Oil Demand:
Dependence or Flexibility?

Joyce Dargay

Oxford Institute for Energy Studies

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The OIES Series of Papers on Gulf and World Oil Issues

The purpose of this series of eight papers is to analyse a number of oil issues - political, economic and industrial - which have always been important but which have acquired additional significance during the current Gulf crisis.

The analysis in each paper attempts to explain the nature of the problem at hand, the behaviour of economic agents in times of crisis and to draw policy implications for both governments and industry.

The series begins with a paper providing a political analysis of the Gulf crisis and of possible future developments. The other papers are concerned more specifically with oil and gas issues. The papers will appear weekly beginning on 3 October 1990 in a sequence in which problems with greater significance for the short term are dealt with first. The series then moves to issues with a long-term dimension (world economy, substitution of oil by gas, demand, environment).

The series extends significantly the work presented at a very early stage of the crisis (mid-August) in the Institute's study *The First Oil War.* Many new topics have been researched, and those addressed in *The First Oil War* developed in greater depth.

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1. Introduction

Iraq's invasion of Kuwait, the boycott of Iraqi and Kuwaiti oil and the consequent surge of international oil prices mark the third major disruption on the oil market in the past two decades. The export reductions provoked by the Arab-Israeli war of 1973, the Iranian revolution of 1978-79 and the present Gulf crisis are very similar - amounting in each case to around 10 per cent of total world consumption. On all three occasions oil prices skyrocketed: the price of crude oil nearly quadrupled in 1974 and tripled in 1979, while the first three months of the present crisis have already seen spot prices at twice their pre-invasion level.

There is no doubt that the price explosions of the seventies have had serious repercussions on the world economy. Aside from the obvious inflationary impact and the deterioration of trade balances of oil-importing countries, high oil prices have had detrimental effects on economic growth, employment and capital formation. In the wake of both the oil price shocks of the seventies, world economic growth fell from an average of 3.5 per cent per annum to under 0.5 per cent at the trough of the ensuing recession. Industrialized countries fared somewhat worse than average with negative growth rates in both 1975 and 1982. In the oil-importing developing countries growth rates fell less dramatically, but at the expense of large current account deficits and increasing foreign debt. Although oil cannot be held solely responsible, it has surely played a significant role.

This is not to say that the present oil crisis need have the same dire consequences. Of course, in the first instance this will depend on how the situation in the Gulf develops, how long it continues and the implications for oil prices. In any given scenario, however, the impact on the economy will be determined by the degree of dependency on oil. The greater the flexibility of oil demand, the more easily the economy can adjust to higher prices by reducing consumption and the smaller the effect will be on the economy as a whole. The more easily industry can replace oil with other energy sources or other production factors, the smaller the effect of higher oil prices will be on production costs. The more easily households can reduce their use of oil, the smaller will be the effect on their overall consumption standard.

Such adjustment, however, takes time. Oil - as all energy - is used in conjunction with capital goods. In the short run the capital stock is given, and there is little flexibility to switch from one energy source to another. Exceptions would be in multiple-fired electricity generation plants, and dual-fired furnaces for process heat in some industries. In general, however, reduction of oil consumption requires investment in new capital equipment. As all investment, the lead lags can be long. In addition to this, because of the longevity of the capital stock, investment decisions are not based on current prices, but on expectations of future prices. Thus a price shock, no matter how excessive, will only affect investment decisions if it is believed to be of a permanent nature. In a situation as uncertain as today's, it is unlikely that price expectations will be adjusted upwards immediately.

In the short run, there is thus little possibility of adjusting consumption to higher oil prices. The only savings can come through a lower utilization of oil-consuming capital goods - lower indoor temperatures can conserve oil in heating, turning off air conditioning and lights can reduce the use of oil for electricity generation. The greatest savings, however, can be made in the transport sector, particularly private automobiles - households can reduce leisure driving, use public transport for more journeys, or drive more economically by reducing speeds.

Of course, prices and demand are both interlinked. The higher prices rise, the greater will be the reduction in oil demand. On the other side of the coin, demand flexibility also affects the extent to which prices eventually rise in response to a given supply reduction, as well as how rapidly. If, in the face of a supply shortage, demand is reduced to compensate for the shortfall - by stock drawdowns or regulatory conservation measures - the immediate upward pressure on prices can in principle be moderated. However, for a number of reasons this has not been the response to the present crisis. Stocks are not being drawn down appreciably, and there is evidence that some are being built up, presumably in fear of further shortages or price increases. In any case, such measures can only have temporary effects. If the initial supply loss is not restored or compensated for by increased production elsewhere within a limited time, the full extent of the price rise will only be delayed until the time when stocks need to be rebuilt. However, such measures do provide a breathing space - to allow both producers and consumers to adjust - as well as help mitigate the worst effects of sudden price shocks. As prices rise, demand will also respond over time, alleviating the pressure on prices. The more responsive demand is to higher prices, the less prices will rise in the longer term and the milder the effects will be on the economy as a whole.

How flexible is oil demand? Have we learned our lessons from the previous oil price shocks and past decades of turbulent oil markets? Are we better prepared to adjust to a crisis today than we were in the seventies? Undeniably many countries have reduced their oil consumption considerably, but are we now more dependent on that which we use? We shall try to answer these questions by comparing the demand situation today with that of the seventies. There are many parallels which can be drawn between today's oil crisis and the second oil crisis of 1978-79, but there are also significant differences. We will begin in the next section by looking at prices.

2. Oil Prices Today, Yesterday and Tomorrow

2.1 The Response of Prices

Since Iraq's invasion of Kuwait we have seen the spot price of crude surge to a maximum of $41/bl, from $20 immediately preceding the invasion. On the Rotterdam market, premium gasoline moved from $262/mt to a peak of $455/mt and gasoil from $182/mt to $356/mt. Other products and other markets were also quick to respond; some considerably more, some slightly less dramatically. Although these extreme prices were not sustained for any longer period of time, the upward trend is manifest. For crude, the monthly average price rose from $18 in July to $28 in August and further to $36 in September and October - a doubling of the price within a few months. Prices of both crude and products have been extremely volatile and responsive to the slightest hint of possible change in the situation in the Gulf.

In many ways the situation in 1978 can be compared with that today - both were spurred by political events in the Gulf leading to a loss of around 10 per cent of non-communist world oil production, first by the Iranian revolution and the virtual absence of Iranian oil from the world market between late December 1978 and mid-March 1979 and today by the boycott of Kuwaiti and Iraqi oil. In both instances, commercial stocks were at relatively high levels at the beginning of the crisis, and increased production from OPEC and elsewhere helped to reduce the actual shortfall in oil supply. And in both cases, much of the replacement crude was heavier than the oil lost.

In the second oil crisis, the loss did not come as immediately as today. Strikes and shutdowns in Iranian oilfields were responsible for large fluctuations in production and hence exports from late October, so that the total curtailment of exports in late December was preceded by months of uncertainty over oil supply. Prices also behaved rather differently. Although peak prices during the Iranian revolution reached similar levels, the spot markets reacted far less rapidly. With the fluctuating Iranian exports during the last two months of 1978 and the fear of further strikes and political unrest, the upward pressure on prices began to mount. Spot crude prices increased from $13/bl in October to a maximum of around $16/bl in December, while gasoil rose from $133/mt to $175/mt and gasoline from $194/mt to $220/mt. During the first two months of the complete curtailment of Iranian exports the maximum spot prices reached on the Rotterdam market were $23/bl for crude, $350/mt for gasoline and $340/mt for gasoil. Only in the case of gasoil was the increase comparable to that experienced during the past two months. The peak prices on the Rotterdam Market of $45/mt for crude, $430/mt for gasoline and $396/mt for gasoil during the 1978-79 crisis were reached in May or later, by which time the resumption of Iranian exports had reduced the shortfall from 5 to less than 2mb/d. The events of 1990 have thus already seen gasoline prices reach an all-time high, with crude and gasoil running not far behind. As for other products, the price of naphtha is just above its peak of 1979, while the price of kerosene has soared to 25 per cent above its previous maximum. Only the price of heavy fuel oil is still well below that attained during the second oil crisis.

The market has clearly reacted differently to two rather similar supply cuts. Of course there are many underlying explanations for this behaviour. One may have to do with inventory behaviour. Initial commercial stocks were slightly higher at the onset of the 1978-79 crisis, and stock drawdowns during the last quarter of 1978 and first quarter of 1979 were larger than normal for that period of the year, so that much of the supply loss was satisfied from stocks, keeping the pressure off prices. Only when stocks began to be replenished from April-May onwards did prices finally surge upwards. Today the reaction appears to have been somewhat different. Although the stock buildup typical for the period July to October has been smaller than normal, there has been little actual stock drawdown and the demand for precautionary inventories for some products has even risen on certain markets. This hoarding behaviour may partially be due to expectations, which may be different today than they were in 1978. If one believes the crisis will continue or worsen so that supplies will become even tighter and prices surge higher yet, stock building makes private economic sense, even though it serves to drive prices up.

There may, however, be another explanation. The large price differentials that have arisen and been sustained across markets during the past few months suggest that severe physical imbalances exist for individual products in certain areas (see Paper 3 in this series by Paul Horsnell). The question of products was not as pronounced in 1979, since the shortfall entailed only crude oil, whereas the crisis today involves the loss of around 2 per cent of world product consumption as well. The removal of these products from the world market was accentuated by little spare hydrocracking capacity elsewhere, and generally high refinery capacity utilization rates (see Paper 2 in this series by Adam Seymour). About half of these exports were destined for the OECD, and 20 per cent for Japan, which represents nearly 4 per cent of total Japanese product consumption. For individual products the Japanese loss is even greater - 17 per cent of its naphtha, 9 per cent of its LPG and 7 per cent of its kerosene consumption. It is no wonder that prices of these products have risen so steeply, particularly on the Pacific markets.

2.2 Oil Prices: High Or Not So High?

Oil prices have clearly reached historical highs, and may still surpass these. But $40 today is obviously not what it used to be. In 1978, it represented 33 per cent of the average American's weekly disposable income, but only 13 per cent today. It could buy twice the quantity of food and three times the amount of metals on commodity markets that it can today. Incomes have risen since 1978, as have the prices of other goods. Seen in this context, a $40/bl oil price does not seem so high. Of course, incomes have not increased equally in all countries, so that to some such a price level is still quite substantial. This is illustrated in Table 1, which shows the cost of a barrel of crude oil, at $40, in per cent of per capita GNP in 1978 and 1987 in various groups of countries. We see that in 1978 a barrel of $40 crude cost from 0.5 per cent of per capita GNP in the industrialized countries to 20 per cent in the poorest countries of Asia. In 1987, the corresponding figures were 0.3 per cent and 14 per cent respectively. However, as per capita income growth differed considerably amongst countries, the decline was not as appreciable everywhere. The third column, which gives the percentage change between 1978 and 1987, shows just this. Although $40 oil would represent 45 per cent less today

Table 1: One Barrel of Crude Oil at $40/bl in % of Per Capita GNP

	1978	1987	% Change
Industrialized	0.49	0.27	-45
Japan	0.57	0.25	-56
USA	0.40	0.22	-45
EEC	0.59	0.36	-39
Low Income	20	14	-30
Africa	15	15	0
Asia	25	16	-36
Latin America	2.7	2.2	-19
Indebted highly	3.1	2.8	-10
Sub-Saharan Africa	10	12	+20
Middle East	5.4	3.3	-39
South Asia	20	14	-36
East Asia	12.5	7.7	-38

(or actually in 1987) in terms of per capita income than it did prior to the second oil crisis in the industrialized world, it would only be 37 per cent less in Asia, 19 per cent less in Latin America, and 20 per cent more in Africa, as a result of falling incomes. Of course these are only average figures, concealing many actual discrepancies among individual countries, but they do give some indication of the differences.

Figure 1 shows the development of crude oil prices over the last two decades, both nominally and in 1990 US dollars. The prices in 1990 dollars are obtained by inflating the nominal prices with the US GDP deflator. The point at the far right is the $40 maximum price reached thus far in the present crisis. The same price in 1979 would correspond to $67 in today's money, and the peak price in 1979 of $45 would compare to a price of $76. Although the average price in the past two months of $36/bl is the same in nominal terms as the average for 1980, in real terms it is actually 40 per cent lower, so prices can still rise by an additional 67 per cent, or $24, before the same real price levels are reached. Even in percentage terms, prices have not yet increased to the extent they did in 1978-79. So far prices have doubled. In 1978-79 they tripled, but not until many months later. However, we are still early on in the present crisis, and may have much more to come.

What happens to prices in the next few months or so depends on how the situation in the Gulf develops. In the best of worlds, the conflict can end tomorrow and prices fall to pre-invasion levels. In the worst, a war can break out and oil supplies be reduced yet further, causing panic on oil markets and a price explosion. If this happens prices can well triple to $55/bl or surpass those of 1979 even in real terms. Prices of $80/bl or more are certainly not impossible. Or, the situation can go on as today for many months to come, with high price volatility and average prices around $30 to $40.

2.3 Consumer Prices

Price rises on the spot market need not reach the consumer immediately, although they generally tend to be passed on rather quickly in economies with a policy of free price setting. In the past few months we have already seen gasoline prices go up and come down in response to fluctuations on the spot market. We can thus assume that a given increase in the spot price of a particular oil product will lead eventually to an equal increase in the price to the consumer - or an even greater increase if there are *ad valorem* taxes. The same, however, will not necessarily be the case in percentage terms. Aside from transport costs and wholesaler and retailer margins, which are comparatively negligible, this difference is primarily due to the nature of taxation. Only if all taxation is purely *ad valorem* - as Value Added Tax or duties which are proportional to the import price - will a given percentage increase in international prices result in a similar percentage increase to the final consumer. On the other hand, quantity-based taxes - as most excise and other special taxes on petroleum products - will cushion the increase in percentage terms.

Taxation systems differ vastly amongst countries, and most have a component of both value and quantity taxation. In Europe, most countries have no duty on crude but have proportional duties on product imports, although most imports are exempted by

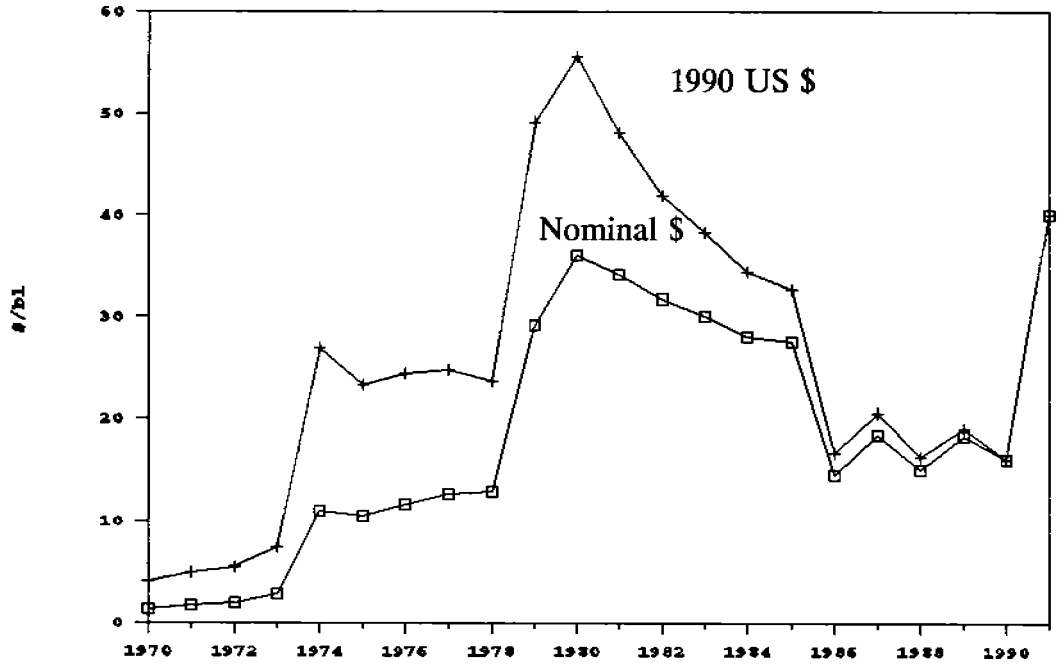

Figure 1: The Spot Price of Crude Oil in Nominal and 1990 US $/bl

various trade agreements. Other countries, such as Japan and the USA have quantity tariffs. All OECD countries have a quantity-based excise tax on gasoline, and many on other products as well. In addition to this, there generally exist *ad valorem* taxes like VAT or sales tax in the USA. A notable exception is Japan, where all oil taxes have been quantity based since 1988. The taxation rate is lower for industrial and commercial consumers, since VAT and sales tax are generally refundable, and in some countries, like the USA, Canada, Belgium and Denmark, such consumers face no tax at all.

Taxation has also changed considerably over the past decades in the individual countries. Some increased more, some less. Generally speaking, however, as prices rose between 1978 and 1980, taxation did not rise to the same degree, so that the percentage of taxes in the final price declined. After the price collapse of 1986, the percentage of taxation rose. In all countries, gasoline is the highest-taxed oil product, so it is here that taxation will give the greatest cushion to price increases. Table 2 shows the effects on consumer gasoline prices in a number of OECD countries of a 100 per cent increase in international gasoline prices. The percentage changes are calculated from the average price in 1978 and the first quarter of 1990, respectively. It is assumed that the entire increase is passed on. Margins, etc. are ignored, so that the actual increases should be somewhat lower. Given today's tax structure in the individual countries, we see that consumer gasoline prices will rise from about 30 per cent in France to 70 per cent in the USA, the countries with the highest and lowest taxation rates. The price rises for the other countries will be somewhere in between. Comparing with 1978, we see that the increased share of taxation over the intervening period has mitigated the effect on consumer prices.

For other products, taxation is much lower, so the percentage price rises to consumers will be closer to those on international markets. For light fuel oil the effects on consumer prices resulting from a 100 per cent price rise are shown in Table 3. Since taxes are generally higher for households than for industry, the effects on consumer prices are somewhat less. And in most cases the impact is smaller today than in 1978. The actual changes, however, in both cases will be smaller than those shown in the table because margins and distribution costs will also cushion the effects.

It is clear that taxation has cushioned consumers from fluctuations in oil prices. But this protection also has negative side-effects. If the full impact of a price rise is not passed on to consumers, their response - in terms of reduced consumption - will also be limited. If we assume, say, a constant price elasticity of -0.5, the effect of gasoline taxation in France, for example, would reduce this effectively to -0.15, in terms of ex-tax prices. In general, as the tables show, increasing rates of taxation over the period will lead to a smaller consumer response today than would have been the case in 1978, given an identical price rise internationally. Clearly, the less consumers respond by reducing their consumption, the more pressure there will be on prices to rise yet further. In a sense, taxation has made oil demand less flexible.

Table 2: Impact of a 100% Increase in World Gasoline Prices on Domestic after-tax Gasoline Prices. Per Cent

	1978	1990
USA	82	71
France	43	28
UK	55	42
Germany	47	39

Table 3: Impact of a 100% Increase in World Gasoil Prices on Domestic after-tax Light Fuel Oil Prices. Per Cent

	Industry		Households	
	1978	1990	1978	1990
USA	100	100	97	97
France	-	-	90	77
UK	92	92	94	92
Germany	96	84	96	84

3. Oil Dependency

Much else has changed since the seventies. High oil prices have led to considerable reductions in oil demand world-wide. In the seventies, oil accounted for nearly 50 per cent of total world primary energy consumption, today it is about 35 per cent. On the whole, one could say we are far less dependent on oil today than previously, although world oil consumption has increased - and more so in some areas than in others. As shown in Table 4, of the country groupings listed, only the OECD consumes less oil in 1987 than in the seventies. Africa and Asia, on the other hand, have increased consumption markedly.

We see, too, that although the significance of oil in world total energy requirements has decreased by 21 per cent, the OECD is responsible for most of this reduction. Other countries have been less successful in reducing oil dependency. It is true that Asia, Africa and Eastern Europe were not as dependent on oil for their energy needs to begin with, but they remain almost as dependent today as they were in the seventies.

Of course, aggregation camouflages much of the actual differences amongst countries. This is illustrated at the bottom of the table, which shows oil's share of total energy consumption in 1973 and 1987 or 1988 in a selection of countries, as well as the percentage change over the period. Of the OECD countries, we see that the USA was least dependent on oil to begin with, as it is today, and that it reduced oil dependency least. The more highly dependent countries in Europe and Japan managed to reduce this dependency significantly more in percentage terms, although on average they are still more dependent than the USA. But there are even considerable differences in Europe. Denmark, starting out as one of the most oil dependent, managed a reduction of 43 per cent - second only to Sweden, at 50 per cent. While Italy, which was also amongst the most dependent on oil only succeeded in a reduction of 21 per cent, and thus remains one of the most oil dependent countries in Europe. The lowest reduction was achieved in Portugal, now the country most dependent on oil for its energy needs. In general, the poorer countries were the least successful in reducing oil dependency.

The newly industrializing countries in Asia also contributed to the declining role of oil in total energy requirements. With the exception of Singapore, all these countries managed a reduction of about 30 per cent. The less developed countries fared much worse. In many of the poor countries in Africa, Asia, Latin America, and the Caribbean, up to 100 per cent of energy needs are still met by imported oil, and in many countries the dependency has even increased.

Oil dependency can be measured in other ways, for example as oil-GDP ratios, or as net oil imports in relation to exports. Measured either way, there have been changes since the seventies. In short, both measures indicate that industrialized countries are less dependent on oil today, but some of the poor countries have increased dependency. This is illustrated in Table 5, which shows the oil intensity of GDP in tonnes per thousand 1985 dollars. In the OECD, the oil-GDP ratio has declined nearly 40 per cent since 1973, although there are vast differences amongst countries. We see

Table 4a: Primary Energy and Oil Consumption.
Per Cent Change 1973-1987

	Total Energy	Oil
World	34	6
OECD	10	-12
Africa	125	109
Asia	121	89
Latin America	80	46
Eastern Europe	55	35

Table 4b: The Share of Oil in Total Energy Requirements.
1973, 1987 and Change 1973-87. Per Cent

	1973	1987	Change
World	48	38	-21
OECD	55	43	-22
Africa	45	41	-9
Asia	34	29	-15
Latin America	72	58	-19
Eastern Europe	34	29	-15
USA	45	41	-11
Japan	75	57	-25
Europe	60	44	-28
Denmark	89	50	-43
Sweden	60	29	-51
Portugal	66	61	-8
Italy	75	59	-21
Germany	56	42	-24
France	68	41	-39
UK	51	38	-25
Singapore	100	99	-1
Hong Kong	78	50	-36
South Korea	64	46	-28
Thailand	94	66	-29
Taiwan	69	48	-30

Table 5: Oil Intensity of Gross Domestic Product
Tonnes/Thousand US$ at 1985 Constant Prices

	1973	1988	% Change
OECD	0.29	0.18	-39
USA	0.27	0.18	-34
Japan	0.29	0.15	-49
Europe	0.31	0.18	-42
Denmark	0.38	0.16	-58
Greece	0.39	0.33	-13
Portugal	0.34	0.40	+18
Luxembourg	0.60	0.35	-42
Switzerland	0.18	0.12	-33
France	0.31	0.15	-50
Germany	0.29	0.17	-41
UK	0.29	0.13	-55
India	0.13	0.15*	+15
Pakistan	0.15	0.17*	+13
Indonesia	0.19	0.23*	+21
South Korea	0.28	0.20*	-29
Thailand	0.30	0.20*	-33
Bangladesh	0.35	0.36*	+5

* 1987

that the USA had a lower oil intensity in 1973 than either Japan or Europe as a whole, but the reduction has been much smaller, so that in 1988 oil intensity in the USA was the same as in Europe and greater than in Japan. The European countries also display vast differences. Denmark, again, has been most successful and has reduced oil intensity by 58 per cent. Poorer countries managed far less well - Portugal even shows an increase over the period. The wealthier countries, even those with low oil intensities to begin with - like Switzerland - experienced substantial reductions. Behind these figures lies the fact that industrial production has become far less energy intensive, particularly in the richer countries, and that oil use for electricity generation has to a large degree been replaced by other energy sources.

As for the rest of the world, the data are unfortunately rather limited. The newly industrializing countries, like South Korea and Thailand, have generally reduced oil intensity, but by less than the OECD, on average. Most other countries have experienced much smaller reductions. Generally speaking, energy-GDP ratios have decreased least in the poorer countries, and in some cases have even increased, as the figures for India and Pakistan show. The greatest increases in oil intensity, however, have occurred in oil-exporting countries.

Clearly, the higher the oil intensity of GDP, the more vulnerable the economy will be to oil price increases. Those countries with a high oil-GDP ratio will suffer the most in this respect, and those who have not reduced it, will be harder hit today than in the seventies.

In order to give an indication of the differences in oil dependency among countries today, the oil intensity of GDP as well as net oil imports in relation to exports of goods and services are shown in Table 6 for various country groupings. The figures are for 1987, the latest year for which data are available. Oil is measured in metric tonnes and GDP and exports of goods and services in 1987 USA dollars. The figures given are the averages for eighty-nine non-oil exporting countries, grouped after per capita income and geographic location. From the oil intensity of GDP we can get a rough idea of the immediate impact of an oil price increase on the cost of domestic demand. Assuming initial external balance, GDP will be approximately equal to total domestic demand. Given this assumption, a $20/bl ($150/mt) increase in the price of both imported and domestic oil would cause the domestic demand deflator to rise by 3 per cent (150 x 0.21) for the average country. Of course, the impact on real income will depend only on imported oil, so the real income effect will be smaller for countries with domestic oil production. The second measure, net oil imports in relation to export earnings, gives an indication of the effect of an oil price rise on the balance of payments. For example, a price rise of $20/bl would represent about 11 per cent ($150 x 0.76/1000) of export earnings on average.

We see that the oil intensity of GDP rises from low to middle income, but is lowest for the countries with the highest incomes. Of course, these are only group averages, and there is a large variation within groups. The figures for net oil imports in relation to exports are much more significant. We see that ability to accommodate higher oil prices falls considerably with decreasing income. On average, a $20/bl increase in the price of oil would represent 16 per cent of export earning in low income

Table 6: Oil Intensity of GDP and Net Oil Imports in Relation to Export of Goods and Services. Tonne/Thousand US$, 1987

	Oil/GDP	Net Oil Imports/ Exports
Low Income	0.20	1.04
Middle Income	0.25	0.75
High Income	0.18	0.40
Average	0.21	0.76
OECD	0.15	0.48
USA	0.17	0.99
Japan	0.09	0.83
Europe	0.14	0.38
Non-OECD	0.21	0.86
Africa	0.20	1.01
S. Asia	0.17	1.13
Latin America	0.18	0.68
Caribbean	0.28	0.61
Pacific	0.29	0.73
E. Asia	0.24	0.48
Eastern Europe	0.20	0.91

countries, but only 6 per cent in countries with high incomes. The low income countries will clearly face the greatest balance of payments difficulties.

The remainder of the table shows the same measures for various country groupings. We see that on average OECD countries will be hit less hard hit than others, both in terms of inflation and balance of payments. Although Japan has one of the lowest oil-GDP ratios, its high dependence on imported oil will have a large impact on the balance of payments. The USA will clearly face similar problems. The greatest inflationary impacts will be felt in the small countries of the Caribbean and Pacific, which have comparatively high oil-GDP ratios. In terms of balance of payments, the poorest countries of Africa and South Asia will face the greatest difficulties, as will Eastern Europe.

In summary, we can say that although oil dependency has decreased globally, there are many countries which have become more dependent. These will be harder hit than in the seventies by an equivalent rise in oil prices. This is not to say that those who have reduced oil dependency will not suffer at all. Clearly, the inflationary impact and the effects on trade balances will not be as great, but they will be felt all the same.

4. Flexibility of Demand?

We have seen that on aggregate we have become less dependent on oil in the sense that less oil is required to produce a given level of output and that a given oil price rise will have a less dramatic effect on the world economy. But does decreased dependency in this sense imply that we are less dependent on the oil we continue to use? Does it imply that world oil demand is more flexible today, in the sense that oil demand can more easily be reduced in the face of an oil crisis? The answer to this question is probably not, as we will try to show.

The differences in the rates of growth in oil consumption in various regions noted in Table 4 have led to a change in the distribution of oil consumption amongst countries. Most significant is the diminishing importance of the OECD, or industrialized countries, in the global oil balance. As shown in Table 7, their share of world oil consumption was reduced from 70 per cent in 1973 to about 56 per cent in 1987. The role of the developing countries has clearly become more substantial. This in itself may have implications for the flexibility of global oil demand. The ability to reduce oil consumption may be less at a lower level of development as the oil used performs more essential functions. In addition, the capital necessary for oil conservation will be less readily available than in wealthier countries. If this is the case, oil demand in these countries will be less price sensitive than it has been in the OECD. Because of the increased importance of these countries, world oil demand will be less responsive to price changes and the flexibility of global oil demand will have diminished.

Not only has the distribution of oil consumption amongst countries changed over the past decades, but so has its allocation among different uses. The reason for this is that the growth of oil consumption since the seventies has not been identical in all sectors of the economy. This is illustrated in Table 8, which shows the average annual percentage change in oil consumption in industry, transport, electricity generation and other sectors in various parts of the world from 1973 to 1986, the last year for which such data is available. Globally, we see that oil use for electricity has declined most significantly, while only oil demand for transport has grown. The total figures tend to reflect the development in the OECD. Not surprisingly, the Middle East shows the most substantial increase in all sectors. In the other areas, oil use for electricity generation has increased considerably in Africa and Eastern Europe and the growth of industrial consumption has been greatest in Asia.

As a result of the differences in growth, the sectoral composition of oil demand has changed both globally and in each area. This is illustrated in Table 9, which shows the share of each sector in total oil consumption (the sum of the four sectors, since non-energy use of oil is excluded as are transformation losses) for 1973 and 1987. We see that globally, the transport sector has become even more important than in the seventies, accounting for 48 per cent of oil consumption as compared to 39 per cent in 1973. The shares for all other sectors have declined. Again, this largely reflects the development in the OECD. For the other areas, the share for electricity generation has increased most in Africa and Eastern Europe, and industry most in Asia.

Table 7: Distribution of World Oil Consumption, 1973 and 1987.
Per Cent of Total.

	1973	1987
OECD	70	56
Africa	2	3
Latin America	6	8
Asia	6	10
Middle East	2	5
Eastern Europe	15	19

Table 8: Oil Consumption. Average Annual Per Cent Change, 1973-86

	Industry	Transport	Residential, Commercial etc.	Electricity Generation
World	-0.68	1.96	-0.64	-1.24
OECD	-3.23	1.36	-2.56	-5.55
Africa	3.80	5.55	5.94	8.97
Latin America	2.28	3.39	3.27	3.52
Asia	9.72	6.19	8.80	2.44
Middle East	13.36	9.91	9.45	10.67
Eastern Europe	2.35	2.21	1.27	4.09

Table 9: Distribution of Oil Consumption by Economic Sector.
Per Cent of Area Total

	Industry		Transport		Residential, Commercial etc		Electricity Generation	
	1973	1986	1973	1986	1973	1986	1973	1986
World	23	20	39	48	22	19	16	13
OECD	25	19	39	55	22	18	14	8
Africa	24	19	46	45	20	21	10	15
Latin America	21	19	47	48	18	18	14	15
Asia	24	34	34	32	15	19	26	15
Middle East	11	15	46	43	22	20	21	22
Eastern Europe	22	22	35	34	24	21	19	24

This, too, may have implications for the flexibility of oil demand. The sectors which have been the most flexible - electricity generation and industry - are now less significant than they were. Transport, on the other hand, which is less flexible as little possibility of substitution for oil exists, dominates more than ever. The increase in the predominance of the transport sector in oil demand is accentuated by the fact that developing countries are now responsible for a greater proportion of this consumption - 31 per cent in 1986 as compared to 26 per cent in 1973. Since this oil use in these countries is mainly for goods and public transport, the price-sensitivity will be small and adjustment possibilities minimal. In a global perspective, the changing composition of oil consumption both sectorally and amongst countries will have led to a declining flexibility of oil demand.

The changes in the sectoral composition of oil consumption also has implications for demand flexibility in the various regions. Of particular importance is the OECD, which still dominates world oil demand. Adjustment to the previous oil crises was made by enormous declines in oil consumption in industry and electricity generation. The significance of industrial oil consumption has declined considerably, and the scope for further adjustment is limited. Much of the slack or inefficiency in oil consumption has been eliminated and many of the substitution possibilities realized. Although further reductions are certainly technically feasible in some industrial processes, the marginal cost will probably be greater. In addition, the structure of production has changed markedly over the past few decades, the process of de-industrialization has gone a long way. Heavy, oil-intensive industries have lost their prominent position and have been replaced by less oil-intensive high-tech industries and services. With this new industrial structure, the possibility of reducing oil use further will be limited.

As far as electricity generation is concerned, there is still substantial scope to replace oil with other energy sources. But electricity generation comprises a far smaller share of total oil demand than it did in the seventies, so that the impact of this adjustment will not be as significant. Electricity generation, however, is one area in which the flexibility of oil demand has definitely increased. In 1980, the first year for which data are available, only 35 per cent of possible oil-fired capacity (i.e. single-fired oil plus multi-fired oil-gas, oil-solid, oil-gas-solid) in the OECD was capable of using other fuels. By 1988, the proportion had risen to 60 per cent. This multi-fuel-fired generating capacity provides a good deal of flexibility to reduce oil consumption relatively quickly. The degree of the reduction, of course, depends on how much of the multi-fuel-fired capacity is initially running on oil.

The increased dominance of the transport sector for oil demand will also play an important role in industrialized nations. Most of this oil is used for private motoring, for which the possibility of substituting alternative energy sources is practically speaking nonexistent, and for which the price-sensitivity appears to be relatively low. Modern society's heavy reliance on the automobile for personal transport will clearly not easily be reduced. We have become too used to the convenience and independence provided by the automobile and for many it has become a necessity, rather than a luxury.

5. Conclusions

In the above we have tried to illustrate how our position in the face of the present oil crisis compares with the situation in the seventies. We have seen that a given nominal price of oil means far less today in terms of the prices of other goods, per capita income, GDP and export earnings. The inflationary effects will thus be smaller, as will the impact on trade balances. The world is less dependent on oil, both for its energy needs and for productive purposes, so the impact on growth need not be as pronounced. Of course this will not be the case for all individual countries, and the adverse effects on the poorest nations can be worse today. We have seen, however, that demand may have become less flexible, that the possibility of further reducing oil consumption, to adjust to higher oil prices is much less today than it was in the seventies.

In an oil crisis, this rigidity will have serious repercussions. Prices will be driven up higher and more rapidly than they would have been otherwise. If this is the consequence, our shield of reduced oil dependency will offer us far less defence.

Can anything be done to avert such a progression of events? Or at least to mitigate the impact? Many measures can be taken to reduce oil demand in a crisis. The use of stocks is surely one of primary importance. Here oil companies as well as governments have a decisive role to play. In addition, regulatory measures can contribute a great deal to reducing demand, and far more quickly than can prices. As an example, the reduction of speed-limits has been shown to have a considerable effect on gasoline consumption in the USA. It certainly could in Europe as well. Cutting down the level of heat, air-conditioning or lighting in public buildings can generally be managed with little loss of comfort. It may be better for the health as well. Even increasing public awareness of the possible consequences of the crisis may reduce demand on a voluntary basis. But again, these or any similar measures require an active role by governments. Should the need arise, let's hope they do not invoke our decreased dependency on oil as a justification for their inaction.

OXFORD INSTITUTE FOR ENERGY STUDIES
57 WOODSTOCK ROAD, OXFORD OX2 6FA ENGLAND
TELEPHONE (01865) 311377
FAX (01865) 310527
E-mail: publications@oxfordenergy.org
http://www.oxfordenergy.org