite compelling for markets. The 27 IEA countries acting at once represent over 50% of world consumption and EU Members who are not yet Members of the IEA are able to join the effort. Much has been said about the need to align EU crisis management and IEA crisis management. The two organizations have spent considerable time studying the differences in the two systems over the years. There are some significant, but not critical differences.

The Agency and EU Commission have been able in the past to collaborate in times of market stress and it has been common to see EU countries who are not members of the IEA join voluntarily IEA collective actions. The most important variable influencing the co-ordination of the Commission and the IEA is the quality of the dialogue between the senior managers of the two groups. There have been periods of tension.

Now is not one of them. But members of the two organizations should make it their business to facilitate close communications on crisis management issues between the two organizations, especially as other more difficult contingency planning issues, i.e. gas, come onto the agenda as it did recently in the Russia/Ukraine gas dispute.

One feature of the current strategic stock arrangements that often draws political fire is that not everyone is involved and there are free riders. This is certainly true, but may not be sufficient rationale to question the utility of the insurance. When collective oil crisis management was initiated in 1974 in the IEA, the vast majority of world oil consumption and production was in IEA countries or controlled by IEA-based companies. That has changed now on the consumption side and even more dramatically on the production side. IEA countries still consume over 50% of world oil, but IEA companies control a small fraction of world production capacity. The question now, as Asia and the Middle East are the fastest growing oil consumers in the world and IEA country consumption is literally in decline, is how to expand the scope of stock holders joining in a collective strategy.

IEA has been in dialogue with China, India and ASEAN members about strategic stocks for over a decade. Considerable progress has been made in explaining the rationale for strategic stocks and the criteria for their deployment. China and certain ASEAN countries have understood. Strategic stocks are for strategic circumstances and when mobilized collectively are more effective at calming markets than any national-level action could be. A country seeking to protect its own domestic market in times of market tension simply makes its strategic stocks a marginal source of global supply – with no benefits for the country's consumers. Getting beyond agreement on the principles of co-ordinated action to a political commitment to co-ordinate with the IEA may still take China and others quite some while. But the market is already taking note of the strategic stocks held outside IEA countries and of the dialogue.

Both China and India recognize the value of substantial stocks with China announcing the opening of its 5th strategic site consistent with its 11th five year plan. China's pace of construction of its strategic sites has been the envy of stockholding agencies around the world. Today – with prices dramatically down from the highs of mid 2008, China is taking the opportunity to fill its strategic reserve. This can only be good business if the futures curves for prices are right that prices will recover towards the middle or end of 2009. India has moved more slowly in identifying sites and the "special vehicle"" to fund their construction and fill. The events in Mumbai in November seem to corroborate the opinions of those who expressed concern about strategic sites on India's northwest coast – close enough to Pakistan's shores to represent a security threat.

The next big increment to collective crisis management will be China at a time that fits with China's political evolution. For now, the greatest threat of China's increasing vulnerability to sea-borne oil is the lack of a blue water navy combined with continuing uncertainty about the ultimate resolution of the status of Taiwan. There are probably many other issues that concern China including the notion of yielding a degree of sovereign control over its strategic stocks to international decision-making, but ultimately, until Taiwanese status is resolved, China will not become a formal part of any collective crisis management arrangement.

What can be aspired to is close c-ordination between the IEA and China during times of market stress. Over the past years, IEA has consulted with China during periods of oil market disruption and kept Chinese officials apprised of IEA market analyses, options for action and decision points. A reasonable objective is for China to choose to voluntarily co-ordinate the proportionate release of its strategic stocks with a collective release by the IEA. That maximizes Chinese and IEA impact on oil market confidence, but does not require the Chinese to commit to the IEA, nor the IEA to wait for China.

Any such collaboration with India will necessarily await India's accumulation of strategic stocks. But in the meantime, the remaining Indian policy makers who still believe that Indian strategic stocks can be mobilized to insulate India from a market disruption, will need to re-examine the merits of their stance. India acting on its own would merely serve as an incremental source of oil to world systems.

There are other countries interested in the concept of strategic stocks. Years of dialogue with ASEAN countries have stimulated interest in building strategic stocks in Thailand and newly oil-importing Indonesia. Further afield, Chile, on the accession path for OECD is in dialogue with IEA about possible collaboration on security systems given its unfortunate experiences with regional suppliers – in particular of gas.

The more countries there are participating in collective oil crisis management, the more convinced the market will be that sufficient supplies are available without a higher price signal. This would be a clear win for consumers.

Engaging the Producers

Producers are essential players in oil crisis management. Earlier in the paper, was the warning that the conditions of a disruption might chill producers willingness to co-operate out of their sense of solidarity with some aggrieved party – an OPEC member or other producing state. But over the years, most producers have recognized enough self-interest in managing global oil market crises that politics are left out to the extent they can be. In any crisis, major producers and the OPEC Secretariat should be consulted for their take on the disruption and the ability of the market to deal with it. There has often been considerable excess capacity in the market which is not something producer countries really want. Only Saudi Arabia has a conscious policy objective of maintaining a surplus capacity of 1.5 to 2.0 mb/d to deal with supply tensions. All other excess capacity is "accidental" and most producers would be quite happy to put it in operation.

Over the years, producers and the market have come to recognize that strategic stocks are not intended for market manipulation and price intervention. That means the market does not view strategic stocks as a market overhang – as was the case in the 1980s. Now it is possible to discuss strategic stock mobilization with OPEC producers and the OPEC Secretariat itself. In most cases where there is spare capacity, producers are happy to ramp up production rather than see consumers draw down strategic stocks. When Iraq invaded Kuwait, Iraq's 3.5 mb/d plus Kuwait's 2.5 mb/d were lost. Increased production from around the world, but in particular Venezuela and Saudi Arabia went some way to bridging the gap. The same was true in March 2003 on the invasion of Iraq. In September 2005, on the event of Hurricane Katrina, OPEC producers were not able to help either with incremental sweet crudes for greater gasoline production or with increased availability of products to meet the product needs of the US Gulf Coast. In this case, they encouraged consumers to get on with a collective response from strategic stocks.

When announcing a collective stock action, it is important to encourage the OPEC Secretariat to take a public stance reflective of IEA/OPEC consultations and for a key producer or two to do the same thing. The closer together these announcements are in the marketplace, the more convincing to the market.

Involving the companies

Unmentioned so far, but critical to a successful evaluation of the market and choice of remedial strategy are the companies. They are well-positioned to understand the implications of a given disruption and how the system might adjust.

A group of companies has always been available to the IEA for consultations under these circumstances. They operate under a limited anti-trust protection that is carefully overseen by officials of the EU Commission and US government. Companies are among the first consulted as a crisis takes shape or in anticipation of an incipient crisis. The companies participate in gaming exercises conducted periodically at the IEA to ensure national authorities are well-briefed on systems and procedures so that in the event of a crisis, officials of the 27 members of the IEA will be able to turn around a response with the shortest delays.

What works in the marketplace

A clear lesson from previous stock deployments and observed market reactions to talk of collective stock actions is that markets are totally unimpressed by calming rhetoric from consumers that is not concrete, timely and appropriate to the circumstances. They will know when talk of a collective action has credibility and they will punish consumers if the market thinks the response is inadequate or perceives a breech in the political consensus among consumers in reaching a collective stock-release decision.

When a collective decision is reached, it must be implemented decisively and concretely. In past circumstances, a guiding principle has been to respond to a crisis rapidly and massively – more than fill the gap. When that clarity is lacking, the market will test political resolve. In December of 2002, Venezuela was having internal political trouble and production started to fall off. Nigeria was experiencing problems in the Delta, and export volumes began to drop off. When there was no response from the IEA, markets started looking behind the calming rhetoric to find that the US Office of the Vice President was counseling strongly against a strategic release. While the logic of that stance became clear in early 2003, the market in 2002 moved to higher and higher market-clearing prices because there was no strategic response from consumers.

The most convincing stocks, when it comes time for a collective response from consuming countries, are those stocks owned and held by governments. They have been paid for by taxpayers, they are designed to be deployment-ready and they are clearly additional barrels to the market. They are the inventories the most closely watched because the process of putting them in the market is the most transparent to the public and the press. Auctions and sales are a matter of public knowledge.

Movements in other forms of stockholding are less visible to the outside. Privately held quantities of strategic stocks or tickets for stocks held elsewhere, once authorized for release, will most often move within the private company's system or to traditional customers. Their mobilization is only verifiable after some days of operation and cannot serve the daily appetite for news about the pace of strategic stock uptake by the market. This does not diminish their ultimate utility in the market, but it does limit the announcement value of their deployment. An additional consideration for practitioners in a collective stock action is that privately held barrels might increase in value if not released immediately – a form of internal speculation.

With all due haste

A clear lesson from past years of market reactions to shocks is that policy makers do not have much time to make a decision. As soon as something happens in global supply that constitutes a significant disruption or even threat of a disruption, the market begins testing the severity of the event and prices start trading up. The market will take on board global stock situations, surplus production capacity, initial assessments of the duration of an event and begin trading against those data points.

Governments need to assess quickly whether the event will have little impact because systems are sufficiently resilient or whether incremental barrels will be necessary to fill a gap ad minimize economic damage. If systems can handle the event, governments need to provide convincing evidence of that including statements from key surplus capacity holding countries, that they are responding.

If incremental barrels are necessary, governments need to act quickly. On the occasion of Hurricane Katrina, the IEA was able to secure unanimous support for a collective action in 24 hours. The ramp up to the hurricane and the immediate pictures of devastation from Katrina's passage through the Gulf of Mexico had governments primed for action. That won't always be possible and a repeat of the 24 hour turn around cannot be a forgone conclusion. But the need for quick action is clear. The price will start up its ramp immediately. The higher it climbs before action is taken, the longer it takes to come back down. Every dollar on the barrel costs consumers $85 million per day.

What kind of stocks?

Most strategic stocks are held as crude, but the Hurricanes showed the utility of product stocks. The US has located its strategic storage near a large population of refineries around the coast of the Gulf of Mexico. The concept is that crude provides the greatest flexibility for use in both heating and driving seasons as refineries can then react to a disruption in any season. This has worked fine in the past as shocks or threats have come for example in August 1990, January 2000 and March 2003.

When Katrina sent a surge of water back down the Mississippi, nearly 3.5 mb/d of refining capacity were taken off line either because of flooding or a loss of power. Some of the SPR sites themselves were inaccessible but even had they been able to pump oil, there was no one in a position to refine it. The major concern was transportation fuels as the heating season had not really started yet. The challenge was to encourage as much release of transportation fuels from European inventories that could reinforce existing trade across the Atlantic. The US has long been a buyer of European gasoline or gasoline feedstock so commercial channels were open, but product had to backfill into areas around the Gulf of Mexico, reversing pipeline direction in many cases, normally gasoline flows from the Gulf into the US mid-west.

Even Japan managed to dispatch a cargo of gasoline to the US west coast in a vigorous adherence to its share of the collective draw. Refineries around the world responded to the loss of Gulf Coast capacity in the US, turning out unusually high percentages of gasoline which in some cases back-filled behind unusually high shipments of gasoline from traditional European exporters. The system was found to have unexpected flexibility, offering a lesson for future disruption scenarios to not underestimate the agility of the market.

Every country needs to think through its specific vulnerabilities. A recent casual conversation with Indian officials identified a number of Tsunami-vulnerable refineries along the Indian coast. There is no doubt that there are many more such refineries around the Indonesian archipelago. That would suggest some need for product stocks on high ground. In the middle of Europe, some disruptions on the Southern Druzhba brought particularly dependant countries close to requiring recourse to strategic stocks. Were stocks appropriate to the needs? China discovered after the earthquakes in Sechuan that one of the greatest problems was a lack of diesel to run bulldozers and other rescue equipment. There is no single formula that fits all.

We need to recognize that as countries struggle to produce the environmentally best fuels in their economies, fuel specifications and their changes to reflect the seasons complicate considerably the choice of stocks. There may not be any easy answer to this until fuel standards begin to stabilize, but administrative provisions can be pre-positioned for loosening environmental constraints on fuels for limited periods of time.

United we stand?

Collective stock measures are not the only way to respond to disruptions. There have been a number of events over the years that have led to considerable dislocations in national or regional markets, but that have not graduated to a global level. A sub national event like an accident in Houston's shipping channel has been dealt with by a small, specific swap or release of crude from the US Strategic Petroleum Reserve (SPR). The occasional typhoon in Asia has led national oil company KNOC of Korea to lend a cargo of crude to a refinery until its ship comes in. The incident referred to earlier on the Southern Leg of the Druzhba could have been met by an authorization to effected countries to tap into their strategic stocks as an interim measure. It proved not to be necessary.

Hypothetical events elsewhere are limited only by the imagination. An incident in the Turkish Straits could require some days to sort out. In the meantime, short haul cargoes to Mediterranean refineries might need replacement. That could be handled locally. A lack of sufficient crude in a Baltic refinery because of a pipeline problem could be addressed through a regional draw-down of strategic stocks of hopefully short duration.

The issue raised by these examples is whether the current arrangements for consensus building and collective action can be reinforced by a mechanism that provides greater agility. There would be no reason to act collectively on a global scale to any of these regional, national or sub-national events, but they are capable of deteriorating into more important problems if unattended. It might be useful to create a "sub-crisis" mechanism for consultations in circumstances of limited disruption. Consulting countries could get broad recognition of their local challenges at the same time a collective authorization to tap into strategic stocks that are otherwise inaccessible.

Crisis management beyond oil

This paper explored collective oil crisis management, experiences and drew lessons from the past 35 years for policy makers. It would be incomplete however, not to signal an increasing need to address contingency planning in gas and ultimately electricity. Unfortunately the continuing tension between Russia and the Ukraine spilled once again into the gas market in January 2009. The opacity of contractual arrangements, general lack of transparency and multiple agendas being played out meant Europeans had to do with severely reduced flows of gas from Russia. The Balkan states were particularly hard hit.

No one believes gas crisis management should be modeled after oil contingency planning. Oil and gas are quite different commodities with very different markets. Co-ordination in times of market stress in gas will need to be built on commercial systems that can move into a crisis mode. It will rely on contract flexibility, system debottlenecking, automaticity in dispatch collaboration and a number of other market based mechanisms. But before any of that can happen, gas markets will need to become much more transparent and better integrated. Oil markets are greatly more transparent than gas markets because a fluid is much easier to handle than a gas.

Electricity is even further down the road and can best be addressed now by debottlenecking. Many incidents have demonstrated the vulnerability of electrical systems, but largely at the national or sub-national level. Nearly everyone has experienced at least one blackout. In November 2006, an incident in Germany cascaded all the way to Morocco. This kind on international incident is the motivation for collective preparations. Intense programs to accelerate renewables in power generation will provide a second incentive as large investments must be made to smarten grids for large proportions of intermittent power.