Oil Prices Have Risen Permanently, But Remain Unstable

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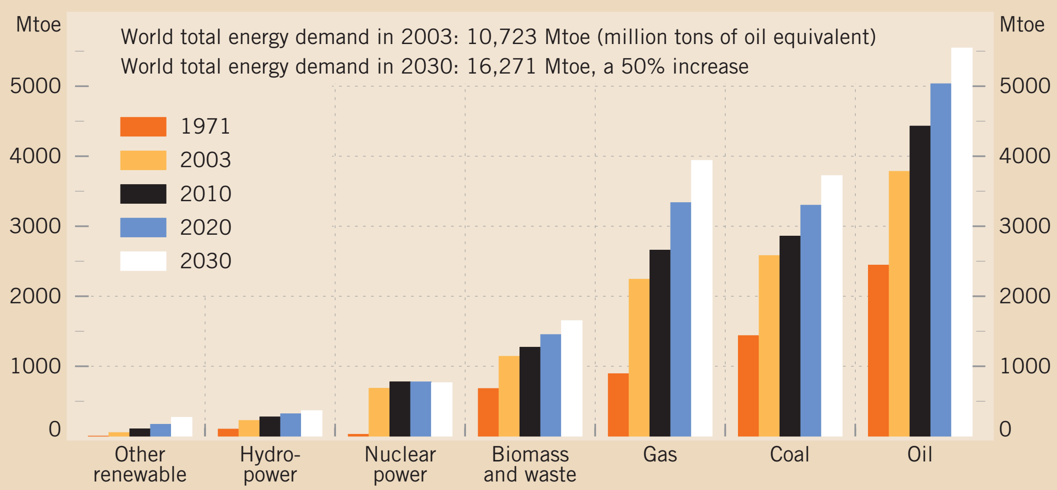
One of the biggest challenges facing the world economy in coming decades concerns how to ensure a sufficient supply of energy, particularly if current growth trends persist. Market mechanisms will make sure that oil supply meets demand. However, rigidities and other problems could make adjustment towards equilibrium difficult, leading to sharp price increases at times.

The crude oil market comprises one facet of the overall energy market. Over the longer term, developments in oil markets are driven also by changes in markets for alternative energy. The price of oil depends on what happens in markets for alternative forms of energy (electricity, heating, fuel) and in markets for sources of energy or technologies that compete with oil. Market interactions can get very complicated. For example, natural gas competes with numerous energy raw materials in different final product markets, since it can be

Trends in World Energy Demand



Sources: EIA, ETLA. ETLA S05.4/f216

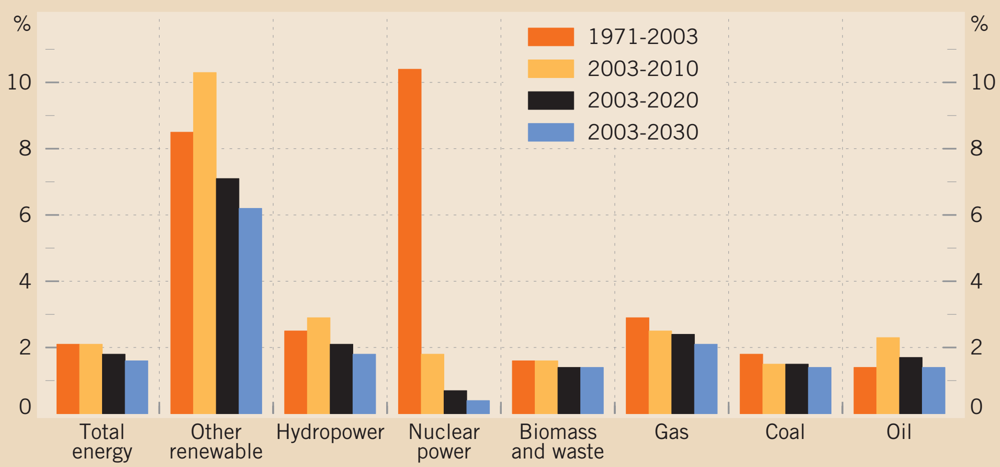
used to produce electricity, heat or fuel. Developments in energy consumption shares depend on how attractive various forms of energy are for use in different purposes.

According to the World Energy Report released by the International Energy Agency (IEA), global consumption of energy will increase by a total of 52 percent during 2003-2030, representing an average annual increase of 1.6 percent during the period. The demand for crude oil is projected to increase only a bit more slowly than overall energy consumption, at an average annual pace of 1.4 percent. In the basic scenario of the report, the structure of energy demand and supply does not change significantly, even though current consumption trends point to bottlenecks in meeting demand for oil and petroleum products. According to the report, energy supply will suffice in meeting demand if technological advances continue and if large oil-sector investments are made. More specifically, as much as USD 17 trillion will need to be invested (at 2004 prices) in the world energy sector, according to the IEA, for supply to meet demand.

Indeed, a major problem plaguing the energy sector is the rapid pace of demand growth, which, if it is to be met, requires massive capacity expansions, since crude oil production, among others, is already running near full capacity. It is difficult to imagine how demand growth could slow significantly, especially since transportation is so dependent on fossil raw materials. It is also difficult and expensive to switch quickly to alternative energy sources.

The problem with fossil fuels is that raising oil production is difficult and costly and that they emit substantial carbon dioxide when burned. Global warming has triggered efforts to contain growth in carbon dioxide emissions. Coal, natural gas, nuclear power, and biomass energy have seen their shares in total energy consumption rise since the oil crises of the 1970s.

Annual Growth in World Energy Demand



Sources: EIA, ETLA.

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According to the IEA, the consumption shares of coal and nuclear power will decline slightly in the future, along with that of oil. The consumption share of biomass energy will remain steady, while natural gas will display a considerable rise in consumption share. Natural gas will surpass coal to become a major source of energy already during the next few years. Use of natural gas leads to half the carbon dioxide emissions as coal, supporting greater use of this relatively cleaner form of energy. Natural gas is also far more environmentally friendly than oil products.

High costs and, in some cases, the need to build distribution networks tend to hinder greater usage of alternative energy sources. Power generated from wind, geothermal and other alternative forms of energy typically require costly investments (IEA 2005), but their use is already becoming as cost effective as traditional forms of energy in certain places. In the future, these alternative energies will become more attractive as technological advances lower their costs, as economies of scale emerge from growing market size, and as fossil fuels become more expensive.

In Brazil, use of alternative fuels, such as ethanol made from sugar cane, is already profitable in the country's transportation sector. Elsewhere, the costs are much higher than in Brazil. However, ethanol costs and biodiesel costs, which are much higher, are already falling, like those of many other alternative forms of energy, thanks to technological advances and growing market size (Worldwatch 2005). The economic attractiveness of alternative energies will depend closely on oil price developments.

OIL IS A LIMITED RESOURCE THAT DOES NOT RUN OUT EASILY

Projecting developments in the oil market is made difficult by the low quality of available statistics. Assessing trends in demand is hampered by the fact that the production of statistics is typically undeveloped in developing countries. Assessing oil supply and reserves, on the other hand, is complicated by the unwillingness of OPEC countries to disseminate the relevant information. The U.S. Energy Information Administration (EIA) estimates that world oil reserves total approximately three trillion barrels. This figure is, of course, highly uncertain because new discoveries of oil reserves and technological changes can change the estimates of the recoverable crude oil resource base. Hence, the EIA has conducted numerous alternative scenarios in this context (see, for example, Wood et al. 2004).

There are many estimates of the size of the oil resource base that are much more pessimistic than those of the EIA. However, these estimates often do not take into account the fact that if oil were to "run out" much sooner than expected, then the price of oil would rise, which would spur technological advances, induce oil conservation, curb demand for oil while prompting oil consumers to switch from oil to alternative forms of energy. Oil will not run out, but, as its price rises and consumers switch to alternative forms of energy, oil will become less important in meeting the world's energy demands.

The volume of oil is declining all the time because it is a limited resource. At some point, supply will also begin to decline as is pointed out in the heated "Peak Oil" debate (see, for example, Wood et al. 2004 or ASPO 2005). The precise timing of when oil production begins to fall depends on many highly uncertain factors: exploitable oil reserves, technological changes and, partly related to this, growth in demand. In the debate, oil is typically defined as conventional oil, which does not include oil-tar sand deposits or coal and gas conversion, to mention just a few. These are, however, promising alternatives if the price of oil remains high.

If markets function well, the supply of alternative energies will increase sufficiently, and no problems will arise. Problems will develop, however, if markets do not react or if they do not have time to react. This could be the case if the scope for economic adjustment and/or the amount of oil reserves have been strongly overestimated, or if unforeseen shocks, such as supply disturbances stemming from terrorist attacks or a substantial strengthening in demand growth, hit the oil markets.

MOST OF THE WORLD'S CRUDE OIL SITS IN POLITICALLY UNSTABLE PLACES

An additional problem facing world oil markets is that a major share (62 percent) of the world's proven oil reserves is located in the Middle East. In fact, OPEC controls around three-fourths of the world's proven oil reserves (BP 2005). In 2004, OPEC accounted for 34.4 percent of total world oil production, even though it has, by far, the largest oil reserves and the lowest costs of production. Production is nevertheless becoming more concentrated in this politically explosive region, because that is where the greatest potential for additional production is.

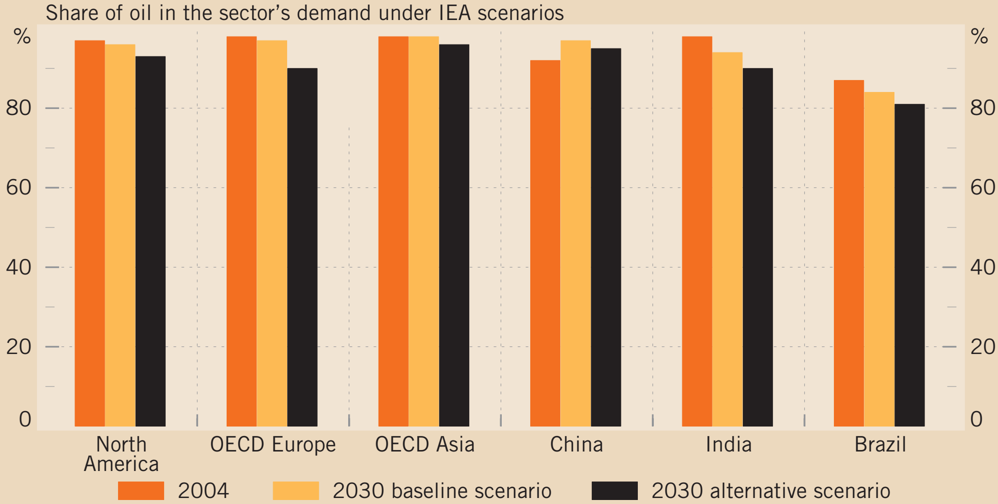
THE TRANSPORTATION SECTOR IS VULNERABLE

The transportation sector faces large challenges with respect to adjusting to changes in the oil market. This is because, according to the IEA (2005), its oil dependency is projected to remain above 90 percent in the year 2030, even under favorable conditions. Even in Brazil, this share will fall to only around 80 percent.

The price of oil has already risen above the IEA's projections. This makes ethanol and even biodiesel attractive alternatives for fuel. In Brazil, ethanol is made from sugar cane to produce an alternative to gasoline equivalent to only 25-30 U.S. cents per liter. The cost of doing so in other countries or of making alternative fuels from other raw materials is much higher. According to Worldwatch, it costs 53 cents to make ethanol from cellulose, but costs are expected to drop rapidly. High oil

Oil Dependency of Transportation Sector

Share of oil in the sector's demand under IEA scenarios



Sources: IEA, ETLA. ETLA S05.4/f214

prices should spur technological advancements and market growth, which will reduce the production costs of alternative energy sources. (Worldwatch 2005)

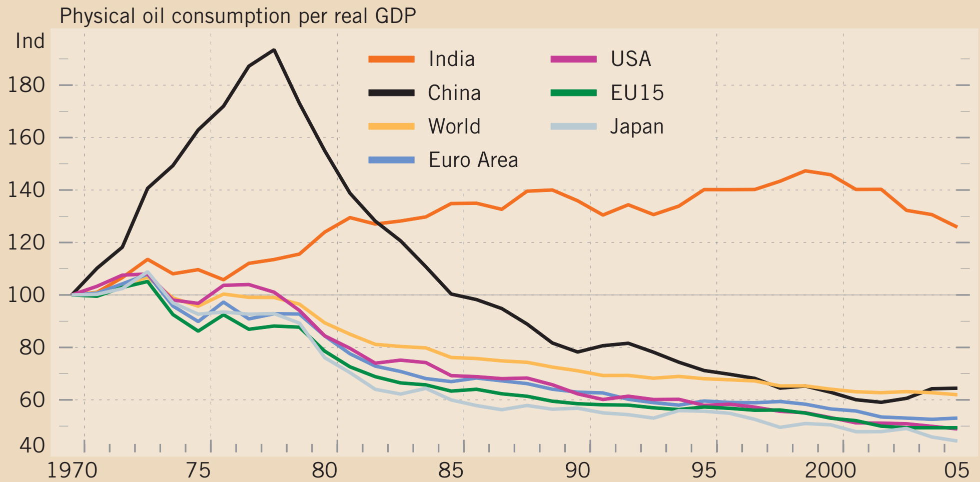
THE EQUILIBRIUM PRICE OF OIL HAS RISEN AND PRICE FLUCTUATIONS HAVE INCREASED

The price of oil increased nearly 20-fold following the two oil supply shocks in the 1970s. The surge in prices depressed the demand for oil at first, reflecting the economic slowdown and greater measures to save energy. At the same time, it induced substitution away from oil towards alternative forms of energy. The amount of crude oil used to produce one unit of GDP, an economy's so-called oil intensity, fell in 2000 to half the level seen just prior to the 1970s oil crises.

The price of oil nearly doubled in 2003-2005. This time around, higher oil prices stemmed from unexpectedly strong demand growth in developing countries, particularly China.

Thanks to two decades of strong economic expansion, China has become a major player in the world economy. China's share in world oil consumption was nevertheless only 8.2 percent in 2004. That same year, however, China's share of world demand growth was as much as 29 percent. Asia as a whole explained 40 percent of the increase in world demand. For purposes of comparison, the U.S. share of growth was slightly smaller than China's, even though America's share of consumption is around 25 percent. The strength of demand for crude oil came as a surprise to the markets, which is visible in the increase in crude oil futures price curves. Markets interpreted the change as being permanent, since the quotations declined only slightly over time. This reflects the IEA's projections that, given current trends, significant oil-sector investments particularly in the Middle East and northern Africa will have to be made in order to raise crude oil supply. Earlier, futures prices tended to converge towards much lower levels.

Crude Oil Intensities in Selected Countries and Regions, 1970 = 100



Sources: IMF, BP, IEA, ETLA.

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The hurricanes that recently hit the U.S. led to significant oil price rises in late August and into September, but the release of strategic reserves quickly eased the market situation. The basic problem facing energy markets is the lack of refining capacity, which fosters wide swings in prices of oil products (Suni 2005A).

Even though part of the price increase is only temporary, it appears that the equilibrium price of oil has risen permanently. The tight market situation combined with greater supply uncertainty is exacerbating price fluctuations that arise from speculative activity, for example. Mere rumors or changes in perception about how cold the winter will be can lead to price fluctuations of several dollars (Suni 2005).

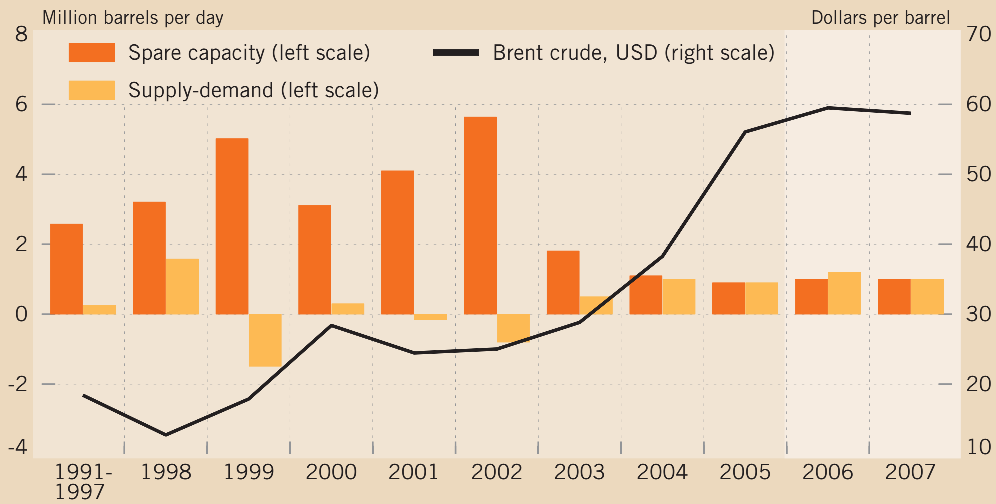
THE MEDIUM-TERM IMPACTS OF A PERMANENT INCREASE IN OIL PRICES

Changes in crude oil prices affect the economy in many different ways. A price rise shifts purchasing power immediately from oil consumers to oil producers. This direct effect depends on a given country's oil intensity (crude oil consumption as a percent of real GDP) and the magnitude of oil imports.

The noticeable decline in oil intensity seen across many countries since the oil crises of the 1970s has reduced the impact of oil price rises on economic activity. Differences across countries are nevertheless large. U.S. oil intensity in 2004 was about 50 percent higher compared to both Japan and the Euro Area. Developing and emerging economies tend to have much higher oil intensities than industrialized countries on average. Of the OECD countries, only the U.S., Great Britain, Norway, Canada and Mexico produce oil in significant amounts. Japan and the Euro Area depend entirely on imports for their oil consumption.

The larger a given country's oil intensity, the larger the impact of an oil price increase on output and the general price level. When con-

The Price of Oil, Market Balance and Spare Capacity

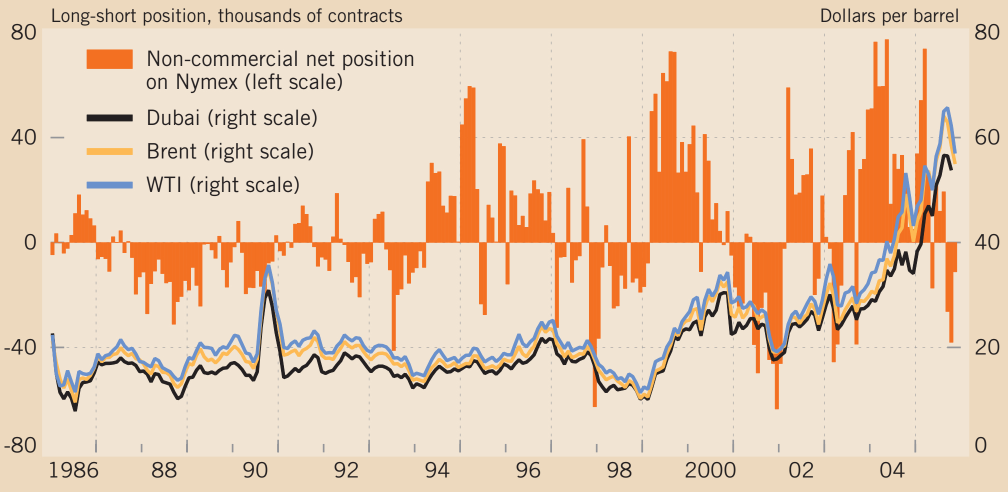


Sources: EIA, OECD, IEA, ETLA. ETLA S05.4/f212 sumer prices rise as a result of an oil price increase, households' purchasing power and consumption fall. Slower consumption and higher interest rates then dampen investment activity. The downturn in domestic demand induces firms to reduce production growth, thereby weakening their demand for labor. Export demand also weakens because the increase in oil prices has curbed activity in trading-partner economies as well. On the other hand, the increase in oil prices boosts the income of oil-producing countries, which over time tends to raise their demand for imports and thus partly offsets the weakening in industrialized countries' external demand. The Euro Area and Finland benefit more than the U.S. or Japan in this respect, given their relatively close trade ties with oil producers. OPEC accounts for a relatively large share of Euro Area exports, whereas Russia has become one of Finland's largest export markets.

The impacts of oil price changes on the economy also depend closely on how the central bank reacts. If central banks do not raise interest rates in response to a rise in oil prices, then inflation can accelerate. Raising interest rates to suppress inflationary expectations, on the other hand, slows economic growth even more, but helps keep inflation in check over the longer term. Bernanke et al. (1997) show that most of the economic instability experienced in the U.S. in the 1970s resulted from the central bank's reaction to oil prices, and not from the rise in oil price per se.

The duration of the shock also has a large impact in forward-looking markets. The more permanent the shock is, the more interest rates rise immediately and the greater the economic slowdown in the short term. Oil price movements can impact exchange rates through changes in interest rates, prices, economic growth, and the terms of trade.

Speculative Trade and the Price of Crude Oil



Sources: HWWA, CFTC, ETLA.

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According to some studies (see, for example, Amano and van Norden 1995), the dollar's external value rises when oil prices increase.

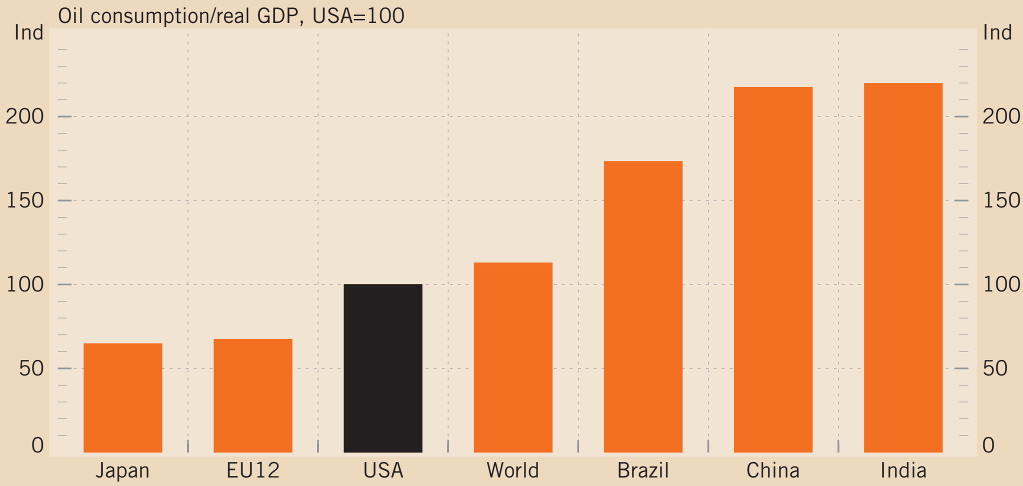
SIMULATION RESULTS OF AN OIL PRICE INCREASE

Even though oil intensities have declined noticeably since the beginning of the 1970s, industrialized countries are still highly vulnerable to oil prices. We simulated the effects of a permanent oil price increase over the medium term using the National Institute Global Econometric Model (NiGEM), which is used widely at ETLA. Our baseline forecast suggests that the price of Brent crude oil settles at a level slightly below USD 60 per barrel over the next few years. The alternative scenario assumes that the oil price increases permanently by 20 percent compared to its baseline level, implying a price fluctuating near USD 70 per barrel in the medium term.

The simulation assumes that markets are forward-looking, so that economic agents are fully aware of the nature of the price increase and thus react immediately. For example, financial-market participants realize that short-term interest rates will eventually rise in response to the oil price increase, thereby bidding up long-term rates immediately. Central banks are assumed to target nominal GDP and inflation. This monetary policy rule leads to smaller hikes in interest rates compared to a rule whereby only inflation is targeted.

According to the simulation results, an oil price shock of this nature would impart significant effects on the world economy in both the short and long term. Inflation would accelerate and economic growth would slow more in the U.S. than in the Euro Area and Japan, reflecting the much higher oil intensity of the U.S. economy. Even though the U.S. is a major producer of oil, economic growth also suffers because the U.S. central bank raises interest rates more aggressively than its Euro Area and Japanese counterparts owing to the stronger pickup in U.S.

Crude Oil Intensities in Selected Countries in 2004



Sources: IEA, OECD, ETLA. ETLA S05.4/f218 inflation. As such, long-term real interest rates rise more in the U.S. than in the Euro Area and Japan.

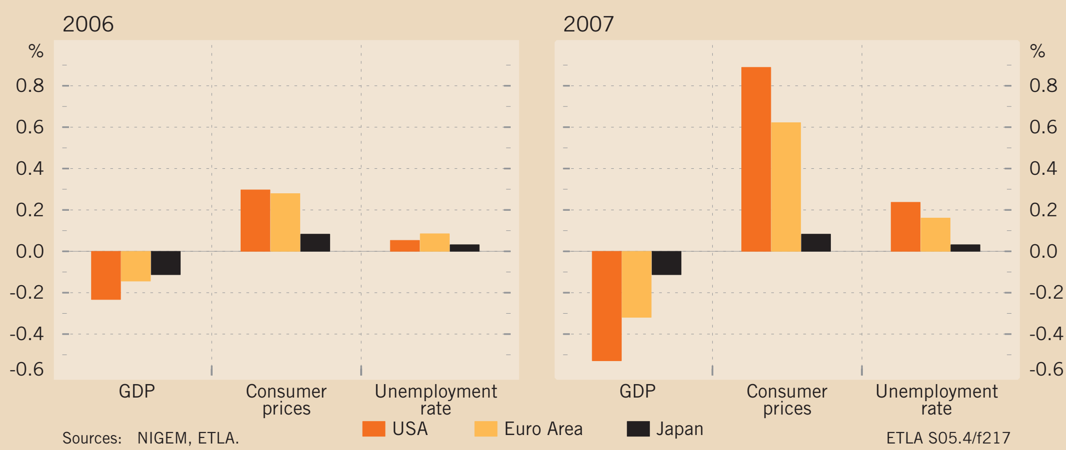
Euro Area inflation picks up less compared to the U.S., reflecting Europe's relatively higher energy taxes and its lower oil intensity. Since inflationary pressures are smaller in the Euro Area, interest rates do not rise so much, and thus their negative impact on growth is smaller. With interest rates rising less in the Euro Area, the euro weakens against the dollar, which offsets some of the effects of slower growth in export demand. The Euro Area also has relatively close trade ties with oil producers such as Russia, Norway and the OPEC countries. When growth in these oil-producing countries accelerates, their demand for imports also increases, buffering export growth in the Euro Area. Japan experiences milder effects from a permanent oil price increase due to its lower oil intensity but also because the central bank does not need to raise interest rates so aggressively. All in all, world economic growth slows somewhat, remaining well below baseline levels for many years.

Turning to some European countries, the UK and Finland would experience only small negative impacts on GDP. As a net exporter of crude oil, the UK economy is somewhat insulated from an oil price increase. Finnish GDP would decline only marginally compared to baseline, reflecting the fact that growth in Russia, which is rapidly becoming Finland's largest export market, would accelerate noticeably. The impact on Italian GDP also appears to be small, thanks to the country's own oil production (around 100,000 barrels per day or 5.6 percent relative to the country's oil consumption) and exports sent to oil-producing countries.

THE SIMULATION RESULTS ARE ONLY INDICATIVE

The simulation results provide, at best, only an indication of the impacts of an oil price increase. The results depend on the structure of the economies comprising the NiGEM model, and these structures can change markedly over time. For example, a permanent increase in oil prices would encourage substitution away from oil towards alternative forms of energy, leading to lower oil intensities in many coun-

Impact of Permanent Oil Price Rise in 2006-2007, % Difference from Baseline



Sources: NIGEM, ETLA.

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tries. The simulation results also depend closely on the monetary policy reaction, which is difficult to assess in advance. More recently, the impacts of higher oil prices have been partly offset by exceptionally low interest rates (see Euroframe 2005).

ENERGY POLICY SHOULD FOCUS ON IMPROVING MARKET MECHANISMS

Finland is very dependent on energy and crude oil. An increase in crude oil prices would hurt the Finnish economy, even though oil dependency has declined substantially in recent decades. The impact of the recent doubling of oil prices on the Finnish economy have been partly offset by euro depreciation from previously strong levels, the positive impact of stronger Russian growth on Finnish exports sent to Russia, as well as buoyant growth in industrialized countries owing to low long-term interest rates.

That the world economy continues to expand well despite the steep increase in oil prices does not mean oil dependency is no longer important. On the contrary, the time is now ripe to begin preparing for large changes in world energy markets. World demand for energy is projected to increase very rapidly over the next few decades, according to many studies. World demand for oil is expected to increase at a slower pace than total demand for energy, but oil dependency will remain high. The growth of oil supply assumed in baseline scenarios already requires huge production and investment increases in the Middle East.

In line with EU initiatives, Finland has committed itself to lowering emissions of carbon dioxide, for which reason it will have to become less dependent on fossil raw materials in the future. The risks associated with oil availability also support a change in this direction. The world's oil reserves are concentrated in the politically explosive Middle East. Changes in oil dependency take a long time to happen, particularly since the transportation industry remains heavily reliant on oil. In this setting, the

Impact of Permanent Oil Price Rise, % Difference from Baseline

	USA	Euro Area	Japan	OECD	OPEC	Norway	Russia	World
2006	-0.2	-0.1	-0.1	-0.2	0.3	-0.2	1.1	0.0
2007	-0.5	-0.3	-0.1	-0.4	1.1	0.2	3.5	-0.1
2008	-0.8	-0.5	-0.2	-0.6	1.6	0.8	4.2	-0.2

Source: ETLA.

GDP Impact of Permanent Oil Price Rise on European Countries, % Difference from Baseline

	UK	Germany	France	Italy	Finland
2006	0.2	-0.2	-0.1	-0.1	0.0
2007	0.0	-0.4	-0.3	-0.1	-0.1
2008	-0.2	-0.6	-0.5	-0.3	-0.2

Source: ETLA.

focus should be on the long term, a time frame where the impacts of technological changes are very difficult to project. Technological advances remain the key to finding a permanent solution to global energy problems.

In these conditions, the safest course of action would be to focus on promoting the smooth functioning of market mechanisms and to encourage the adoption and use of cleaner alternative energy forms. Tax breaks that encourage the use of energy- and fossil-fuel-saving alternative energies in, for example, the transportation sector would help raise preparedness for oil market risks. Natural gas is a fossil fuel that will be globally very popular in coming decades, particularly since it is abundant and because burning it produces less carbon dioxide compared to coal. Natural gas will undoubtedly provide relief to Finland's energy supply. At the same time, measures to ease Finland's dependence on Russian gas imports should be made by encouraging the construction of pipelines from the west.

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