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Economic and Trade Policy Impacts of Sustained High Oil Prices

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Gábor Pellényi,
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Economic and Trade Policy Impacts of Sustained High Oil Prices

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Executive summary

High oil prices are a phenomenon of the new millennium. The price of crude oil rose more than six-fold between the end of 1998 and the summer of 2006, and then rose further still in late 2007 and early 2008, breaching the USD 100 per barrel mark for the first time in history. The emergence of new industrial powerhouses in Asia have 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. Finally, purely financial phenomena seem the most likely explanation for the most recent price increases. While analysts are divided as to what should constitute a 'fair price' of oil based on fundamentals, it is now widely assumed that relatively high prices, i.e. of at least USD 60 per barrel (at 2006 prices), will persist far into the future.

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. Furthermore the European economy is in a relatively favourable situation for at least three reasons:

- *Recent oil price increases were accompanied by a weakening dollar, thus mitigating the oil price shock in Euro terms.*

- *Energy intensity has fallen substantially since the 1970s, enabling the European economy to better withstand the effects of high oil prices than before. Moreover the European economy is less oil-intensive than its major trade partners, potentially leading to a relative production cost advantage.*

- *Imports of net oil exporting countries are biased in favour of European products: at times of high oil prices their demand for European goods and services 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 the production costs of metals and minerals as well as transport costs. The relationship between oil and agricultural product prices is complex. While higher oil prices do increase costs (especially transport and fertilizers), current market tightness seems to be the key driver, although expanding biofuel production is also a relevant issue.

European businesses are responding to the challenge of high oil prices:

- *Current supply chain practices were designed under the assumption of low oil prices, enabling just-in-time and offshore sourcing. A number of corporations are beginning to restructure their distribution networks in order to hold down transport costs.*

- *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 are not currently threatened by higher transport costs, though this could begin to change if oil price increases continue.*

- *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 subsidize the energy consumption of their industries, putting European producers at an unfair disadvantage.*

- *The EU has substantial export potential in environmental goods and services and energy-saving technologies which may be realized with further liberalization.*

- *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 restrict foreign and private investment 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 further improved 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.*

Overview of possible trade policy instruments to tackle the effects of high oil prices

Measure		Impact on					Notes
		Subsidies	Biofuels	Investments	Efficiency and recycling	Adjustment potential	
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 harmonize 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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Economic and trade policy impacts of sustained high oil prices

1. Introduction

Key findings and issues

- Oil prices have risen from below USD 20 in the 1990s to above USD 100 in early 2008; they are expected to remain permanently above USD 60 (in 2006 prices) until 2030 and may remain above USD 70 (in 2006 prices) until 2010 due to capacity shortages and strong global demand
- The medium-run fundamentals behind currently high oil prices are the emergence of Asian and other developing economies, tightness in production, storage and transit capacities, and collusive behaviour of major oil producers
- In addition, shorter-run financial phenomena seem to contribute to higher prices, in particular the pricing-in of a risk premium, which reflects uncertainties with respect to security of supply and expectations of ongoing market tightness, as well as portfolio investment reallocations, possibly as a reaction to a weakening US dollar.
- In the longer run, the price of oil depends heavily on investments in the global oil industry; IEA simulations suggest that an investment shortfall of 25% would push up the price of oil by 34% in nominal terms by 2030.

Figure 1.1

Share of oil and gas in gross inland energy consumption, EU-27, 2005
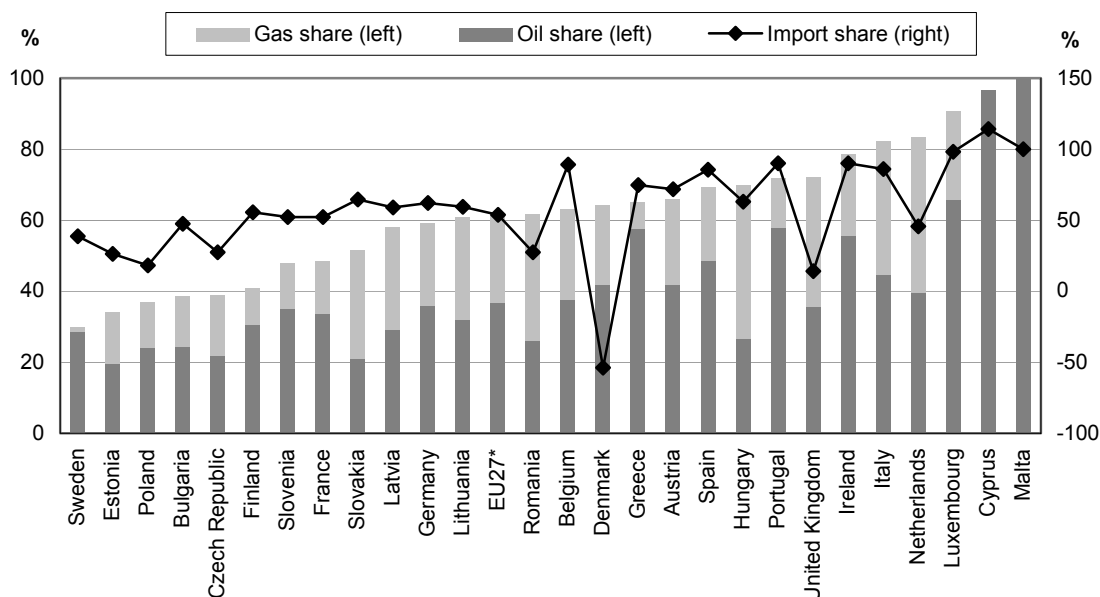
Note: * Extra-EU-27 net imports.
Source: Eurostat.

Oil prices have risen considerably in recent years. Whereas prices below USD 20 per barrel were common for most of the 1990s, they rose more than six-fold between the end of 1998 and the summer of 2006. Some moderation took place in the second half of 2006, but 2007 brought a new rally, breaching the USD 100 mark for the first time in history in January 2008. 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. For example, nominal oil prices (in dollar terms) rose by 68% in the course of 2007, but adjusted for inflation and expressed in euro terms they increased by 43%. In sum, favourable exchange rate developments have given Europe some protection against the rise of oil prices, but its impact has still been considerable.

The current trend of oil price increases 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 industrialized 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 has 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 OECD countries.

Figure 1.2

Nominal and real price indices of Brent crude oil
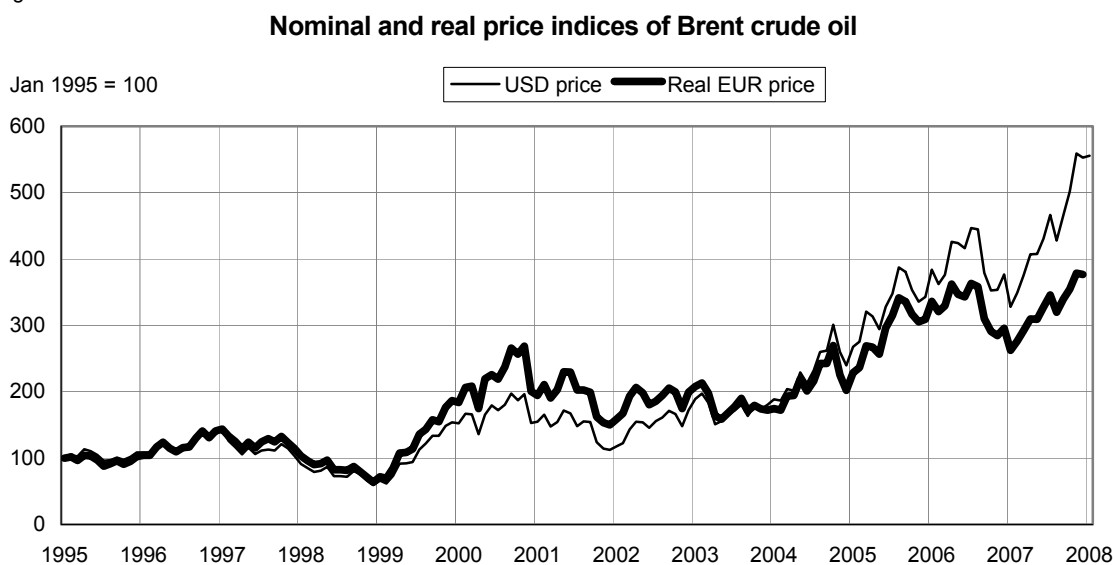
Note: Real price deflated by producer price index for the EU-27.
Source: Eurostat, IMF.

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 has been able to improve the competitiveness of its exports. This helped 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 has increased demand for the euro.[1]

There is however some lack of clarity about the reasons behind the most recent developments in the price of oil. While the purpose of this study is to discuss the impact of higher oil prices – rather than its causes – it is of interest to give a brief overview of the main apparent drivers, as well as a benchmark for medium- to long-term price developments.

The general background is the increase in net oil import demand on the part of major economic world regions that are already net importers, chiefly the OECD and developing Asian countries, first and foremost China and India. This development is driven by absolute growth in total demand combined with decreases in domestic production in those countries, leading to strong demand growth on the international market. As a result, supply is increasingly dominated by a small number of major producers – OPEC's share in global oil production is forecast to rise substantially up to 2030 – leading to strong increases in global energy trade flows. On the supply side there is a pressing need for investment in new production and extraction capacities to compensate for declines in mature fields, however there are uncertainties about whether the new capacities that are currently planned will be sufficient by the time they become fully operational. As pointed out in IEA (2007a), this general pattern threatens to exacerbate both short- and long-run energy security risks, particularly given possible delays in the implementation of new production capacities. In turn, the perceived energy security risk is a key short-run driver of the oil price. Turning to events of the recent past, ongoing physical supply disruptions in Nigeria and in Iraq, as well as more general geopolitical concerns, have also contributed to the 'risk premium' on the oil price, while IEA (2008) considers that OPEC's immediate spare production capacity seems too low in the current climate. Additionally, according to Dées et al. (2008), oil stocks held by net importing countries play an important positive role in terms of energy security, and thus ultimately in holding down crude prices. However total stocks expressed in terms of days of forward consumption have decreased over the last 20 years due to oil consumption levels growing faster than stockholdings.

What is less clear from the point of view of fundamentals is what has driven the increases in the oil price in late 2007 / early 2008, which coincided with significant falls in the US dollar relative to other major currencies. Financial media reports have suggested that

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[1]   Bénassy-Quéré et al. (2005).

some shift from US dollar positions into commodities (not only oil, but also gold for example) had taken place, though a non-speculative rationale (e.g. as a hedge against further dollar depreciation) for such moves is not entirely convincing. Also, short-run falls as seen for example in mid-March 2008 resemble classical limited profit-taking on the part of speculators. In any case, there is a lack of consensus as to what exactly is driving the most recent price movements. This uncertainty seemed important enough for the IEA to organize a special round-table on the topic of oil price formation on 17 March 2008. However the results seem dispiriting, as the IEA's press release stated that *'… opinions on the topic were as strong as they were diverse, making clear that there is no single explanation for higher oil prices […] There was general concern at the lack of data transparency which exists, both financial and fundamental, and that this hinders the understanding of price formation.'*

In spite of these difficulties, it is of course desirable to have some kind of assumption about possible future developments of the oil price, not for the short-run, but rather for the medium- to long-run. For this purpose, this study adopts the reference scenario of the International Energy Agency (IEA), as published in its World Energy Outlook 2007 (IEA, 2007a). Our assumption is that this constitutes a fair estimate based on fundamentals as understood in early 2007. Given recent developments, one may thus view the price scenario shown as a lower-bound, while an unknown share of the difference between the scenario and currently observed prices may be due to short-run speculative activity.

Table 1.1

IEA average crude oil import price assumptions, USD per barrel

	2006	2010	2015	2030
Real (at 2006 prices)	61.7	59.0	57.3	62.0
Nominal (assuming 2.3% inflation)	61.7	65.0	70.7	107.6

Source: IEA (2007), p. 64.

The IEA uses its own mathematical forecasting model, the World Energy Model, in order to obtain detailed sectoral and regional forecasts of energy market trends. It assumes an average world GDP growth of 3.6% between 2005 and 2030 and the continuing emergence of China and India (with assumed average real annual growth rates of 6.0% and 6.3% respectively over the same period). The price scenario which is consistent with these assumptions and the model's other assumptions concerning supply capacities is shown in Table 1.1. The gist of the model's supply-side assumptions is that production and refining capacities will rise slightly faster than demand up to 2015, thus pushing real prices down by small amounts. What is also implicitly clear from the scenario shown is that the IEA does not believe that the world will reach 'peak oil' during the period.

It should be borne in mind that the scenario shown does not include short-run shocks to market fundamentals. Given the tightness of the market and the existence of physical bottlenecks in transportation, accidents, extreme weather, terrorist attacks and geopolitical tensions can all lead to sharp price hikes in the short-run.

Most importantly, the reference scenario assumes that necessary investments in new production capacity will take place in a timely manner. Conversely, a lower level of investment, or significant delays in investment, would result in higher prices than what is shown. IEA (2007a) expresses marked uncertainty as to how things will evolve in this respect, citing the additional concern that even minor deviations from the expected decline rate from existing mature fields would have major medium-run consequences given low spare capacity. In total, IEA (2007a) estimates that investments worth USD 5.36 trillion (at 2006 prices) are needed in the oil sector between 2006 and 2030 to cover growing demand. Several problems may arise. 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 on oil sector investments. In its 2006 edition, the IEA's World Energy Outlook included a scenario of *deferred investment*. Under that scenario, should upstream investments remain 25% below the prescribed level, oil prices could be 34% higher in nominal prices in 2030 than in the reference scenario.

Higher oil prices have adverse first-round effects on the European economy. These include a slowdown in growth, rising inflation and 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 be carefully 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 the 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 assess the need for such policies in general, and then analyse potential trade policy responses in particular. Section 5 concludes.

2. The impact of high oil prices on the economy

2.1 Macroeconomic effects

Key findings and issues

- The effect of a permanent oil price increase on economic growth is relatively short-lived. According to most simulations, the bulk of the negative impact on output occurs in the first two years and wears off rapidly thereafter. Output effects from *temporary* price shocks are similar initially but of very small magnitude in the longer-run.
- The magnitude of the impact on output depends on the oil intensity of the economy. Simulation results for a permanent USD 10 increase in the oil price suggest a *cumulative* loss over the first two years of around 0.4% of GDP for the euro area and of around 0.5% for the United States, though certain New Member States may experience higher losses.
- The effect on inflation is less clear and strongly depends on monetary policy responses. Assuming that monetary policy seeks a compromise between short-run and long-run price stability, simulations suggest that the impact on overall inflation peaks in the second year at around 0.3 percentage points for the euro area and at around 0.5 percentage points for the United States, while stronger effects are possible for more oil-intensive countries.
- Higher oil prices improve the non-energy trade balance of the EU: the EU economy is less energy intensive than its trading partners and the import demand of energy exporting countries is biased in favour of European goods and services.
- High oil prices are historically associated with a stronger U.S. dollar, which during earlier oil price increases further contributed to expanding EU exports while increasing the size of the cost shock on the EU. The current episode is the reverse: EU exports suffer from unfavourable exchange rate developments, but the oil price shock is mitigated.
- As higher oil prices hurt the EU less than its major (net oil importing) trade partners, the EU can gain by liberalizing 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 utilization (Finn, 2000): an oil price rise lowers energy use and capital utilization. This directly reduces output and through this the marginal product of

labour. As a consequence, real wages fall. A lower capital utilization 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, in the US case, that as the Federal Reserve 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 more limited.
- Terms of trade: rising oil prices worsen the terms of trade for oil importers and leads to a transfer of wealth from them to oil exporters, while weakening the purchasing power of oil importers.
- Revenue recycling: there is however some (limited) mitigation of these negative effects due to revenue recycling on the part of oil exporting countries, as additional export revenues typically contribute to higher demand for imports from, as well as to capital inflows to, the 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% price increase causes a fall in GDP which is more than double the fall due to a 10% price increase). The latter implies that an oil price increase and an oil price decrease of the same amount lead 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.[2] Finally, the impact of oil price shocks varies with time: thanks to technological developments and falling energy intensity more recent oil price shocks have had smaller effects on growth than previous ones.

The link between oil price increases and inflation is another important area of research. High oil prices directly affect the costs of production and transportation of goods. This will to some extent spill over into producer prices, and ultimately into consumer prices. Expected consumer price inflation may then feed into nominal wage negotiations, opening up the possibility of a "price-wage spiral". However if nominal wage adjustments are moderate and product market competition is strong this type of second-round effect will be limited.

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[2] 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)

2.1.2 Empirical findings on growth and inflation

Empirical research efforts covering the effects of oil price shocks on growth and inflation are of two main types: backward-looking empirical estimates and forward-looking projections or simulations from calibrated models. Recent empirical estimates for the US economy (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 two years. In other words, a 10% rise in oil prices shaves 0.5% off GDP for two years but the effect gradually wears off.

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[3] 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:

- While an appreciation of the euro vis-à-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 (see 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.

For the purposes of the current study we choose to refer to model simulations made by Barrell and Pomerantz (2004), as it provides dynamic simulation results for several EU member states as well as for the euro area. The simulations of Barrell and Pomerantz (2004) are based on the NiGEM model, a global macroeconomic model based on a 'New Keynesian' framework with forward-looking agents and nominal rigidities. Each OECD country is modelled separately, as are China, Russia and a few other countries. The rest of the world is modelled as a set of regional blocks. In their simulations, the authors assume that the monetary authorities of OECD countries target inflation both in the short-run and in the long-run. Crucially, the authors conduct separate simulations for temporary and permanent oil price shocks.

According to their simulations, the effect of a permanent oil price increase on economic growth is relatively short-lived. The bulk of the negative impact on output occurs in the first two years and wears off rapidly thereafter. Output effects from temporary price shocks are similar initially but of very small magnitude in the longer-run. These results are in keeping

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

with the results of other types of dynamic models. A review of several simulation results for the US economy can be found in EIA (2006).

Figure 2.1

Energy intensities of major economies relative to the EU-27, 2005
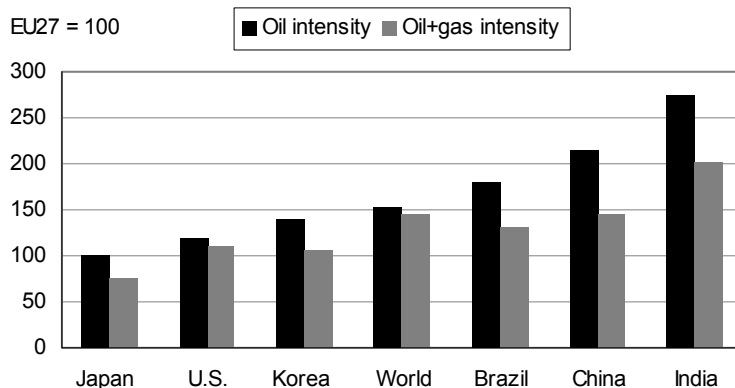
Note: Energy intensities calculated at 2000 purchasing power parities. Russia was not included for better visibility; its oil intensity is 526% of the EU-27 while its combined oil and gas intensity is 1141% of the EU-27.
Source: OECD.

The magnitude of the impact on output of a permanent oil price shock depends on the oil intensity of the economy. Simulation results for a permanent USD 10 increase in the oil price suggest a *cumulative loss over the first two years* of 0.38% of GDP for the euro area and of 0.47% for the United States, though certain New Member States may experience higher losses due to higher oil intensities. In particular, the simulations suggest that the losses in the first year of the shock would amount to 0.21% for the euro area. These estimated responses should however be interpreted as an upper-bound concerning the most recent oil price increases for two main reasons: first, the starting level of the oil price for the increase that occurred between 2007 and 2008 was higher, leading to a smaller percentage change; and second, as mentioned earlier, exchange rate developments dampen the shock in euro terms.

The effect on inflation is less clear and strongly depends on monetary policy responses. Assuming that monetary policy seeks a compromise between short-run and long-run price stability, simulations suggest that the impact on overall inflation peaks in the second year at around 0.3 percentage points for the euro area and at around 0.5 percentage points for the United States, while stronger effects are possible for more oil-intensive countries.

Given that recent oil price increases have been quite dramatic, these simulation results seem relatively high. Strongly negative growth impacts had not been observed until mid- to late-2007, leading some analysts and economists to conclude that 'oil shocks no longer shock', as evidenced for example in Segal (2007), or at least that their impacts are much smaller for certain key reasons, as expounded in Blanchard and Gali (2007). In order to offer a balance

of views on the issue we briefly review their arguments. The explanations given for the absence of serious drops in growth until 2007 break down into three main categories. First and foremost, past oil shocks have been critically re-evaluated, and the conclusion which is currently gaining ground is that one of the main reasons for recessions after oil shocks in earlier days was because of inappropriate monetary policy responses, i.e. with too much focus on fighting short-run inflation and not enough focus on upholding growth. If one pictures a Taylor Rule, this is akin to saying that the weight given to reducing the (short-run) inflation gap was too high in the past, while the weight given to reducing the output gap was too low. Accordingly, authors such as Segal (2007) believe that monetary authorities have learnt from past mistakes, so that they would now not worsen shocks which, in most cases, are much less potent than generally believed. Another argument, developed in Blanchard and Gali (2007) is that nominal wage rigidity has decreased in OECD countries. In other terms, real wages can adjust downwards more rapidly and more strongly today after an oil shock than they could in the 1970s. As a result, wage inflation remains more subdued, reducing the likelihood and extent of restrictive monetary policy responses. Finally, both Blanchard and Gali (2007) and Segal (2007) argue that the substantial lowering of the oil intensity of GDP since the 1970s has reduced both the direct output effect and the direct inflationary effect of oil price shocks. This latter argument is supported by oil and energy intensity indicators. Sector-specific examples are presented in Chapter 2 of this report.

In spite of these caveats, it would however be very wrong to assume that 'oil price shocks no longer shock'. After all, the model-based simulations made by Blanchard and Gali (2007) lead to results that are quite similar to those of Barrell and Pomerantz (2004) and others for the US case. Ultimately this is a quantitative question, suggesting that further modelling work and improved calibration may be necessary in order to fine-tune existing research efforts. More generally, what growth path the EU economy would have been on with lower oil prices is unknown, while a number of contemporaneous factors, e.g. the sub-prime market collapse, obscure immediate empirical assessments. It may be that recent simulation results are overly pessimistic, but there could also be non-linear or threshold effects that we are not yet fully aware of, which would lead to more severe effects.

Asymmetries across EU economies in terms of energy intensity

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 both oil and natural gas are taken into account, differences are more pronounced.

Some Eastern Member States[4] rely heavily on Russian gas, and can be particularly exposed to high hydrocarbon prices.

Figure 2.2

Energy intensities of EU Member States, 2005
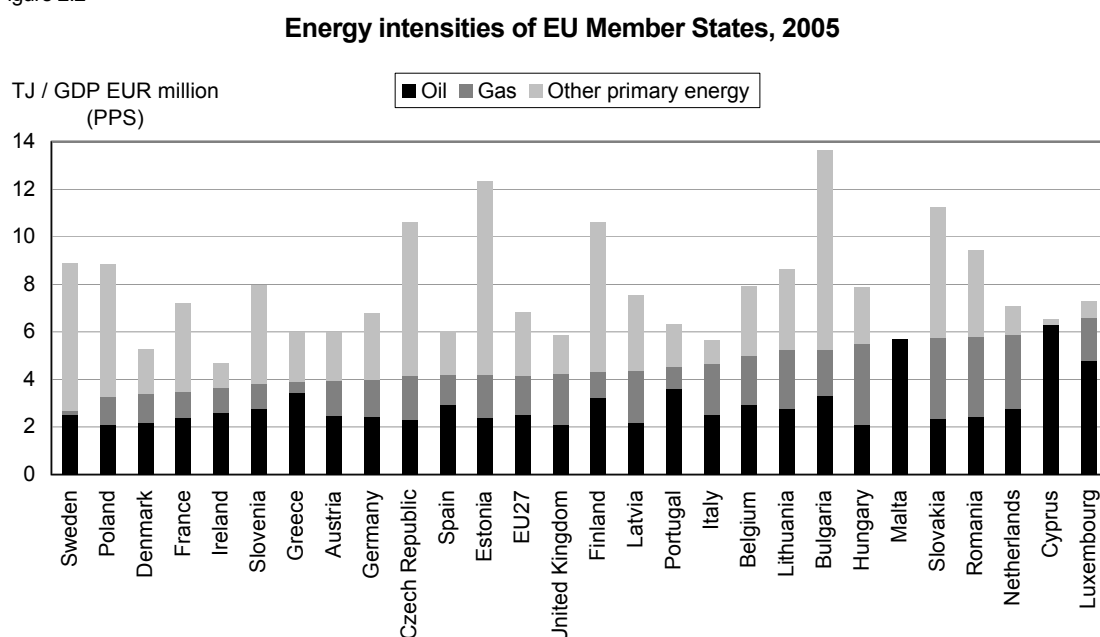
Note: Countries are ordered according to their combined oil and gas intensity.
Source: Eurostat.

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 and 2007 the total trade deficit widened from EUR 60 billion to EUR 186 billion. This was entirely driven by the deficit on energy products that quintupled by 2007 to reach almost EUR 270 billion (it peaked in 2006 with EUR 282 billion); meanwhile the non-energy trade balance improved strongly up to 2005, but has slightly worsened since. Price changes accounted for 86% of the rise in the energy trade deficit; changing volumes caused the remaining 14%. 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[5] 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[6] also investigates the dynamic effects of oil price shocks on the trade

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[4] In particular Bulgaria, Hungary, Lithuania, Romania and Slovakia.

[5] 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.

[6] Kilian, Rebucci and Spatafora (2007).

balance of the euro area. It finds that the net effect of an oil price increase is negative in the first two years but later turns positive as non-energy exports expand.

Figure 2.3

Evolution of energy and non-energy trade balances of the European Union
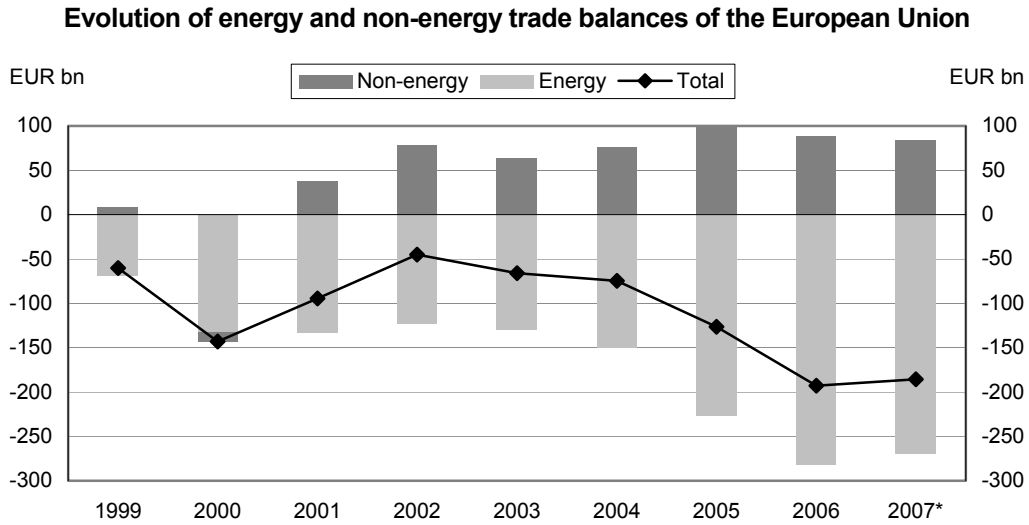
Note: Energy = SITC 3 commodity group; * preliminary data;
Source: Eurostat.

Figure 2.4

Net energy imports of EU Member States, 2006
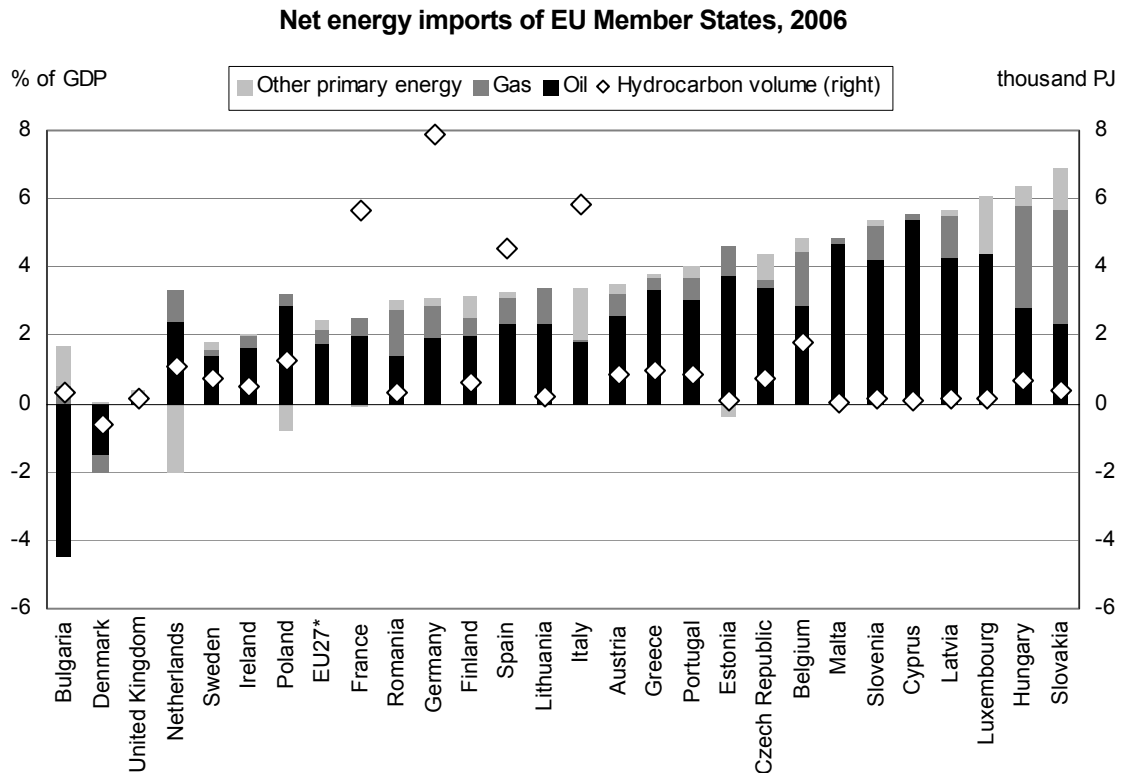
Note: * Net extra-EU-27 imports. Hydrocarbon quantity = sum of net oil product and gas imports measured in heating value.
Source: Eurostat.

Asymmetries across EU economies in terms of energy import dependence

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, while the balance is slightly negative in the Netherlands and the United Kingdom. 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.

2.1.4 A simulation exercise

This part of our study is devoted to simulating shifts in international trade patterns due to a higher oil price. For this purpose we employ the global simulation model (GSIM), which is designed 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 one composite good, in other words sectoral effects are not considered. The results of GSIM allow the assessment of importer and exporter effects related to tariff revenues, exporter (producer) surplus, and importer (consumer) surplus, changes in trade turnover, domestic output and prices.

Our simulation is based on the idea that there exists a specific set of changes to import tariffs which is equivalent, in its effects on trade flows, to a change in the price of oil. We therefore introduce equivalent ad valorem tariff rate changes which simulate the effects of an assumed increase in the oil price. The additional simulated tariffs are computed using the different oil intensities of national production of the selected countries. These simulated new tariffs come in addition to existing official tariff rates for each single trade flow. Our simulation focuses on the EU, the USA, China, Japan and the rest of the world. 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. 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.

We decided to conduct a simulation of the past increase in the oil price, with the price shifting from EUR 25 to EUR 60 per barrel, assuming an average past exchange rate of 1.3 USD/EUR. We assumed 2004 levels of oil intensities, constant throughout the simulation period. As a result of the price shock, we estimate that EU exporters face the equivalent of an additional import tariff rate of 1.6% in ad valorem terms; 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%. These additional rates lead to higher consumer prices, lower demand and lower output in all countries. The results of our simulation are shown in Table 2.1. The numbers on the diagonal represent the estimated changes in domestic output, while the numbers off the diagonal represent the estimated changes in bilateral trade flows.

Table 2.1

Simulated effects of an oil price shock on bilateral trade flows, % change

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.

As can be seen, this substantial oil price shock (EUR 35 per barrel, equivalent to USD 45 per barrel under our assumptions) leads to one-off static drops in output of 1.1% for the EU and Japan, of 1.9% for the USA, and of 4.5% for China. These results should however be interpreted with caution, as the model used is suitable for trade simulation rather than for output effects. The changes in trade quantities in the aftermath of an oil price increase are expected to be mixed. 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 more oil-intensive trading partners, namely 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).

These simulation results confirm the idea that those countries that use oil more efficiently in their production, such as the EU, can expect, ceteris paribus, an improvement in their trade balances with respect to more oil-intensive net oil importers. This effect of course does not contradict the negative trade balance developments with respect to oil exporting countries, but it is interesting to see that not all net oil importing countries are likely to fare equally in a global environment of higher oil prices. Of course, the results shown must be put in context. The recent fall in the USD/EUR exchange rate may more than compensate the EU's energy intensity advantage with respect to EU-US trade. On the other hand, that very

development means that the relative changes in production costs are more favourable to the EU than is assumed in our simulation.

To conclude, our simulation results suggest that there is no general need for protectionist trade measures in the wake of high oil prices. On the contrary, the EU could use periods of rising oil prices in order to liberalize its trade regime further and to ensure that its partners are committed to similar policies. The usual gains from lower import tariffs apply regardless of the oil price level, i.e. decreasing consumer prices, higher consumer welfare, and increased import competition that contributes to more efficient resource allocation. In order to simulate such effects, we carried out an additional simulation combining the simulated rise in the oil price with a unilateral 50% import tariff reduction by the EU. The outcome of that simulation is that, although import penetration into the EU would increase, the EU would still face an improved trade balance thanks to the changes in 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 have risen 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 individual sectors to oil price shocks is highly differentiated, primarily due to large differences in energy intensity. We start off with an analysis of historical trends in the energy intensity of the EU's most energy-intensive industries, including an analysis of the sectoral impacts of past oil shocks. This is followed by a description of the recent experiences of energy-intensive sectors, notably with respect to the recent evolution of their cost structures and profit margins, as well as a descriptive analysis of future prospects for selected industries.

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 EU-15 over the period 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).[7] This is a measure which strips out price differences between countries within the EU-15 as well as price changes through time.

The transport sectors are by far the most oil product intensive. Estimates for 2004 for air and land transport[8] 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[9], and non-metallic minerals (which includes cement, lime, glass and ceramics) with 139 toe/million EUR.

Figure 2.5

Real oil product intensity of land and air transport, EU-15, 1970 and 2004
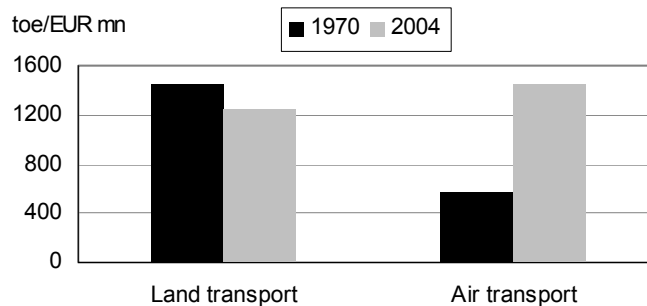
Unit: Gross value added at 1995 PPS.

Source: IEA, KLEMS database, own calculations.

How have 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 EU-15 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 prices.

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[7]   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).

[8]   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.

[9]   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.

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 output 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.

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. Chemicals, non-metallic minerals and agriculture are the most sensitive, 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 EU-15, 2004
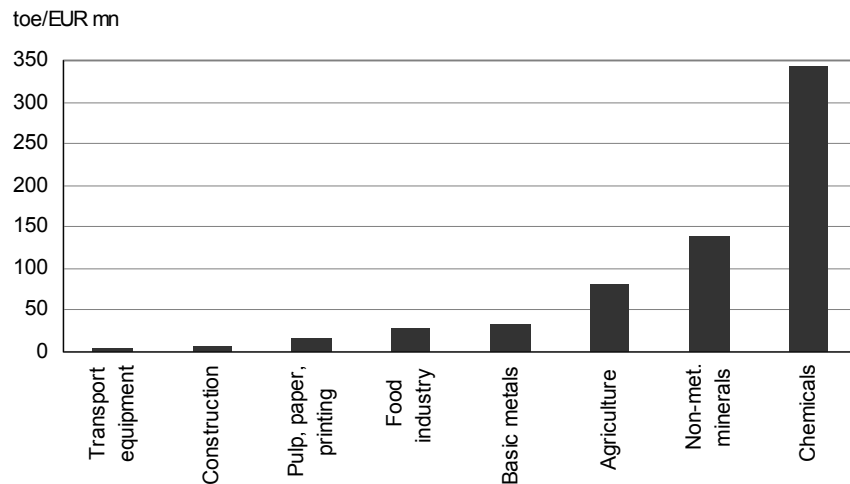
Unit: Tonnes of oil equivalent per million euro of gross value added at 1995 PPS.

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 vulnerable 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.

Figure 2.7

Index of oil product intensity in selected sectors of the EU-15, 1970-2004
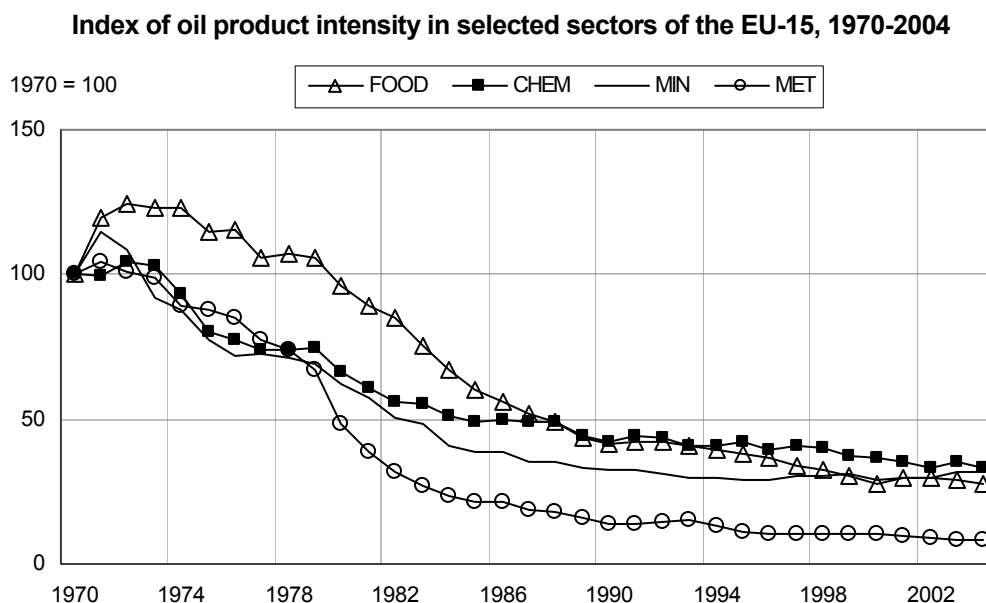
Source: IEA, KLEMS database, own calculations.

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).

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

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sectors and the oil price in two sub-periods: 1970-87 and 1988-2004.[10] Our expectation, based on the descriptive analysis above, was that we would find a significant relationship for the 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.

Figure 2.8

Index of real gross value added in selected sectors of the EU-15 and the evolution of the real price of oil, 1970-1987
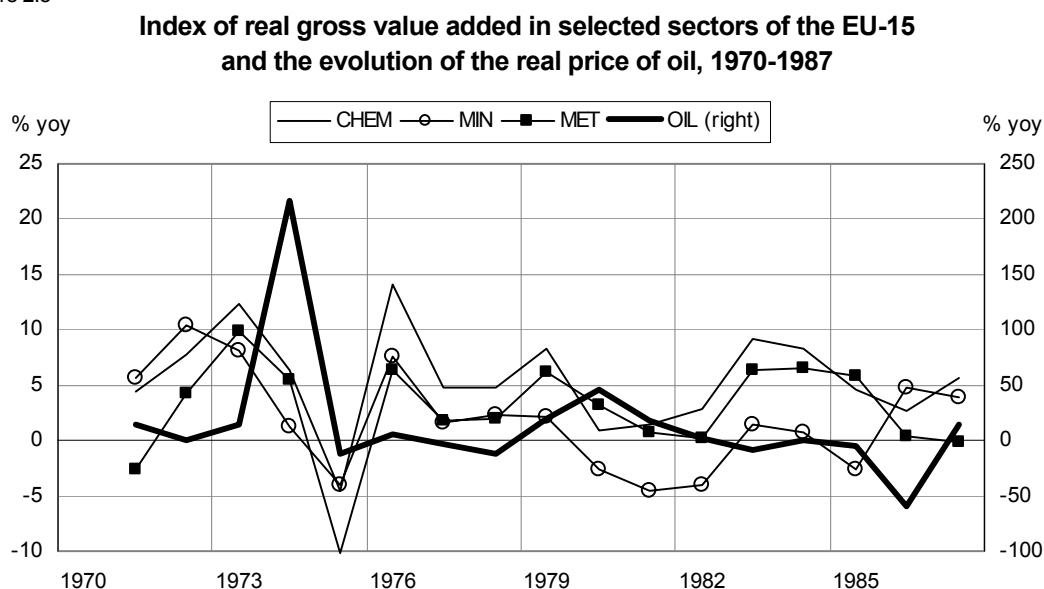
Source: IEA, KLEMS database, OPEC, own calculations.

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

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[10]   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.

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 real 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).[11]

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 selected energy-intensive industries, of transport and of 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 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.[12] The no-frills market is characterized 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

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

[12] Bozon, Campbell and Lindstrand (2007).

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).[13]

- 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).

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
Chemicals	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 plastics	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: 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 EU-27; 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).

The growth performance of the most energy-intensive manufacturing sectors is summarized in Table 2.2. These industries typically grew less than the manufacturing average (2%); however, the growth of the chemicals industry on the whole was strong. The performance of sub-groups is more diverse: there are successful and ailing branches in

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[13] European Commission (2006c).

every sector. Negative growth rates in some branches may, in some cases, be a sign of relocation of activities (see section 3.2 for detailed analysis).

Firm-level data from the BACH database of the European Commission suggest that the energy and raw material price increases between 1999 and 2005 led to their cost share (relative to turnover) rising by about 5 percentage points. However there is no clear trend in the profitability of energy-intensive sectors. Margins in the pulp and paper industry appear to have narrowed considerably while non-metallic minerals also saw falling returns. On the other hand, profit margins increased in petroleum refining and to some extent in the chemicals 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.[14]

Chemicals industry

Despite strong growth the European chemicals industry has lost its number one rank to Asia. The rise of the 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. As a result, access to affordable materials is becoming a critical issue, though capacity in these countries is rising fast: the share of China in world crude steel production rose from 15% in 2000 to 34% in 2006. Improvements in energy efficiency are under way everywhere as a response to high energy prices. European metal industries could also benefit from strong global demand, although the industry is 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

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[14] 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.

increased use of forests for other purposes (e.g. biomass for energy production). One increasingly popular strategy for paper mills to reduce costs is to extract energy from pulp liquor and other waste products. 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.[15] 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 theses industries could pass fuel price increases on to consumers. This has prompted investigations by the European Commission and complaints by energy-intensive industries.[16] With more competitive electricity markets production may become more responsive to energy prices (see section 3.3.1).

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.[17] 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 a third between 1997 and 2007; its trend generally follows the development of oil prices. Price increases for different types of inputs varied greatly: the cost of seeds, pesticides and animal feed rose

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[15] Since excise taxes are levied by quantity and not by value, they constitute a fixed element of the final consumer price of gasoline if excise rates are constant. See section 2.3.1 for recent trends in EU countries.

[16] 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)

[17] The countries analysed include France, Germany, Italy, the Netherlands, Portugal and Spain. Data source: BACH database of the European Commission.

by around 15% but price increases of fertilizers and energy were 57% and over 90% respectively. 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 have rebounded, driven by strong world demand for raw materials and the increase in production costs. As a result of these trends, the margins of agricultural producers using energy-intensive production methods dropped but are recovering.

Figure 2.9

Evolution of agricultural output and input prices in the EU
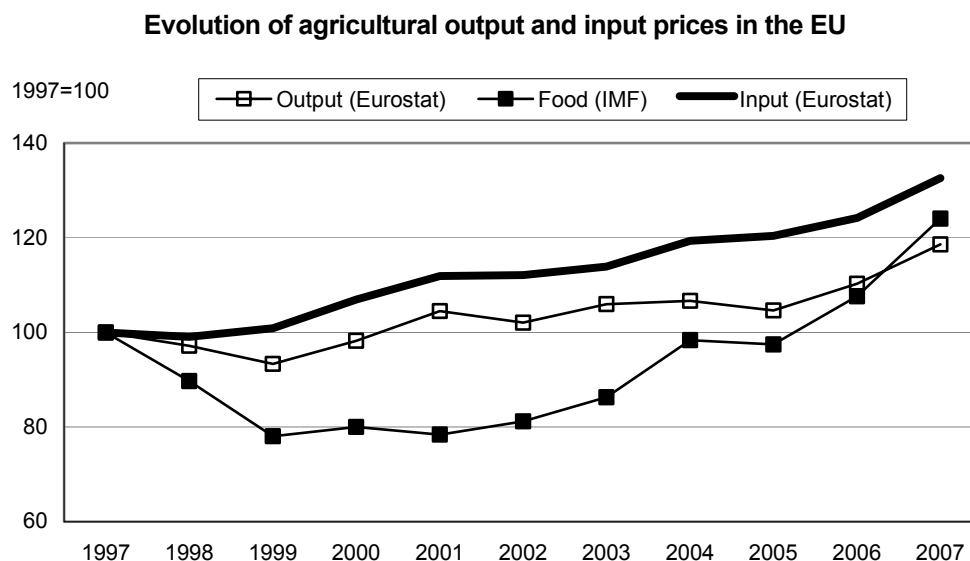
Note: EU and IMF output definitions differ. Only inputs directly used for production are considered.

Source: Eurostat, IMF, own calculations.

The direct impact of high oil prices on the farm sector depends on farm size and production patterns, notably the use of fertilizers.[18] Higher oil prices benefit smaller farms and organic farming (using more labour-intensive production methods) as well as shorter supply chains and more local production (see section 3.1). Global price developments suggest generally favourable long-term prospects for European agriculture despite current difficulties. The (partial) liberalization 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[19] 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.

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[18] 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.

[19] A comparison of recent forecasts is available in European Commission (2007a). See section 2.3.3 for a discussion of recent price trends.

- Demand for meat and dairy products is rising in developing and transition countries thanks to improving living standards. This should lead to higher demand for crops as inputs for animal feed production.

2.3 Price effects

Key findings and issues
- The pass-through of higher oil prices into final energy product prices varies quite strongly among EU member states, partly due to differences in taxation, and partly due to differences in mark-ups on the part of refineries and wholesalers.
- The effect on retail gasoline prices has been relatively moderate so far (EU average: +22% over the last 3 years), while stronger increases, on average around +50%, have occurred for residual fuel oil and natural gas. Further increases should be expected in the short-run.
- 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 fuel prices strongly influence fertilizer, steel and cement prices. Rising fertilizer and transport costs also impact agricultural prices, though the main driver for recent price increases for grain seems to be market tightness. In this context the expansion of biofuel production may have an exacerbating effect.

The link between oil prices and the final prices of energy products is strong and significant for two main reasons. First, oil is the input that is transformed into petroleum products in the refining industry. Second, the prices of other energy products respond to higher oil prices due to actual fuel substitution effects that drive up relative demand for them and/or due to pre-emptive price increases on the part of energy producers. This is particularly true of natural gas deliveries to most EU countries, for which there are long-term supply contracts that contain oil price indexation clauses. The final price effects are however strongly influenced by high, heterogeneous and changing taxation levels in member states, as well as by differences in market structures and distribution mark-ups.

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 their 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 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 comes into place, the latter being 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.

2.3.1 Final prices of energy products

In the event of rising crude oil prices, one naturally expects a pass-through effect onto the final wholesale and retail prices of a number of key energy products, in particular petroleum products such as gasoline, kerosene and fuel oil. In addition, price adjustment clauses (e.g. indexation to the oil price) that are part of long-term supply contracts for natural gas should also lead to increases in final prices of natural gas for households and for industry. In this sub-section we briefly review recent price developments for selected energy products. We start with the most commonly used automotive fuel: standard premium unleaded gasoline (Ron 95). The increases that have occurred between the second half of 2004 and the second half of 2007 are shown for 25 EU member states[20] in Figure 2.10. Given the very significant role played by taxation, the data are split between pre-tax prices and taxes. The latter include the total contribution from all types of taxes, i.e. excise taxes as well as VAT, so that the totals shown represent the increases in final retail prices. As can be seen, the average retail price increase has been much more moderate than the increase in the price of crude oil. Over the same period, the average US dollar price per barrel increased by approximately 107%. In euro terms, the corresponding increase was 85%. This is in sharp contrast to retail prices which, on average across the EU, increased by 22%, with the largest increases occurring in Latvia (44%) and Estonia (35%).

The smallest increases occurred in Poland (14%), the Czech Republic (12%) and Slovakia (7%)[21]. Looking only at the price increase contributions due to pre-tax prices, one sees that the contributions over the period are in a range of 1% (Denmark) to 30% (Latvia). This suggests that refinery margins have had a relatively moderate evolution overall. However the rather large differences between member states suggest a quite heterogeneous pattern in terms of price competition.

In Figure 2.11 the same type of exercise is conducted for residual fuel oil[22]. The data shown refer to the price paid by industrial customers for deliveries of up to 24,000 tonnes per year (or up to 2,000 tonnes per month).

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[20] Data for Romania and Bulgaria were not available from Eurostat.

[21] A part of the explanation could be that, over the same period, each of these three countries experienced significant currency appreciation vis-à-vis the Euro, and hence stronger appreciation vis-à-vis the US dollar than other member states.

[22] In tonnage terms, residual fuel oil accounted for around 28% of total petroleum product consumption by industry in the European Union in 2005. This makes residual fuel oil one of the most important individual petroleum products for industry in the EU.

Figure 2.10

**Increases in the retail price of premium unleaded gasoline (Ron 95)
Second half of 2007 as compared to second half of 2004 (%)**
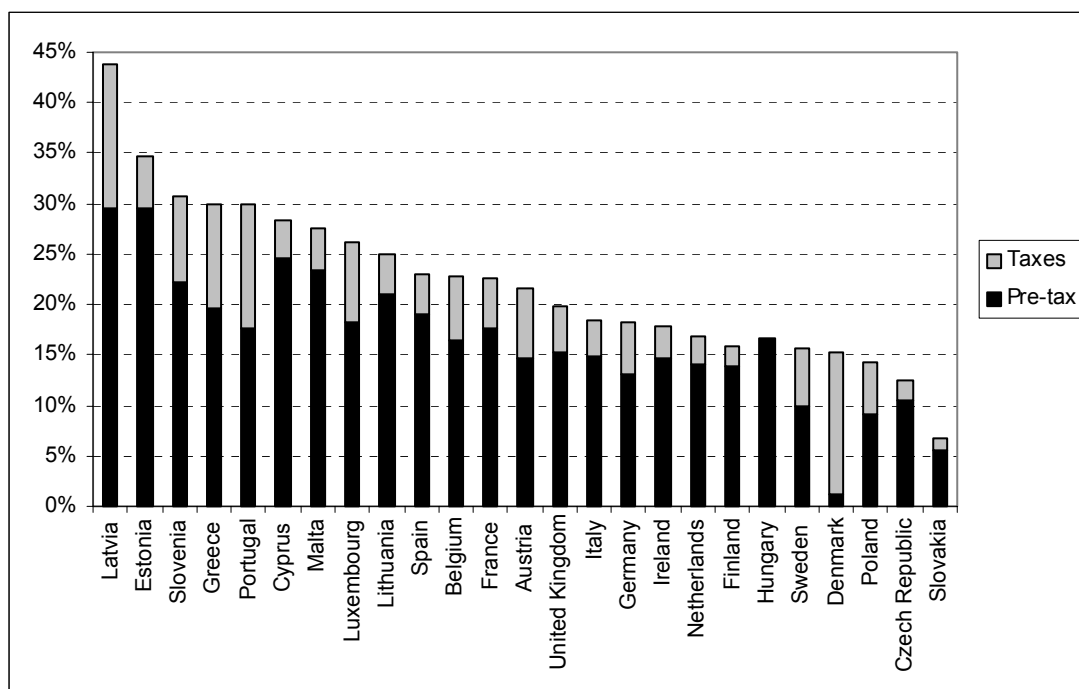
Note: Based on national currency.

Source: Eurostat and own calculations.

Not all member states could be included due to data availability constraints, however the countries shown accounted for 95% of the EU's industrial consumption of residual fuel oil based on 2005 data.[23] Ireland is excluded for presentational reasons[24]. Generally speaking, we find that price increases have been much higher than those observed for gasoline. Taking unweighted averages for the countries shown, including Ireland, we find that the average nominal price increase was 50%, of which 40 percentage points were due to the rise in pre-tax prices. Also, the pattern of increases is somewhat different than the one found with respect to gasoline prices. While Slovakia is again the country with the smallest total increase, the Czech Republic and Poland have experienced relatively stronger increases, and while the UK and Belgium have seen the strongest increases, they are close to the middle of the range in terms of gasoline price increases.

In Figure 2.12 we look at the price increases for natural gas for medium-sized industrial customers. The data shown cover all EU member states except Malta, Cyprus, Greece and Ireland, for which data were not available from Eurostat. Sweden is not shown for presentational reasons, as there was a sharp decrease in taxation which mitigated the

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[23] This is based on the total for the 25 countries that were members in 2005. The share is 92% if one includes Romania and Bulgaria.

[24] It is the only exception in the sample, the price of residual fuel oil having fallen by 8% over the period in that country.

pre-tax price increase.[25] It is important to note that the data shown refer to a comparison between the first halves of the years 2004 and 2007 respectively. This choice was made in order to increase country coverage given missing data for the second half of 2007. As can be seen, the strongest increases occurred in the UK and in Romania, while the smallest increases took place in Denmark and Finland. Taking unweighted averages, the increase in final prices over the period was 52%, of which 45 percentage points were due to the increases in pre-tax prices, and 7 percentage points were due to increases in taxation.

Figure 2.11

Increases in the wholesale price of residual fuel oil
Second half of 2007 as compared to second half of 2004 (%)
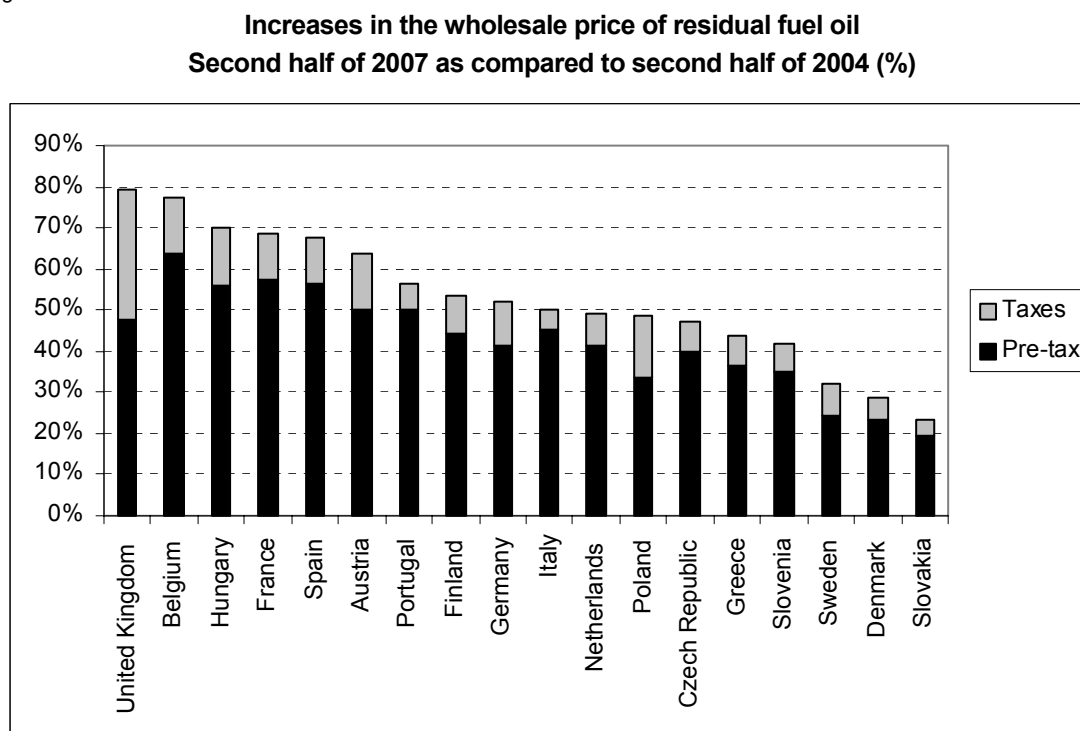
Note: Based on national currency; deliveries of up to 24,000 tonnes per year, or of up to 2,000 tonnes per month.

Source: Eurostat and own calculations.

The conclusion of this sub-section on final prices of energy products is that substantial pass-through effects can be observed, especially for industry given average nominal price increases of around 50% for both residual fuel oil and natural gas between 2004 and 2007. On the other hand, these increases are somewhat lower than the increases in the price of crude oil in Euros, which is in part explained by the role of increased domestic taxation. Also, increases in gasoline prices have been relatively restrained so far. Nevertheless, further increases are ongoing and should be expected for the first half of 2008 if the oil price remains around or above USD 100 per barrel.

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[25]   In Sweden the pre-tax price increase as compared to the final 2004 price was 48%. This was partly compensated by a reduction in taxation equal to 21% of the final 2004 price. Hence the total increase in the final price was 27%.

Figure 2.12

Increases in the price of natural gas charged to medium-sized industrial customers
First half of 2007 as compared to first half of 2004 (%)
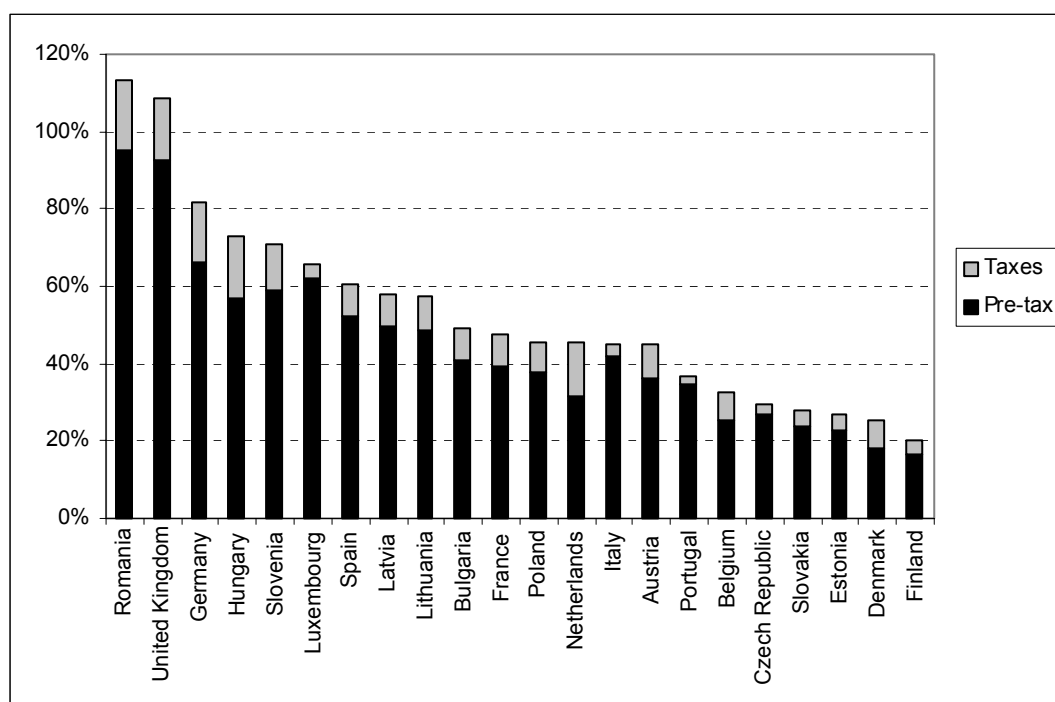
Note: Based on national currency; data refer to medium-sized industrial customers, Eurostat category I3-1, annual consumption of up to 41,860 Gigajoules.

Source: Eurostat and own calculations.

2.3.2 Industrial commodity prices

After a relatively stable period between 1998 and 2003, metal prices almost tripled between 2003 and 2006-2007 (Figure 2.13). 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 industrialization 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 prices played a part in driving up metal prices, given the energy-intensive nature of metals production and given increased transport costs.

Figure 2.13

Global evolution of metals prices, 1998 – 2007

1998 = 100

Metals ——— Crude oil
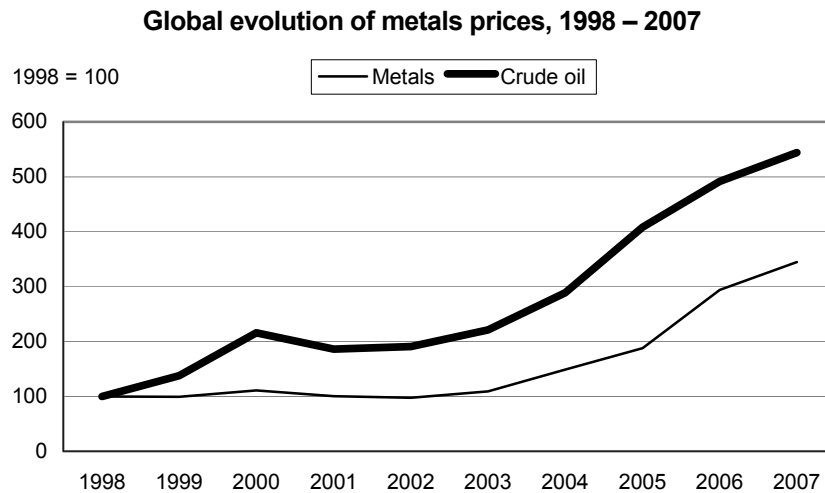
Source: IMF.

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.[26] The comparative evolution of fertilizer prices and crude oil prices over the 1997-2007 period is shown in Figure 2.14.

We performed an econometric analysis to identify the impact of oil prices on the selected commodity prices. Owing to missing data for several countries for many of the earlier years, we used domestic producer prices for these commodities in France as an example. The data covered 1980-2007 for fertilizers and for plastics in primary form, and 1992-2007 for steel tubes. We ran vector auto-regressions and subsequently performed Granger causality tests to check whether the level or lagged level of the oil price was driving the prices of the selected commodities. We found a positive and significant effect of the oil price (expressed in French Francs per barrel, as our analysis covered the case of France) on the French domestic producer price index for fertilizers. Furthermore the relationship passed the Granger causality test. The price index of steel tubes was likewise found to be significantly driven by the price of crude oil, with a significant result for the Granger causality test. This result is plausible, but must be seen in the context of the global evolution of demand and supply of steel, as discussed earlier. On the other hand, prices of plastics in primary form do not appear to be significantly driven by the price of crude oil.

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[26] We extracted nominal producer price indices at the corresponding NACE 4 digit level from Eurostat covering these commodities, namely fertilizers and nitrogen compounds (24.15), plastics in primary form (24.16) and steel tubes (27.22). The prices of these commodity groups should respond to the oil price. In the case of fertilizers, nitrogen production requires the use of natural gas, while naphta (a petroleum product) is the main input for primary plastics. Steel tubes are included given the energy intensity inherent to steel production.

Figure 2.14

Producer price index of fertilizers, EU25, 1997q1 – 2007q4
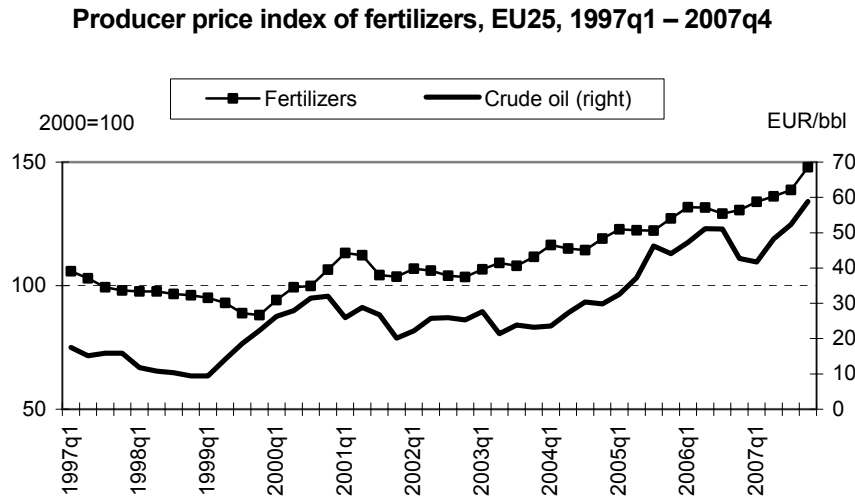
Note: Producer price index for NACE 24.15 – fertilizers and nitrogen compounds
Source: Eurostat, EIA.

2.3.3 Commodity prices in agriculture

Agricultural commodity prices have followed trends similar to those of crude oil prices (Figure 2.15). However, the magnitude of recent increases was much more limited: 38% for food (as a whole) and 21% for raw materials between 1998 and 2007 compared with 470% for crude oil. We performed the same econometric tests as for industrial commodities over the period 1980-2006.

Figure 2.15

Global evolution of agricultural commodity prices
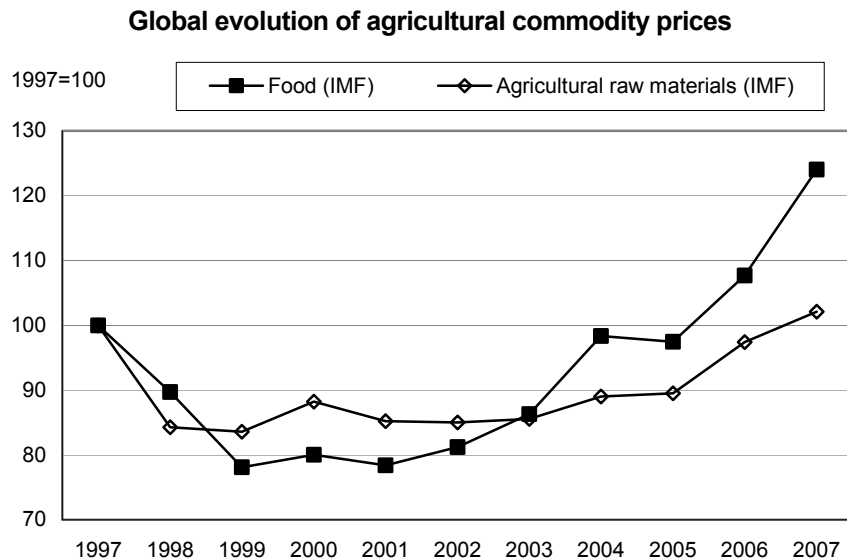
Note: Food = cereals, vegetable oils, meat, seafood, sugar, bananas, oranges. Agricultural raw materials = timber, cotton, wool, rubber, hides.
Source: IMF.

Neither the level of oil price nor its growth rate was found to Granger-cause agricultural commodity prices over that period, and the relationships were statistically insignificant. However, given recent food price increases, it seems possible that specific short-run thresholds have been breached with respect to shipping prices and fertilizer prices. More generally, recent co-movements of oil and commodity prices, including agricultural commodity prices, are occurring in a context of generalized market tightening across many commodity types, leading to stronger cost shock propagation and higher price volatility.

Turning more specifically to grain, it is clear that higher transport costs as well as higher fertilizer prices both push up food prices and are both caused by higher oil prices, the latter being therefore a contributory factor to the currently looming crisis with respect to grain prices. This comes in addition to the core driver for the current situation, which is excess demand in a context of increasing market tightness. The general picture is that global consumption has been growing, mainly due to ongoing world population growth, but also due to per capita income growth. This has led to higher demand for grain for direct human consumption, as well as to growing demand for meat and dairy products in developing countries, in turn raising demand for animal feed and hence for grain[27].

Figure 2.16

Global grain production, consumption and stocks, 1999/2000 – 2007/2008
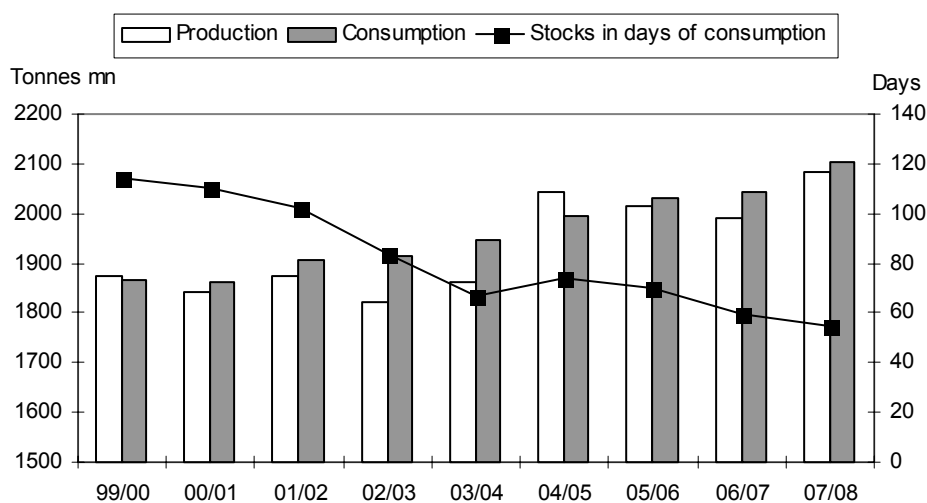
Note: Grain = wheat, milled rice and coarse grain ; data spans July to June

Source: USDA Foreign Agricultural Service (FAS) and own calculations; 07/08 forecast as of March 2008.

The resulting total demand growth for grain does not seem enormous at first sight, but it has outstripped supply growth in seven out of the last nine years, leading to large cumulative falls in global stocks. The outcome of these developments is summarized in

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[27] World population increased on average by 1.21% per year over the 1999-2007 period, while grain consumption increased by an average of 1.51% per year. This suggests that roughly 80% of demand growth can be explained by population growth, the remaining 20% by structural shifts.

Figure 2.16 which shows global production and consumption of grain in millions of tonnes for the years 1999 to 2007, as well as the decline in global end-of-year stocks expressed in days of global consumption of the corresponding year. Concerning the supply side, both the amount of land used for grain production as well as yields per hectare have grown slightly in recent years, but this has proved to be insufficient.

The ultimate result of recent developments on international grain prices has been extremely strong, as can be seen in Figure 2.17, with strong accelerations occurring in the last two quarters of 2007 and in the first quarter of 2008.

Figure 2.17

International grain prices, USD per tonne
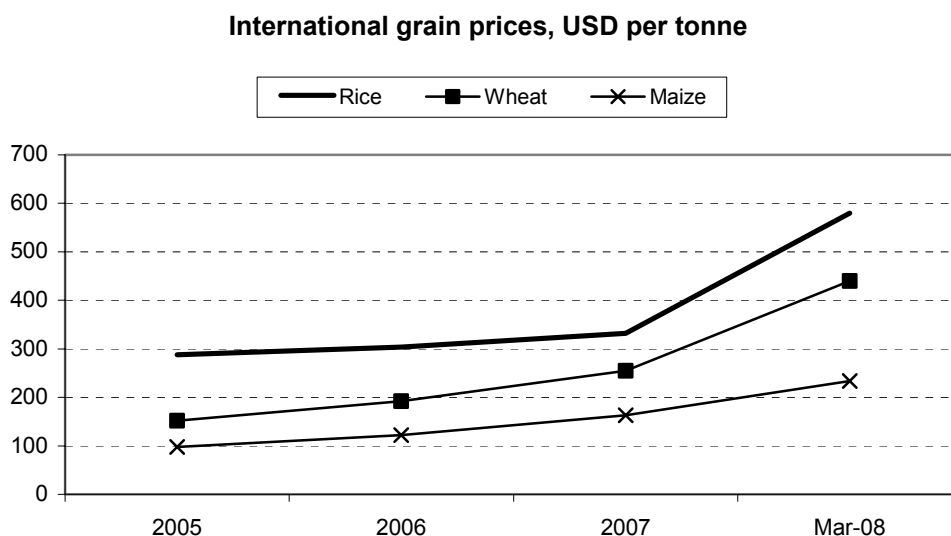
Note: Wheat: US No. 1 hard red winter, FOB ; Maize: US No. 2 yellow, FOB ; Rice: Thai white milled, FOB

Source: IMF, data for 2007 and for March 2008 is preliminary, as released on 9 April 2008.

Another set of developments in food prices is also related, in part at least, to higher oil prices, namely the increase in biofuel production. This has had knock-on effects on sugar prices and on vegetable oils in earlier years. For example, the free market price of sugar more than doubled between 2002 and 2006 as rising crude oil prices boosted biofuel production, though international sugar prices have strongly fallen back since. More recently, ethanol production from maize (corn) has expanded particularly in the United States. Globally, data and forecasts from FAO (2007) suggest that most of the growth in coarse grain utilization has gone towards uses other than food or animal feed production, with growth rates over the 2005/06 to 2007/08 period of 0.1% for animal feed and 3.7% for food, but of 25.3% for other uses. These results suggest that the recent expansion of biofuel production may be having a significant knock-on effect on prices given current market tightness.

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 manufacturing and transportation costs of firms. Not surprisingly, their responses consist in a combination of passing on these costs to consumers and seeking efficiency gains. 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

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Key findings and issues

- Current practices of supply chain management took advantage of cheap transport fuels in the 1990s; firms need to adapt to higher oil prices.
- Firms have become more aware of the role of oil prices in their supply chains and are beginning to respond, though the ultimate impact is not yet clear.
- Diminishing margins in the freight and logistics industry could lead to consolidation and decreased competition in the medium-run.
- Higher transport costs could lead to a reduction in the role of air and road freight in favour of rail freight, though important challenges remain with respect to mode switching.

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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 minimized and product life-cycles shortened. These methods made full use of low fuel costs:[28]

- Just-in-time manufacturing: materials being brought into the plant only when they are needed; this resulted in smaller, more frequent shipments.
- Relocation and overseas sourcing: producers taking advantage of lower manufacturing costs overseas, leading to higher transport requirements and costs.
- Shorter product life-cycles: in many industries (including high-tech and apparel) products must reach the shelves quickly; because of high margins on these goods transport costs are a minor issue and air freight is frequently used.
- Oil-based materials and packaging: there has been a steady switch from glass (bottles, jars) and paper packaging to plastics, leading to more oil consumption, while the gains from improved product image and other benefits of substantial use of packaging materials have outweighed correspondingly higher transport costs.
- E-commerce: online internet shopping is typically associated with parcel shipping, typically in smaller quantities and often via air.

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[28]   Lapide (2007).

There is growing concern that current supply chain management techniques will become unsustainable with persistently high (and more volatile) fuel prices. For example, Industry Directions (2007) finds 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 eroded margins. Cost efficiency plays the key role in addressing the effects of high oil prices according to 53% of firms.

What can firms do to reduce the oil dependence of their supply chains? Boston Logistics Group (2007) recommends that manufacturers keep their lean production systems because their benefits outweigh higher energy costs. At the time, their conclusion was that most supply chains would not need major changes until the oil price reached USD 100. Now that this has occurred there is an urgent need for reassessing the issue. In any case, the key suggestions remain the same, i.e. that firms should regularly assess their transport modes, actively manage energy spending and pay more attention to transport costs in their offshoring decisions. Several adjustments are possible with respect to logistics operations. These include consolidating orders, making deliveries larger and less frequent, using more flexible delivery windows, taking on more inventories, and restructuring warehousing and distribution network nodes[29]. While fuel price volatility is a concern, temporary adjustments may occur through higher reliance on renting or sharing of storage facilities.

At the European level Braithwaite (2008) suggests that existing market structures in the logistics and freight industries are not sustainable. Increased cost pressure (partly driven by increased fuel costs, partly by expected environmental policies) should reduce margins. However existing margins are already low, thus setting the stage for significant market exit on the part of smaller players, ultimately leading to more concentrated market power, higher mark-ups and price increases for freight and logistics services in the medium-run.

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 globalization 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).[30] 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

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[29] Total transport costs can also be reduced by decreasing fuel costs per tonne-kilometre, rather than by reducing the total number of tonne-kilometres travelled to achieve a given level of sales which is the main logistical issue. Such measures are discussed in section 3.4.

[30] DEFRA (2005).

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).[31] Similarly 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 such 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.

The example of Asda's use of rail transport for long distances raises the issue of transport modes, their relative importance, and the potential for mode switching for freight purposes. So far, overland freight in Europe has responded quite weakly to price changes in terms of transport mode switching. This is due to the large sunk costs of existing road 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. 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. While the evolution of road freight can be partly explained by recent robust GDP growth trends in the New Member States, it seems that there are structural constraints which prevent rail from growing in relative importance, even in the presence of rising gasoline prices.

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[31]   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).

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

3.2 Production relocation

Key findings and issues

- Relocation is usually motivated by lower labour costs in target countries.
- Sourcing of final and intermediate goods from China constitutes an important cost-saving strategy for multinational enterprises. Lower production costs have outweighed higher transport costs so far, though this could begin to change with much higher oil prices.
- Within energy-intensive sectors, there is evidence of relocation in the rubber industry, inorganic chemicals, colouring and man-made fabrics, fertilizers and paper products. These relocations took place in a period of rising oil prices, suggesting that energy cost considerations may have influenced relocation decisions.
- In the longer term, relocation could also affect the petrochemical industry due to cheaper feedstock and hence much higher profit margins in the Middle East.

Relocation 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 realized abroad instead of at home. Relocation is driven by various factors, the same factors that are also responsible for deep structural changes in the global economy. Trade liberalization, freer movement of capital, technological progress and reduction of transportation and communication costs, among others, allow markets to become more integrated. This also enables the fragmentation of production chains, as companies look for the most cost-effective locations for individual production stages. In sum, relocation is a cost-minimizing response of companies to a more competitive business environment in an increasingly integrated global market. 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.[33] As EMCC (2005b) indicates, more energy-intensive processes of the EU chemicals industry are being relocated outside the EU. According to EMCC (2005a) new capacities in the industry are being set up by Western companies closer to oil and gas resources, exploiting upstream linkages. FACE (2006) suggests a similar trend in primary aluminium production.

The trend towards relocation of production was, until recently, relatively unaffected by transport costs. However this may start to change. Using survey results for US firms, Boston Logistics Group (2007) estimated that sourcing of goods from China by US firms lead to an average 18% net final cost saving based on conditions prevalent in 2005. This was assuming an oil price of USD 30 per barrel and a contribution of shipping fuel costs to the final cost of goods sourced from China of around 4%. Holding all other costs constant, this suggests that the break-even point would be reached at an oil price of USD 165 per barrel. This is a very basic rule-of-thumb estimate, and it is clear that a proper modelling framework would be required in order to assess the effect of various oil price scenarios on

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

the final prices of Chinese goods on OECD markets. The point we wish to illustrate here is that China's cost advantage could be significantly eroded with much higher energy prices.

On the other hand, an important share of Western FDI to China is also of the market-seeking type, i.e. designed to better access China's rapidly growing domestic market, while not being detrimental to activities elsewhere. This aspect of multinational activity is therefore less affected by transport costs. Still, Boston Logistics Group (2007) advises companies 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 can encourage 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 exports from the new location to the initial location, as well as to those destinations that were previously supplied from the old location. We therefore analysed trade data to identify potential cases of production relocation.[34]

Table 3.1

Potential relocations in energy-intensive industries between 1999 and 2006

Product group	Potential 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: Potential 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.

Considerable changes in shares in the EU's trade flows and changing export positions of EU members and partner countries would be consistent with relocations. However such

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[34] Firm level data would be ideal for this analysis, but were not available to us. Even sectoral FDI data would help, but we could not trace them on the EU-15 or EU-25 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 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.

shifts could 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 us to interpret the results as definitive evidence of relocation, though the trends 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 summarizes our results. From our analysis one can note that relocation is concentrated on selected sectors. Reactive or defensive trade policy measures against relocations (e.g. as motivated by wanting to defend local employment) are mostly unavailable and in essence undesirable from a practical viewpoint, given potential conflicts of interests between EU stakeholders (and the respective distortions that would arise from a signal given to them to lobby for their interests) and given the broader picture of the EU's external relations with its main trade partners. From a theoretical viewpoint standard results from economic theory with respect to the gains from free trade remain valid. Therefore the consequences of relocations must be handled by other measures, e.g. active labour market policies.

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 and feedstocks on their domestic markets at much lower prices than world market prices. Thus petrochemicals companies locating steam crackers in such countries 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. According to data from Petrochemistry.net, cash margins in the Middle East in 2005 were around 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 unfold in the medium term.

3.3 Fuel substitution

Key findings and issues

- Substitution to coal has taken place in some manufacturing branches and in power generation. However technical limitations and the rising price and inferior environmental properties of coal have limited this process.
- Fuel substitution in transport is inherently very limited. The best available opportunities for the medium-run are biofuels. As a result, global consumption is growing steadily, with the support of active 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 EU-27 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

In this brief overview we focus our attention on the EU's three largest economies only: Germany, the United Kingdom and France, given the significant structural differences between them. A more detailed version of this section can be found in Christie (2007).

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.

In the case of Germany, 2006 data indicate that coal is the most important source, (around 52%), followed by nuclear energy (30%), while gas is less important (11%). Germany's power-generation sector exhibits some responses to price changes, but these are typically fairly limited in magnitude. However, the current 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.

Electricity generation in the UK is much more responsive to oil prices than in France or Germany due to the competitive nature of domestic energy markets which makes producers strongly responsive to relative changes in prices. 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%. More recently the government has announced significant new investment plans both in renewables (wind power) and in nuclear energy. This comes as a response to the twin challenge of reducing greenhouse gas emissions and securing the country's longer-term energy security, given the ongoing depletion of its oil and gas reserves in the North Sea.

In sum, the potential for fuel substitution in the electricity sector is limited, in the short-run, by the structure of existing power generation capacities, though competition can play a positive 'cost smoothing' role in member states that have liberalized their domestic energy markets, as in the UK. The case of France also strongly suggests that new investments in nuclear generating capacity could help provide member states with a (larger) safety margin in the face of rising fossil fuel prices, an idea which seems to be gaining ground, notably in the UK where large investment plans have been announced, and in Finland where new nuclear capacity is under construction.

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). Natural gas use 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 then European manufacturers had to opt for low sulphur content types. This has led to a rise in the price of coal as well as in the price of other solid fuels, notably petroleum coke.

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 the 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 distribution 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, 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, on natural gas 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 (including policies to reduce 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.

Fuel substitution for freight and commercial transportation of persons is also limited for mainly the same reasons, e.g. lack of flexible alternatives, although the case of public transport operators, given fixed routes and existing depots, offers by far the greatest possibilities. Nevertheless, in all cases existing vehicle fleets would have to be substantially

modified or replaced (at great cost) in order to obtain significant cost smoothing results. Alternative vehicle fuels and corresponding vehicle types are at an insufficiently mature stage of development to enable significant movement in that direction in the medium-run, although biofuels are an important exception to some extent.

Opportunities for biofuels in fuel substitution

There is growing worldwide interest in biofuels. Technically they can substitute oil products in road transportation and they can also be produced by domestic agriculture. They are seen as a promising response 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 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 utilizing its technical biomass and biofuel potential. It meets 4% of its energy needs from biomass with a production of 69 million tonnes of oil equivalent (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 by Walter et al., 2007, the European Union will become a net importer of biofuels by 2020 as economically viable supply will not keep up with growing demand.

3.4 Energy efficiency and recycling

Key findings and issues
- The potential for energy efficiency savings throughout the EU economy is estimated to be large: 20-30% of incremental energy demand up to 2020 can be saved in a cost-effective way, using currently available technologies 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 simultaneously, notably increased competitiveness, sustainable development and energy security. Furthermore, in a world of scarce and ever more expensive natural resources, high efficiency is becoming a critical issue for corporations.

There is a large potential for reducing oil dependence by improving energy efficiency. The European Commission estimates[35] that savings of around 28% 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 would affect oil consumption. These savings could lower net oil imports by 16% in 2020, thus improving the EU's trade balance by EUR 32 billion at current prices.[36] 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 estimate that 38% of these savings could be realized 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 considering energy-saving investments.[37] However firms that operate 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.[38] In turn this suggests that additional support for R&D in energy-saving technologies could offer precious leverage at the current juncture.

Example – Energy savings in selected European companies

Once firms become aware of the cost saving potential from improved 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 optimizes freight loads and routes to cut fuel costs.

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

[36] 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).

[37] Rohdin and Thollander (2006).

[38] De Groot et al. (1999).

- Unilever, a household goods firm, is making 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 chemicals 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 rationalization 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 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 GBP 20,000.

Source: Corporate websites (Salt Union case study from the ABB website).

Energy efficiency in road freight is another area of opportunity. Unit transport costs, i.e. transport costs per unit-kilometre of delivered goods, can be reduced by the technical streamlining of vehicle fleets. Some existing examples are reviewed in Ryan (2008). These include improved vehicle aero-dynamics, automatic tire-inflating systems, low rolling-resistance tires and lighter (aluminium) wheels. As in the example of Unilever above, reducing packaging weights and volumes can also reduce unit transport costs.

Finally, improved 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.[39] 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 EU-25. 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, equivalent to 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.

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[39] 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, our conclusion is that the European economy is already able to adapt to somewhat higher oil prices without serious disruptions. Some firm- and industry-level adjustments get under way as and when necessary. 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 in certain non-EU countries provide companies from those countries with an unfair cost advantage against EU companies. In particular, energy subsidies ensure access to energy below the actual cost of supply. Such subsidies can take many forms including under-pricing or non-collection of bills.[40] Developing countries often resort to subsidizing 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).[41]

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[40] Lower taxes on energy products are not subsidies in the strict sense but have similar effects.

[41] Source of data: IEA (2006), pp. 277-281..

These subsidies give an edge to the energy-intensive industries (e.g. metals) of these countries; but they also lead to wasting of energy, higher energy consumption and more greenhouse gas emissions.[42] Another source of trade (and market) distortion in certain countries is the existence of double pricing systems of raw materials and feedstocks. This is especially present in the petrochemicals industry, notably in the Middle East. There is also evidence that China is introducing policies that distort global trade in energy and natural resources. In some cases China subsidizes 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.[43] Double pricing practices for resources (e.g. coal) in effect subsidize favoured domestic producers, putting their competitors at a disadvantage. Trade policy encompasses the appropriate instruments to tackle these issues and to 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), and 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 protect domestic producers throughout the world. As there are no clear international accounting rules for biofuels, data on their international trade are hard to collect. The European Union is committed to the promotion of biofuels. The 2003 Biofuels Directive[44] 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 facilitate 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, public 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:

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[42] 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.

[43] European Commission (2006a).

[44] 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).

- Imported biofuels are cheaper: the unsubsidized production of Brazilian ethanol competes with fossil fuels if oil prices are around USD 50 per barrel; subsidized European biodiesel needs at least USD 70 while ethanol requires USD 100.[45]
- 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%.
- Development effects: the growth of biofuel industries can contribute to economic development in third-world countries (though possible indirect effects on local food prices should be more thoroughly assessed).

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 The need for investments in energy infrastructure

The global oil and gas industries require massive investments to keep up production with growing demand. Estimates made in 2006 (presented in IEA, 2006) showed that investments would need to total USD 4.3 trillion between 2004-30 (in real-2005 dollars) in order to keep oil prices at around USD 60 per barrel in real terms over that period. 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 fully materialize:

- Major oil producing countries (including Saudi Arabia, Kuwait and Russia) restrict both foreign and private domestic investment 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

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[45] EIA (2006), pp. 405-412. The European Commission (2006b, p. 27) reports similar figures: EUR 60 per barrel for diesel and EUR 90 for ethanol.

encounter obstacles to their investments, there are doubts that Russia's state-owned oil and gas companies will be able to satisfy growing demand.[46]

- Most hydrocarbon reserves are held by state-owned companies, which often enjoy monopolistic positions as well (e.g. in Saudi Arabia and in Russia). 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 the monopolist itself have less incentives to eliminate waste.[47]

- Investments are also limited by war and civil conflict (e.g. Iraq, Nigeria) 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 down in the 1990s, sharply reducing the value of their investments. The world is now experiencing the opposite: oil producers are wary of investment over-shooting as they fear another drop in oil prices; the resulting shortage of capacities keeps prices high.[48]

All these factors suggest that capacities may remain insufficient in the medium term, resulting in higher oil prices. IEA (2007a) predicts that oil prices may remain around their current level until the end of this decade. Appropriate policies on investments in energy infrastructure can help reduce oil prices in the longer term. These should help energy-producing countries cope with increasing demand. The European Union can and should use its international standing and its economic bargaining power to create a more favourable environment for necessary investments to happen. In this area increased coordination with other OECD and IEA member countries should also be considered.

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 in some cases fail to make investments with rates of return well above 30%, a phenomenon called the 'energy efficiency paradox'.[49] 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 actual future payback of these

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[46] See e.g. Ahrend and Tompson (2006), Christie (2007), IEA (2007c).

[47] 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.

[48] 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.

[49] DeCanio (1998).

investments; decision-makers are poorly informed and risk-averse, leading to sub-optimal outcomes; furthermore, the organization 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.[50]

The issue of energy efficiency is addressed by the Commission with the 2006 Action Plan for Energy Efficiency[51]. 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 promoting 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 for 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 EU-27 had a trade surplus of EUR 1.2 billion in waste and scrap metals; net exports amounted to 5 million tonnes in ferrous metals and 1 million tonne in non-ferrous waste and scrap metals according to Eurostat trade statistics. This paradox is partly the result of an externality: non-EU countries can also enjoy the benefits of the EU's comparatively well-developed 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.[52]

4.1.5 The adjustment potential of the European economy

Both economic theory and empirical evidence suggest that the economy can adjust to relatively sharp oil price increases. There is a relatively short-lived loss of output, but long-term development prospects remain essentially 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

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[50] Kuper and van Soest (2006).

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

[52] 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.

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 unionization 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.[53] 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 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 liberalization 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 (Emissions Trading Scheme) to include transport in order to encourage the use of energy-efficient freight modes

4.2.1 Tariffs and quotas

Lower import duties for materials

The post-Uruguay round tariff schedule of the European Union displays 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[54]. As far as oil-related finished products are

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[53] 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).

[54] 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.

concerned, a slight tariff escalation provides a modest protection to European processing industries.[55] 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 reductions in order to increase the competitiveness of European processing industries. However it should be borne 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.

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%.[56] 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 liberalization of biofuels trade.

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 (2005 data). 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 SMEs.

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.

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[55] 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.

[56] According to the calculations in OECD (1999).

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.

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).

Push for liberalization 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, thus 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-saving and waste treatment technologies. 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 (…)'*.[57]

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.

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[57] 'Energy security and climate change – what role for trade policy?', Speech by Peter Mandelson at the Conference organized by Confederation of Norwegian Enterprise and EC Delegation in Norway at the Oslo Military Society, Oslo, Norway, 9 February 2007.

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

Liberalize 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.[58] 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.[59] 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 weak carbon performance if we can import cheaper, cleaner biofuels.'[60] We recommend the endorsement of this approach in upcoming trade negotiations.

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[58] Biomass Action Plan, COM(2005) 628 final, Brussels, 7.12.2005.

[59] 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 liberalization' 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 liberalization and three times as much as autarky. See: European Commission (2006c).

[60] The biofuels challenge. Speech by Peter Mandelson, Brussels, 5 July 2007.

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 recognized, 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.[61] For example, though not directly related to energy efficiency, Russian officials recently admitted that the Russian chemicals 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.[62] 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.[63] 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 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

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[61] '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.

[62] 'Russia "forced" to apply costly EU chemical standards', EUbusiness, 17 July 2007.

[63] 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.

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 more energy-efficient transport. However, there are two major disadvantages of such food labelling:

- The 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 labelling of origin 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.[64]

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.[65]

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[64] 'Air-freighted food may lose organic label', The Guardian, 26 January 2007.

[65] 'EU highlights biofuels drawback', EUbusiness, 9 July 2007.

Develop and globally harmonize 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 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.[66]

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.[67] 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 by the EU does not foresee anti-subsidy investigations concerning economies in transition, including China, due to the difficulty of assessing the amounts of subsidies in those countries. Instead, the Commission has preferred the use of anti-dumping instruments. During anti-dumping procedures against non-market economies price and cost benchmarks of market economy third countries (e.g. Brazil for China) are used.[68] 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 the calculations; as a result, dumping margins can fall and the level of protection can drop.[69] Effective anti-subsidy measures can maintain protection against unfair competition from this group of countries.

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[66] '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.

[67] 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.

[68] Mayer, Brown, Rowe & Maw (2005).

[69] 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.

Anti-subsidy measures require more attention among European trade defence policies, and energy-related subsidies are one area where they could be applied.[70] On the other hand, such defensive measures 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 the steel industry, resuming the OECD Steel Subsidy Talks could provide the appropriate institutional framework for action.

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

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

> 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.

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.

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 measures affecting investments in the analysis.

Trade policy can contribute to the development of energy sectors in major energy exporting countries. EU Commissioner Mandelson has also made this case, stating that 'the most promising scope for stronger and mutually beneficial relationships on energy trade and investment exists on our own continent, in Europe. Most notably in our relations with Russia, the Ukraine and Turkey.'[71] 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.

Making 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

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[71] Speech by Peter Mandelson at a Conference on strategic energy policy, Brussels, 21 November 2006.

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.[72] 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,
- EU accession negotiations with Turkey.

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 promised higher prices ('double tariff') to encourage investments in the country's power sector. However, Latvenergo then denied Windau this higher price. Seeing the returns on its investment in jeopardy, 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 enforce the higher price 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.

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[72] Energy Charter (2007).

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.[73] 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 on the part of 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.

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 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 realize this potential.
- Fuels in air transport are currently exempt from taxation; this implicit subsidy has contributed to the rapid growth in air freight. By internalizing 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.

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[73] '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 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 in relative terms 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.

Higher 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 deep systemic changes are not yet necessary. Relocation of production is taking place in some sectors (including energy-intensive industries), but its overall impact on employment is small. Also, the increase in transport costs is still more than compensated by other gains (especially labour cost savings) from international relocation of production for those companies that have pursued it. Fuel substitution is limited by technological constraints in most sectors, particularly in transport where short-run fuel substitution is presently negligible. Biofuels are currently the best candidate for substitution in transportation. Finally, European firms have actively invested in energy efficiency measures, while increases in the use of waste and scrap materials also contributed to reducing energy dependency; this has led to significant reductions in the energy intensity of European industries in recent decades. Further such improvements need to be supported.

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 further improved by creating more flexible and competitive product and factor markets. This includes the EU's internal energy market. Trade policy can contribute to better adjustment by promoting international competition.

Overall, the need for trade policy responses to high oil prices is relatively limited, though improvements are desirable with respect to trade in biofuels and in environmental products (see overview table below). As mentioned, the other important policy areas include the facilitation of the adjustment potential of European companies, energy-saving measures, and long-term security of energy supply.

Overview of possible trade policy instruments to tackle the effects of high oil prices

Measure		Impact on					Notes
		Subsidies	Biofuels	Investments	Efficiency and recycling	Adjustment potential	
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 harmonize 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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