ICEG EUROPEAN CENTER

The Impact of Sustained High Oil Prices on Trade Flows

Prepared by ICEG European Center, Vienna Institute for International Economic Studies (wiiw) and GKI Energy Research & Consulting

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CONTENTS

PREFACE

This study was originally prepared for the Policy Department External Relations of the European Parliament under the contract ECPO/B/INTA/2007/17. The final version of the study was submitted on 24 August 2007; this paper is the unchanged publication of that study; the same paper is available on the European Parliament website (with a different cover page).

The paper was written in collaboration of seven authors from three research institutes (ICEG European Center, Hungary; Vienna Institute for International Economic Studies, Austria, and GKI Energy Research & Consulting, Hungary). They are (in alphabetical order):

- Judit Barta, GKI Energy Research & Consulting
- Edward Christie, Vienna Institute for International Economic Studies
- Miklós Hegedűs, GKI Energy Research & Consulting
- Mario Holzner, Vienna Institute for International Economic Studies
- András Oszlay, ICEG European Center
- Gábor Pellényi, ICEG European Center (editor)
- Magdolna Sass, ICEG European Center and Institute of Economics, Hungarian Academy of Sciences

EXECUTIVE SUMMARY

High oil prices are a phenomenon of the new millennium. The price of crude oil rose more than sixfold between the end of 1998 and the summer of 2006, and hover around USD 60-70. The emergence of new industrial powerhouses in Asia boosted global demand for oil and other natural resources, pushing their prices upwards in the process. Insufficient capacities and the collusive behaviour of oil producers also contributed to rising oil prices. All these factors point to the persistence of high oil prices while geopolitical factors and extreme weather among others will keep prices volatile as well. According to forecasts by the International Energy Agency (IEA), the price of oil will remain around USD 55 by 2030; possibly even higher if production capacities are not expanding as fast as demand growth requires. Most recent IEA analyses suggest that oil prices could remain around their current level (about USD 70) for the coming years since capacity expansions are being delayed.

Oil price increases have preceded most recessions since World War II. However, the estimated impact of oil price shocks on economic growth is both temporary and of fairly limited magnitude. Europe can even benefit from high oil prices for at least three reasons:

- High oil prices are historically associated with a stronger dollar, hence improving terms of trade for Europe. Recent oil price increases were accompanied by a weak dollar, but this shielded Europe from price increases in euro terms.
- The European economy is less oil-intensive than its trade partners; in addition, energy intensity has fallen much since the 1970s, therefore the European economy is more able to withstand the effects of high oil prices than before.
- Imports of oil exporter countries are biased towards European products: at times of high oil prices their demand for these goods increases.

The effects of oil price increases are asymmetric across sectors; energy- and transport-intensive sectors are particularly exposed. Still, the overall estimated effect of oil price increases is short-lived and limited on the industry level as well. High oil prices do not threaten the long-term growth prospects of industries; they incur temporary adjustment costs. A more significant challenge emerges in the form of Asian producers operating with much lower labour costs in a less stringent regulatory environment. Some energy-intensive industry sectors are set to lose in this contest but competitive firms producing goods with high value added content can be winners.

Current high oil prices coincide with high and rising commodity prices. High oil prices drive up production costs of metal as well as transport costs. The relationship between oil and agricultural product prices is not clear; however, higher oil prices increase input costs (including transport and fertilisers). However, strong demand for agricultural products and biofuels drives up prices, compensating producers for higher costs.

European business is already responding to the challenge of high oil prices:

- Although current supply chain practices were designed under the assumption of low oil prices, transport-intensive production modes (including just-in-time and offshore sourcing) need no major adjustments while oil prices remain below USD 100.
- Relocation of production is taking place in some sectors, including energy-intensive industries, but its overall impact on employment is small. Typical cost savings from

relocating to China will not be annulled by higher transport costs until the oil price reaches USD 150.
- Fuel substitution is limited by technological constraints in most sectors. Coal is readily available but polluting; gas is clean but increases import dependence at a period when concerns over energy security are rising. Biofuels, when produced at the right locations, are clean and may even be competitive if oil remains expensive.
- Firms actively invest in energy efficiency and increase the use of waste and scrap materials to reduce energy dependency; this has led to significant reductions in the energy intensity of European industries in recent decades.

Community-level policies can help the European economy in adjusting to an environment of high oil prices in a number of areas:

- While there is a strong case for free trade, the fairness of trade should be maintained. A number of developing countries subsidise the energy consumption of their industries among others, putting European producers at an unjust disadvantage.
- Biofuels markets are promising but immature; governments in the EU and the US try to protect their domestic biofuel producers, but do so by opting for more expensive and environmentally less friendly production methods.
- Some energy exporting countries close their borders for foreign investors in their energy sectors. By doing so, they threaten long-term energy supply and contribute to sustained high oil prices.
- Although there is huge potential in energy-saving investments, consumers let even highly profitable opportunities pass because of uncertainty, lack of information or distorted or inadequate incentives.
- The adjustment potential of the European economy can be improved even further by creating more flexible and competitive product and factor markets. For example, businesses regularly complain about the lack of competition on European energy markets and about the complexity and costliness of product market regulations in the European Union.

Overall, the need for trade policy responses to high oil prices is limited. Still, policies that facilitate the adjustment of European companies, encourage consumers to save energy while help secure long-term energy supplies, are worthy of consideration.

Overview of possible trade policy instruments to tackle issues related to high oil prices

Measure		Impact on: Subsidies	Biofuels	Investments	Efficiency and recycling	Adjustment potential	Notes
Tariffs and quotas	**Lower import duties for materials**				X	X	▪ Harms basic material producers but benefits downstream firms ▪ One-off benefit of cost reduction ▪ Long-term benefit of more competition
	Free trade of environmental products				X	X	▪ Under discussion in DDA ▪ Significant export potential for EU ▪ Improves domestic and global energy efficiency
	Free trade of biofuels		X			X	▪ Better economic and environmental properties of imported biofuels ▪ Environmental effects and domestic agriculture need consideration
Non-tariff barriers	**Improve market access for exporters**	X		X	X	X	▪ Complements free trade of environmental products and biofuels, can be linked to investments
	Environmental standards and labels		X		X	X	▪ Improves energy efficiency ▪ EU can become global lead market ▪ ‘Carbon footprint’ difficult to assess ▪ Complements free trade of environmental products and biofuels
	Improve and harmonise global waste regulations				X	X	▪ Great energy saving potential in recycled materials
Trade defence instruments	**Develop anti-subsidy procedures**	X					▪ Under discussion in DDA ▪ Subsidies difficult to prove ▪ Ongoing review of EU instruments
Investments	**Promote the Energy Charter Treaty**			X			▪ Russia, Belarus should ratify ▪ Everyone should abide
	Energy-related trade talks	X	X	X			▪ Distant dream
Emissions	**Widen ETS to include transport**				X	X	▪ Promotes efficient transport modes

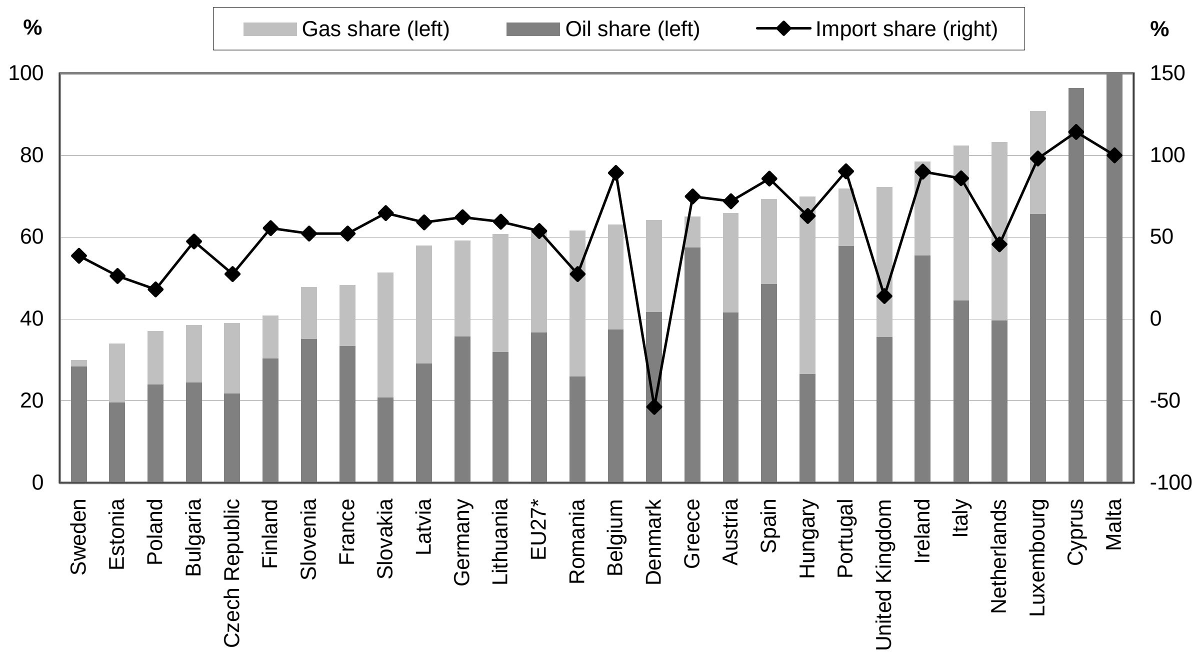
1. INTRODUCTION

Key findings and issues

- Oil prices have risen from below USD 20 in the 1990s to over USD 60; they are expected to remain above USD 50 until 2030. They can remain around USD 70 until 2010 due to capacity shortages and strong global demand.
- The main drivers behind a high oil price are the emergence of Asian and other developing economies, shortages of oil production and transit capacities, and collusive behaviour of major oil producers.
- In the long run, the price of oil depends heavily on investments in the global oil industry; if investments fall 25% short of the necessary USD 4.3 trillion, the price of oil could be 34% higher than otherwise by 2030.

Oil price developments undoubtedly have a significant effect on the European economy. Oil products account for 36.7% of gross energy consumption in the EU27 and gas (whose price is closely related to that of oil) has a share of 24.6%. Dependency on oil and gas varies by Member State from as low as 30% in Sweden to 100% in Malta; in 17 Member States their combined share exceeds 60%. As indigenous resources are scarce the European Union, most countries increasingly rely on imports from outside the EU to secure their energy. As a result, import dependence (the share of net imports to gross inland energy consumption) exceeds 80% in seven Member States and is between 50-80% in ten further countries. Oil and gas typically account for the bulk of energy imports. Thus, higher oil prices not only add to the energy bills of domestic consumers but also have significant effects on external trade. However, differences in energy use between Member States also suggest that the impact of high oil prices is asymmetric across countries.

Figure 1.1 – The share of hydrocarbons and imports in gross inland energy consumption in 2005



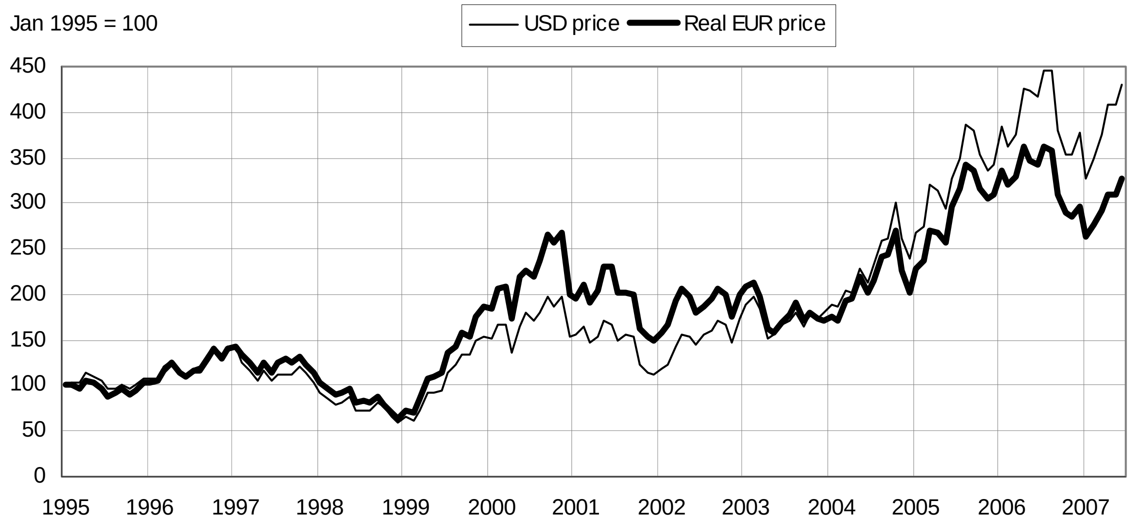
*Note: * extra-EU27 net imports. Source: Eurostat*

Oil prices have indeed risen considerably in recent years. Whereas prices below USD 20 per barrel were common for most of the 1990s, they rose more than sixfold between end-1998 and the summer of 2006. Some moderation took place since then, but prices for major blends still hover above USD 60. For European consumers the depreciation of the euro against the dollar aggravated initial oil price increases during 1999-2001. On the other hand, the recent weakness of the dollar is favourable for Europe therefore recent oil price increases were more moderate when expressed in euro terms. Nominal oil prices (in dollar terms) were 260% higher in May 2007 than at end-2001, the start of the latest rally. In euro terms and adjusted for inflation, real oil prices rose by 100% during the same period. In sum, favourable exchange rate developments gave Europe some protection against the rise of oil prices, but its impact was still considerable.

The current trend of oil price rise differs from former oil price shocks. Since 2003 the rise of oil prices (and prices of other commodities) has been influenced by strong demand growth in newly industrialised countries (especially China) and by rising demand for gasoline in the USA. Energy import prices grew at the same pace in every major region and price increases of other raw materials had followed. Overall price increases and strong growth of demand for industrial products allowed producers to pass through raw material price increases onto semi-finished or finished product prices. This tendency is visible in the rise of producer prices throughout the OECD countries.

China also plays a special role through its exchange rate policy. High oil prices are historically associated with an appreciating dollar. However, by effectively pegging its currency to a weakening dollar, China could improve the competitiveness of its exports. This fuelled the country's massive economic growth, which then fed into higher demand for natural resources and a rising oil price. On the other hand, part of the appreciation of the euro is also caused by China: by diversifying its huge stock of reserve assets away from dollar assets, China increases the demand for euro.[1]

Figure 1.2 – Nominal and real price indexes of Brent crude oil



Note: real price deflated by producer price index for the EU27. Sources: Eurostat, International Monetary Fund

[1] Bénassy-Quéré et al. (2005)

How will oil prices develop in the future? This study adopts the forecast by the International Energy Agency (IEA), published in its World Energy Outlook 2006 (IEA 2006). The IEA uses its World Energy Model, a large mathematical construct to obtain detailed sectoral and regional forecasts of energy market trends. It assumes a world GDP growth of 3.4% between 2004-30 with the continuing emergence of China, India and developing Asia. The share of energy-intensive heavy industry in output will continue to fall while lighter industries and services are set to rise in every region. Based on these growth predictions the average IEA import price of crude oil is expected to moderate in the coming years from about USD 60 per barrel (in real-2005 US dollars) to USD 47 by 2012.[2] However, the most recent forecast of IEA (2007) suggests that due to capacity shortages the current level of oil prices could persist until the end of the decade. This is thanks to tempering demand and the introduction of new production and refinery capacity. In the longer term the share of OPEC production will rise and marginal production costs outside OPEC will increase. The higher market power of OPEC countries is expected to result in gradually rising prices, up to USD 55 in 2030 at 2005 prices and close to USD 100 in nominal terms.

Table 1.1 – IEA average crude oil import price forecasts (USD per barrel)

	2005	2010	2015	2030
Real (at 2005 prices)	50.6	51.5	47.8	55.0
Nominal (assuming 2.3% inflation)	50.6	57.8	60.2	97.3

Source: IEA (2006), page 61.

Based on the IEA forecast 'sustained high oil prices' of about USD 55 in current prices (about USD 50 at real-2005 prices) can be expected in the coming decades.[3] However, IEA also warns about extremely high uncertainty in future oil prices and predicts great short-term price volatility. Temporary hikes in oil prices are brought about by the interaction of a number of factors. Both crude oil and refined product markets are tight due to strong demand and capacity shortages; transport routes are increasingly overcrowded. Under these circumstances accidents, extreme weather or geopolitical uncertainty can easily cause supply disruptions. Furthermore, the share of transport in oil consumption is rising: it accounts for 63% of the demand growth between 2004 and 2030. Because the oil demand of the transport sector is insensitive to price changes in the short term, temporary shortages are not easily offset by a reduction in consumption; as a result, short-term surges in prices are becoming more frequent.

Finally, a lack of investments in the oil sector may result in higher oil prices in the longer term. IEA estimates that investments worth USD 4.3 trillion are needed in the oil sector between 2004 and 2030 (in real-2005 dollars) to cover growing demand. These investments will not necessarily materialise. Major oil producing countries (including Saudi Arabia, Kuwait and Russia) limit foreign investments in their energy sectors while state-owned oil companies in many countries may not be able to invest with maximum efficiency. War and civil conflict (e.g. in Iraq or Nigeria) as well as environmental concerns (e.g. in the United States and Canada) put further limits to oil sector investments. Should upstream investments fall short of their necessary level, non-OPEC oil production is set to decline and the market

[2] Reference prices are expected to be slightly above the IEA average. In 2005 West Texas Intermediate price was about USD 6 higher than the IEA crude import price, while the Brent was USD 4 higher.
[3] Effects of euro/dollar exchange rate movements will not be considered; instead, the exchange rate is assumed to remain stable in the future.

share of OPEC will rise. If upstream investments remain 25% below the prescribed level, oil prices could be 34% higher by 2030 reaching USD 74 in real terms (at 2005 prices) and about USD 130 at nominal prices.

High oil prices can have adverse effects on the European economy. These include macroeconomic disruptions including a slowdown in growth, rising inflation and potentially deteriorating external balances. The picture is less clear on the sectoral level: some industries and firms are better prepared to cope with high oil prices than others. As a result, high oil prices will have asymmetric effects both across countries and across sectors. Since oil prices are expected to be persistently high, such effects can be long-lasting. Companies have already started to adapt to this new environment. However, various market failures, rigidities and institutional arrangements set back adjustment. Well-designed policies (including trade policy measures) can facilitate this process but their costs and benefits should carefully be weighed.

This paper will first explore the impact of high oil prices on the economy at the macroeconomic and sectoral levels; it will also focus on the interaction between oil and other commodity prices (Section 2). It will then assess spontaneous reactions of economic agents to high oil prices including production relocation, fuel substitution and other responses. These reactions take place without any additional policy measures (Section 3). However, appropriate policies can ease the adjustment to high oil prices. Therefore Section 4 will first assess the need for such policies, and then analyse potential trade policy responses. Section 5 concludes.

2. THE IMPACT OF HIGH OIL PRICES ON THE ECONOMY

2.1 Macroeconomic effects

Key findings and issues

- The effect of oil price increases on economic growth is short-lived: a 10% rise in oil prices shaves off 0.5% of GDP for two years but the effect gradually fades out. The impact on inflation is less clear and depends on the response of monetary policy.
- Depending on the energy intensities of European economies, the impact of high oil prices can be asymmetric among them.
- Higher oil prices improve the non-energy trade balance of the EU: the EU economy is less energy intensive than its trading partners, the import demand of energy exporting countries is biased towards European goods, and high oil prices are historically associated with a stronger U.S. dollar.
- As higher oil prices hurt the EU less than its trade partners, the EU can gain by liberalising its trade regime in times of high oil prices.

High oil prices affect the economy in many ways; among others, they influence economic activity, prices and the trade balance. Because the mechanism of oil price shocks involves many indirect channels, we start with a brief theoretical overview and then proceed to empirical results. We finally present a simulation to gain some insight on the global trade effects of high oil prices.

2.1.1 Effects on growth and inflation – some theoretical considerations

Global recessions since World War II were almost always preceded by marked increases in the price of crude oil. This is especially shocking if one considers that the share of energy expenditures (a part of which is not even related to oil) within total output is quite small: around 4% for the United States in recent years and even less for the EU. Such small factor shares would not directly cause macroeconomic disruptions on their observed scale (Hamilton, 2005). This leads us to conclude that oil price shocks also affect other factors of production, thereby creating second-round effects. The most important explanations are:

- Capital utilisation (Finn, 2000): an oil price rise lowers energy use and capital utilisation. This directly reduces output and through this the marginal product of labour. As a consequence, real wages fall. Lower capital utilisation rate also implies less investment in the future, further curtailing GDP growth.

- Imperfect competition (Rotemberg and Woodford, 1996): if producers have collusive capacity then they can further increase their mark-up while decreasing output in response to an oil price shock.

- Monetary policy: Bernanke, Gertler and Watson (1997) argued that as the Fed (the US monetary authority) raised interest rates after oil price rises to control inflation, it deepened the downturn in output. What's more, these responses were the principal reasons behind the deceleration of output, not rising oil prices. This paper sparked a lively debate among economists. More recent contributions with more sophisticated methodologies (e.g. Barsky and Kilian, 2004) conclude that the role of monetary policy is much more limited.

- Terms of trade effects: rising oil prices worsen the terms of trade for oil importers. This is in fact a wealth transfer from them to oil exporters, weakening their purchasing power in oil importers. On the other hand, extra export revenues of oil exporters may not increase their demand for foreign goods and services at the same magnitude. This leads to contracting GDP in oil importing countries.

The relationship between oil price changes and GDP changes is neither linear nor symmetric. The former means that the response of GDP is disproportionate to the size of the change in oil prices (e.g. a 20% rise in oil prices induces GDP to decelerate more than two times than does a 10% increase). The latter implies that an oil price increase and an oil price decrease of the same amount leads to different changes in GDP; an improvement in GDP growth due to oil price decreases is much smaller than a deceleration due to oil price increases. Frictions in reallocating factors of production between sectors explain much of this asymmetry.[4] Finally, the impact of oil price shocks varies with time: thanks to technological developments and falling energy intensity more recent oil prices shocks have had smaller effects on growth than previous ones.

The link between oil price rises and inflation is another important area of research. High oil prices directly affect the costs of production and fuel prices. These latter then spill over to many other sectors in the economy pushing consumer prices even higher. However, oil price rises, at least in theory, lead to real wage decreases, thereby dampening the effect on inflation. In reality, however, the second-round effects of price increases could give rise to price-wage spirals, and thus the extent of oil price rises on inflation is ambiguous, but the direction in general should be positive.

2.1.2 Empirical findings on growth and inflation

Most empirical findings concern the United States; however, some studies analyse European countries as well. Empirical papers are partly simulations, partly 'genuine' estimates. Since a simulation always assumes a baseline scenario (the trajectory without an oil price shock), there are additional complexities stemming from the uncertainties surrounding the baseline scenario itself. The best current estimates (e.g. Jones, Leiby and Paik, 2004) yield a relatively stable elasticity parameter between GDP growth and oil price shocks: approximately -0.05 for one quarter, assuming that the oil price shock lasts for 2 years. In other words, a 10% rise in oil prices shaves 0.5% off GDP for two years but the effect gradually dies out.

For European countries the effects of oil price shocks on GDP are lower. There are few empirical papers offering a direct comparison between the United States and Europe with respect to the effects of oil price shocks on GDP. A paper by Kilian (2005), however, clearly demonstrates that in France, Italy and the United Kingdom[5] the impact of oil price shocks is considerably smaller than in the US; in Germany the magnitude is similar to the US. There are many reasons why an oil price shock has a smaller effect on the European economy:

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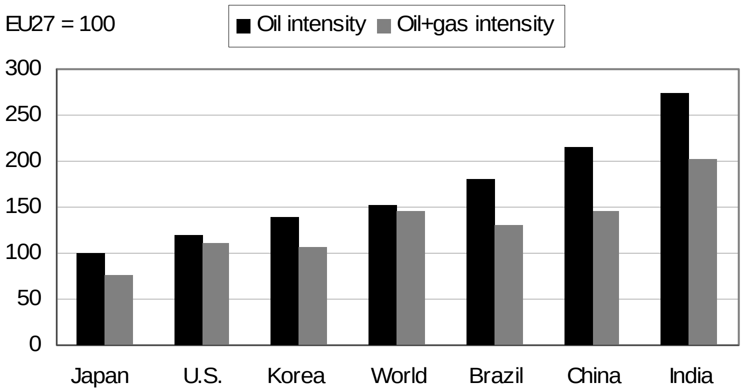
[4] It should be noted that these sectoral reallocations can often be observed only at the 3- or even 4-digit SITC levels. Therefore aggregate analyses often fail to capture these effects. See: Davis and Haltiwanger (2001)

[5] It is to be noted, however, that the United Kingdom is a significant exporter of crude oil.

- While an appreciation of the euro vis-a-vis the US dollar can dampen the effect of rising oil prices, a depreciation improves the terms of trade for EU exporters.
- The European economy is less dependent on oil (and gas) than the United States or some other major economic powers, or indeed the entire world economy (Figure 2.1).
- The exports of the euro area to oil-exporting countries usually exhibit a strong growth at times of oil price rises, as the latter use some of their increased oil revenues to buy European products.

Figure 2.1 – Energy intensities of major economies relative to the EU27, 2005



Note: energy intensities calculated at 2000 purchasing power parities. Russia was not included for better visibility; its oil intensity is 526% of the EU27 while its combined oil and gas intensity is 1141% of the EU27. Source: OECD

We also performed some calculations to assess both the long- and short-term effects of rising oil prices on growth.[6] We found that neither fuel prices including all taxes nor crude oil import prices have a significant effect on the real GDP of European countries in the long run, given the countries' investment in physical and human capital. It appears that European economies were able to accommodate to any level of the oil price in the last two decades without suffering severe problems. These results suggest that the European economies are able to effectively reallocate resources in an environment of rising oil prices towards less oil-intensive production, more technologically innovative sectors and more alternative energy resources.

However, one caveat has to be made. In more than half of the period analysed the crude oil price was at around EUR 15 per barrel. It is only the most recent years that the European economy faces oil prices above EUR 40 per barrel. Thus our model might have covered a rather stable period of low prices and it is even more difficult to predict future developments; more so as the non-linearity of the oil price-growth relationship is established in the literature.

A recent estimate by the IEA (2006) suggests that the oil price increase in the period 2002-2005 caused a GDP growth loss of 0.3 percentage points in the OECD countries. Nevertheless, based on our long-run estimates and what is known from economic theory we are rather confident that short-run losses will already be compensated in the medium term,

[6] We employed a panel data set including EU, EU candidate and EFTA countries' data over the period of 1985-2007 as available from Eurostat. We explained real GDP with the two standard variables of physical and human capital input and in addition, with fuel or crude oil prices alternatively. The models were augmented with short-run dynamic effects (of lags and leads) of the variables' growth rates, in addition to the current growth rate, according to panel data cointegration methods. Including these short-run effects should rule out reverse causality and allow us to concentrate on the long-term relationship.

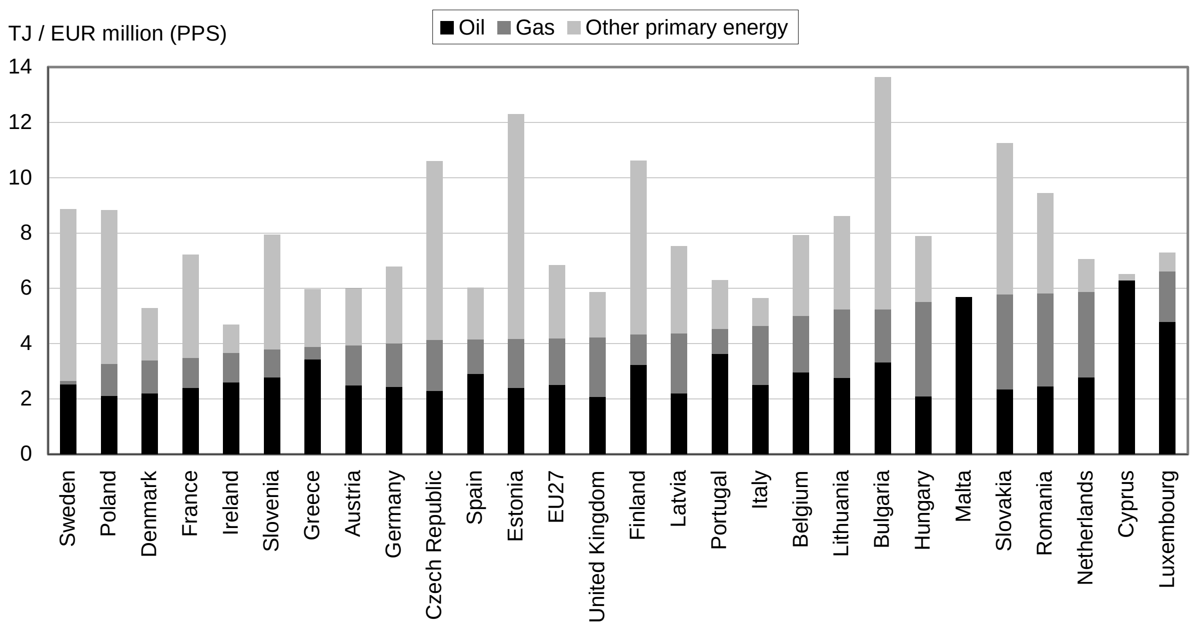
when new investment and fresh technology in less energy intensive industries will boost the economy in the aftermath of an external oil price shock. Thus, our conclusion is that in the long run the macroeconomic effects of high oil prices are insignificant for the European economies.

Regarding the relationship between oil price shocks and inflation, the assumed positive correlation (i.e. higher oil prices lead to higher inflation) is verified by Kilian (2005) for the European countries (except the United Kingdom, where on average oil price shocks were neutral regarding the development in consumer prices), but for the United States there were episodes, when oil price hikes were associated with decelerating inflation. The size of the effects on inflation, however, is markedly lower than in the case of GDP.

Asymmetries across EU economies

The impact of high oil prices also depends on the energy intensity of the economy. In this respect there are large differences between EU Member States: Bulgaria needs three times as much energy as Ireland to produce the same amount of value added (Figure 2.2). The economies of New Member States in Central and Eastern Europe are particularly energy-intensive; this is due to their lower development levels and less efficient use of energy. On the other hand, countries with indigenous resources are less dependent on (mostly imported) hydrocarbons. The amount of oil required for producing a unit of value added is fairly similar across Member States; only Cyprus and Malta are extremely reliant on oil. If all hydrocarbons are also taken into account, differences are more pronounced. Some Eastern Member States[7] rely heavily on Russian gas, and can be particularly exposed to high hydrocarbon prices.

Figure 2.2 – Energy intensities of EU Member States (2005)



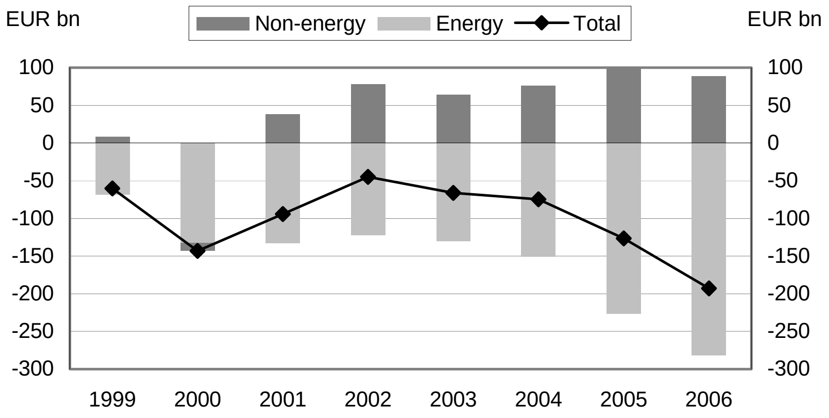
Note: countries are ordered by their hydrocarbon intensity. Source: Eurostat

[7] In particular Bulgaria, Hungary, Lithuania, Romania and Slovakia

2.1.3 Trade balance effects

The trade balance of the European Union is significantly affected by high oil prices (Figure 2.3). Between 1999-2006 the total trade deficit widened from EUR 60 billion to EUR 193 billion. This was entirely driven by the deficit on energy products that quintupled within seven years to reach almost EUR 282 billion; meanwhile the non-energy trade balance even improved. Price changes accounted for 88% of the rise in the energy trade deficit; changing volumes caused the remaining 12%.

Figure 2.3 – The evolution of energy and non-energy trade balances of the European Union



Note: Energy = SITC 3 commodity group. Source: Eurostat

However, the same factors that mitigate the growth-reducing effect of high oil prices in Europe also act against the deterioration of the trade balance (see section 2.1.2). According to our simple, static projections[8] a USD 10 rise in oil prices adds EUR 43 billion to the energy import bill while it increases non-energy exports by EUR 23 billion; the net effect is a EUR 20 billion rise in the trade deficit. A recent econometric study[9] also investigates the dynamic effects of oil price shocks on the trade balance of the euro area. It finds that the net effect of an oil price increase on the trade balance is negative in the first two years but later turns positive as non-energy exports expand.

Asymmetries across EU economies

Again, effects should vary across countries depending on their energy imports (Figure 2.4) and the structure of their exports. Only two Member States (Bulgaria and Denmark) are net exporters of energy and the balance is slightly negative in the Netherlands and the United Kingdom due to their North Sea production. Other countries need to spend 2-7% of their GDP on (net) energy imports. Oil typically accounts for the biggest chunk although gas is dominant in Hungary and Slovakia. The share of energy imports to GDP is the largest in these two countries. Regarding absolute import volumes of oil and gas, the most affected countries are among the biggest economies: Germany, Italy, France and Spain.

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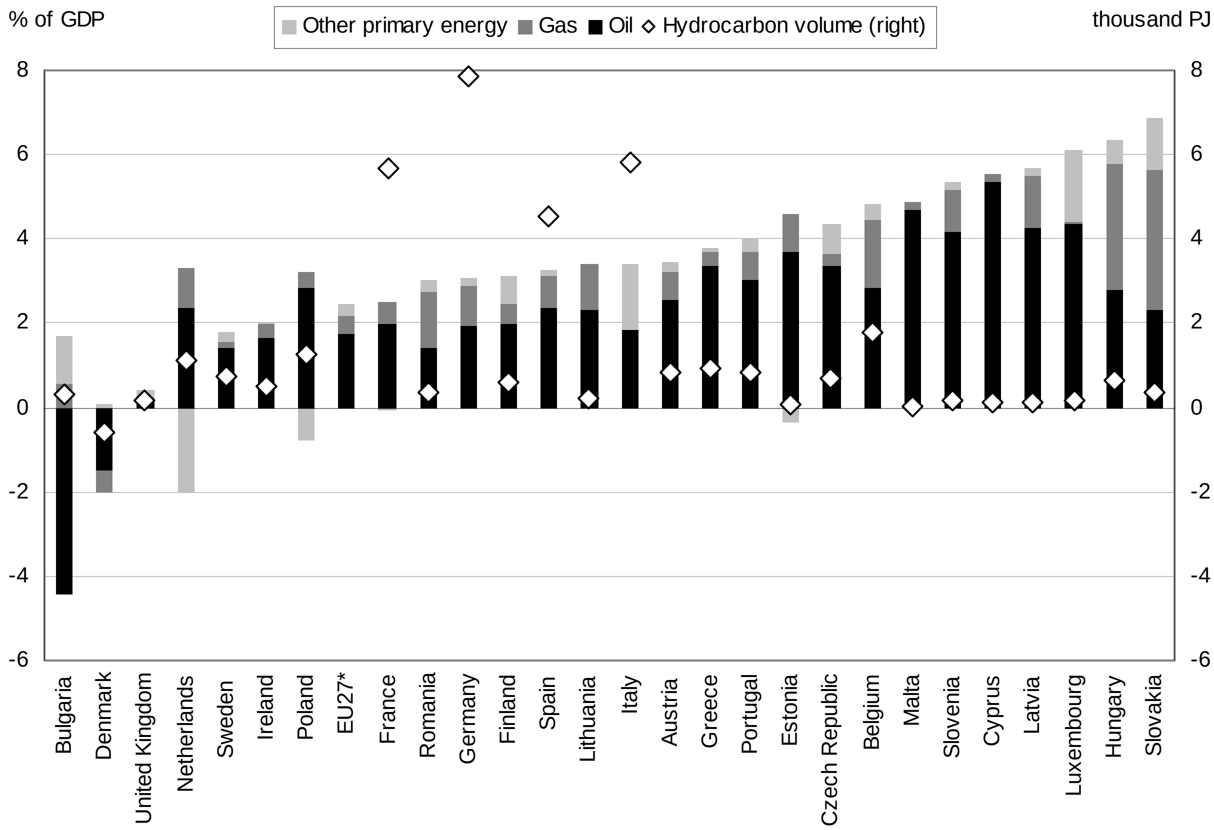
[8] We estimated the oil price elasticity of EU non-energy exports to OPEC countries, Norway and Russia and the oil price elasticity of EU energy exports and imports. Non-energy exports to other countries and non-energy imports were assumed to be independent of the oil price. We then simulated the evolution of the EU trade balance with various oil price levels.
[9] Kilian, Rebucci and Spatafora (2007)

Figure 2.4 – Net energy imports in Member States (2006)



*Note: * net extra-EU27 imports. Hydrocarbon quantity = sum of net oil product and gas imports measured in heating value.*
Source: Eurostat

2.1.4 A simulation exercise

This part of our research is devoted to the simulation of a policy change in the case of a sustained high world oil price. We employ the global simulation model (GSIM) for the analysis of global, regional, and unilateral trade policy changes by Francis and Hall (2003). The model is a multi-region, imperfect substitutes model of world trade employing a partial equilibrium approach. Each country produces only one composite good, therefore sectoral effects are not considered here. The results of the GSIM allow the assessment of importer and exporter effects related to tariff revenues, exporter (producer) surplus, and importer (consumer) surplus, changes in trade, output and prices.

We assume that each measure of economic policy can be substituted by another one that has the same effects. We therefore introduce into GSIM equivalent ad-valorem tariff rates, which simulate the effects of the assumed increase in the oil price.[10] This is in addition to official tariff rates for each single trade flow. The additional simulated tariffs are computed using the different oil intensities of national production of the countries in the world. For clarity we will concentrate on the EU, the USA, China, Japan and the rest of the world. The data we used was taken from the Global Trade Analysis Project (GTAP), the Energy Information Agency and the International Energy Agency. We do not take into consideration trade flows with countries that are net exporters of oil such as Russia or OPEC countries. The latter have an opportunity to benefit in terms of both output and non-oil exports under certain conditions.

[10] For our calculations, levying a 10% ad valorem tariff is equivalent to a 10% rise in oil prices for consumers.

However the goal here is to focus on the world's most important non-oil trade flows and on those of the EU in particular.

The following short-term, 'year 2010' scenario is considered. The oil price shifts to from EUR 25 to EUR 60 per barrel.[11] This could happen either with current oil prices and a strong depreciation of the euro, or due to further increases in the dollar price of oil. We assume the 2004 levels of oil intensities to remain constant throughout the simulation period. In ad valorem terms we estimate that EU exporters will face the equivalent of an additional import tariff rate of 1.6%; an equivalent intra-EU barrier to trade is also assumed by the model. Similarly, given the different levels of oil use in production, US exporters will face an additional equivalent rate of 2.9%, the Japanese 1.7%, the Chinese 6.6% and the rest of the world 3.2%. Adding these rates to the base year tariff rates provides us with the following simulation results.

Given the increase in the oil price and the subsequent, short-run rise in consumer prices, demand declines and overall production is estimated to fall slightly, as compared to the base year. For the EU this is assumed to be less than one percentage point. For the other countries, which use oil more intensively in their production, this loss is expected to be higher. The most interesting result of our simulation though is the estimated change in real trade flows (see Table 2.1).

Table 2.1 – Bilateral trade quantities: percent change

'Year 2010' scenario: Oil price shifts from EUR 25 to EUR 60 per barrel

		Destination				
		EU	**USA**	**Japan**	**China**	**ROW**
Origin	**EU**	-1.1	0.9	-0.8	6.4	1.1
	USA	-3.6	-1.9	-2.9	4.3	-1.6
	Japan	-0.9	0.9	-1.1	6.5	1.1
	China	-10.4	-8.4	-9.9	-4.5	-6.5
	ROW	-4.4	-2.6	-4.1	3.5	-2.0

Note: ROW = Rest of world. Source: Own calculations

Changes in trade quantities in the aftermath of an oil price increase are expected to be mixed. Domestic sales decrease in all countries. However, in the EU and in Japan this is only a bit more than one percentage point. In the other regions of the world the drop is between 2% and 4.5%. In terms of exports we expect the two least oil intensive players, the EU and Japan, to profit from a rising oil price, as compared to their oil intensive trading partners in the US, China and the rest of the world. The EU could expect to increase its exports to the US by about 1% and to China by more than 6%. If the technological level of 2004 was assumed not to change, China would be a net loser of a higher oil price. Its highest rate of export drop (-10%) would be vis-à-vis the EU. In general the EU would face reduced import penetration from all the trading partners considered here (notwithstanding oil-exporting countries).

Overall, in the short-run a higher oil price of about EUR 60 per barrel would not have dramatic effects on world trade. In fact those countries that use oil more efficiently in their production, such as the EU, can expect an improvement in their trade balances, notably

[11] Roughly from USD 33 to USD 80 (at the exchange rate of USD 1.3/EUR). Different magnitudes of oil price changes do not change the conclusions of the simulation qualitatively.

because of a strong decrease in imports that are more oil-intensive than domestic EU goods. Also, due to the fact that energy taxes in the EU are partly not ad-valorem (i.e. defined in EUR per unit rather than as a percentage of price), the same increase in the price of oil across the world reduces the relative difference between final prices of fuel between the EU and other regions. Therefore a global rise in oil prices does not worsen the EU's price competitiveness on world markets, even in the case of oil-intensive industries.

This piece of evidence suggests that there is to be no need for protectionist action in the wake of high oil prices. Quite on the contrary, the EU could use periods of rising oil prices in order to liberalise its trade regime further. The usual gains from lower prices of imported goods (decreasing consumer prices and as a consequence increases in consumer welfare) apply in this case as well. Increased import competition also contributes to more efficient resource allocation. In this respect we calculated an additional simulation under the assumption that apart from the rising oil price, the EU would reduce its import tariffs by 50%. The outcome is that, although import penetration into the EU is lower, the EU would still face an improved trade balance due to the changes of relative prices.

2.2 Sectoral effects

Key findings and issues

- The energy intensity of European industries has improved greatly since the 1970s, enhancing their adjustment potential to high oil prices.
- The sectoral effects of high oil prices are short-lived and usually moderate: the employment and output effects fade away after just two years. The most exposed sectors are transport, chemicals, non-metallic minerals, agriculture, followed by basic metals.
- The petrochemical industry benefited from recently high oil prices thanks to strong demand for their products. Electricity generation with its concentrated market structure could pass costs onto consumers. Basic chemicals and metallurgy are feeling the double squeeze of high energy costs and stiff competition from Asia and other developing regions.
- Agricultural input costs rose faster than output prices. Strong demand for raw materials and biofuels can partially offset cost increases.

Besides aggregate effects on the macroeconomic level, our study also analyses sectoral impacts as the sensitivity of different sectors to oil price shocks is quite different, depending mainly on their energy intensity. Therefore we start off with the analysis of trends in energy intensities for European industries, and then proceed to the recent experiences of energy-intensive sectors with respect to high oil prices.

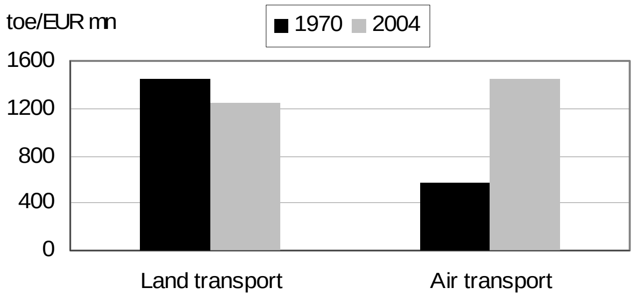
2.2.1 The energy intensity of European industries

Which sectors of activity are the most intensive users of petroleum products? This question can be analysed by comparing the oil product intensity of value added formation between sectors. Furthermore, comparisons can be made across time to see whether the vulnerability of specific sectors has changed over time. For this purpose we constructed a dataset covering 10 economic sectors of the EU15 over the period from 1970 to 2004. The indicator we use is each sector's consumption of oil products in tonnes of oil equivalent divided by gross value added in constant PPS euros (toe/million EUR).[12] This is a measure which strips out price differences between countries within the EU15 as well as price changes through time.

The transport sectors are by far the most oil product intensive sectors. Estimates for 2004 for air and land transport[13] were 1446 and 1241 toe/million EUR respectively. These intensities are several times larger than those of the most oil product intensive branches of manufacturing activity which are chemicals with 343 toe/million EUR[14], and non-metallic minerals (including cement, lime, glass and ceramics, etc.) with 139 toe/million EUR.

How had these intensities evolved since 1970? Concerning transport services, land and air transport have had completely different evolutions (Figure 2.5). The efficiency improvements in land transport have been modest since 1970, not least because the strongest efficiency gains had already been made by that time as the road network in the EU15 countries and the vehicle fleets then in existence had already guaranteed a large degree of flexibility and competition. Land transport therefore remains, as it was in 1970, highly exposed to oil.

Figure 2.5 – Evolution of the real oil product intensity of EU15 transport sectors



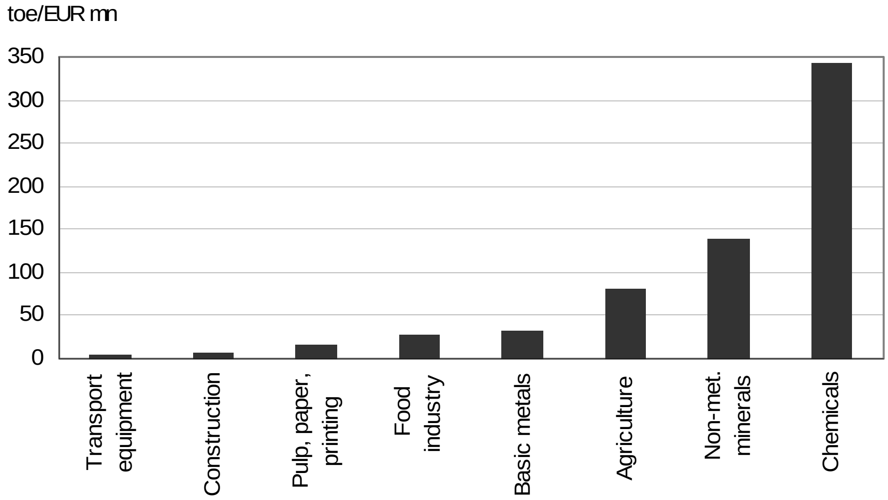
Unit: Gross value added at 1995 PPS. Source: IEA, KLEMS database, own calculations

Air transport evolved from operating in an environment of very low competition (i.e. an industry which could afford some inefficiency not only in terms of fuel use but also in terms of the rest of its cost structure) to a competitive industry that provides services to an expanding market. This was reflected by a fall in real prices which more than compensated for substantial fuel efficiency improvements. This development continued in the most recent years, as can also be understood from cost-based measures. As reported by IATA (2007), fuel costs as a share of total operating costs jumped from 12.2% in 2001 to 20.5% in 2006 for airlines registered in Europe. Due to strong price competition in the context of the industry's continuing expansion, the rise in fuel prices between 2001 and 2006 was mostly absorbed by efficiency measures rather than by increases in flight prices. In other words, competition has shielded consumers from a carry-over of higher fuel prices so far. This may continue in the short run. However there are long-term limits to fuel and non-fuel efficiency improvements, so that further fuel price increases would push the industry to raise prices to passengers.

[12] This is comparable to the standard measure of overall energy intensity of GDP (usually measured as gross inland consumption of energy in physical units divided by GDP at constant purchasing power standards, or PPS).
[13] For reasons of data availability and comparability it was not possible to include maritime and inland waterway transportation. It was also not possible to split road from rail or pipeline transport.
[14] For the purposes of this analysis we have included the feedstock (mostly naphta) that is used in the industry as part of the industry's consumption of oil products.

Turning to the other sectors, the picture for 2004 is shown in Figure 2.6. There are large differences in potential vulnerability to oil price shocks between the selected sectors. Chemicals, non-metallic minerals and agriculture are the most sensitive activities, followed by basic metals (iron, steel as well as non-ferrous metals such as copper or zinc). On the other hand, the manufacture of transport equipment and construction are not vulnerable.

Figure 2.6 – Real oil product intensity of selected non-transport sectors in the EU15, 2004

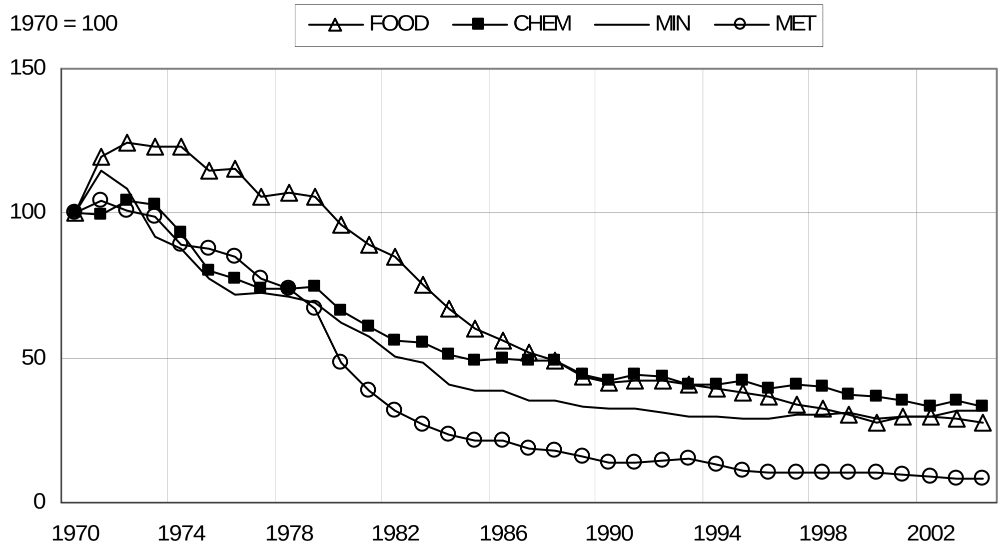


Unit: tonnes of oil equivalent per million Euro of gross value added at 1995 PPS
Source: IEA, KLEMS database, own calculations

The changes over the 1970-2004 period have been remarkably strong for most sectors, with significant reductions in oil product intensity in all sectors except construction, which is anyway not significantly vulnerable. These changes indicate that the more fuel-intensive sectors, though still comparatively sensitive to high fuel prices, are much less sensitive to oil product price changes than they were before the first oil shock of the 1970s. This is illustrated in Figure 2.7 which shows the evolution of real product intensity for the most sensitive manufacturing sectors since 1970, namely food and beverages (FOOD), chemicals (CHEM), non-metallic minerals (MIN) and basic metals (MET). As can be seen, the fastest improvements in fuel efficiency started after the first and second oil shocks (1973 and 1979), though improvements continued up to the late 1990s for non-metallic minerals and up to 2004 for the other sectors.

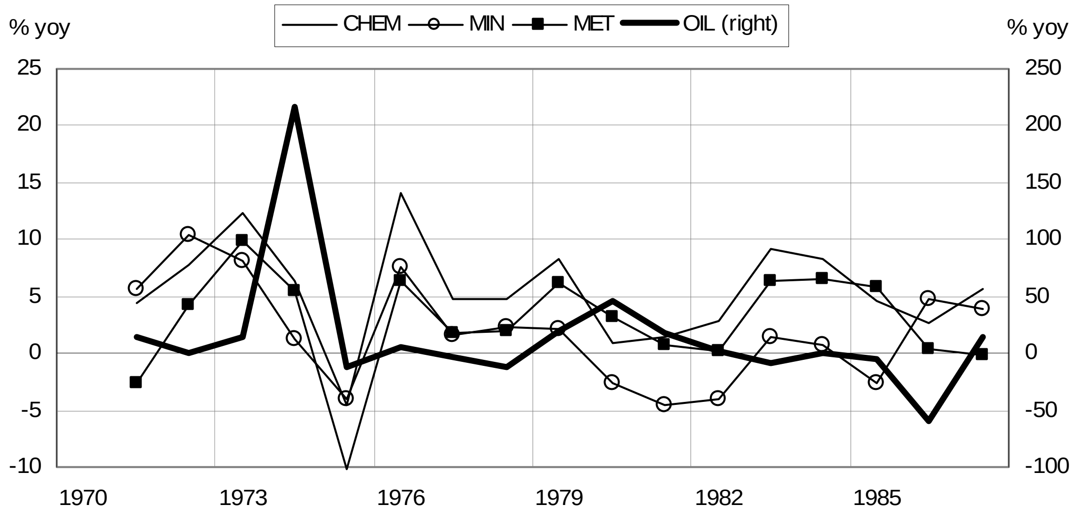
The effects of the oil shocks of the 1970s are also clearly visible from real GVA data for certain sectors. As can be seen from Figure 2.8, the sharp rise in the real price of oil (OILP, right-hand side axis) led to a contraction of real GVA in chemicals, non-metallic minerals and basic metals in 1975. However growth resumed already from 1976, until the next oil shock. The second oil shock is more interesting: chemicals and metals suffered only a temporary slowdown, while non-metallic minerals entered a four-year phase of slow absolute decline and then stagnated for the entire period during which oil prices were high, whereas growth in the other two sectors decisively picked up again 2-3 years earlier. Construction activity stagnated throughout the entire 1970-1987 period, which partly explains the stagnation of demand for non-metallic minerals. (The food industry was not visibly affected by the oil shocks, although it also took significant steps to improve fuel efficiency. For better visibility it was omitted from Figure 2.8).

Figure 2.7 – Index of oil product intensity in selected sectors of the EU15, 1970-2004



Source: IEA, KLEMS database, own calculations

Figure 2.8 – Index of real gross value added in selected sectors of the EU15 and the evolution of the real price of oil, 1970-87



Source: IEA, KLEMS database, OPEC, own calculations

In order to offer a more systematic approach to these considerations we opted for an econometric assessment of the relationship between the real gross value added of the ten sectors and the oil price in two sub-periods: 1970-87 and 1988-2004.[15] Our expectation, based on the descriptive analysis above, was that we would find a significant relationship for the

[15] We ran a series of vector autoregressions with real GVA as the dependent variable and the oil price as the explanatory variable, thus allowing for effects from the lagged values of the oil price as well as lagged values of year-on-year changes in the oil price. These regressions were performed for each sector separately. Furthermore we estimated the relationships for each sector separately over two distinct periods: 1970-1987 and 1988-2004. We then performed Granger causality tests for each of these 20 VARs to determine whether oil price levels and/or changes were helpful in explaining changes in real GVA.

first period, but a non-significant (or significant but weaker) relationship for the second period. The results we found were very clear and confirmed our expectations.

Real GVA in pulp, paper and printing, chemicals, non-metallic minerals, basic metals, transport equipment, construction and land transport was found to react negatively and significantly to positive changes in the oil price with a lag of one year, i.e. real GVA grows less than its own trend one year after an oil shock. There is evidence for a causal link between the oil shock and the shortfall in activity in those sectors. However these results hold only for the first period 1970-1987. Both the relationship and the causality break down for all these industries for the 1988-2004 period. In other words, changes in the oil price no longer drive changes in GVA in those sectors: they have become much less responsive to oil price shocks. The results for food and beverages and air transport were not significant in either period. In the case of food and beverages, this is due to the structure of demand for food products in high-income countries. In the case of air transport this is due to market structures which have (so far) protected the industry, as discussed above. Finally for agriculture a puzzling result was found, suggesting a dependence on the change of oil price with a lag of two years. However this relationship was not found to be significant for the second period.

To conclude, there is no doubt that an oil price shock can adversely affect value added generation in sectors such as non-metallic minerals, chemicals or basic metals, not to mention transport. However even in the proportionately largest shock so far, the one of 1973, and even given oil product intensities almost three times larger than what they are today, the dips in real GVA were only short-lived and were not particularly disastrous in real terms. European industries are today much less vulnerable than they were and should therefore be able to avoid any major losses over the next few years if the real price of oil does not increase much more than it has so far. These conclusions are also supported by previous empirical findings on US industries. These show that the employment and output effects of oil price shocks are typically modest and short-lived; they effectively fade away after just two years. Sectoral effects are also asymmetric: firms and industries with higher energy intensity, higher product durability and younger plants are relatively more affected (especially petroleum refinery, industrial chemicals and the automotive industry).[16]

2.2.2 Recent developments in selected European economic sectors

How did individual sectors cope with recent oil price increases and what are their prospects in an environment of persistently high oil prices? This section will assess the situation of some energy-intensive industries, transport and agriculture.

Some general trends are clearly visible:

- Asia and the Middle East emerge as formidable competitors in many energy-intensive industries (e.g. aluminium, chemicals, paper and steel). Their resource costs (labour and energy, respectively) are lower and their markets are growing faster than Europe. Resource owners also diversify their economies by building up energy-intensive sectors (e.g. aluminium in Dubai, iron and steel in Russia). This is sometimes accompanied by trade-distorting practices in resource pricing (see section 4.1 for

[16] See: Davis and Haltiwanger (2001); Lee and Ni (2002)

further discussion). Finally, energy-intensive industries in the EU also face potential cost increases in the EU emissions trading scheme (EU-ETS).

- Consumer goods sectors are increasingly segmented into two parallel markets: a premium market for wealthy consumers and a ‘no-frills’ market for the emerging swathes of consumers in developing countries.[17] The no-frills market is characterised by massive volumes and low costs; the premium market contains global brands and several niches. As a result, separate markets for low-cost and specialty products emerge in material industries as well. Europe is gaining market shares in up- and mid-market products (where it is the largest exporter of the world), but it is losing shares down-market. China overtook Europe as number one down-market supplier between 1995 and 2003; it is rapidly gaining share in mid-market and even some up-market product groups (e.g. electronics).[18]

- In such an environment, managing costs is becoming even more critical for materials companies (e.g. steel, paper) in the face of competition from countries with low wages and of rising energy and raw material prices. They can respond basically by relocating or by improving their efficiency (see sections 3.2 and 3.4).

The growth performance of the most energy-intensive manufacturing sectors is summarised in Table 2.2. These industries typically grew slower than the manufacturing average (2%); however, the growth of chemical industry on the whole was strong. The performance of sub-groups is more diverse: there are successful and ailing branches in every sector. Negative growth rates in some branches may signal relocation of activities (see section 3.2 for detailed analysis).

Firm-level data of the BACH database of the European Commission suggest that as energy and raw material prices increased, their cost share (relative to turnover) increased by about 5 percentage points between 1999 and 2005. There is no clear trend in the profitability of energy-intensive sectors. Margins in the pulp and paper industry appear to have squeezed considerably while non-metallic minerals also saw falling returns. On the other hand, profit margins increased in petroleum refining and to some extent in chemical industry. Profitability of land, water and air transport (not included in Table 2.2) also improved in recent years. These developments suggest that most companies could offset higher energy and material costs with efficiency improvements and the strict control of other (e.g. labour) costs.[19]

[17] Bozon, Campbell and Lindstrand (2007)
[18] European Commission (2006c)
[19] Note that the BACH database covers a limited number of countries and it uses either variable samples (changing every year) or sliding samples (identical in adjacent years). Therefore intertemporal comparisons are should be taken with great care.

Table 2.2 – Recent performance of energy-intensive manufacturing

	Average annual growth (%, 1999-2006)	Best performing branches	Poorest- performing branches	Material costs / turnover (%)		Profit / turnover (%)	
				1999	2005	1999	2005
Pulp and paper	1.7	Household and sanitary goods (3.2%)	Paper stationery (-0.7%)	65	70	4	1
Coke, petroleum and nuclear fuels	1.2	Coke oven prod. (3.2%)	Refined petroleum prod. (1.2%)	80	88	3	7
Chemical	3.3	Pharmaceutical preparations (6.2%), synthetic rubber in primary forms (4.4%), industrial gases (3.2%)	Pesticides (-4.0%), man-made fibres (-3.0%), essential oils (-1.3%), fertilizers (-0.7%)	67	73	7	9
Rubber and plastic	1.8	Plastic packing (2.2%)	Builder's ware of plastic (-0.8%), rubber tyres and tubes (-0.7%)	63	67	4	4
Other non-metallic minerals	1.1	Plaster products for construction (4.7%), glass fibres (3.8%)	Ceramic household and ornamental articles (-7.4%), ceramic tiles and flags (-1.5%), hollow glass (-1.1%)	56	61	7	6
Basic metals	1.7	Cast iron tubes (4.6%), casting of light metals (4.0%), steel tubes (3.3%)	Precious metals (-5.4%), lead, zinc, tin (-1.9%), wire drawing (-1.6%)	71	75	4	5
Fabricated metals	2.1	Forging, pressing, stamping and roll forming, powder metallurgy (4.4%), treatment and coating (3.9%), general mech. engineering (3.7%)	Tanks, reservoirs, containers (-2.9%), steel drums (-2.1%)	62	65	4	4

Notes: Memo: annual average production growth of manufacturing was 2% between 1999 and 2006. Best and worst performance among 4-digit NACE branches (3-digit where not available; annual average growth rate between 1999 and 2006 in parentheses). Data in first four columns refer to EU27; last three columns refer to the arithmetic mean of selected countries (Austria, France, Germany, Italy, the Netherlands, Portugal, Spain). Source: Eurostat (first four columns), BACH database of the European Commission (last three columns).

Chemical industry

Despite strong growth the European chemical industry has lost its number one rank to Asia. The rise of oil price affects the petrochemical industry most directly; still, firms could pass the rise of energy prices to consumers thanks to their market power, and refinery margins surged. There is a risk of relocation in the medium term to the Middle East as domestic feedstock prices are much lower in these countries. Negative growth in some basic chemical branches is a signal of ongoing relocation (see section 3.2). The manufacture of fine chemicals, pharmaceuticals and consumer chemicals are less energy-intensive; they also have a favourable growth potential.

Basic and fabricated metals

The rapid development of Asian economies has increased the demand for steel, pushing up global metal prices. Capacity in these countries is rising; the share of China in world crude steel production rose from 15% in 2000 to 34% in 2006. In general, European metal industries could also benefit from strong global demand; improvements in energy efficiency are under way as a response to high energy prices. Access to affordable materials is becoming a critical issue for them. Basic metals industries can be subject to trade-distorting subsidies in some developing and energy-exporting countries (see section 4.1).

Wood and paper industries

According to the Confederation of European Paper Industries (CEPI), access to affordable raw materials remains one of the key issues for European wood and paper enterprises, particularly in the first processing stages of the production chain. This is partly due to the increased use of forests for other purposes (e.g. biomass for energy production). One way for paper mills to reduce the cost is to extract energy from the pulp liquor and other waste products, and this strategy is increasingly popular. Using recovered paper for paper production can also reduce costs.

Automotive industry

The impact of high oil prices could be crucial if price movements influenced the transport/travel behaviour of consumers. Gasoline prices affect such habits only in the long run; the high tax content of gasoline also shields consumers from abrupt changes in crude oil prices.[20] Certain market trends affect customers as well: demand for heavy passenger cars (SUVs) is strong despite their large fuel consumption, whereas 'green fuel policy' has influenced only a limited number of customers. Fuel prices mainly affect the choice between gasoline and diesel engines; demand for diesel cars rose faster in recent years.

Electricity and gas industries

Due to their highly concentrated market structures they could pass fuel price increases on to consumers. This has prompted investigations by the European Commission and complaints by energy-intensive industries.[21] With more competitive electricity markets production may become more responsive to energy prices as evidence from the UK shows (section 3.3).

Transport

The transport sector has coped fairly well with rising oil prices. Strong demand helped to push up revenues while stiff competition encouraged cost savings. For example, return on assets rose by over 1% in French and by over 2% in Spanish road transport between 2000 and 2005; the profitability of water and air transport also increased in a number of Western European economies during the same period.[22] The share of fuel in the cost structure is rising, but this was more than offset by efficiency gains and the control of labour costs. For example, unit costs in European short-haul air transport fell by 16% between 2001 and 2005 despite rising fuel prices, according to IATA.

Agriculture

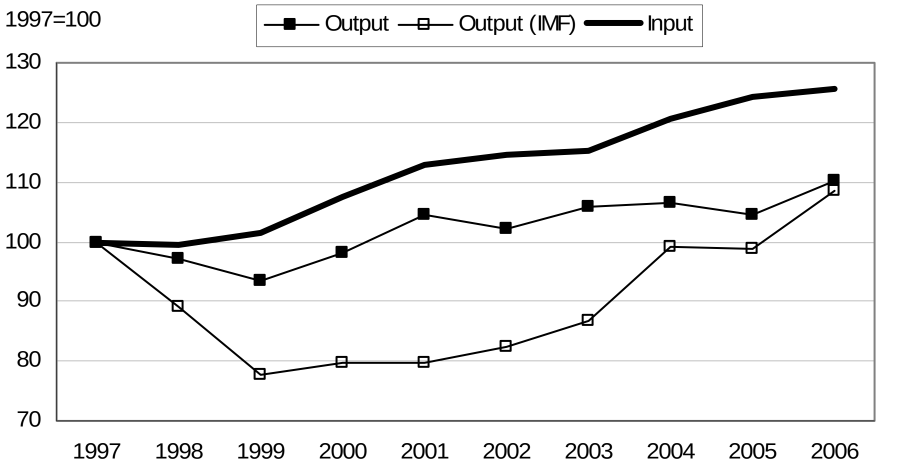
As Figure 2.9 shows, the cost of agricultural inputs for EU farmers rose by over 25% between 1997 and 2006; its trend follows the development of oil prices. Price increases for different types of inputs varied greatly from no change (seeds, pesticides, animal feed) to 40% for

[20] Since excise taxes are levied by quantity and not by value, they constitute a fixed element of the final consumer price of gasoline.
[21] Communication from the Commission Inquiry pursuant to Article 17 of Regulation (EC) No 1/2003 into the European gas and electricity sectors (Final Report) {SEC(2006) 1724} /* COM/2006/0851 final */ and DG Competition report on energy sector inquiry (SEC(2006)1724 of 10 January 2007)
[22] The countries analysed include France, Germany, Italy, the Netherlands, Portugal and Spain. Data source: BACH database of the European Commission.

fertilisers and 83% for energy. The trend of output prices is much less clear. World market prices dropped sharply between 1997 and 1999 but EU producers were partly shielded thanks to the intervention system of the Common Agricultural Policy (CAP). Since then, global prices rebounded, driven by strong world demand for raw materials and the increase in production costs. As a result, margins of agricultural producers using energy-intensive production methods could have dropped.

The direct impact of high oil prices on the farm sector depends on farm size and production patterns, notably the use of fertilisers.[23] Higher oil prices benefit smaller farms and organic farming (using more labour-intensive production methods) as well as shorter supply chains and local production (see section 3.1).

Figure 2.9 – Evolution of agricultural output and input prices in the EU



Note: IMF = agricultural product prices on world markets. EU and IMF output definitions differ. Only inputs directly used for production are considered. Source: Eurostat, IMF, own calculations

Global price developments suggest generally favourable long-term prospects for European agriculture despite current difficulties. The (partial) liberalisation in the EU should enable changes in output prices to be more responsive to changes in both global and internal market demand. Agricultural prices are projected to remain high[24] over the coming decade for two main reasons:

- With permanently high oil prices global biofuel production is set to rise. This will push up the prices of these commodities (e.g. sugar, corn); rising demand for arable land can indirectly raise the prices of other products as well.
- Demand for meat products is rising in developing and transition countries (chiefly China) thanks to improving living standards. This should lead to higher demand for crops as inputs for animal rearing.

[23] For example Ceccon et al. (2002) analyse the energy use of farming systems in northeastern Italy; Pimentel (2006) assesses a number of products in the U. S.; Refsgaard et al. (1998) investigate dairy production in Denmark.
[24] A comparison of recent forecasts is available in European Commission (2007a).

2.3 Effects on commodity prices

Key findings and issues

- Rising mineral commodity prices are mostly influenced by the emergence of China and other developing economies. The impact of oil price increases is less prominent.
- High oil prices strongly influenced fertilizer, steel and cement prices. The link between oil and agricultural commodity prices is less clear although the increasing use of biofuels could have some effect on crop prices.

Commodity prices respond to changes in energy prices for two main reasons. First, the production process of many commodities requires the use of energy products, in the form of feedstock as well as in the form of energy. Second, energy prices affect the cost of transportation of the commodities to its consumers.

Nevertheless, the prices of commodities crucially depend on a number of other factors, in particular market structures and the evolution of supply and demand. It is therefore not always easy to identify the size of the impact of energy prices on commodity prices, as that effect can be more than compensated by the effect of excess supply capacity or of excess demand. Moreover it is common for commodity prices to rise for a few years in a row, and then fall for a few years in a row, as the full effect of past investments in production capacity come into place, themselves the result of past forecasts of supply and demand which may have been inaccurate. In addition, prices are in certain cases made less stable and subject to more violent swings due to their tradability on purely financial exchanges, enabling, in some cases, speculation on future prices to get out of hand, as happened for example with metal prices in the first half of 2006.

In spite of these caveats, we will attempt to give a picture of recent developments and explore their main drivers. We start off by looking at the overall evolution of metals prices at the global level, given the enormous changes in metals prices that have occurred in the last few years. We then turn to an assessment of domestic prices of selected commodities in the European Union.

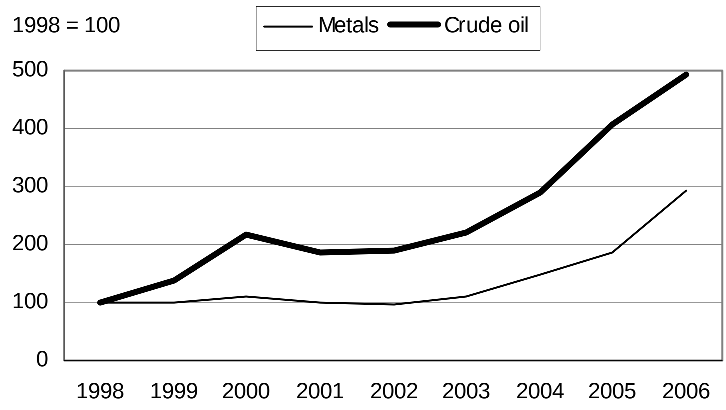
2.3.1 Industrial commodity prices

After a relatively stable period between 1998 and 2003, metal prices almost tripled between 2003 and 2006-2007 (Figure 2.10). However IMF (2007) forecasts that there should be a 14% fall in prices by 2008. There are several explanations for these changes:

- China has emerged as an economic giant in material terms. Its very strong economic growth, which includes very rapid industrialisation as well as enormous investments in infrastructure and construction, has led to strong excess demand for metals.
- Major global and Chinese producers have been reacting to this growth in demand by investing in new supply capacity. These investments came with a lag and in some instances under-estimated the extent of demand growth, thus leading to upward pressure on prices. This phenomenon seems to be coming to a close as the new supply capacity comes online, leading to the fall in prices forecast for 2008.

- Higher crude oil price played a part in driving up metal prices, given the energy-intensive nature of metals production and given increased transport costs.

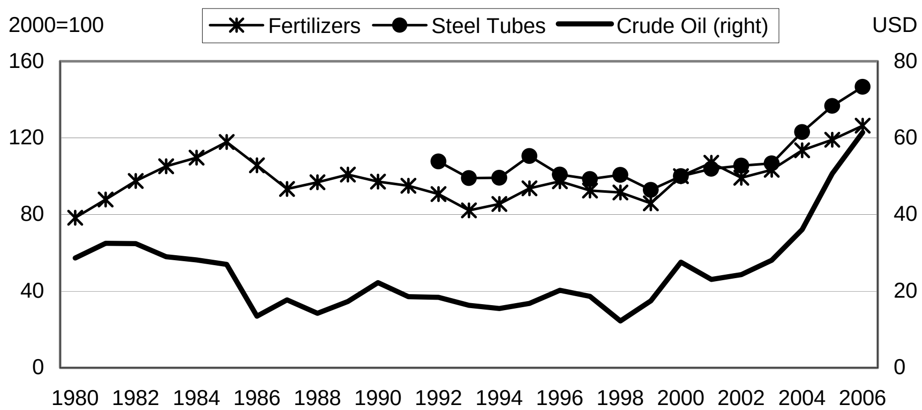
Figure 2.10 – Global evolution of metals prices



Source: IMF

We now turn to the evolution of selected domestic commodity prices in the European Union. We focus our analysis on selected commodities which are internationally tradable and may be influenced by the price of oil, namely fertilizers, primary plastics and steel tubes (Figure 2.11).[25] We performed an econometric analysis to identify the impact of oil prices on these commodity prices.[26]

Figure 2.11 – Selected domestic producer price indices, France, 1980-2006



Source: Eurostat, OPEC

Our results were as follows: there are positive and significant level and first-difference effects of the oil price onto the price of fertilizers. Furthermore the first-difference effect passes the

[25] We extracted nominal price indices data from Eurostat covering these commodities. Owing to missing data for several countries for many of the earlier years, we used domestic prices for these commodities in France as an example. The data covers 1980-2006 for fertilizers, plastics in primary form, and 1992-2006 for steel tubes.

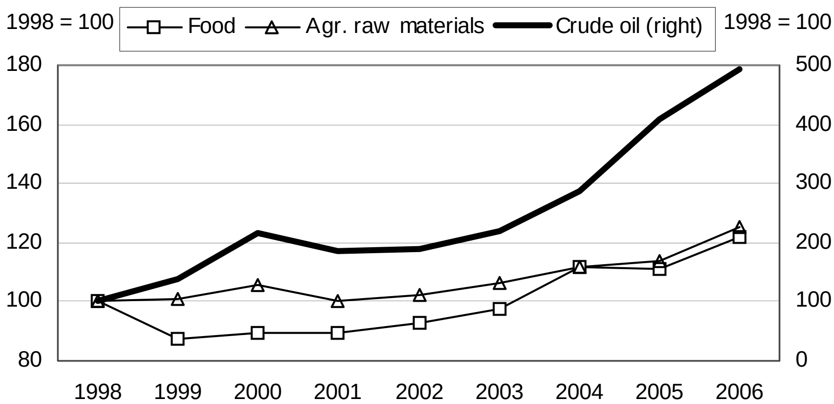
[26] We ran vector autoregressions and subsequently performed Granger causality tests to check whether the level or lagged level of the nominal oil price was driving the prices of the selected commodities, and how strong that effect may be. We also tested for the effect of year-on-year changes in the oil price.

Granger causality test. The regression results suggest a knock-on effect of 0.19 percentage points on the price increases of fertilizers for every percentage point acceleration in the price increase of crude oil. Prices of plastics in primary form do not appear to be significantly affected by the price of crude oil. Prices of steel tubes were significantly driven by the price of crude oil, with a significant, positive impact from year-on-year changes in the price of oil. This result is plausible, but must be seen in the context of the global evolution of demand and supply of steel, as discussed earlier.

2.3.2 Commodity prices in agriculture

Agricultural commodity prices have followed a similar tendency to crude oil prices (Figure 2.12). However, the magnitude of recent increases was much more limited: about 20% between 1998 and 2006 compared with 400% for crude oil. We performed the same econometric tests as for industrial commodities over the period 1980-2006. Neither the level of oil price nor its growth rate was found to Granger-cause agricultural commodity prices, and the relationships were statistically insignificant. Based on these results we can conclude that the recent co-movement of oil and agricultural commodity prices is driven by a common third factor, namely the strong growth of the global economy. This situation is changing in the case of sugar and vegetable oils, whose potential use as biofuel make their price responsive to oil prices. For example, the free market price of sugar more than doubled between 2002 and 2006 as rising crude oil prices boosted biofuel consumption.

Figure 2.12 – Global evolution of agricultural commodity prices



Note: Food = cereals, vegetable oils, meat, seafood, sugar, banana, orange. Agricultural raw materials = timber, cotton, wool, rubber, hides. Source: IMF

3. ECONOMIC RESPONSES TO HIGH OIL PRICES

Firms and consumers are naturally adapting to changes in the economic environment, including the rise of oil prices. Higher energy prices affect both their manufacturing and transportation costs of firms. Not surprisingly, their responses concern either passing on these costs to consumers or reducing them. Four issues will be discussed in detail: changes in corporate supply chains, production relocation, fuel substitution as well as energy efficiency and recycling.

3.1 Responses of corporate supply chains

Key findings and issues

- Current practices of supply chain management took advantage of cheap transport fuels in the 1990s; they need to adapt to higher oil prices.
- Although firms have become more aware of the role of oil prices in their supply chains, major changes are not expected until the price of oil exceeds USD 100.
- A more conscious management of energy costs and a reassessment of transport modes is taking place, potentially reducing the role of air and road freight and shifting to intermodal transport.

Current theories and practices of supply chain management were largely designed in the 1990s in a period of historically low oil prices. Supply chain innovations of this era were concentrated around the idea of lean manufacturing, the notion that inventories should be minimised and product life cycles shortened. These methods made full use of low fuel costs:[27]

- Just-in-time manufacturing: materials are brought into the plant only when they are needed; this results in smaller, more frequent shipments.
- Relocation and overseas sourcing: producers take advantage of lower manufacturing costs overseas, leading to higher transport requirements and costs.
- Shorter product lifecycles: in many industries (including high-tech and apparel) products must get on the shelf quickly; because of higher margins for these goods transport costs are less of a concern and air freight is frequently used.
- Oil-based materials and packaging: there is a steady switch from glass (bottles, jars) and paper (packaging) to plastic, leading to more oil consumption during production.
- E-commerce: online internet shopping is typically associated with parcel shipping, typically in smaller quantities and often via air.

There is growing concern that current supply chain management techniques become unsustainable with persistently high (and more volatile) fuel prices. For example, Industry Directions (2007), a market research firm revealed that 78% of surveyed US industrial firms are more focused on supply chain operations as a result of higher energy costs and almost 70% are looking to change their supply chain strategy. Passing costs on to customers is a popular but often unfeasible response. Only 15% of respondents believed that price increases are possible while over 20% reported eroding margins. Cost efficiency plays the key role in addressing the effects of high oil prices according to 53% of firms.

[27] Lapide (2007)

What can firms do to reduce the oil dependence of their supply chains? Boston Logistic Group (2007), a consulting firm recommends that manufacturers keep their lean production systems because their benefits outweigh higher energy costs. They reckon that most supply chains do not need major changes until the oil price reaches USD 100. However, they suggest that firms regularly re-assess their transport modes, actively manage energy spending and pay more attention to transport costs in their offshoring decisions.

In sum, systemic changes to supply chains are not probable yet. However, some adjustment is expected. This includes consolidating orders, making deliveries larger and less frequent, offering more flexible delivery windows, taking on more inventories, and the consolidation of warehouses.

Supply chains for some agricultural products (e.g. fruits and vegetables, seafood, cut flowers) have become longer as well. This trend is driven by the globalisation of the food industry, the concentration of food suppliers, changes in delivery patterns (proliferation of regional distribution centres) and changes in shopping habits (customers travel more to shop in supermarkets).[28] Studies evaluating the supply chains of foods have focused on the environmental effects of 'food miles' (the transport requirements of food). These analyses offer little guidance in assessing whether food supply chains will be affected by current high oil prices. Still, some case studies show that importing food from overseas can result in lower total energy use as overseas production methods may be much less energy intensive. Furthermore, energy use in production and transport can dwarf in comparison with energy use during consumption (e.g. cooking).[29] Similar to industrial products, some rebalancing of agricultural supply chains is taking place (see example below). However, fresh out-of-season food and perishable premium products (e.g. cut flowers) command higher margins; therefore air freight is expected to remain important for these goods.

Example – Reducing food miles by more efficient supply chains

Food retailers in the UK are now focusing on convincing consumers of their eco-friendliness, partly by reducing their food miles. This also helps them to cut fuel costs and improve their competitiveness. For example, Asda saves almost 26 million kilometres of road transport every year (reducing its road transport by 25% since January 2005) with the following measures:

- Use of rail transport for long distances
- New port located close to distribution centres (saves 4 million km)
- Purchase of double-deck trailers that carry more goods per trip (about 3 million km)
- Less empty running of trucks is achieved in collaboration with suppliers and transport operators. For example, lorries that deliver products to store backhaul cardboard and plastic waste. (over 14 million km)
- Collect lamb directly from farms (2 million km)
- Eight regional food hubs for local small fine food producers enable them to cut their own transport costs and reach 12 million customers per week.

Source: company website

[28] DEFRA (2005)
[29] Existing case studies include dairy products, lamb, apples and onions supplied from New Zealand to the United Kingdom (Saunders et al., 2006) or tomatoes from Spain to the United Kingdom (DEFRA, 2005).

3.2 Production relocation

Key findings and issues

- Relocation is usually motivated by lower labour costs in target countries.
- Production location to, and sourcing from China are important cost-saving strategies for a number of multinational enterprises. The benefits of lower production costs outweigh higher transport costs, possibly up to oil prices around USD 150.
- Within energy-intensive sectors, there is evidence for relocation in the rubber industry, inorganic chemicals, colouring and man-made fabrics, fertilizers and paper products. These relocations could have been directed both to New EU Members and to extra-EU locations, including China. They took place in a period of rising oil prices, suggesting that energy cost considerations could have influenced the decision.
- In the longer term, relocation could also affect the petrochemical industry due to cheaper feedstock and much higher refinery margins in the Middle East.

Relocation is a process in which companies shift their production from an old to a new, usually foreign location. It can take two forms: the case when the closing down or reduction of domestic capacities is accompanied by expansion abroad; and the case when capacity expansions are realised abroad instead of at home. Relocation is driven by various factors, the same that are also responsible for deep structural changes in the global economy. Trade liberalisation, freer movement of capital, technological advancements and reduction of transportation and communication costs, among others, make markets more integrated. They enable companies to slice production processes up and locate parts of production to those production sites that are the most efficient in carrying them out. Thus, relocation is a response of companies to the more competitive business environment in a more and more integrated global market and to faster technological development, by reducing costs.

According to surveys that analyse relocations inside Europe, reducing labour costs is the key motivation for relocation. Relocations occur most often in the automotive, machinery and electronics industries. However, certain services, chemical products and household appliances are also affected.[30] As EMCC (2005b) indicates, more energy-intensive processes of the EU chemical industry are being relocated from the EU. According EMCC (2005a) new processing capacities in the chemical industry are built by Western companies close to oil and gas resources, exploiting upstream linkages. FACE (2006) suggests a similar trend in primary aluminium production, where new capacities are located outside the EU. Downstream linkages also count: the relocation of textile and clothing production induced the manufacturers of man-made fibres to set up their relocated capacities close to the buyers. Thus, high energy and oil prices may result in relocations directly, through moving capacities closer to raw materials, and indirectly, when non-energy-intensive relocated activities are followed by related, energy-intensive industries.

Decisions to move production abroad are partially affected by higher transport costs, potentially reducing the willingness to relocate. The Boston Logistic Group (2007) reckons that companies moving to China can realise 18% production cost savings. Based on their transport cost estimates, oil prices must reach USD 150 to annul such a cost advantage. Besides, companies also move to China to access its rapidly growing domestic market; this

[30] Marin (2004), Sachwald (2004) or Hunya and Sass (2005)

aspect of their operations is less affected by transport costs. Still, companies are advised to evaluate their relocation decisions more carefully in light of higher and more uncertain transport costs. This result also suggests that if high oil prices indeed cause relocation, it is most likely to happen in energy-intensive industries and not in sectors with long supply chains. Therefore we undertook a simple analysis to check whether recently high oil prices could have induced relocations in European energy-intensive sectors.

Relocation typically results in higher exporting from the new site to the area from where activities were relocated, and also to countries that were previously supplied from the old site. We therefore analysed trade data to identify potential flows of production relocation.[31] Considerable changes in shares in the EU trade flows and changing export positions of EU members and partner countries are a necessary condition for relocations. However, they may also stem from increased competitiveness of the indigenous companies of partner countries on EU markets. Differentiating between these two reasons is impossible on the basis of the data available. To gain some further insight about these trends, we also checked whether changes in the trade patterns for these products were associated with marked changes in their production within the EU. In most cases this test supported the hypothesis of relocation.

The roughness of the method applied does not allow handling the results as definitive evidence of relocation, though the tendencies indicate (in some cases quite strongly) that relocation could have taken place. Due to the energy-intensive nature of these products, high oil/energy prices are expected to have played a substantial part in the transfer of capacities. Table 3.1 summarises our results.

Table 3.1 – Potential relocations in selected energy-intensive industries between 1999 and 2006

Product group	Suspected direction of relocation	Evidence from EU production data
Dyeing and tanning extracts	China, Denmark, India, the Netherlands, Peru, U. S	Partly
Fertilizers	Egypt, Lithuania, Russia	Yes
Inorganic chemicals, colouring, man-made fabrics	Canada, China, India, Turkey	Yes (man-made fibres), also supported by EMCC (2005a)
Mineral manufactures	China, Germany, Poland	Yes (hollow glass, ceramic household and ornamental articles)
Organic chemicals	Belgium, the Netherlands, Singapore	Partly
Paper and paperboard	China, Czech Republic, Poland	Yes (stationery, wallpapers)
Rubber products	Czech Republic, Poland, Romania, Slovakia	Yes (rubber tyres and tubes)
Synthetic rubber	Germany, Russia	No
Textile fabrics	China, Czech Republic, India	Yes

Note: Suspected direction of relocation includes both EU members and extra-EU countries. Evidence from production data is supportive of relocation ('Yes') if the EU production volume decreased between 1999 and 2006; it is partly supportive ('Partly') if production growth was slower than in related SITC branches; it is not supportive ('No') otherwise. Source: Eurostat, own calculations

From our analysis one can note that relocation is concentrated on selected sectors. Trade policy measures against relocation (i.e. defending local employment) are mostly unavailable and maybe even undesirable taking into account conflicts of interests between EU workers, consumers, investors (companies investing outside the EU and exporting back to the EU) and

[31] Firm level data would be ideal for this analysis, but these are not available. Even sectoral FDI data would help, but we could not trace them on the EU15 or EU25 level. As a very rough measure, total trade (intra- plus extra-EU) of the European Union is analysed, in terms of major changes in the main trading partners' EU market shares (including EU Member States) between 1999 (low oil prices) and 2006 (high oil prices). We have identified 23 major energy-intensive product groups mainly at the SITC 3-digit, and in some cases at the 2-digit level, which are directly or indirectly affected by changes in oil prices.

'incumbent' (inside-EU) companies. Therefore the consequences of relocations must be handled by other (e.g. labour market) measures, which help the laid off workers to find employment in other activities.

The petrochemicals industry

The petrochemical industry can be considered as a special case as it could become sensitive to relocation in the future. Capital costs of steam crackers are high, so the likely scenario is a gradual geographical shift in the location of production due to sustained investment flows into other countries, rather than the rapid outright relocation of existing facilities. The important factor here is the local price of oil feedstock. The challenge for the European petrochemicals industry comes from oil-exporting countries, particularly in the Persian Gulf region, which provide oil on their domestic markets at much lower prices than the world market price. Thus petrochemicals companies locating steam crackers in such countries may benefit from lower costs of inputs and could then export their output back to the EU with higher profits than if they were producing inside the EU: cash margins in the Middle East are three times the average Western European margin.

The ongoing capacity build-up in the Middle East and its inherent cost advantage is mainly targeted toward the East Asian markets, chiefly China. Europe is currently in a stable situation: it is a mature market with supply capacity and production levels that match demand and with very low import penetration from non-EU countries. The risk to the location of the industry in Europe is therefore not an immediate issue, but rather one that could potentially develop in the medium term if oil prices remain high.

3.3 Fuel substitution

Key findings and issues

- Substitution to coal is taking place in some manufacturing branches and in power generation. However, technical limitations, the rising price and inferior environmental properties of coal limit this process. Trade policy should instead focus on making oil available and improving energy efficiency.
- Fuel substitution in transport is very limited. Major shifts between transport modes are not observable yet. The best available opportunities are biofuels and their global consumption is growing steadily, helped by government policies in major economies.

The recent global trend which is perhaps most noteworthy in terms of fuel substitution is the rise of demand for coal, notably for the purposes of power generation, as reported for instance in IEA (2006). Consumption of hard coal and its derivatives had been on a downward trend in the EU27 since 1990, falling by 30% by 1999. This was partly due to the deep economic restructuring in the formerly socialist New Member States which had inherited very energy-intensive (and also quite coal-intensive) economic structures. However developments in Western Europe went in the same direction, helped by low oil and gas prices throughout the 1990s and efforts to comply with environmental regulations which, implicitly, tended to favour natural gas over other fossil fuels. Since 1999 hard coal consumption fluctuated in the 70-75% range in terms of the 1990 level. According to IEA (2006), global coal consumption is expected to rise owing to recent investments in coal-fired plants outstripping new investments in gas-fired plants, the latter development coming as a result of the change in relative prices which has favoured coal. This is in part due to the fact that gas prices are in many cases indexed to the price of crude oil in the context of the majority of long-term supply agreements.

3.3.1 Fuel substitution in power generation

Up-to-date data covering most or all EU member states is unfortunately not available from Eurostat or from the IEA. We therefore focus our attention on the EU's three largest economies only: Germany, the United Kingdom and France.

In France the issue of fuel substitution is not particularly relevant given the country's very high reliance on primary electricity, in particular nuclear electricity. The share in total electricity generation from thermal plants (e.g. gas-fired or coal-fired) has fluctuated around 10%-11% of the total in recent years without any discernable trend. Thanks to its important nuclear-power capacity, France is shielded from oil price changes as far as its domestic electricity production is concerned.

Electricity generation in the UK is more responsive to oil prices for two reasons: gas, coal and nuclear energy are equally important in the generation mix, and the competitive nature of the UK electricity market makes producers more responsive to costs. The relative price of coal and gas (the latter linked to oil) is particularly important. The price of coal was high relative to that of gas in 2003-2004, leading to more electricity generation from gas-fired plants: the share of gas rose from 38% in 2003 to 40% in 2004 while that of coal fell from 35% to 33%. Gas has also taken up most of the slack left from the steady reduction in nuclear electricity generation. The situation then reversed as gas prices rose relatively to coal prices since 2005. As a result, the share of gas fell to 36% by 2006 while the share of coal rose again to 37%.

In the case of Germany, coal has traditionally been the most important source (around 52%), followed by nuclear energy (30%), while gas is less important (11%). Germany's power-generation sector responds to price changes more slowly and less drastically than its UK counterpart. However, the trend in investment in Germany seems to favour coal-fired plants over other types of facilities. Two forces contribute to this development: oil prices (which affect gas prices) may remain high; furthermore, energy security concerns have made a comeback, while Germany is abundant in brown coal. At the same time, there are concerns that such a trend would make environmental targets, notably CO_2 emissions targets, impossible to achieve in future, so that there is also ongoing political lobbying against the current investment trend.

In sum, the potential for fuel substitution in the electricity sector is limited by the structure of power generation capacities, while the extent of competition also appears to play some role.

3.3.2 Fuel substitution in industry

The oil price was not the most decisive force with respect to fuel substitution in Europe between the early 1990s and the beginning of the millennium due to its low level in dollar terms. Instead environmental regulations, especially with respect to sulphur emissions, have proved important in discouraging the use of a number of types of fossil fuels (e.g. coal, coke, petroleum coke and fuel oil). Instead, natural gas grew in importance as it is among the cleanest fossil fuels and was available relatively cheaply. Furthermore there was also growth in the use of alternative fuels. However as the price of oil rose strongly especially from 2003 interest turned again to coal and certain other fuels, although by now European manufacturers must choose only those types that have low sulphur content. This trend was given a further push given energy security concerns with respect to Russia starting from 2006. This has led to a rise in the price of coal as well as in the price of other solid fuels, notably petroleum coke.

Since the technical potential for fuel substitution is limited (see the examples below), trade policy should focus instead on making oil and gas available by influencing global energy supply, as well as on improving energy efficiency in industry.

Example – Fuel substitution in cement and glass production

In the context of cement production, it is desirable for technical reasons to favour solid fuels such as coal and petroleum coke for the first stage of production (production of cement clinker), although natural gas and fuel oil are also used. The recent trends in the industry at the European level furthermore indicate that the use of alternative fuels (e.g. used tyres, packaging waste, organic waste) grew from just 3% to around 15% in 2006 according to Cembureau (2006). Recent developments indicate that the price of petroleum coke has overshot, and that coal is now a more attractive option for the industry. Cembureau (2007) therefore recommends that those who had switched to petroleum coke now revert to using coal and/or a higher proportion of alternative fuels over the next few years.

In glass industry, several EU producers use furnaces that can accommodate the use of both fuel oil and natural gas. This enables the manufacturer to switch between the two depending on price movements. However this does not provide a full defence against the effect of rising oil prices given the link between gas prices and oil prices. Furthermore, the possibility of fuel switching depends crucially on the existing natural gas pipeline network. Also, most of Europe’s glass production by volume (i.e. flat glass and container glass) takes place in relatively large facilities, for which the use of other sources of energy such as electricity would not be commercially viable. All in all that the bulk of European glass production is expected to continue with a broadly similar fuel mix as in the past, using mostly natural gas, though short-term switching will continue to happen, enabling the well-located facilities to smooth their energy bills.

3.3.3 Fuel substitution in the transport sector

Fuel substitution in the case of private transportation (e.g. private cars and motorcycles) is virtually non-existent owing to the very limited alternative possibilities, i.e. cars running on electricity, on hydrogen-based fuel cells or on biofuels (see below). The absence of a sufficient network in terms of filling stations, as well as the lack of availability and choice of such vehicles on private vehicle markets is such that, in the short-run at least, demand for alternatives to gasoline on the part of households responds very weakly to changes in gasoline prices at the pump.

The one type of substitution which is materially feasible given current infrastructure and installed capacities would be a substitution between modes of transport, i.e. car-owners choosing to use public transportation more often than they previously did. However the extent of that substitution is also relatively weak, and moreover depends on many other variables besides the price of gasoline or diesel fuel, i.e. traffic and parking space congestion, the supply, quality and price of public transportation services, the lifetime of already purchased vehicles and individual perceptions and preferences concerning transport mode use (including policies to reduce congestion).

Transportation of goods (freight) also lacks flexibility due to the large sunk costs of existing vehicle fleets, the inherently higher flexibility of road as opposed to rail (or other) transportation, and the lack of inter-modal facilities enabling transhipment of containers from road to rail.

As things stand, road freight is considerably more important than rail freight in the European Union, in a ratio of slightly more than 4-to-1. Estimates for 21 EU countries[32] based on quarterly freight transportation data from Eurostat indicate a total road freight traffic of 1561 billion tonne-kilometres in 2006, as opposed to 373 billion tonne-kilometres for rail. Most importantly, the importance of road freight has risen relative to that of rail between 2004 and 2006.

The evolution of road freight can be partly explained by recent robust GDP growth trends. On the other hand the decrease in road freight in several Western European countries is quite remarkable. Road freight fell particularly strongly in Belgium, the Netherlands, Luxembourg and Finland (between 7% and 10% lower in 2006 as compared to the 2004 level).

The data suggests that, overall, the opposite of what one may expect has happened as growth in road freight was slightly more than in rail freight in recent years. This could be the result of structural differences between road and rail transportation in the EU which prevent rail from growing more significantly in importance, even in the presence of quite high gasoline prices. At the same time, developments especially in the Benelux countries suggests that there was a negative effect from higher oil prices on road freight, with rail freight only partly compensating that development.

Opportunities for biofuels in fuel substitution

There is growing interest worldwide in biofuels. Technically they can substitute oil products in road transport and they can also be produced by domestic agriculture. They are seen as a promising reply to a wide range of issues including rising oil prices, the long-term depletion of fossil fuel stocks, environmental concerns (greenhouse gas emission), security of energy supply, rural development and a means to help developing countries. Currently there are two types of liquid biofuels in commercial use: ethanol (produced from sugar and starchy crops e.g. corn) and biodiesel (from oil-seed crops e.g. rape or soybeans).

Bioethanol and biodiesel are usually blended with fossil fuels. Nearly all vehicles can use the ethanol blend E10 (containing 10% ethanol, 90% gasoline) without modifications. Blends with higher ethanol content require some modifications to the vehicle and the engine. Biodiesel can be used in its pure form or virtually any blended ratio with conventional diesel fuel.

The global production of biofuels in 2005 covered about 1% of road-transport fuel consumption in 2005. The largest producers are Brazil and the USA with 80% of global

[32] Excluding Italy, Greece, Cyprus, Malta, Romania and Bulgaria, due to missing data.

output. Global trade of biofuels is limited, but an estimated 10% of demand is covered by trade (Walter et al., 2007). In 2005 48% of exports originated from Brazil.

At present the European Union is far from utilising its technical biomass and biofuel potential. It meets 4% of its energy needs from biomass with a production of 69 million toe; this could be raised to 185 million toe by 2010. Biofuels accounts for a small share of biomass output: 0.48 million toe of ethanol and 2.53 million toe of biodiesel were produced in 2005. Still, the EU accounts for 87% of world biodiesel output. The main European producers (and consumers) are Spain, Germany, Sweden and France. According to forecasts the European Union will become a net importer of biofuels by 2020 as economically viable supply will not keep up with growing demand (Walter et al., 2007).

3.4 Energy efficiency and recycling

Key findings and issues

- High oil prices have provided strong incentives to firms to improve their efficiency. The potential for further energy savings throughout the economy is massive: 20-30% of incremental energy demand over the coming decades can be saved in a cost-effective way, using currently available techniques alone.
- Waste management and recycling offer significant savings in some energy-intensive industries.

Energy efficiency and recycling are particularly important because they contribute to a number of policy goals including competitiveness and employment, sustainable development and energy security. Furthermore, in a world of scarce and ever more expensive natural resources, high efficiency is becoming a critical issue to firms.

There is a huge potential for reducing oil dependence by improving energy efficiency. The European Commission estimates[33] that 28% savings in primary energy consumption can be achieved in the European Union by 2020 in a cost-effective way. Savings on energy bills can exceed additional costs by over EUR 100 billion by 2020. For transport the energy saving potential is estimated at 26% by 2020; the volume of potential savings (105 Mtoe) is the largest in this sector. Since 98% of the energy consumed in transport is fossil fuel, almost all these savings affect oil consumption. These savings can lower net oil imports by 16% in 2020 improving the trade balance by EUR 32 billion at current prices.[34] A study by McKinsey (2007) comes up with similar figures: they estimate that by 2020 about 20-24% of global end-use demand can be saved using existing technologies in energy-saving investments with internal rates of return of 10% or more. They reckon that 38% of these savings could be realised in industry, 18% in power generation and refining, and 10% in transport.

Firm-level studies suggest that fears of production disruptions and hidden costs, lack of time and resources and low motivation are important obstacles companies encounter when

[33] Action Plan for Energy Efficiency: Realising the Potential, COM(2006) 545 final of Brussels, 19 October 2006.

[34] These figures were calculated with a USD 55 per barrel oil price and a USD 1.25/EUR exchange rate; it was assumed that 98% of transport sector savings were realised in oil consumption which directly translated into lower oil imports. The baseline forecast for 2020 net oil imports was taken from European Commission (2004).

considering energy-saving investments.[35] Firms on more competitive markets are more likely to invest in energy efficiency as it can improve their competitiveness. Cost savings are the key motive behind energy efficiency investments, but companies may prefer to wait for more efficient technologies to emerge, letting current opportunities pass.[36]

Example – Energy savings in European companies

Once firms become aware of the cost saving potential in energy efficiency, they make the best of these opportunities. Some selected examples from European companies in a wide range of industries:

- DHL Express, a logistics firm launched an eco-driving training programme for its truck drivers and its subcontractors. The programme resulted in 2-8% fuel savings. Besides, the firm also optimises freight loads and routes to cut fuel costs.
- Unilever, a household goods firm makes efforts to reduce the weight of its packaging. The plastic used for packaging household cleaners was reduced by over 5% (in some cases by 15%); a design change in cans reduced the amount of metal needed by 15%.
- BASF, a chemical company applies eco-efficiency life-cycle assessment to its products and processes. This allowed the firm to identify a number of energy-saving solutions including the processing of by-products in its Ludwigshafen isophytol plant to obtain heating oil-type substitute fuels and reduce natural gas consumption.
- Corus, a steel company reduced its energy use per tonne of steel by 10% from 2000 to 2005 through rationalisation and process developments. For example, an ongoing EUR 20 million investment in a new annealing facility in Düsseldorf will deliver a 30% improvement in energy efficiency.
- Salt Union, a UK salt producer saved 60% of its energy use by changing a single salt dryer fan. The new equipment, supplied by ABB, brought annual cost reductions of GBP 100 000 with an initial investment of GDP 20 000.

Source: corporate websites (Salt Union case study from ABB website)

Appropriate waste management can also contribute to reducing oil dependency. This entails both the reduction of waste production and the recycling of waste materials. The EU uses 16 tonnes of materials per head every year and produces 4 tonnes of waste.[37] Part of this waste is the result of inefficient production: a third of waste is produced in manufacturing and 10% in energy and water supply. Waste generation is growing faster than GDP, so the absolute volume of waste is increasing despite rising recycling rates (e.g. plastic waste is expected to rise by 40% between 1990 and 2020, and 7% of EU crude oil production is used for the production of plastics). Waste recycling offers huge potential for energy savings for a number of materials: 95% lower energy consumption for aluminium production, 85% for copper, 74% for steel, 65% for lead. Industry is responding to these opportunities: the waste recycling sector employs an estimated 500 000 to 1 000 000 people in the EU25. The metals recovery sector alone comprises over 60 000 enterprises and employs around 500 000 people. Over 100 million tonnes of metal scrap are recycled each year worth around EUR 20-25 billion. At least 50% of paper and steel, 43% of glass and 40% of non-ferrous metal output is produced through recycling in the EU.

[35] Rohdin and Thollander (2006)
[36] De Groot et al. (1999)
[37] Impact Assessment on the Thematic Strategy on the Prevention and Recycling of Waste and the Immediate Implementing Measures, Commission Staff Working Document, Brussels, 2004

4. POLICY RESPONSES TO HIGH OIL PRICES

4.1 The need for policy responses

Key findings and issues

- A number of developing countries use energy-related subsidies to improve the competitiveness of their firms, potentially harming European companies.
- Biofuels are the only available fuel to directly substitute oil products in transport; however, there are significant barriers to their development.
- The global energy infrastructure requires massive investments to be able to fulfil growing global demand – yet, a number of energy-exporting and transit countries limit the role of private and foreign investors.
- Energy efficiency and recycling offer large potential to reduce dependence on oil, but numerous market failures and other obstacles limit their exploitation.
- The adjustment potential of the European economy could be raised by more product market competition.

Based on the evidence presented in Sections 2 and 3, the general impression is that the European economy is able to adapt to high oil prices without serious disruptions. Firm- and industry-level adjustment is under way when necessary. Therefore the need for trade policy in adjusting to high oil prices is limited. Still, a few important areas can be singled out where policies are worth considering:

- Trade-distorting subsidies,
- Promotion of biofuels,
- Investments in global energy infrastructure,
- Energy efficiency,
- Adjustment potential of the European economy.

4.1.1 Trade-distorting subsidies

Government subsidies to private enterprises reduce their costs and give them unfair advantage against international competitors. These subsidies can be attached to energy use: they can ensure firms' access to energy below the actual cost of supply. Such subsidies can take many forms including underpricing or non-collection of bills.[38] Developing countries often resort to subsidising energy supply to pursue competitiveness and social goals. Explicit and implicit subsidies amounted in 2005 to over 10% of GDP in the Ukraine and Egypt, around 6% in Saudi Arabia and Indonesia, 4% in Russia, 2% in India and 1% in China. In absolute terms, Russia handed out USD 40 billion subsidies; China spent USD 25 billion, while Saudi Arabia, India, Indonesia, Ukraine and Egypt all had subsidies in excess of USD 10 billion. The largest shares of these subsidies go to oil and gas; they can amount to as much as 80% of the reference price/cost of oil products (e.g. Egypt, Saudi Arabia) and over 70% of gas prices (e.g. Saudi Arabia, Ukraine, Egypt, India).[39]

[38] Lower taxes on energy products are not subsidies in the strict sense but have similar effects.
[39] Source of data: IEA (2006), pp. 277-281.

These subsidies give an edge to the energy-intensive industries (e.g. metallurgy) of these countries; but they also lead to wasting of energy, higher energy consumption and more greenhouse gas emissions.[40] Another source of trade (and market) distortion is a double pricing system of raw materials and feedstocks. This is especially present in the petrochemical industry. There is also evidence that China is introducing policies that distort global trade in energy and natural resources. In some cases China subsidises raw material imports for its own manufacturing while limiting the exports of some domestically abundant resources (e.g. coal, coke), distorting the availability and price of these products in the world market.[41] Double pricing practices for resources (e.g. coal) in effect subsidise favoured domestic producers, putting their competitors at disadvantage. Trade policy has the appropriate instruments to tackle these issues and ensure the fairness of international competition.

4.1.2 Biofuels

As biofuels offer the only widely available form of fuel substitution (especially transport), they deserve particular attention in trade policies. There are a number of obstacles to the development of biofuels markets (IEA Bioenergy Task 40); international trade barriers feature prominently among them. At present there are no specific technical specifications and import regulations for biofuels. Since they are classified as agricultural products, high tariffs and other barriers are protect domestic producers throughout the world. As there are no clear international accounting rules for biofuels, data on their international trade is hard to collect.

The European Union is committed to the promotion of biofuels. The 2003 Biofuels Directive[42] set reference values of a 2% market share of biofuels in 2005 and a 5.75% share in 2010. The 2005 target was missed; meeting the 2010 objective requires significant efforts to boost domestic production and/or help biofuel imports.

Biofuel market development can be fostered by a number of policies: Promotion of biofuels should be encouraged by national targets, biofuel obligations (mandatory blending of fossil fuels with biofuels), instruments of agricultural policy, demonstration and information campaigns as well as research and development. Trade policy can and should contribute to the development of biofuels. Whether biofuel targets are best pursued using free trade or protectionism is currently debated. The main arguments for free trade in biofuels are:

- Imported biofuels are cheaper: the unsubsidised production of Brazilian ethanol competes with fossil fuels if oil prices are around USD 50 per barrel; subsidised European biodiesel needs at least USD 70 while ethanol requires USD 100.[43]
- More CO_2 emission savings: if biofuels are produced in Europe from rapeseed or sugar beet, the primary energy input (excluding biomass feedstock) is 40-60% of the energy contained in the biofuel output. For corn-based ethanol this ratio can be as high as 80% but for sugar-cane based ethanol it is as low as 12%.

[40] Lower taxation of energy can have similar effects to subsidies. Many countries levy lower taxes on energy than EU Member States due to their different taxation systems. For example, even in OECD countries taxes on gasoline range from 13% to 70% of the final consumer price; the highest rates are applied in Europe while rates in developing countries can be even lower.
[41] European Commission (2006a)
[42] Directive 2003/30/EC of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport (OJ L 123, 17.5.2003)
[43] EIA (2006), page 405-412. The European Commission (2006b, p. 27) reports similar figures: EUR 60 per barrel for diesel and EUR 90 for ethanol.

- Development effects: the growth of biofuel industries can contribute to economic development and reduction of poverty in third-world countries.

The arguments against unconstrained free trade include:

- Fears of deforestation and loss of biodiversity: the problem is mitigated by the fact that many of these lands were previously used to produce sugar.
- Lower security of energy supply: not a strong argument since even a diversification of fuel suppliers reduces risk; self-sufficiency is not an absolute necessity.
- Protection of domestic producers and the fostering of rural development in Europe: the costs of this strategy should be compared with those of alternative approaches to rural development. Programmes for less energy-intensive production (e.g. organic farming) seem to be an equally important potential scenario for Europe as the increasing of biofuels output.

4.1.3 Need for investments in energy infrastructure

The global oil and gas industries require massive investments to keep up production with growing demand: USD 4.3 trillion between 2004-30 (in real-2005 dollars) according to IEA (2006). Downstream investments account for USD 0.8 trillion while upstream investments take USD 3.5 trillion; 90% of upstream investments are for maintenance while the rest is needed to expand capacity. There are doubts that these investments will become reality:

- Major oil producing countries (including Saudi Arabia, Kuwait and Russia) limit foreign (or indeed, any private) investments in their energy sectors. The Russian situation is particularly crucial for Europe as 30% of EU crude oil imports and 33% of EU natural gas imports originate from Russia and the country's share is rising. As major Russian oil and gas fields mature, and private investors frequently encounter obstacles to their investments, there are doubts that Russia's state-owned oil and gas companies will be able to satisfy growing demand.[44]

- Most hydrocarbon reserves are owned by public companies, which often enjoy monopolistic positions as well (e.g. in Saudi Arabia). It is widely established in the economic literature that public monopolies can lead to lower efficiency than competition and private ownership, because both the state (as owner) and a monopolist itself have less incentives to eliminate waste.[45]

- Investments are also limited by war and civil conflict (e.g. in Iraq) as well as environmental concerns (e.g. in the United States and Canada).

- The concentrated market structure of oil production and the long payback period of investments should be taken into account. OPEC members built up new capacities after the oil price shocks of the 1980s only to find that excess capacity pushed prices

[44] IEA (2007). Worrying cases in Russia include the Yukos affair as well as the Sakhalin II and Kovytka gas projects. For their brief description see for example: 'After Sakhalin', Economist, 13 December 2006; 'Russian arm twisting', Economist, 22 June 2007. Ahrend and Tompson (2006) offer a comprehensive analysis of the Russian energy sector's problems.
[45] A negative example is Venezuela where the production of the state-owned oil company fell in the last years as a result of serious mismanagement.

down in the 1990s, sharply reducing the value of their investments. The world is now experiencing the opposite: oil producers are unwilling to take large bets fearing another drop in oil prices; the resulting shortage of capacities keeps prices high.[46]

All these factors suggest that capacities may remain insufficient in the medium term, resulting in higher oil prices. The most recent outlook of IEA (2007) predicts that oil prices can remain around their current level until the end of this decade. Appropriate policies on investments in the energy infrastructure can help reduce oil prices in the longer term. These should help energy-producing countries cope with increasing demand if they are unable to do so; and get them to invest in new capacities if they are unwilling. The European Union can use its international and trade relations to create a favourable environment for necessary investments to happen.

4.1.4 Energy efficiency and recycling of waste

Even though there is great scope for cost-efficient energy-saving investments, both households and firms are reluctant to engage in them. Companies may fail to make investments with rates of return well over 30%: a phenomenon called the ‘energy efficiency paradox’.[47] McKinsey (2007) reports that companies apply internal return hurdle rates of 20% to energy-saving investments. There are many explanations to this. There is much uncertainty surrounding the total cost and the payback of these investments; decision-makers are poorly informed, risk-averse and do not maximise their objectives; furthermore, the organisation of firms and their corporate culture may hinder efforts to improve energy efficiency. Distorted price signals (e.g. through price caps and subsidies) can also discourage energy efficiency investments. The uncertainty of future energy prices also plays its part. A recent study found that with more energy price volatility the sensitivity of oil demand to price increases is smaller.[48]

The issue of energy efficiency is addressed by the Commission by the 2006 Action Plan for Energy Efficiency[49]. The six key areas for Community action are energy performance requirements to improve end-user efficiency, improving energy transformation, making transport more energy-efficient, financing energy efficiency, changing energy behaviour and promotion of energy saving through international cooperation. Environmentally based taxation can also contribute to greater efficiency. Trade policy can help indirectly, by encouraging firms to improve their efficiency through more openness and competition, and by improving the access of consumers to energy-efficient products.

The potential of waste prevention and waste recycling and recovery is also underexploited at present. A trade-related issue is that although EU industries import many natural resources, recyclable waste is being exported from the EU, among others to China, India and the USA. For example, in 2006 the EU27 had a trade surplus of EUR 1.2 bn in waste and scrap metals; net exports amounted to 5 million tonnes in ferrous and 1 million tonne in non-ferrous waste

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[46] The status quo is convenient for OPEC. Non-OPEC producers with higher extraction costs can increase their production, but this brings forward the depletion of their stocks; new projects in more remote and unfavourable locations are getting costlier, driving up the marginal cost (and price) of oil in the long run.
[47] DeCanio (1998)
[48] Kuper and van Soest (2006)
[49] Action Plan for Energy Efficiency: Realising the Potential, COM(2006) 545 final of Brussels, 19 October 2006

and scrap metals. according to the trade statistics of Eurostat. This paradox is partly the result of an externality: extra-EU countries can also enjoy the benefits of a comparatively well-developed EU waste management (in terms of access to recyclable resources) without investing in their own waste systems. Waste exports can also arise to avoid EU waste regulations (environmental leakage); on the other hand, certain procedures under the Basel Convention can act as a barrier to importing waste to the EU.[50]

4.1.5 The adjustment potential of the European economy

Both economic theory and empirical evidence suggest that the economy can adjust to any oil price with a one-off loss of output, but leaving its long-term development prospects unchanged (see section 2.1.1). Producers and consumers share the costs of adjustment in the forms of lower production and loss of jobs and higher prices respectively. However, the length and costs of adjustment, as well as the distribution of this burden among economic agents depends on institutions and can be influenced by policies. For example, high net replacement rates for the unemployed or strong unionisation of labour contribute to high and persistent unemployment; less integrated and competitive financial markets can limit the growth potential of firms; or sheltering firms from competition allows them to shift the burden of adjustment to their consumers.[51] These policies are a high priority for the European Union. They are at the heart of the Growth and Jobs strategy and they are also essential for the smooth functioning of the Economic and Monetary Union.

Trade policy plays an indirect part in improving the adjustment potential of firms. Undistorted competition on international markets is a powerful incentive for companies to improve their efficiency, also in terms of energy use. This can make them more resilient to future energy price developments.

4.2 Potential trade policy measures

Key trade policy recommendations

- Tariffs and quotas: lower import duties for materials, push for liberalisation of trade in environmental products and biofuels
- Technical barriers to trade: reduce limits to market access for European firms, apply environmental standards to imported goods and food, help biofuel trade with common standards and sustainability certificates
- Trade defence instruments: use anti-subsidy procedures against energy-related subsidies in some countries
- Investments: push for protection of investors' rights in energy exporting countries using the Energy Charter Treaty, launch comprehensive trade talks focusing on energy
- Widen the EU-ETS by including transport to encourage the use of energy-efficient freight modes

[50] See the materials of the High Level Group on Competitiveness, Energy and Environment, especially 'Ad hoc Group 3 Competitiveness of and access to cost-effective energy inputs for energy intensive industries, Chairman Issues Paper' (6 April 2006); and 'Ad Hoc Group 10 on "Natural resources, secondary raw materials and waste" Chairman Issues Paper' (17 April 2007). Both documents are available at http://ec.europa.eu/enterprise/environment/hlg/whois.htm

[51] The detailed analysis of these issues is outside the scope of this study. A brief introduction can be found for example in Leiner-Killinger et al. (2007).

4.2.1 Tariffs and quotas

Lower import duties for materials

The post-Uruguay round tariff schedule of the European Union shows one of the highest levels of binding (100 %) and the lowest level of simple bound means among the members of the WTO. Industrial tariffs are especially low in international comparison, with the lowest number of tariff peaks and the lowest levels of tariff dispersion, which is also true for the product sub-groups analysed in our study[52]. As far as oil-related finished products are concerned, a slight tariff escalation provides a modest protection to European processing industries.[53] Maintenance of the existing tariffs provides some competitive edge to the refining and transforming industries (e.g. non-ferrous metals and processing of petroleum). In cases, where raw materials have higher (though usually moderate) duties, one can consider the reduction of these, in order to increase the competitiveness of European processing industries. However, it should be kept in mind that tariff reductions offer a one-off direct benefit while they tackle long-term competitiveness issues only indirectly, through exposing primary materials sectors to more competition.

Example – Elimination of import duty on primary aluminium

The European Union imports about 4 million tonnes of primary aluminium per year, 56% of its total consumption. There are two types of aluminium companies in the EU: integrated producers who produce and process primary aluminium, and independent transformers who process purchased primary aluminium. The role of independents has increased over the last decades; they now account for nearly half of EU primary aluminium consumption and employ almost half of the EU downstream aluminium workforce, mostly in SME's.

At present a 6% import duty is levied on primary aluminium, raising domestic prices. Since integrated companies consume the primary aluminium they produce, the duty gives them a cost advantage against independents, who must purchase the material on the marketplace. Exporters to the EU enjoying duty-free status enjoy similar benefits. The extra costs of independents are estimated at EUR 500 million per year. In an environment of rising raw material and energy prices this puts a disproportionate burden on independents compared with their direct competitors, integrated companies and non-EU producers.

The duty on primary aluminium also raises the price of processed aluminium products. This puts EU producers at disadvantage against U.S. and Japanese producers, where imports are duty-free.

Primary production capacity in the EU is stable and new capacities are planned in extra-EU countries with lower costs, including lower energy costs (primary aluminium production is very energy-intensive, energy accounts for 37% of total costs). Therefore the protective effects to EU producers are declining.

On 7 May 2007 the European Commission decided on a gradual phasing-out of the duty by 2008. This will raise the profitability and competitiveness of EU downstream aluminium companies, partially offsetting the effects of high energy prices. It will also lower the prices of aluminium products and create a level playing field among aluminium companies.

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[52] For a detailed analysis of the post Uruguay round tariff schedules of the OECD member countries and selected non-OECD countries see: Review of Tariffs. Synthesis Report. OECD TD/TC(99)7/FINAL.
[53] In the case of tariff escalation, raw materials are affected by lower (or in the case of the EU, in most cases duty free) tariffs, while semi-processed and processed products are burdened with a higher tariff.

Messages:

- Import duties cannot prevent the relocation of energy-intensive basic material industries, because this process is driven by the limited availability of domestic resources and/or much lower resource and energy costs in third countries.
- The elimination of import duties on primary materials helps downstream processors of these materials to tackle the effects of higher energy costs. This is a one-off benefit.
- As a knock-on effect, the abolition of duties contributes to rising competitiveness in these industries. This improves their adjustment potential to further energy price shocks.

Source: FACE (2006)

Quotas are less relevant from the point of view of our topic as their use is limited to agricultural products. The trade-inhibiting role of IQTR and OQTR regimes of the European Union is small: they cover only a relatively lower number of products in international comparison, the mean IQTRs and OQTRs are relatively low in international comparison, and quota fill rates are relatively far from 100%.[54] However, from the point of view of biofuel production, some product groups bearing a quota can be relevant (e.g. corn), though the multiple use of these (i.e. not for bioethanol production) and possible conflicts with agricultural policies make considerations for the abolishment of quotas for these products problematic. A more beneficial solution here is the liberalisation of biofuels trade.

Push for liberalisation of trade in environmental products

Free trade of environmental goods and services would enhance the availability of these products. This could contribute to improving European and global energy efficiency, mitigating the effect of high oil prices. Furthermore, Europe could be a significant exporter of such goods and services due to its leading role in energy efficiency. For example, only the Chinese market for environmental products could grow to EUR 98 billion by 2010.[55] Therefore it is in the interest of the EU to push for the zero tariffs and quotas on environmental goods, as stated by Trade Commissioner Peter Mandelson: "(…) an important hidden imperative behind Kyoto (…) is the creation of an open global market in environmental technologies and in investment in green technological change. Here the EU is a global leader (…)".[56]

In 2001, in Doha, an agreement was reached to start negotiations on the reduction and/or elimination of tariffs and NTBs on environmental goods and services in order to enhance the mutual supportiveness of trade and environment. Advancement in this field is hurdled by numerous problems (definition of environmental goods and services, various approaches to the liberalisation of trade in that field, the problems of dual or multiple use of environmental goods, taking into account the impact of technological change during the review process of

[54] According to the calculations in OECD (1999)
[55] European Commission (2007b)
[56] Energy security and climate change – what role for trade policy? Speech by Peter Mandelson at the Conference organised by Conference of Norwegian Enterprise and EC Delegation in Norway at the Oslo Military Society, Oslo, Norway, 9 February 2007. Available at http://trade.ec.europa.eu/doclib/docs/2007/february/tradoc_133277.pdf

product coverage etc.), though the role of the European Union is of crucial importance in pushing through the negotiations to their final success.

Example – Elimination of duties on Chinese light bulbs

A 60% anti-dumping duty on Chinese light bulbs was introduced in 2001; it expires in 2008 if not renewed. It gave an edge to German lighting company Osram against its Dutch competitor, Philips, because the latter relocated more of its production to China. However, consumers were forced to pay 60% more for light bulbs that consume 20% of the energy needed by traditional bulbs because of the duty. On 26 July 2007 the European Commission gave initial backing to drop the duty despite a German initiative for its renewal. By scrapping the duty the consumption of cheaper and more energy-efficient products is expected to rise, contributing to lower energy consumption.

Messages:

- Cutting trade barriers on products with superior environmental characteristics can help to improve energy efficiency and lower the exposure to energy price shocks.
- Business interests of European enterprises with production relocated outside the EU should be taken into account when applying trade policy instruments.

Source: 'EU backs cutting duties on Chinese light-bulbs' EUbusiness, 26 July 2007. Available at http://www.eubusiness.com/Trade/1185469202.22/

Liberalise biofuel trade

There are significant benefits in international biofuel (especially ethanol) trade, related to the environment and diversification away from oil. As a consequence, biofuels are an important element of bilateral trade negotiations with a number of countries including Brazil which alone accounted for 23% of EU biofuel imports in 2002-04 under most favoured nation (MFN) treatment. Many developing countries export biofuels to the EU under preferential trade regimes (including GSP+, EBA and the Cotonou Agreement) and will also be involved in trade negotiations with the EU.

The European Commission initially proposed a balanced approach to trade in biofuels.[57] This entailed an amendment of the biodiesel standard to allow more biodiesel imports; maintaining bioethanol import conditions that are no less favourable than those in force; respecting the interests of producers both in the EU and in developing countries in trade negotiations; minimum sustainability standards for biofuels production; and support of biofuels production in developing countries. In our view this approach is not desirable. It is more expensive than either total autarky or free trade.[58] The economic and environmental cases for free trade are stronger than the (sometimes vague) arguments against it. There are doubts that the industry to be supported (production of first-generation biofuels) will ever be competitive on its own.

The latest comments by Trade Commissioner Peter Mandelson suggest an alternative line of thinking: "We should certainly not contemplate favouring EU production of biofuels with a

[57] Biomass Action Plan, COM(2005) 628 final, Brussels, 7.12.2005.
[58] If oil prices are USD 35 per barrel, the cost of the balanced strategy is EUR 8.29 billion, 23% higher than the cost of the 'full liberalisation' strategy and three times as expensive as the autarky strategy. If oil prices are USD 75 per barrel, the balanced strategy costs USD 4.06 billion; 64% more than full liberalisation and three times as much as autarky. See: European Commission (2006c).

weak carbon performance if we can import cheaper, cleaner biofuels."[59] We recommend the endorsement of this approach in upcoming trade negotiations.

4.2.2 Technical barriers to trade

Reduce limits to market access for European firms

Although the importance and the significant trade-reducing impact of non-tariff measures are recognised, they do not figure prominently on the Doha Development Agenda, except for trade facilitation. Various non-tariff measures are used by the trade partners of the European Union, which (intentionally or unintentionally) make market access lengthy, problematic and costly. In the field of oil-related products, such non-tariff measures (e.g. not easily accessible local distribution systems; complex standards and technical regulations; lengthy registration, testing or licensing procedures) act as deterrents for EU exporters in many foreign markets. These issues can play more and more important roles in future rounds of trade negotiations. Moreover, bi- or multilateral trade agreements can include certain solutions to these problems. Market access should be especially improved for environmental products.

Apply environmental standards to manufactured goods

Environmental labelling and minimum performance standards and voluntary agreements are already in place for a number of household appliances in the European Union. By applying these standards to imported products the EU can play a leading role in raising (European and global) demand for energy-efficient products thereby mitigating the effects of high oil prices. The High Level Group on Competitiveness, Energy and Environment also urges the EU to set ambitious but achievable benchmarks of energy efficiency, which can eventually lead to global standards.[60] For example, though not directly related to energy efficiency, Russian officials recently admitted that the Russian chemical industry will have to adopt the REACH regulation because the EU is one of its key export markets; even though compliance costs can amount to 10% of export earnings.[61] WTO allows these benchmarks and standards to be applied to imported products as well, as long as they are not stricter than those that apply to domestic producers.

Label origin and environmental properties for food products

The labelling of origin is currently mandatory for food in the European Union only when the lack of labelling could mislead consumers.[62] Likewise, organic food labelling does not take into account the transport requirements of products. The WTO does not mandate labelling of origin either; it only says that rules of origin must be transparent; must not restrict or distort

[59] The biofuels challenge. Speech by Peter Mandelson, Brussels, 5 July 2007. Available at http://trade.ec.europa.eu/doclib/docs/2007/july/tradoc_135190.pdf
[60] 'Third Report of the High Level Group on Competitiveness, Energy and the Environment: Helping energy intensive industries adapt to the energy and climate change challenges; incentives, innovation and technology policies', 27 February 2007. Available at http://ec.europa.eu/enterprise/environment/hlg/whois.htm
[61] 'Russia "forced" to apply costly EU chemical standards', EUbusiness, 17 July 2007. Available at http://www.eubusiness.com/Chemicals/1184590802.0/
[62] Article 3(8), Council Directive 2000/13/EC on the approximation of the laws of Member States relating to the labelling, presentation and advertising of foodstuffs

trade; must be administered in a reasonable manner; and must lay down conditions that confer origin. The European Union considers geographical indications a key element of the Doha Development Agenda negotiations, but these indications cover only well-known brands.

Another possibility that has received much attention recently is the environmental labelling of food products based on the energy use and/or greenhouse gas emissions during their production, transport and use. Origin and/or environmental labels could help consumers make more responsible decisions and could encourage food retailers to use less and more energy-efficient transport. However, there are two major disadvantages of such food labelling:

- Its costs may exceed the benefits: a public consultation of the European Commission (2006d) suggests that a general mandatory indication of origin may go beyond EU consumers' present demands. However, many consumer NGOs and agricultural producers are in favour of origin labelling for a number of raw materials and meat products.
- There are serious methodological difficulties in environmental impact assessments. For example, UK supermarket chain Tesco announced in January 2007 that it aims to attach carbon labels to all 70 000 products it sells, but the research it commissioned from UKERC (2007) has highlighted several methodological difficulties. DEFRA (2005) found similar problems when evaluating the usefulness of food miles labelling.

Keeping these caveats in mind, a minimum, mandatory labelling of country of origin could still be considered for some products. Furthermore, the organic labelling could be amended to include environmental standards for transport, such as the abstinence from air freight, as suggested by the Soil Association in the UK.[63]

Help biofuels trade with common standards and sustainability certificates

The WTO can also play a role in developing biofuels trade, which in turn could contribute to lower dependence on fossil fuels. At present, bioethanol is classified as an agricultural product, subject to higher tariffs than fossil fuels. Bioethanol could either be reclassified as an industrial good (similar to biodiesel) to help lower their trade barriers. Alternatively, it can be classified as an environmental good as the removal of trade barriers to these products is envisaged by the Doha Development Agenda. However, sustainability standards for biofuel production could be insisted upon in these negotiations, as the contribution to sustainable development on a global scale is an important aim behind the promotion of biofuels. Such standards could be developed on the own initiative of the European Union, as suggested by Energy Commissioner Andris Piebalgs in July 2007.[64]

Develop and globally harmonise waste regulations

Trade policy could contribute to the increasing domestic use of recycled materials and to the prevention of environmental leakage by further developing EU and international standards for recycled materials, and through ensuring that secondary materials and waste leaving the EU

[63] 'Air-freighted food may lose organic label', Guardian Unlimited, 26 January 2007. Available at http://www.guardian.co.uk/environment/2007/jan/26/food.food
[64] 'EU highlights biofuels drawback', EUbusiness, 9 July 2007. Available at http://www.eubusiness.com/Energy/1183636805.22/

are treated to the same standards as in the EU. The High Level Group on Competitiveness, Energy and Environment recommends the application of certification schemes and international best practices for transparency and traceability purposes.[65]

4.2.3 Trade defence instruments

WTO regulations allow the European Union (at least in theory) to launch anti-subsidy procedures against countries that use trade-distorting energy subsidies.[66] According to the Anti-Dumping Agreement of GATT, enterprise-, industry- or region-specific subsidies to domestic producers that put foreign competitors at disadvantage in either country or in third countries are actionable, if the complaining party can prove the harm done to its own producers. If the Dispute Settlement Body of WTO is convinced by the evidence, it can prohibit the subsidy or it can allow the use of countervailing duties. Current provisions and procedures lack clarity and are only partly operational. As a result anti-subsidy procedures are rarely initiated (see the related example below).

The Doha Development Agenda foresees the elaboration of these rules and mechanisms. It is in the interest of EU to push for well-functioning anti-subsidy measures to protect its producers from the potentially harmful effects of energy subsidies applied in a number of countries. Current practice of the EU does not foresee anti-subsidy investigations concerning economies in transition, including China, due to the difficulty of assessing the amount of subsidies in these countries. Instead, the Commission has preferred the use of anti-dumping instrument. During anti-dumping procedures against non-market economies price and cost benchmarks of market economy third countries (e.g. Brazil for China) are used.[67] Since prices and costs in these benchmark economies are often higher than in the country concerned, estimated dumping margins may be unreasonably strict. By granting transition countries market economy status the lower local prices and costs must be used in calculations; as a result dumping margins can fall and the level of protection can drop.[68] Effective anti-subsidy measures can maintain protection against unfair competition from this group of countries. Anti-subsidy measures require more attention among European trade defence policies; energy-related subsidies are one area where they could be applied.[69] On the other hand, such defences should not be excessive (they should not defend uncompetitive industries): they should not make domestic industries complacent and reduce their adjustment potential. They should also take into account business interests of European firms operating outside the EU.

Besides, the issue of trade-distorting (energy) subsidies should also be included in future free trade agreements with China and other countries. These agreements should be used to achieve the convergence of competition laws and state aid rules, and to promote transparency in state aid. In the specific context of steel industry resuming the OECD Steel Subsidy Talks could provide the institutional framework for action.

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[65] 'Fourth Report of the High Level Group on Competitiveness, Energy and the Environment: Ensuring future sustainability and competitiveness of European enterprises in a carbon and resource constrained world', 11 June 2007. Available at http://ec.europa.eu/enterprise/environment/hlg/whois.htm

[66] Other trade defence instruments of the European Union, less relevant compared to anti-subsidy measures from the point of view of the topic of this paper, include anti-dumping and safeguard measures.

[67] Mayer, Brown, Rowe & Maw (2005)

[68] China can be treated as an economy in transition in anti-dumping investigations until 2016, but there is increasing pressure to award market economy treatment to the country.

[69] The chemical, metallurgical and non-metal industries urge the finalisation of Doha Development Round to achieve free and rule-based trade with safeguards against dumping or subsidised imports.

Anti-subsidy cases are one area where there is potential for cooperation between the EU and the USA. These two regions cover a significant part of world trade (and imports from China), therefore a concerted effort to improve anti-subsidy enforcement could prove fruitful and mutually beneficial.

The European Commission has recently launched a comprehensive review of trade defence instruments, which highlights the timeliness of the issue, and presents an opportunity to put the presented ideas into practice.

Example – Energy-related anti-subsidy procedures initiated by the European Union

The European Communities has initiated 643 anti-dumping and anti-subsidy investigations to date; of these, 54 were anti-subsidy procedures. There were four cases with allegations of energy-related subsidies, including preferential utility rates and in some cases preferential transport rates. Energy-related subsidies were not the sole reason for investigations: they were listed among several other allegations of subsidies. All these anti-subsidy procedures were terminated because total subsidies were found to be negligible.

There are many potential explanations why energy-related subsidies were not raised more often in anti-subsidy procedures:

- The existence and the significance of subsidies may be hard to prove in general.
- The issue is not relevant for less energy-intensive product groups.
- Subsidies had a lower impact when oil prices were low.
- Anti-subsidy cases were not initiated against transition economies including China, Russia and the Ukraine, where energy-related subsidies may be considerable.

Nevertheless, these explanations do not rule out the usefulness of anti-subsidy procedures in the context of energy-related subsidies in the future.

Energy-related anti-subsidy procedures initiated by the European Union

Product	Country	Year of initiation	Energy-related allegations	Results of procedure
Binder or baler twine	Saudi Arabia	1998	Preferential air freight and utility rates	Terminated in 1999, negligible subsidies
Hot-rolled coils	South Africa	1998	Preferential transport and electricity rates	Terminated in 2000, negligible subsidies
Plastic sacks	Thailand	1999	Provision of electricity for less than adequate remuneration	Terminated in 2000, no Community interest
Stainless steel fasteners	Thailand	1999	Preferential electricity rates	Terminated in 2000, negligible subsidies

Messages:

- The existence and significance of subsidies may be difficult to prove, limiting the current effectiveness of anti-subsidy procedures.
- Energy-related subsidies gain prominence in an era of high energy prices. They are expected to be more relevant in countries with transition economy status that are currently exempt from anti-subsidy cases.

Source: 'Anti-dumping and anti-subsidy measures list', DG TRADE. Available at http://trade.ec.europa.eu/doclib/docs/2006/december/tradoc_113191.xls. OJ references to the cases are available in the file.

4.2.4 Investments

Foreign direct investments (FDI) and trade can be both complements and substitutes. Their interdependence and the leading role of the European Union in FDI (both globally and in energy- and oil-related industries and services) provide ground for including the measures affecting investments in the analysis.

Trade policy can contribute to the development of energy sectors in major energy exporting countries. Commissioner Mandelson has also made this case, stating that "the most promising scope for stronger and mutually beneficial relationships on energy trade and investment exist on our own continent, in Europe. Most notably in our relations with Russia, the Ukraine and Turkey."[70] Opening up the energy sectors to investment and ensuring open access to oil and gas pipelines are the most important goals, which could be pursued on many fronts.

Make the Energy Charter Treaty work

The Energy Charter Treaty was designed to integrate the energy markets of Western Europe and countries in transition. Promotion of cross-border energy investments and more open access to pipelines and power grids have been a central element of the Treaty. These are issues that are not covered in current WTO arrangements. The Treaty was signed by more than 50 countries and came into force in 1998. However, it has contributed little to the opening up of European energy markets. Russia and Belarus have not ratified the Energy Charter Treaty and currently have respectively 11 and seven notified exceptions from the principle of non-discrimination of foreign investors. The Ukraine (which has ratified the Treaty) has six exemptions while Turkey has only two.[71] There are also ongoing investor-state disputes concerning these countries: Russia and Turkey are involved in three cases each while the Ukraine is involved in one.

There is obvious room for improvement. Besides leading by example in complying with the Treaty, the EU should insist on the ratification of the Treaty by Russia and Belarus, on the phasing-out of some exceptions (which would make the investment climate more friendly), and on continuous compliance with its provisions. This way, the Treaty could contribute better to the development of energy sectors, and through this, on the oil and gas supply of Europe.

The ratification of the Energy Charter Treaty and compliance with its provisions could be raised as conditionalities for example in:

- bilateral trade negotiations,
- WTO membership talks with Belarus, Russia and the Ukraine,
- OECD membership talks with Russia,
- EU accession negotiations with Turkey.

[70] Speech by Peter Mandelson at a Conference on strategic energy policy, Brussels, 21 November 2006. Available at http://trade.ec.europa.eu/doclib/docs/2006/november/tradoc_131225.pdf

[71] Energy Charter (2007)

Example – Settlement of investor-state disputes under the Energy Charter Treaty

There were two investor-state dispute settlement cases where the parties settled the case with mutual agreement and two further cases where an arbitral tribunal has made an award. One of these cases was between Nykomb, a Swedish energy company and the Republic of Latvia. Nykomb purchased a Latvian subsidiary, Windau, which undertook to build a cogeneration power plant to supply electricity and heat to the Latvian electricity monopoly Latvenergo in 1997. The plant was built by 1999 and started production in 2000. There was a dispute between the parties over the pricing of electricity. As electricity was available in Latvia at dumping prices from Lithuania and Russia, foreign investors were granted double prices to encourage investments in the country's power sector. However, Latvenergo denied Windau this double price. Seeing the returns on its investment in risk, Windau halted its other cogeneration projects. As their dispute could not be resolved amicably, Nykomb took the case to arbitration in 2001 claiming that Latvia, a signatory to the Energy Charter Treaty, violated the principle of equal treatment of foreign investors.

On 16 December 2003 the tribunal of the Arbitration Institute of the Swedish Chamber of Commerce decided that the Republic of Latvia must pay LVL 1.6 million (EUR 2.3 million) damages, 6% interest as well as the arbitration costs of Nykomb. Latvia was also ordered to ensure double tariffs for Windau until 16 September 2007.

Messages:

- Stability of the investment climate is crucial for energy sector investors due to the capital intensity and long payback period of these investments.
- The Energy Charter Treaty can be used as a mechanism of investor-state dispute settlement to ensure fair treatment of energy sector investors.

Source: Arbitral Award Nykomb v Latvia, available at http://www.encharter.org/fileadmin/user_upload/document/Nykomb.pdf

Launch comprehensive trade talks on energy

In 2006 Commissioner Mandelson hinted that a new round of global trade talks should focus on energy to bring oil and gas trade and investments under the rules and enforcement procedures of the WTO.[72] A key issue would be free access to transit routes, which could rebalance the terms of trade in energy in favour of consumers. Talks could also touch upon energy-related subsidies as well as biofuels. Energy producers could be offered more security on consumer markets and better access for investments. The main difficulty of such negotiations is the lack of interest by energy producing countries, especially as high oil prices bring huge benefits to them, and because they treat domestic resources as national security issues and sources of political strength. Furthermore, given the glacial pace of the Doha negotiations, another global trade round is likely to be years away.

4.2.5 Emission permits trading

The Kyoto Protocol and the EU Emission Trading Scheme (ETS) can also be viewed as trade policy instruments because a central element of these arrangement is the international trade of carbon emission permits.

[72] 'EU seeks to put global trade in energy under WTO rules – Proposed new talks would be tough to sell to producer nations', The Wall Street Journal Europe, 23 June 2006.

The EU-ETS is already in operation. However, its coverage is incomplete; for example, energy use in households and transport is excluded. Besides fixing the flaws of the system (e.g. the over-generous distribution of permits), it should be expanded to cover at least air transport. This is desirable on two of grounds:

- Transport is one of the key greenhouse gas emitters, and the energy saving potential of the sector is significant. Capping emissions in transport would provide a strong incentive to realise this potential.
- Fuels in air transport are currently exempt from taxation; this implicit subsidy has contributed to the rapid growth in air freight. By internalising the additional social costs of air transport, companies and individuals would be encouraged to make more use of environmentally friendlier (and less energy-intensive) transport modes.

5. CONCLUSIONS

High oil prices are a phenomenon of the new millennium. The emergence of new industrial powerhouses in Asia, insufficient energy supply capacities and the collusive behaviour of oil producers are some of the key factors. In the foreseeable future oil prices will remain not only high but volatile as well.

The estimated impact of oil price shocks on economic growth is both temporary and of fairly limited magnitude. Europe can even benefit from high oil prices, mostly because the European economy is less oil-intensive than its trade partners. As energy intensity has fallen much since the 1970s, the European economy is more able to withstand the effects of high oil prices than before.

High oil prices do not threaten the long-term growth prospects of individual economic sectors either, but they incur temporary adjustment costs. Still, a more significant challenge emerges in the form of Asian producers operating with much lower labour costs in a less stringent regulatory environment. The emergence of Asia lies behind the rise of other commodity prices as well.

European business is already responding to the challenge of high oil prices. Supply chains are adjusting, although systemic changes are not necessary yet. Relocation of production is taking place in some sectors (including energy-intensive industries), but its overall impact on employment is small. On the other hand, the increase of transport costs is far from unbearable for companies locating overseas. Fuel substitution is limited by technological constraints in most sectors. Biofuels appear the best opportunity to substitute oil, especially in transport. Finally, firms actively invest in energy efficiency and increase the use of waste and scrap materials to reduce energy dependency; this has led to significant reductions in the energy intensity of European industries in recent decades.

Community-level policies can help the European economy in adjusting to an environment of high oil prices in a number of areas:

- While there is a strong case for free trade, the fairness of trade should be maintained by tackling trade-distorting energy-related subsidies in a number of countries.
- Biofuels markets are promising but immature; the arguments for free trade are strong.
- The long-term security of global energy supply will require massive investments in energy-producing countries; investors need opportunities and protection.
- Although there is huge potential in energy-saving investments, consumers let even highly profitable opportunities pass because of uncertainty, lack of information or distorted or inadequate incentives. The same can be said of recycling waste.
- The adjustment potential of the European economy can be improved even further by creating more flexible and competitive product and factor markets. Trade policy can contribute to better adjustment through promoting international competition.

Overall, the need for trade policy responses to high oil prices is limited. Still, policies that facilitate the adjustment of European companies, encourage consumers to save energy while help secure long-term energy supplies, are worthy of consideration. The proposed measures are summarised below.

Overview of possible trade policy instruments to tackle issues related to high oil prices

Measure		Impact on: Subsidies	Impact on: Biofuels	Impact on: Investments	Impact on: Efficiency and recycling	Impact on: Adjustment potential	Notes
Tariffs and quotas	**Lower import duties for materials**				X	X	▪ Harms basic material producers but benefits downstream firms ▪ One-off benefit of cost reduction ▪ Long-term benefit of more competition
	Free trade of environmental products				X	X	▪ Under discussion in DDA ▪ Significant export potential for EU ▪ Improves domestic and global energy efficiency
	Free trade of biofuels		X			X	▪ Better economic and environmental properties of imported biofuels ▪ Environmental effects and domestic agriculture need consideration
Non-tariff barriers	**Improve market access for exporters**	X		X	X	X	▪ Complements free trade of environmental products and biofuels, can be linked to investments
	Environmental standards and labels		X		X	X	▪ Improves energy efficiency ▪ EU can become global lead market ▪ 'Carbon footprint' difficult to assess ▪ Complements free trade of environmental products and biofuels
	Improve and harmonise global waste regulations				X	X	▪ Great energy saving potential in recycled materials
Trade defence instruments	**Develop anti-subsidy procedures**	X					▪ Under discussion in DDA ▪ Subsidies difficult to prove ▪ Ongoing review of EU instruments
Investments	**Promote the Energy Charter Treaty**			X			▪ Russia, Belarus should ratify ▪ Everyone should abide
	Energy-related trade talks	X	X	X			▪ Distant dream
Emissions	**Widen ETS to include transport**				X	X	▪ Promotes efficient transport modes

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