

AS Economics

Oil Market and the Effects of Changing Oil Prices

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Revision Focus on the Oil Market and the Effects of Changing Oil Prices

AS Syllabus Requirements

Markets: Candidates should be able to apply their knowledge of the basic model of demand and supply to markets, such as commodity markets including the oil market

Inflation: Candidates should understand that inflation can be caused by excessive aggregate demand and sustained increases in costs (i.e. demand and supply-side factors)

Using AD-AS analysis: Candidates should be able to use AD/AS analysis to help them explain macroeconomic problems and issues. For example, they should be able to use AD/AS diagrams to illustrate causes of inflation, demand deficient unemployment and economic growth.

The importance of oil

The ramifications of changes in the price of crude oil traded on the **international petroleum exchanges** can be far-reaching, not just for the British economy but for the global economy as a whole. A basic study of the oil market is a useful application of the principles of supply and demand analysis. It extends to the theory of costs, prices and profits studied at A2 and also into the analysis of macroeconomics. For example, tracing how a significant rise in the world oil price feeds through the economy to affect government policy objectives such as economic growth, inflation, interest rates and the balance of payments. This revision focus considers some of the effects with particular reference to the recent surge in world oil prices beyond the \$40 per barrel level.

Theory: what determines crude oil prices?

Oil is one of the most heavily traded commodities in the world. Fluctuating prices have important effects for oil producers/exporters and the many countries that remain dependent on oil as a key input in their energy, manufacturing and service industries.

The demand for oil

1. **Cyclical demand:** There is a strong link between the demand for oil and the rate of global economic growth because oil is an essential input into many industries – when the economy is expanding, the demand for oil rises. The best recent example of this is the extreme growth of the Chinese economy. Fast growth of national output in energy-intensive sectors has led to a surge in demand for crude oil into the Chinese economy. (There is a chart on the next page which tracks China's demand for oil over recent years) - China's burgeoning economy guzzled about 6m barrels per day in the first quarter of 2004, 15% more than a year ago. China now accounts for 7.1% of world oil demand and a third of the increase in global oil demand in 2003 is due to the growth in the Chinese economy.
2. **Prices of substitutes:** Demand also affected by the relative prices of oil substitutes (e.g. the market price of gas). If in the longer term, reliable and relatively cheaper substitutes for oil can be developed, then we might expect to see a shift in demand away from crude oil towards the emerging substitutes
3. **Changes in climate** – e.g. affecting the demand for heating oil. It is often said that if the winter in North America is particularly fierce, then the price of crude is almost certain to rise as the USA

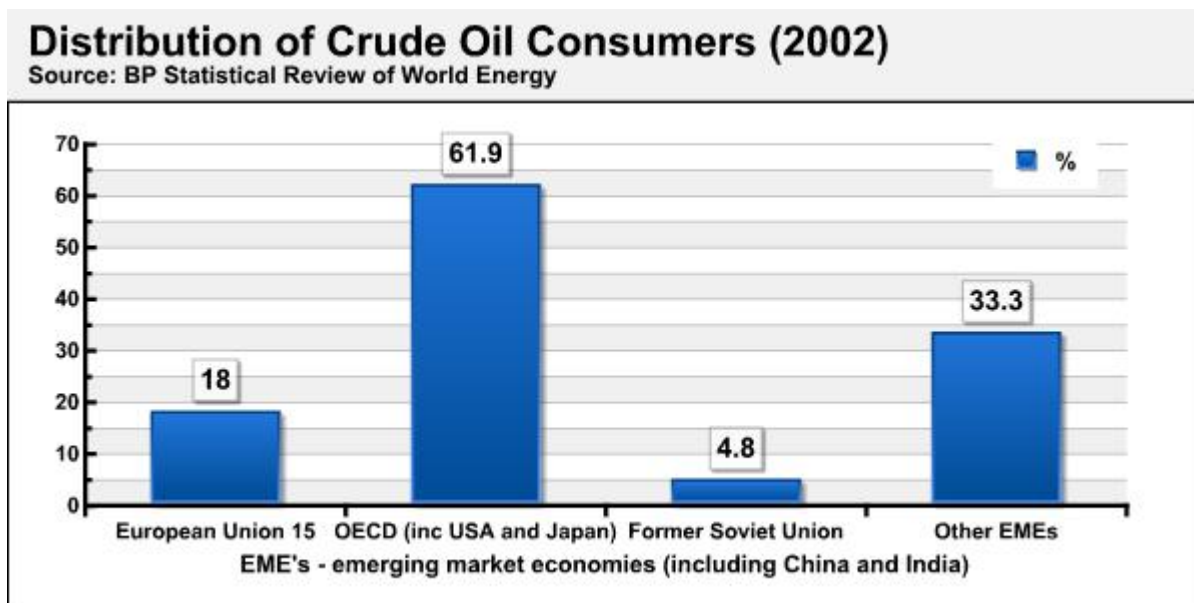
and Canadian economies raise their demand for oil to fuel household heating systems and workplaces

4. **Market speculation:** There is also a speculative demand for oil (i.e. purchasers hoping for a rise in prices on world markets). Indeed one of the features of the most recent spike in oil prices (through the spring of 2004) has been the very high level of speculative demand by hedge funds and other investors pouring in the international petroleum exchanges to buy up any surplus oil futures contracts. They hope that by the time the contracts are ready to be fulfilled, they will have made a large profit.

The basic economics is straightforward! When the global demand for crude oil is rising and if short term supplies of oil in the international markets cannot keep pace with demand, there is only one way that prices can head – higher! This headline in a recent edition of the Financial Times says it all!

Oil prices moved beyond \$40 a barrel yesterday, the highest for 13 years, amid fears that economic growth was stimulating an increase in oil demand that producers were struggling to fulfil. The International Energy Agency, said that further investment in oil exploration and refining was needed to sustain higher oil consumption from the global economy www.ft.com and www.iea.org

Who are the main consumers of oil? The chart below provides a very broad summary. Nearly two thirds of global crude oil production is consumed by the leading industrialised nations – i.e. the 24 nations that make up the Organisation of Economic Cooperation and Development (www.oecd.org). But a rising share of oil demand is coming from the emerging market economies including China. The data shown in the chart below covers the year 2002. Chinese demand has soared even higher in the intervening period. Just under one fifth of total demand comes from the European Union.



The supply of oil

When we consider the global market supply of oil we need to make a distinction between short-term and longer-term supply to the international markets. The short run supply curve is normally drawn on the basis of a given state of production technology and fixed capital inputs (i.e. the oil industry is supplying from a known level of oil reserves and a given stock of capital used to extract that oil). There is inevitably a short-run limit on daily oil supply and, as production gets close to capacity limits, so the short run supply

of oil becomes more inelastic. One possible way of modelling this is to assume the supply curve for oil is non-linear (shown in the left hand diagram below). An alternative is to suggest that more oil can be supplied elastically at a fairly constant price until the capacity limit is reached, when the short run supply curve becomes vertical.

In short, the short-run supply of crude oil is affected by a series of different factors

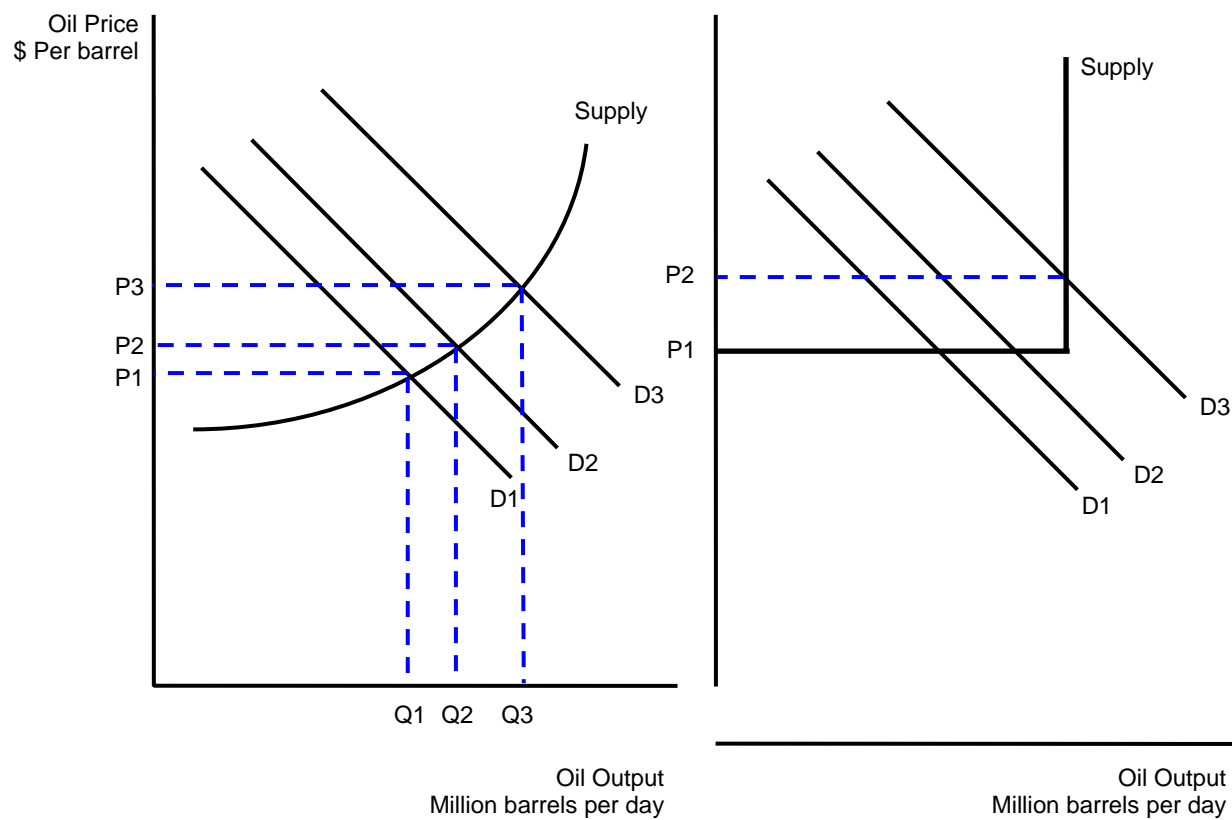
1. **Profit motive:** The production decisions of OPEC and Non-OPEC countries (see revision notes on OPEC below)
2. **Spare capacity:** The level of spare production capacity in the oil sector
3. **Stocks:** The current level of crude oil stocks (inventories) available for immediate supply from the major oil refineries – i.e. a high level of stocks means that extra oil supplies can be released onto the market quickly when demand fluctuates
4. **External shocks:** The effects of production shocks (e.g. loss of output from rig closures or disruption of oil supplies due to war and terrorist attacks)

Taking a longer-term perspective, the long run world oil supply is linked to

1. **Reserves:** Depletion of proven oil reserves – the faster that demand grows, the quicker the expected rate of depletion
2. **Exploration:** Investment spending on exploring, identifying and then exploiting new oil reserves. When oil prices are rising and are expected to stay strong for the foreseeable future, it makes financial sense to invest more resources in exploring for new reserves, even though these may not come on stream for some years.
3. **Technology:** Technological change in oil extraction (which affects the costs of extraction and the profitability of extracting and then refining the oil)

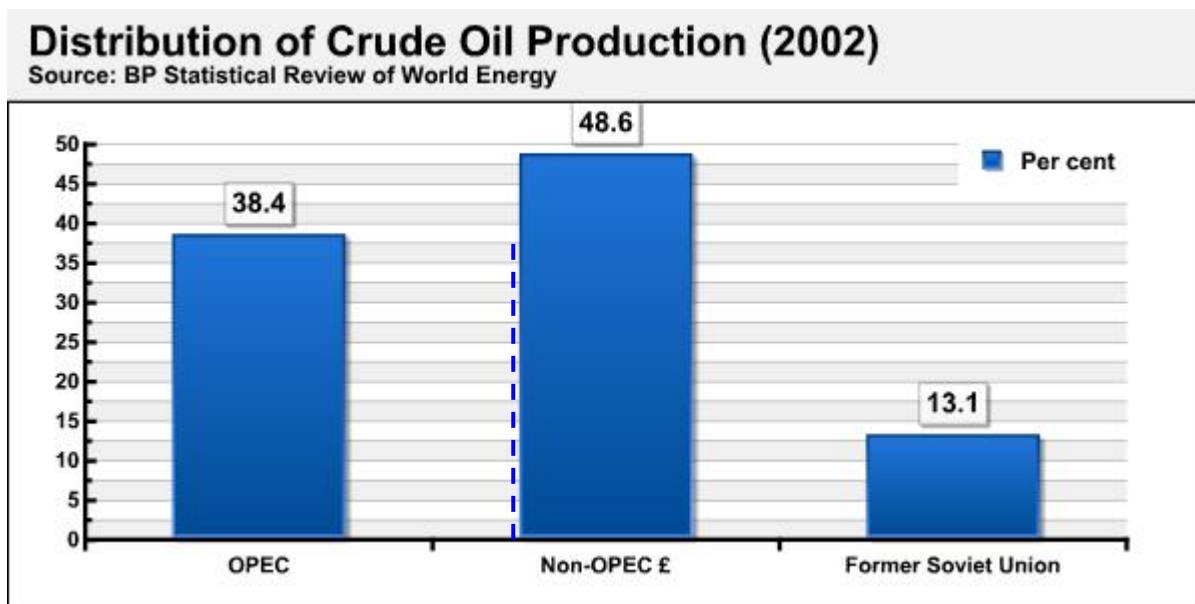
The interaction between oil demand and supply in the short run

Higher oil demand matched against an inelastic short run supply of oil invariably drives market prices higher – this is shown in the diagram below. An increase in demand causes a fall in oil stocks at the major international refineries and pushes prices higher. This acts as a signal to suppliers to expand production. However there are time lags between a change in price and extra supplies coming on stream. The demand for oil is also price inelastic. This combination of an inelastic demand and supply helps to explain some of the volatility in world oil prices.

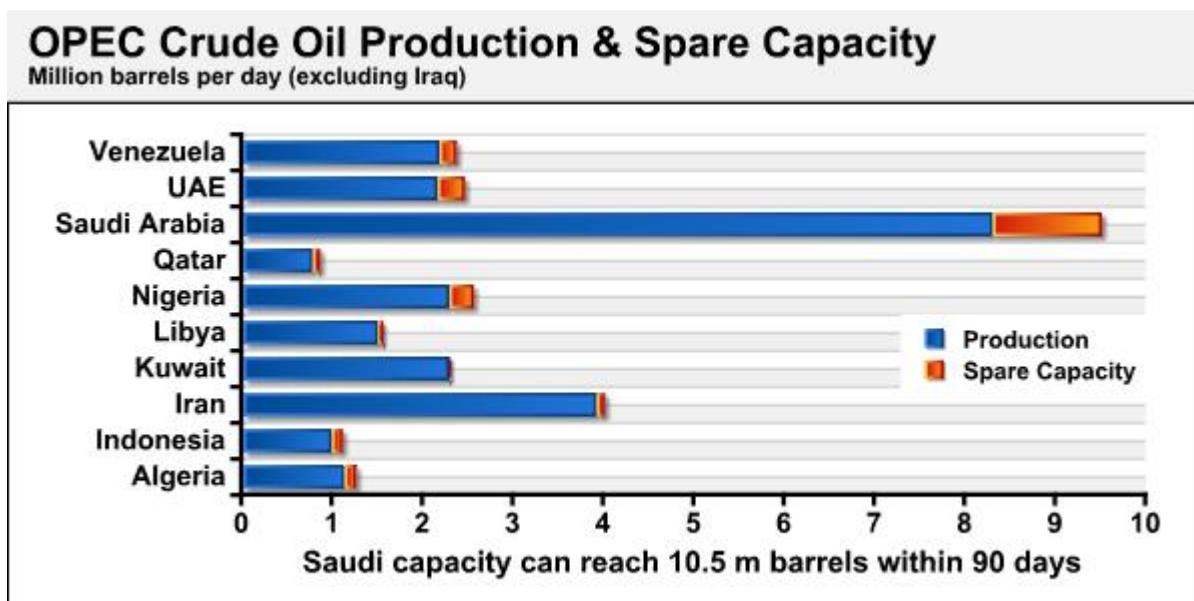


The role and impact of the OPEC cartel

The **Organization of Petroleum Exporting Countries** (OPEC) accounts for around 40% of current world supply. This gives OPEC a pivotal influence in shaping the direction of oil prices – but only when the cartel acts together to control production and balance supply and demand in the international market. Non-OPEC countries account for the largest portion of total supply. Oil is produced in nearly every corner of the world, and nearly every region has been expanding oil production in the last decade. This includes Europe, where Norwegian oil companies are achieving a rapid increase in oil extraction and also Russia now one of the world's largest oil suppliers.



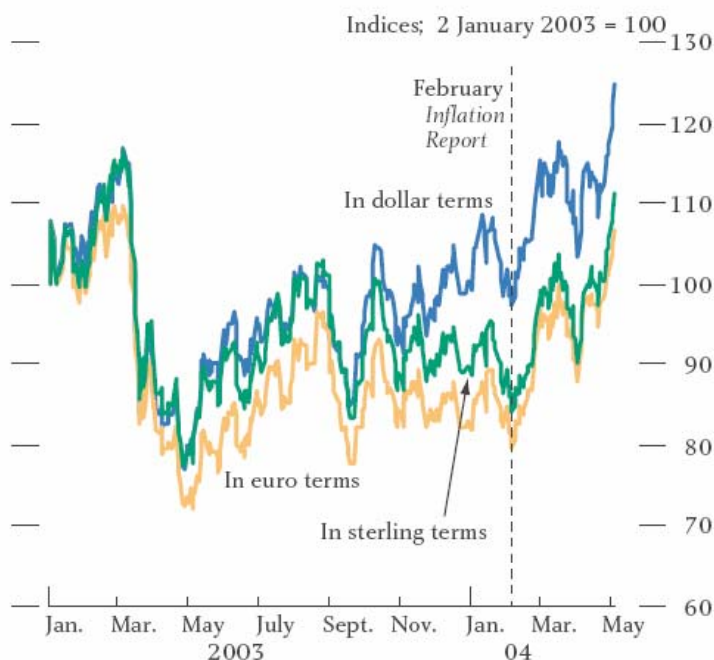
OPEC sets **quotas** for how much crude oil they want to produce with the aim of stabilising the price at a target level. There are always major doubts about OPEC's ability to keep to output limits. The evidence in recent months is that the OPEC group of countries have been exceeding their planned quotas by up to 2 million barrels per day. Even this high level of production though has been unable to stop crude oil prices surging above \$40 per barrel. The chart below shows production levels for April 2004 together with estimates of spare capacity for OPEC – in other words, the extent to which, in the short term, they might be able to raise production levels and boost output should they want to and in response to the price signals sent from the petroleum exchanges.



The evidence from the previous chart is that, in the Spring of 2004, most OPEC countries are producing pretty close to their short run capacity. Saudi Arabia is the nation with the highest production possibilities and some industry experts believe that if really pushed, Saudi Arabia could expand supply beyond ten million barrels per day within the space of a few months. The key point from the previous chart however is that the short run supply of crude oil is pretty inelastic when the major producers are close to their capacity limits.

Why have crude oil prices risen so sharply in recent months?

Brent crude oil price



Sources: Bank of England and Thomson Financial Datastream.

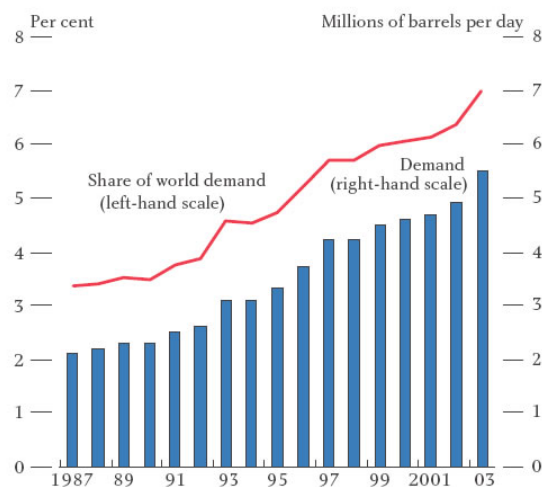
The left hand chart tracks the market price of Brent crude during 2003 and the early months of 2004. The price is represented as an index number with three line graphs, one is the price in US dollar terms, one expressed in euro terms and the third in sterling terms.

Since January 2004, the dollar price of crude oil has surged by 25% - a major external shock to the global economy (particularly if oil prices remain that high). The price increase has not been as great in euro or sterling terms because of a depreciation of the US dollar against these two currencies. Crude oil is traded in dollars - so although the dollar price of crude has jumped above \$40 per barrel, because one pound of sterling now buys more

dollars than it did a couple of years ago, the price of the oil that we import when translated from US dollars into pounds is not quite as steep. To this extent, the fall dollar (or the appreciation of sterling) has helped to insulate the British economy from some of the effects of the high price of black gold.

So why have oil prices increased so sharply? The answer is a mix of demand and supply-side factors.

Chinese oil demand



1. **A strong recovery in global GDP growth** – fuelling an increase in the demand for many essential raw materials and energy products including oil. A significant influence has been fast growth in the emerging market economies notably China
2. **Speculative demand for oil.** Because oil inventories (stocks) are low, investors are buying up stocks when they become available and thus driving the price higher. Fear about the future supply of oil given the political crisis in the Middle East is also causing higher prices. Major consumers of oil are desperate to guarantee their supplies and are buying forward contracts

3. **Production limits:** The decision by OPEC to hold back on oil production at the start of 2004 – although there is now pressure on OPEC to expand their output quotas. However as we saw earlier, the OPEC producers are quite close to their short run production limits

The microeconomic consequences of higher oil prices

Crude oil has many uses in many different markets and industries. So changes in the global price of oil inevitably have an effect on the microeconomics of particular sectors of the economy

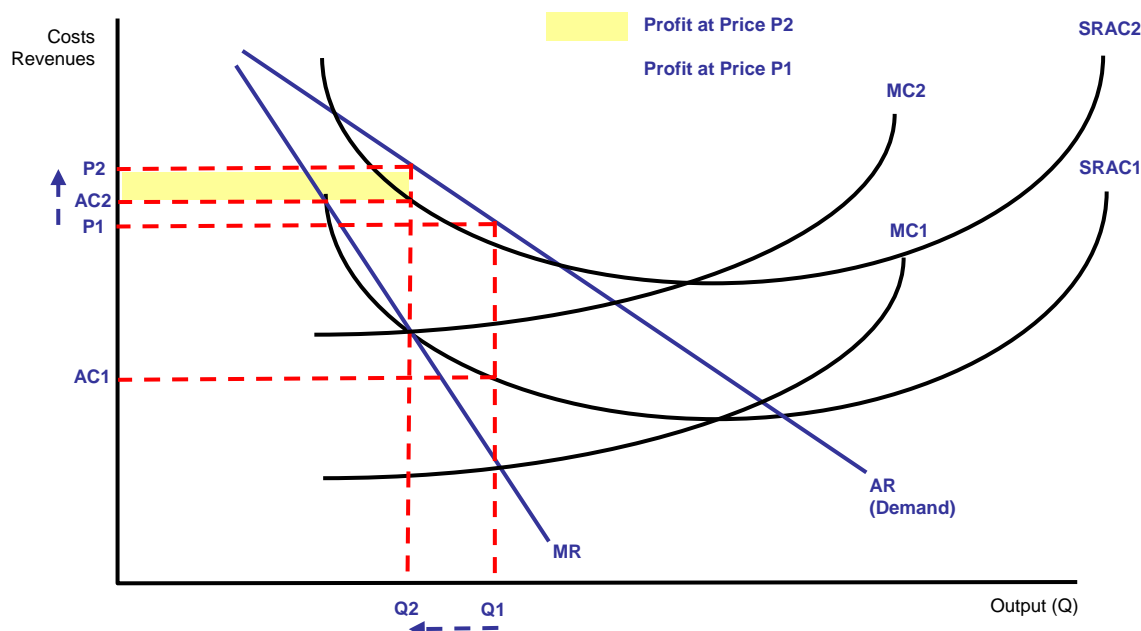
Main uses for crude oil:

1. Gasoline: motor spirit/petrol
2. Middle Distillates:
 - a. Diesel - vehicles and other motors/engines
 - b. Jet fuel
3. Kerosene – cooking/heating
4. Heating Oil
5. Fuel Oil: boiler fuel for industry, power and shipping
6. Other: lubricants, bitumen etc

For those industries that use oil as a key input into their production process, then a rising price acts as a supply-side shock – leading to higher input costs i.e. a rise in their variable costs of production. The more an industry relies on oil, the bigger will be the impact of a rise in oil prices on its costs and profitability, and hence the bigger the fall in its production is likely to be in the long run.

The effects can be modelled using cost and revenue curves, an example of which is shown below

The effects on price and output and profit maximising equilibrium of a rise in variable costs (e.g. brought about by higher oil prices)



The increase in costs causes a profit maximising firm to increase price and reduce the equilibrium level of output. The extent to which a business is able to pass on an increase in costs depends on the price elasticity of demand for their products. If demand is price inelastic, then the supplier may choose to pass on some or all of any rise in variable costs to the consumer of the final product. In May 2004 for example, British Airways decided to impose a £5 surcharge per passenger to compensate for the effects of high oil prices on their cost base. Not every airline has chosen to do this. For some, absorbing the cost rise and seeking ways to reduce other costs is the best approach, particularly when demand is elastic and there is a fierce battle for market share in the industry. An airline's fuel bill typically accounts for 12-16 per cent of its total expenditure and is second only to its labour costs. The impact of the surging oil price varies greatly from airline to airline around the world, however, depending on factors such as the amount of protective hedging they have in place (i.e. whether they have purchased oil in the futures market) and where they find themselves in the fleet replacement cycle with the introduction of more fuel-efficient aircraft.

The diagram shows that higher costs (*ceteris paribus*) leads to higher prices but also a much smaller profit margin and a reduced level of supernormal profit / producer surplus.

Macroeconomic consequences of high oil prices

There have been three global recessions in the past 30 years, and all of them were pre-dated by a sharp rise in oil prices. Britain and the US may be able to weather the storm better this time because lower levels of inflation mean that there is less pressure to push interest rates up to crippling levels, but there will still be a dampening effect on living standards and growth.

Larry Elliot in the Guardian, 12 May 2004)

The macroeconomic implications of rising oil prices depend on several factors

1. The extent to which rising prices are temporary (i.e. lasting only a few months before falling back) or more permanent (i.e. we might be facing a period of 3-4 years of high prices). In general, the impact of higher oil prices will be larger the longer the price rise is expected to last
2. Whether a country is a net importer or exporter of oil – Britain is still a net exporter of oil (though we import a lot too!) whereas Germany is a large importer of oil
3. The scale of oil dependency of an economy i.e. the ratio of oil used per unit of national output produced. Some countries have a reliance on high-energy using industries and are therefore more susceptible to changing commodity prices. Others have a much smaller manufacturing base and their national output is dominated by industries that are less energy intensive
4. The extent to which oil users (consumers) can switch their demand away from oil towards alternative energy substitutes. In the short term, demand is price inelastic (i.e. $P_{ed} < 1$).
5. The economic policy response to rising oil prices from central banks (changes in monetary policy) and the government (changes in fiscal policy)
6. The effects of exchange rate changes
7. The extent to which the labour market is flexible (in particular the flexibility of real wages) and the ways in which businesses in product markets react to higher oil costs

Main disadvantages of higher oil prices for the UK economy

A threat to growth

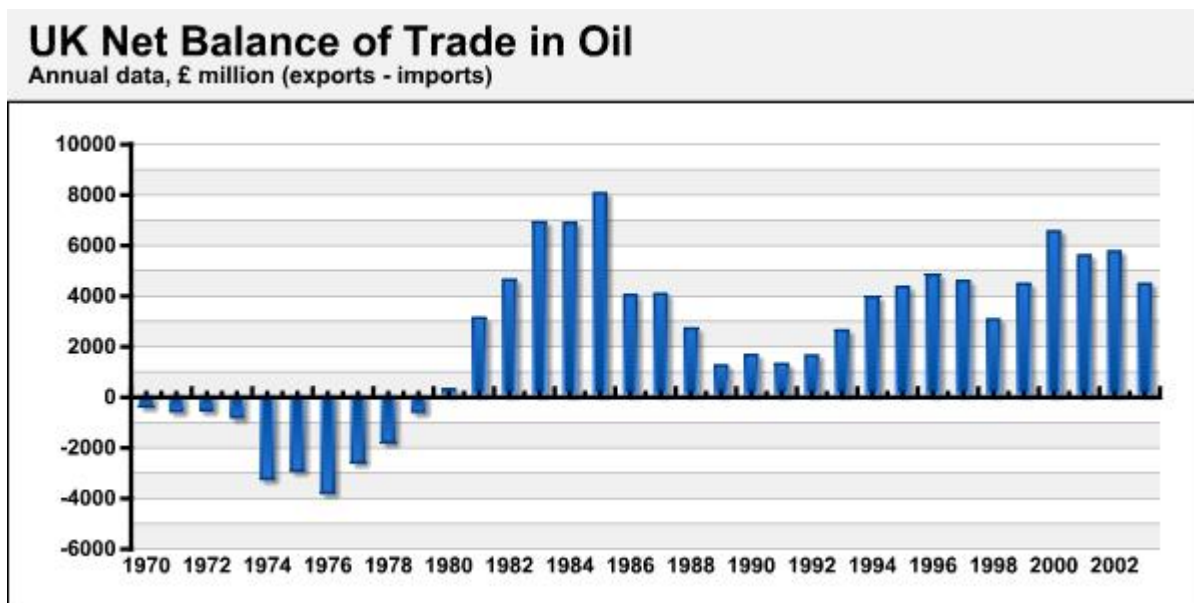
Higher oil prices threaten to trim the rise in corporate profitability on which the revival in stock prices worldwide has been built. They may also boost inflation, prompting higher interest rates which would in turn choke growth in consumer spending. Britain should brace itself for higher fuel costs. With electricity prices also rising, the age of cheap power appears to be drawing to a close

Press Association report on rising oil prices, March 2004

1. **A fall in SRAS and higher inflation:** The main effect of rising oil prices in the short term is on aggregate supply. A higher price causes an inward shift in SRAS and puts upward pressure on the general price level. This is an example of an 'exogenous inflationary shock'. Research carried out by the International Energy Agency for the leading OECD industrialised countries suggests that if world oil prices were to remain 10% above a base forecast level for two years this would add 0.4% to the average rate of inflation for leading economies in each year. The effects on inflation can be increased if **wages follow prices** – because if inflation expectations rise, this can cause an increase in wage demands as people seek to protect their real incomes. Higher oil costs work their way through the supply chain. Manufacturers pass on higher costs to wholesalers and retailers. Consumers often end up paying the price for higher oil prices when they make their final purchase. Air fares rise and petrol prices increase – these are two most obvious symptoms of higher oil prices in the immediate term. But gradually higher oil prices filter their way through most parts of our economy.
2. **Slower economic growth:** Higher oil prices act as a dampening effect on the rate of growth of real GDP. According to the IEA research mentioned above, a sustained \$10 per barrel increase in oil prices from \$25 to \$35 would result in the OECD as a whole losing 0.4% of GDP in the first and second years of higher prices. This is because higher prices cut into people's real incomes and their real purchasing power. And because companies are making less profit (because of higher costs) this can lead to a reduction in planned capital investment. Both consumption and investment are important components of aggregate demand. The result can be a slowdown in growth

leading to actual GDP falling below potential – i.e. a negative output gap. And slower growth will hit jobs, not just in those industries that depend on oil but across the whole economy. Another effect of rising oil prices could be to erode business confidence. This too will have a negative effect on output and investment intentions. Similarly a reduction in company profits might have a negative effect on share prices, falling share valuations effectively increases the cost of capital for firms wanting to issue new shares to finance an expansion and a decline in equities would also hit consumer confidence.

3. **A worsening of the terms of trade** – the terms of trade measure the relative price of imports compared to the prices that exporters receive for selling their output overseas. An oil-price increase leads to a transfer of income from importing to exporting countries through a shift in the terms of trade – i.e. the terms of trade for oil importing countries gets worse because they are now having to pay more per barrel for their oil – and therefore having to export a greater volume of exports to pay for this. Conversely, higher oil prices improve the terms of trade for the leading oil-exporting countries. Their oil is worth much more on the global market, their potential export revenues are much higher as a result and this will be an injection of income and demand into their circular flow.
4. **Impact on the balance of payments** - the effects of higher oil prices on the balance of payments are somewhat different for the UK compared to most other Western European countries. The UK has large reserves of North Sea Oil and we have run surpluses in trade in oil for over twenty years as the next chart shows. Higher oil prices will increase the cost of our imports of crude, but the value of our exports of Brent crude also rise. The net effect is probably positive for the current account of the balance of payments. However exporters of non-oil products may suffer from the oil price shock. Since higher oil prices reduce real incomes of oil consumers around the world, firms suffer not only from a drop in demand in their home market but from overseas as well. So exports fall causing a reduction in aggregate demand and exacerbating the fall in GDP growth.



So how great is the current world oil price shock?

The recent rise in the real oil price has been nothing like as large as the surges seen in 1972-74 and 1978-80. Even after the recent rise, oil prices are still substantially lower in real terms than they were in 1981 and the major developed countries are much less dependent on oil now than at the time of the

1979-80 oil shock, reflecting both improved energy efficiency and the shift away from energy-intensive industries towards the service sectors. N