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Focus

ENERGY SECURITY

Pro and Contra

WHAT SORTS OF RICH-COUNTRY JOBS (AND HOW MANY) ARE AT RISK TO GLOBALISATION?

Special

Spotlights

Trends

Energy Security

World energy prospects and challenges

Fatih Birol*

In recent years, demand for energy has surged. This unrelenting increase has helped fuel global economic growth but placed considerable pressure on suppliers buffeted by geopolitics, violent weather conditions and other potentially disruptive factors. On the demand side, increased energy security and environmental concerns may lead to changes in consuming countries' energy policies. These uncertainties have been reflected in the market through volatility and high prices. Is the world running out of energy? Where will future supplies come from? Will adequate investment be made to make energy supplies available to meet future demand? What role will governments play?

The oil and gas resources of the Middle East and North Africa region (MENA) will be critical to meeting the world's growing appetite for energy. A large share of the world's remaining reserves lie in that region. They are relatively under-exploited and so there is considerable potential for increasing production. But there are significant uncertainties surrounding the pace at which investment in the region's upstream industry will actually occur, how quickly production capacity will expand and, given rising domestic energy needs, how much of the expected increase in supply will be available for export. The implications for both MENA producers and consuming countries are profound.

This paper draws on the main findings of the World Energy Outlook 2005, published by the International Energy Agency. The 2005 Outlook assessed quantitatively the prospects for global energy markets through to 2030, with a special focus on the Middle East and North Africa. In addition, it analysed the possible impact of deferred investment in the region's energy sector and also considered the potential effects of changing policies in consumer countries to address energy security and environmental concerns.[1]

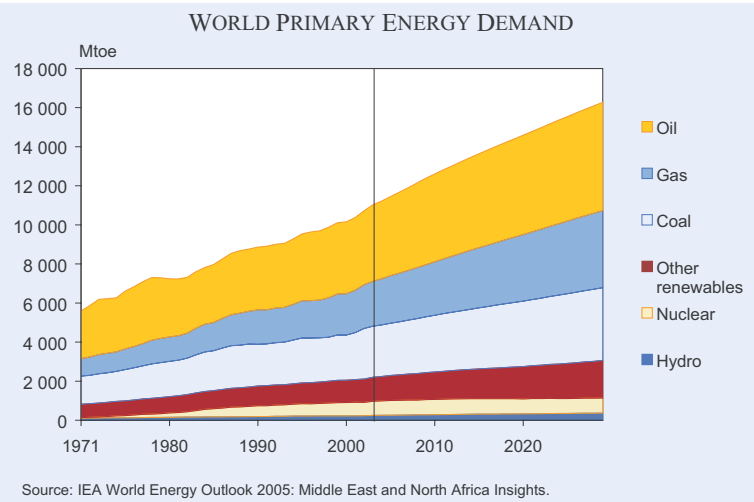
Global energy trends

Global energy needs are likely to continue to grow steadily for at least the next two-and-a-half decades. If governments stick with current policies – the underlying premise of the *World Energy Outlook's* Reference Scenario – the world's energy needs would be more than 50 percent higher in 2030 than today, an average annual growth rate of 1.6 percent. More than two-thirds of the growth in world energy use will come from the developing countries, where economic and population growth rates are highest.

Uncertainties about supply conditions and consuming countries' energy policies have led to greater volatility and higher prices

Fossil fuels continue to dominate energy supplies, meeting more than 80 percent of the projected increase in primary energy demand in this scenario. Oil remains the single largest fuel, with two-thirds of

Figure 1



Source: IEA World Energy Outlook 2005: Middle East and North Africa Insights.

* Chief Economist, International Energy Agency.

[1] The next edition of the World Energy Outlook series, due on November 7th 2006, will contain the latest projections as well as an enhanced World Alternative Policy Scenario, analysis of the potential of nuclear power and the economics of biofuels, among other topical energy issues.

the increase in oil use coming from the transport sector. Demand reaches 92 mb/d in 2010 and 115 mb/d in 2030. Natural gas demand grows faster, driven mainly by power generation. It overtakes coal as the world's second-largest primary energy source before 2015. In this scenario, the share of coal in world primary demand declines a little, with demand growth concentrated in China and India. Nuclear power's market share declines marginally, while that of hydropower remains broadly constant. The share of non-hydro renewables, including biomass, geothermal, solar, wind, tidal and wave energy, will remain flat at 11 percent.

The world's energy resources are adequate to meet the projected growth in energy demand in the Reference Scenario. Global oil reserves today exceed the cumulative projected production between now and 2030, but more reserves will need to be "proved up" in order to avoid a peak in production before the end of the projection period. The exact cost of finding and exploiting energy resources over the coming decades is uncertain, but will certainly be substantial. Cumulative energy-sector investment needs are estimated at about $17 trillion (in 2004 dollars) over 2004-2030, with about half of that in developing countries. Financing the required investments in non-OECD countries is one of the biggest challenges facing the energy industry.

In the reference scenario, the world's energy resources will be able to meet demand until 2030

Middle East and north Africa energy prospects

Rapidly expanding populations, steady economic growth and heavy subsidies will continue to drive up MENA energy demand. In the Reference Scenario, demand is projected to grow on average by 2.9 percent per year over 2003 to 2030. As a result, demand more than doubles. The biggest contributors to demand growth will be Saudi Arabia and Iran. Between them, they will account for about 45 percent of MENA energy demand in 2030, the same as today.

Most MENA countries will continue to rely almost exclusively on oil and natural gas to meet their energy needs. Gas will overtake oil by 2020 as the region's main energy source for domestic use, thanks partly to policies aimed at freeing up oil for export. Despite rapid growth in MENA energy use, average per capita consumption projected for 2030 will still be barely half the current level in OECD countries, though consumption will remain very high in the Gulf states. The power and water sectors will absorb a growing share of the region's total primary energy use as electricity and desalinated water needs expand rapidly. Heavy subsidies to both services are accentuating this trend.

Output of oil and natural gas in the MENA region is poised for rapid expansion. Reserves are large and costs are lower than in most other parts of the world. In the Reference Scenario, oil production (including natural gas liquids) is projected to rise from 29 mb/d in 2004 to 33 mb/d in 2010 and to 50 mb/d by 2030. Saudi Arabia, which has the largest proven reserves of oil in the world, will remain by far the largest supplier. Its output will rise from 10.4 mb/d in 2004 to 11.9 mb/d in 2010 and just over 18 mb/d in 2030. Iraq is expected to see the fastest rate of production growth, and the biggest increase in volume terms after Saudi Arabia. In some countries, including Iraq, increased production will hinge on large-scale foreign investment. These trends will boost MENA's share of world oil production from 35 percent in 2004 to 44 percent in 2030.

MENA oil production will outpace the growth in domestic demand, allowing the region's net oil exports to rise by three-quarters from 22 mb/d in 2004 to 39 mb/d by 2030. Most exports will still be as crude oil in 2030, but refined products will account for a growing share. Exports to developing Asian countries will increase most, but will grow to all the major consuming regions.

MENA production of natural gas is projected to grow even more rapidly than that of oil, trebling over the projection period to 1210 billion cubic metres in 2030. The biggest volume increases in the region occur in Qatar, Iran, Algeria and Saudi Arabia. The bulk of the increase in MENA output will be exported, mostly as liquefied natural gas. Demand for the region's gas will be driven by strong global demand and dwindling output in many other gas-producing regions.

Net gas exports from MENA countries to other regions are projected to more than quadruple to 440 bcm in 2030, with a marked shift in sales to Europe and the United States. Europe will remain the primary destination for North African gas exports. Major oil and gas importers, including most OECD countries and South Asia, will become ever more dependent on imports from MENA countries.

MENA oil- and gas-export revenues, which have surged in the last few years, will remain high. Aggregate MENA oil and gas revenues are projected to rise from about $310 billion in 2004 to $320 billion in 2010 and $635 billion in 2030. Natural gas will make a growing contribution. Cumulative revenues will far exceed the investment needed to make them possible. Total oil and gas investment is projected to amount to about $1 trillion over the period 2004 to 2030 (in year-2004 dollars), or $39 billion per year.

The impact of deferred oil investment

Securing reliable and affordable energy will hinge on adequate investment. The rate of investment in developing crude oil production capacity in the Middle East is particularly important for world energy markets. Current rates of investment in that region are not high enough to meet the gap that is expected to open up between global oil demand and oil-production capacity in other parts the world. Without urgent and sizable increases in Middle East investment, a shortfall in production capacity will emerge and prices will rise and become more volatile – to the long-term economic detriment of both producers and consumers. Under-investment also carries short-term security risks. The relatively low level of spare oil-production capacity currently available to counteract any unexpected loss of supply has resulted from many years of under-investment. This increases the likelihood that the sudden loss of even a modest volume of oil will lead to a very sharp increase in prices.

A major shortfall in MENA investment in upstream oil would radically alter the global energy balance. Our Reference Scenario projections involve a doubling of the rate of upstream investment in MENA countries. It is far from certain that all that investment will be forthcoming: MENA governments could choose deliberately to develop production capacity more slowly than we project in our Reference Scenario. Or external factors such as capital shortages could prevent producers from investing as much in expanding capacity as they would like. The Deferred Investment Scenario analyses how energy markets might evolve if upstream investment in each MENA country were to remain constant as a share of GDP at the average level of the past decade. This would result in a $110 billion, or 23 percent, drop in cumulative upstream MENA investment over 2004 to 2030.

Lower investment on this scale would cause MENA oil production to drop by almost a third by 2030 compared with the Reference Scenario. Production falls further than investment by the end of the projection period because of the cumulative effect over the projection period. In 2030, total MENA output reaches 35 mb/d, compared with 50 mb/d in the Reference Scenario. MENA's share of world oil production drops from 35 percent in 2004 to 33 percent in 2030 (it rises to 44 percent in the Reference Scenario). As a result, MENA oil exports are almost 40 percent lower in 2030. By contrast, higher prices stimulate an 8 percent increase in non-MENA oil production. The average IEA import price increases gradually over time relative to the Reference Scenario and is almost one-third higher in 2030. The prices of gas and coal also increase. Gas production in MENA countries also falls significantly, due to lower global demand and lower output of associated gas, causing the region's gas exports to fall by 46 percent.

As a result of higher prices and lower world GDP, global energy demand is reduced by about 6 percent in 2030, compared with the Reference Scenario. On average, demand growth is 0.21 percentage points lower over the projection period. World GDP growth, the main driver of energy demand, is on average 0.23 percentage points per year lower. Among the primary fuels, global demand for oil falls most. At 105 mb/d in 2030, world oil use is 10 mb/d lower. Demand for both gas and coal also falls, mainly as a result of lower demand for fuel inputs to power generation.

Sizable increases in investment in the MENA region are needed to prevent a shortfall in crude oil production

Our analysis suggests that MENA producers would lose out financially were investment to be reduced in the way assumed in the Deferred Investment Scenario. Over 2004 to 2030, the cumulative value of aggregate MENA oil- and gas-export revenues would be more than a trillion dollars lower (in year-2004 prices) than in the Reference Scenario. The loss of revenues is almost four times more than the reduction in investment. Revenues also fall in terms of net present value.

Uncertainty about future supply-side infrastructure investments is by no means limited to the Middle East or to crude oil production. The prospects for urgently needed investment in new refining capacity are clouded by environmental restrictions and local opposition, especially in OECD countries. Under-investment in gas-production facilities and transmis-

sion pipelines in Russia and Central Asia threatens to create a supply crunch in the next few years. The lack of competition in the Russian gas sector is an impediment to the efficient and timely development of Russian and Central Asian gas resources. And current capital flows to the electricity sector in many countries – notably in the poorest developing regions – cannot even maintain system reliability, let alone meet the increasing demands of economic and population growth.

Growing energy security and environmental concerns

Over time, consuming countries will grow increasingly reliant on oil and gas imports from an ever-smaller group of suppliers – notably Russia and the big Middle East producers. Expanding trade is to be welcomed as it binds suppliers and customers in mutually beneficial relationships. But, at the same time, the risk of a major supply disruption – whether from terrorism, piracy, accidents, severe weather, political tensions or war – will undoubtedly increase. The terrorist attack on the processing facility at Abqaiq in Saudi Arabia provided a graphic illustration of the terrorist threat to energy infrastructure. Russia's decision to cut off gas supplies to Ukraine in early 2006 called into question its reputation as a reliable supplier and raised doubts about how Europe would deal with a more prolonged disruption.

Reliance on an ever smaller group of oil and gas producers increases the risk to energy security

Further cause for concern is the growing reliance on strategic transportation channels through which almost all the oil and gas exported by Middle Eastern countries must flow. Consuming countries' vulnerability to a disruption in supplies from that region will, therefore, grow – as will the risk that some producing countries may use their dominant market position to raise prices or to withhold supplies for political reasons. Diversity of sources, of suppliers and of routes is crucial.

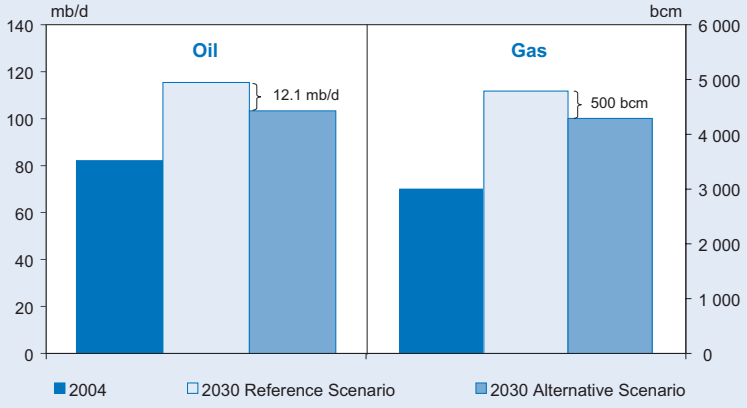
Consuming countries must identify policies and measures aimed at reducing the risk of disruptions and higher prices, as well as mitigating their consequences. They need to strengthen their ability to handle a supply emergency, including maintaining adequate volumes of strategic stocks. For example, total oil stocks in the OECD would need to rise, in the Reference Scenario, to 3.7 billion barrels in 2030 for them to be equal to 90 days of net imports – 1.1 billion barrels more than in 2003. Consuming-country governments also need to consider long-term policies that promote further diversification of their energy supplies as a means of both lowering their vulnerability to supply disruptions and of addressing environmental challenges, including rising greenhouse-gas emissions. Reducing dependence on oil and gas through diversification of fuels and their geographic sources and more efficient use of energy must be central to long-term policies aimed at enhancing energy security.

But consumer country concerns are not limited to energy security. Because energy consumption accounts for approximately 80 percent of global GHG emissions, consumer governments are under increasing pressure to take steps to reduce or mitigate the effects of domestic energy consumption. The G8 leaders, meeting with leaders from several key developing countries at Gleneagles in July 2005, acknowledged as much when they called for stronger action to combat rising consumption of fossil fuels and related greenhouse-gas emissions.

The World Alternative Policy Scenario takes into account all the new measures that governments are currently considering to curb energy use and to reduce emissions for energy-security and environmental reasons. Under these new assumptions, primary energy demand grows by 1.2 percent per year to 2030, 0.4 percentage points less than in the

Figure 2

OIL/GAS DEMAND IN THE REFERENCE AND ALTERNATIVE POLICY SCENARIOS



Source: IEA World Energy Outlook 2005: Middle East and North Africa Insights.

Reference Scenario. Demand for oil would be 10 percent lower in 2030 than in the Reference Scenario, but oil would still account for 34 percent of world primary energy demand. Two thirds of the savings would come from the transport sector. Natural gas demand in 2030 would also be 10 percent lower in 2030 than in the Reference Scenario. Most of the savings would come from power generation.

The results suggest that importing countries' aggregate dependence on MENA could be sharply reduced in the long term. In this scenario, world energy demand in 2030 falls even more relative to the Reference Scenario than in the Deferred Investment Scenario. The fall in the share of oil and gas in primary energy demand in oil-importing regions – an indicator of vulnerability to supply disruptions – is also larger in most regions than in the Deferred Investment Scenario. MENA oil production is lower than in the Reference Scenario, but still grows by more than 50 percent, or 16 mb/d, between 2004 and 2030.

In practice, the policies of producing and consuming countries will change over time in response to each other, to market developments and to shifts in market power. If MENA upstream investment falters and prices rise, the more likely it becomes that consuming countries will adopt additional policies to curb demand growth and reliance on MENA. This would have the effect of tempering the long-term impact on prices of lower MENA investment. It would also amplify the depressive effect of higher prices on oil and gas demand. The more successful the importing countries' policies are, the more likely it is that the producing countries will adopt policies to sustain their production and their global market share. Lower prices would result.

Deepening the consumer-producer dialogue

These interactions illustrate the case for improving market transparency, for more effective mechanisms for exchanging information between oil producers and consumers, and for a more profound dialogue between them.

The uncertainty surrounding the outlook for global energy markets has rarely been greater. For as long as the world economy continues to expand, demand for oil and other forms of energy will increase commensurately. But the rate of growth in primary energy needs and the mix of fuels will depend on what action governments decide to take to curb demand and emissions and on developments in energy technology. Other factors, including extreme weather, natural disasters and geopolitics, will complicate our ability to anticipate energy-market developments with confidence. Energy security is more than ever a matter of managing risk and coping with uncertainty.

Deepening the dialogue between oil and gas producers and consumers would help all energy players handle uncertainty and help industry to mobilise much-needed investment. The aim should be to improve market transparency, by developing more effective ways of exchanging information, and co-operating on policies to enhance the efficiency of the oil and gas sector. Producing countries are as much concerned about security of demand as consuming countries are about security of supply. Working together, consumer and producer governments can improve the mechanisms by which we meet our common challenges and achieve mutually beneficial outcomes. But they need to identify this objective as a priority and take the first steps. And they should start now.

The policies of energy producing and consuming countries are interdependent, calling for a deepening of the dialogue

Green paper: A European strategy for sustainable, competitive and secure energy*

AN ENERGY STRATEGY FOR EUROPE: BALANCING SUSTAINABLE DEVELOPMENT, COMPETITIVENESS AND SECURITY OF SUPPLY

Europe has entered into a new energy era.

- There is an urgent need for investment. In Europe alone, to meet expected energy demand and to replace ageing infrastructure, investments of around one trillion euros will be needed over the next 20 years.
- Our import dependency is rising. Unless we can make domestic energy more competitive, in the next 20 to 30 years around 70 percent of the Union's energy requirements, compared to 50 percent today, will be met by imported products – some from regions threatened by insecurity.
- Reserves are concentrated in a few countries. Today, roughly half of the EU's gas consumption comes from only three countries (Russia, Norway, Algeria). On current trends, gas imports would increase to 80 percent over the next 25 years.
- Global demand for energy is increasing. World energy demand – and CO_2 emissions – is expected to rise by some 60 percent by 2030. Global oil consumption has increased by 20 percent since 1994, and global oil demand is projected to grow by 1.6 percent per year.
- Oil and gas prices are rising. They have nearly doubled in the EU over the past two years, with electricity prices following. This is difficult for consumers. With increasing global demand for fossil fuels, stretched supply chains and increasing dependence on imports, high prices for oil and gas are probably here to stay. They may, however, trigger greater energy efficiency and innovation.
- Our climate is getting warmer. According to the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas emissions have already made the world 0.6 degrees warmer. If no action is taken there will be an increase of between 1.4 and 5.8 degrees by the end of the century. All regions in the world – including the EU – will face serious consequences for their economies and ecosystems.
- Europe has not yet developed fully competitive internal energy markets. Only when such markets exist will EU citizens and businesses enjoy all the benefits of security of supply and lower prices. To achieve this aim, interconnections should be developed, effective legislative and regulatory frameworks must be in place and be fully applied in practice, and Community competition rules need to be rigorously enforced. Furthermore, the consolidation of the energy sector should be market driven if Europe is to respond successfully to the many challenges it faces and to invest properly for the future.

The energy landscape implies great interdependence of the world's regions and demand a common European strategy

This is the new energy landscape of the 21st century. It is one in which the world's economic regions are dependent on each other for ensuring energy security and stable economic conditions, and for ensuring effective action against climate change.

The effects of this landscape are felt directly by everyone. Access to energy is fundamental to the daily lives of every European. Our citizens are affected by higher prices, threats to the security of energy supply and changes to Europe's climate. Sustainable, competitive and secure energy is one of the basic pillars of our daily life.

This landscape requires a common European response. Heads of State and Government, at their summits in October and December 2005, recognised this and asked the Commission to take this forward. Recent events have underlined that this challenge must be met. An approach based solely on 25 individual energy policies is not enough.

The EU has the tools to help. It is the world's second largest energy market, with over 450 million consumers. Acting together, it has the weight to protect

* Commission of the European Communities, Brussels, March 2006.
Commissioner Andris Piebalgs, Energy.

and assert its interests. The EU has not just the scale but also the policy range to tackle the new energy landscape. The EU leads the world in demand management, in promoting new and renewable forms of energy, and in the development of low carbon technologies. If the EU backs up a new common policy with a common voice on energy questions, Europe can lead the global search for energy solutions.

Europe must act urgently: it takes many years to bring innovation on stream in the energy sector. It must also continue to promote diversity – of energy type, country of origin and transit. In this way it will create the conditions for growth, jobs, greater security and a better environment. Work has been progressing on these issues since the Commission's 2000 Green Paper on Security of Energy Supply, but given recent developments on energy markets, a new European impetus is needed.

This Green Paper puts forward suggestions and options that could form the basis for a new comprehensive European energy policy. The Spring European Council and the European Parliament are invited to react to this Paper, which should also spark a wide-ranging public debate. The Commission will then table concrete proposals for action.

This Green Paper identifies six key areas where action is necessary to address the challenges we face. The most fundamental question is whether there is agreement on the need to develop a new, common European strategy for energy, and whether sustainability, competitiveness and security should be the core principles to underpin the strategy.

From that flow the following questions:

1. Competitiveness and the internal energy market.
Is there agreement on the fundamental importance of a genuine single market to support a common European strategy for energy? How can barriers to implementing existing measures be removed? What new measures should be taken to achieve this goal? How can the EU stimulate the substantial investments necessary in the energy sector? How to ensure that all Europeans enjoy access to energy at reasonable prices, and that the internal energy market contributes to maintaining employment levels?

2. Diversification of the energy mix.
What should the EU do to ensure that Europe, taken as a whole, promotes the climate-friendly diversification of energy supplies?

3. Solidarity.
Which measures need to be taken at Community level to prevent energy supply crises developing, and to manage them if they do occur?

4. Sustainable development.
How can a common European energy strategy best address climate change, balancing the objectives of environmental protection, competitiveness and security of supply? What further action is required at Community level to achieve existing targets? Are further targets appropriate? How should we provide a longer term secure and predictable investment framework for the further development of clean and renewable energy sources in the EU?

5. Innovation and technology:
What action should be taken at both Community and national level to ensure that Europe remains a world leader in energy technologies? What instruments can best achieve this?

6. External policy.
Should there be a common external policy on energy, to enable the EU to speak with a common voice? How can the Community and Member States promote diversity of supply, especially for gas? Should the EU develop new partnerships with its neighbours, including Russia, and with the other main producer and consumer nations of the world?

The Green Paper identifies six key areas for action

Developing a European energy policy will be a long term challenge. This needs a clear but flexible framework: clear in that it represents a common approach endorsed at the highest level, flexible in that it needs periodic updating. As a foundation for this process the Commission therefore proposes that a *Strategic EU Energy Review* be presented to the Council and Parliament on a regular basis, covering the issues identified in this Green Paper. This would constitute a stocktaking and action plan for the Spring European Council, monitoring progress and identifying new challenges and responses on all aspects of energy policy.

SIX PRIORITY AREAS

Energy for growth and jobs in Europe: completing the internal European electricity and gas markets

Sustainable, competitive and secure energy will not be achieved without open and competitive energy markets, based on competition between companies

looking to become European-wide competitors rather than dominant national players. Open markets, not protectionism, will strengthen Europe and allow it to tackle its problems. A truly competitive single European electricity and gas market would bring down prices, improve security of supply[1] and boost competitiveness. It would also help the environment, as companies react to competition by closing energy inefficient plant.

In July 2007, with very few exceptions, every EU consumer will have the legal right to purchase electricity and gas from any supplier in the EU. This offers a major opportunity for Europe. But whilst much has been done to create a competitive market, work is not yet complete. Many markets remain largely national, and dominated by a few companies. Many differences remain between Member States' approaches to market opening, preventing the development of a truly competitive European market – including powers of regulators, level of independence of network operators from competitive activities, grid rules, balancing and gas storage regimes.

By the end of 2006, the second electricity and gas Directives will have been implemented by all Member States and the Commission will have completed its competition inquiry into the functioning of the European gas and electricity markets. A final decision, based on a full impact assessment, will then be made on any additional legislative measures needed: in particular to ensure non-discriminatory network access, adequate available network capacity, liquidity on gas and electricity markets and effective regulation. However, it is already clear that five core areas need particular attention:

Companies must become Europe-wide competitors rather than dominant national players

(i) A European grid

Consumers need a single European grid for a real European electricity and gas market to develop. This can be done by ensuring common rules and standards on issues that affect cross-border trade. Progress is being made on these issues, but it is too slow.

A European grid code could encourage harmonised, or at least equivalent, grid access conditions. This would take the form of common rules on regulatory issues that affect cross-border trade. Experts are taking a first step forward on a regional basis, in particular energy regulators through the Council of European Energy Regulators and the European Regulators Group. But further and quicker progress is necessary before all business and private consumers will be able to purchase their electricity and gas from suppliers in other Member States. To this end, the Commission will examine (i) what needs to be done to address the differences between existing equivalent powers and independence for national regulators and (ii) whether existing forms of collaboration between national regulators and national grid operators are adequate, or whether a closer level of collaboration is needed – with for example a European energy regulator to look at cross-border issues. Such a regulator could have decision-making powers for common rules and approaches such as a European grid code and would work together with the network operators. A European Centre for Energy Networks could also bring the network operators together in a formal body to assist work on developing a European Grid Code.

(ii) A priority interconnection plan

At the Barcelona European Council in 2002, the Heads of State and Government agreed to increase minimum interconnection levels between Member States to 10 percent. Progress has not been satisfactory. There can be no truly competitive and single European market without additional physical capacity: this is particularly vital for countries such as Ireland and Malta or for the Baltic States, which remain an "energy island", largely cut off from the rest of the Community. Equally, additional electricity interconnection capacity is necessary between many areas and in particular between France and Spain to permit real competition between these two countries to develop. Similarly there is a need for new investment in infrastructure in gas markets. In many Member States, action needs to be taken to free up capacity reserved for former incumbents under electricity and gas long term contracts. Interconnection is a crucial mechanism for solidarity.

Private and public investments in infrastructure need to be stimulated and authorisation procedures accelerated. The greater the interconnection in the European electricity grid, the lower the need for spare capacity and, in time, the lower the costs. This is important at a time when Europe's previous overcapacity is becoming history. The Commission will by the end of 2006 identify the individual measures that it considers important at the level of Member States. Further actions at Community level will also be

[1] "Lessons from liberalised electricity markets". IEA, 2005.

identified, such as more effective use of the Trans-European Network instruments.

Finally, relations with Switzerland are important in this respect, which is a major transit country for electricity.

(iii) Investment in generation capacity
To replace ageing electricity generation capacity and to meet demand, the EU will need substantial investment over the next 20 years. This includes capacity to deal with peaks. The necessary reserve must exist in order to prevent disruptions at times of high demand and to serve as back-up for intermittent renewable energy sources. For timely and sustainable investments, a properly functioning market is needed, giving the necessary price signals, incentives, regulatory stability and access to finance.

(iv) A level-playing field: the importance of unbundling
Significant differences persist in the level and effectiveness of unbundling of transmission and distribution from competitive activities. This means that in practice national markets are open to fair and free competition to differing degrees. The provisions of the second electricity and gas Directives on unbundling need to be fully implemented, not just in their letter but also in their spirit. If progress to a level playing field does not result, further measures at Community level should be considered.

(v) Boosting the competitiveness of European industry
One of the most important objectives of the internal energy market is to promote the competitiveness of EU industry and thus contribute to growth and jobs. Industrial competitiveness requires a well-designed, stable and predictable regulatory framework, respectful of market mechanisms. Energy policy therefore needs to favour cost-effective options and be based on a thorough economic analysis of different policy options and their impact on energy prices. Secure availability of energy at affordable prices is crucial.

Integrated and competitive electricity and gas markets with the minimum of disruption are essential. The new High–Level Group on Energy, Environment and Competitiveness will play an important role in identifying ways to promote the competitiveness of all sectors of affected industry.

This requires considering, for example, what is the best way to accommodate the legitimate needs of energy intensive industry whilst, at the same time, respecting competition rules.

Conclusions on this issue should be contained in the report on the internal market scheduled for the end of 2006. In addition, consideration needs to be given on how best to ensure effective coordination between the Commission, national energy regulators and national competition authorities.

An Internal Energy Market that guarantees security of supply: solidarity between Member States

(i) Enhancing security of supply in the internal market
Liberalised and competitive markets help security of supply by sending the right investment signals to industry participants. But for this competition to work effectively, the market needs to be transparent and predictable.

The physical security of Europe's energy infrastructure against risks from natural catastrophe and terrorist threat, as well as security against political risks including interruption of supply is critical to predictability. The development of smart electricity networks, demand management and distributed energy generation could all help at times of sudden shortage.

Security of energy supply calls for competitive markets, better exchange of information and solidarity among countries

This points to several areas for possible future action:

- The establishment of a European Energy Supply Observatory as soon as possible to monitor the demand and supply patterns on EU energy markets, identifying likely shortfalls in infrastructure and supply at an early stage and complementing on an EU level the work of the International Energy Agency.
- Improved network security through increased collaboration and exchange of information between transmission system operators in defining and agreeing common European security and reliability standards. A more formal grouping of transmission system operators, reporting to the EU energy regulators and to the Commission, could build on the work already started in the wake of the 2003 blackouts. This could develop into a European Centre for Energy Networks, with powers to collect, analyse and publish relevant information, as well as to implement

schemes approved by the relevant regulatory institutions.

- With respect to the physical security of infrastructure, two main actions merit further consideration. Firstly, a mechanism could be developed to prepare for and ensure rapid solidarity and possible assistance to a country facing difficulties following damage to its essential infrastructure. Secondly, common standards or measures might be taken to protect infrastructure.

(ii) Rethinking the EU's approach to emergency oil and gas stocks and preventing disruptions

Oil is a global market and major supply disruptions, even if local or regional, require a global response. The release of emergency stocks organised by the IEA in response to Hurricane Katrina worked well. Any stronger Community action in this area should therefore be compatible with this global mechanism. This might still point to a more coordinated Community response in the event of an IEA decision to release stocks. In particular, this would be helped by a new Commission legislative proposal ensuring the publication on a more regular and transparent basis the state of Community oil stocks, to contribute improving transparency on oil markets.

The review of an EU energy strategy should discuss the framework for national decisions on the energy mix

Furthermore, the existing Directives on gas and electricity security of supply should be reexamined to ensure they can deal with potential supply disruptions. Recent experience has raised important questions, including whether Europe's gas stocks can meet the challenge of shorter term supply disruptions. This review should also consider whether the appropriate signals are being given to encourage the necessary investment in Europe's gas and electricity markets in the years ahead, including investments in security of supply and infrastructure to enable mutual assistance. This could, inter alia, include a new legislative proposal concerning gas stocks to ensure that the EU can react to shorter term emergency gas supply disruptions in a manner that ensures solidarity between Member States, whilst taking account of the different potential for storage in different parts of the EU.

Tackling security and competitiveness of energy supply: towards a more sustainable, efficient and diverse energy mix

Each Member State and energy company chooses its own energy mix. However, choices made by one Member State inevitably have an impact on the energy security of its neighbours and of the Community as a whole, as well as on competitiveness and the environment. For example:

- decisions to rely largely or wholly on natural gas for power generation in any given Member State have significant effects on the security of supply of its neighbours in the event of a gas shortage;
- decisions by Member States relating to nuclear energy can also have very significant consequences on other Member States in terms of the EU's dependence on imported fossil fuels and CO_2 emissions.

The *Strategic EU Energy Review* would offer a clear European framework for national decisions on the energy mix. It should analyse all the advantages and drawbacks of different sources of energy, from indigenous renewable energy sources such as wind, biomass and biofuels, small hydro and energy efficiency to coal and nuclear, and the knock-on effects of these changes for the EU as a whole. This could be based on a standard methodology.

Coal and lignite, for example, presently account for around one-third of the EU's electricity production: climate change means that this is only sustainable if accompanied by commercialised carbon sequestration and clean coal technologies on an EU level.

The Review should also allow a transparent and objective debate on the future role of nuclear energy in the EU, for those Member States concerned. Nuclear power, at present, contributes roughly one-third of the EU's electricity production and, whilst careful attention needs to be given to the issues of nuclear waste and safety, represents at present the largest source of largely carbon free energy in Europe. The EU can play a useful role in ensuring that all costs, advantages and drawbacks of nuclear power are identified for a well-informed, objective and transparent debate.

Furthermore, it might be appropriate to agree an overall strategic objective, balancing the goals of sustainable energy use, competitiveness and security of supply. This would need to be developed on the basis of a thorough impact assessment and provide a benchmark on the basis of which the EU's developing energy mix could be judged and would help the EU to stem the increasing dependence on imports. For example, an objective might be to aim for a min-

imum level of the overall EU energy mix originating from secure and low-carbon energy sources. Such a benchmark would reflect the potential risks of import dependency, identify an overall aspiration for the long term development of low carbon energy sources and permit the identification of the essentially internal measures necessary to achieve these goals. It would combine the freedom of Member States to choose between different energy sources and the need for the EU as a whole to have an energy mix that, overall, meets its core energy objectives. The Strategic EU Energy Review could serve as the tool for the proposal and subsequent monitoring of any such objective agreed by the Council and Parliament.

An integrated approach to tackling climate change

Effective action to address climate change is urgent and the EU must continue to lead by example and, above all, work towards the widest possible international action. Europe needs to be ambitious and must act in an integrated manner that promotes the EU's Lisbon objectives.

The EU is already at the forefront of approaches to decouple economic growth from increasing energy consumption. Its action has combined robust legislative initiatives and energy efficiency programmes with encouragement to competitive and effective renewable energy. However, the EU's commitment to fighting climate change is a long-term one.

In order to limit the forthcoming rise of global temperatures at the agreed target of maximum of 2 degrees above pre-industrial levels, global greenhouse gas emissions should peak no later than 2025, and then be reduced by at least 15 percent, but perhaps as much as 50 percent compared to 1990 levels. This huge challenge means that Europe must act now, in particular on energy efficiency and renewable energy.

Action on renewables and energy efficiency, besides tackling climate change, will contribute to security of energy supply and help limit the EU's growing dependence on imported energy.

It could also create many high-quality jobs in Europe and maintain Europe's technological leadership in a rapidly growing global sector.

In this respect, the EU Emissions Trading Scheme creates a flexible and cost-efficient framework for more climate friendly energy production. The full review of the EU Emissions Trading Scheme gives an opportunity for expanding and further improving the functioning of the scheme. In addition, the EU Emissions Trading Scheme provides the nucleus for a gradually expanding global carbon market, hereby giving European business a head-start.

Making more from less: leading on energy efficiency

An effective energy efficiency policy does not mean sacrificing comfort or convenience. Nor does it mean reducing competitiveness. In fact an effective policy in this area means the opposite; making cost-effective investments in order to reduce the waste of energy, thereby increasing standards of living and saving money, and using price signals, that would lead to more responsible, economical and rational use of energy. Market-based instruments, including the Community energy tax framework, can be a very efficient tool in this respect.

Although Europe is already one of the world's most energy efficient regions, it can go much further. In its 2005 Green Paper on Energy Efficiency, the Commission showed that up to 20 percent of EU energy use could be saved: equivalent to spending as much as 60 billion less on energy, as well as making a major contribution to energy security and creating up to a million new jobs in the sectors directly concerned.

Greater energy efficiency could save up to 20 percent of EU energy use

One useful instrument in this respect is the EU's cohesion policy, which identifies as objectives supporting energy efficiency, the development of renewable and alternative energy sources and investments in networks where there is evidence of market failure. The Commission calls upon Member States and regions, when preparing their National Strategic Reference Frameworks and operational programmes for 2007 to 2013, to make effective use of the possibilities provided for by cohesion policy in support of the present strategy.

The Commission will this year propose an Action Plan on Energy Efficiency to realise this potential. This effort needs consistent support and determination at the very highest political level throughout Europe. Many of the tools are in national hands, such as grants and tax incentives, and the national level holds the key to convincing the public that energy efficiency can bring them real savings. But the EU level can have a decisive impact and the Action Plan

will propose concrete measures to reach this 20 percent potential by 2020.

Examples of possible action include:

- Long-term targeted energy efficiency campaigns, including efficiency in buildings, notably public buildings.
- A major effort to improve energy efficiency in the transport sector and in particular to improve rapidly urban public transport in Europe's major cities.
- Harnessing financial instruments to catalyze investments by commercial banks in energy-efficiency projects and companies providing energy services.
- Mechanisms to stimulate investment in energy efficiency projects and energy services companies.
- A Europe-wide "white certificates" system, tradable certificates, which would enable companies that exceed energy efficiency minimum standards to "sell" this success to others that have failed to meet these standards.
- To guide consumers and manufacturers, more focus will need to be put on rating and showing the energy performance of the most important energy-using products including appliances, vehicles, and industrial equipment. It may be appropriate to set minimum standards in this area.

To develop the full potential of renewable energy, the Commission will issue a Renewable Energy Road Map

Finally, energy efficiency needs to become a global priority. The Action Plan can serve as a "launch pad" to catalyse similar action worldwide, in close collaboration with the IEA and the World Bank. The EU should propose and promote an international agreement on energy efficiency, involving both developed and developing countries and the expansion of the Energy Star Agreement.

Increasing the use of renewable energy sources

Since 1990, the EU has been engaged in an ambitious and successful plan to become world leader in renewable energy. To take one example, the EU has now installed wind energy capacity equivalent to 50 coal fired power stations, with costs halved in the past 15 years. The EU's renewable energy market has an annual turnover of € 15 billion (half the world market), employs some 300,000 people, and is a major exporter. Renewable energy is now starting to compete on price with fossil fuels.

In 2001, the EU agreed that the share of electricity from renewable energy sources in the EU consumption should reach 21 percent by 2010. In 2003, it agreed that at least 5.75 percent of all petrol and diesel should be bio-fuels by 2010. A number of countries are showing a rapid increase in renewable energy use through supportive national policy frameworks. But under current trends, the EU will miss both targets by 1 to 2 percentage points. If the EU is to meet its longer term climate change goals and reduce its dependence on fossil fuel imports, it will need to meet and indeed go beyond these targets. Renewable energy is already the third electricity generation source worldwide (after coal and gas) and has the potential to grow still further, with all the environmental and economic advantages that would follow.

For renewable energy to fulfil its potential, the policy framework needs to be supportive and in particular to stimulate increasing competitiveness of such energy sources while fully respecting the competition rules. While some sources of low-carbon indigenous energy are already viable, others, such as offshore wind, wave and tidal energy need positive encouragement to be realised.

The full potential of renewable energy will only be realised through a long-term commitment to develop and install renewable energy. In parallel to the Strategic EU Energy Review, the Commission will bring forward a Renewable Energy Road Map. This would cover key issues for an effective EU policy on renewables:

- an active programme with specific measures to ensure that existing targets are met;
- consideration of which targets or objectives beyond 2010 are necessary, and the nature of such targets, in order to provide long-term certainty for industry and investors, as well as the active programmes and measures needed to make this a reality. Any such targets could be complemented by extended operational targets on electricity, fuels and possibly heating;
- a new Community Directive on heating and cooling, complementing the Community energy saving framework;
- a detailed short, medium and long term plan to stabilise and gradually reduce the EU's dependence on imported oil. This should build on the existing Biomass Action Plan[2] and the Strategy for Biofuels[3];

[2] Communication from the Commission – "Biomass Action Plan" – COM(2005) 628, 7.12.2005.
[3] Communication from the Commission – "An EU Strategy for Biofuels" – COM(2006) 34, 8.2.2006.

– Research, demonstration and market replication initiatives to bring clean and renewable energy sources closer to markets.

The Road Map would be based on a thorough impact assessment, assessing renewable energy sources against the other options available.

Carbon capture and geological storage
Carbon capture and geological storage, in combination with clean fossil fuel technologies provides a third opportunity of near zero emission technology. Today it can already be economically used for enhanced oil or gas recovery. It can be particularly important for countries which choose to continue the use of coal as a secure and abundant energy source.

However, this technology needs a stimulus to create the necessary economic incentives, provide legal certainty for the private sector and ensure environmental integrity. R&D and large scale demonstration projects are needed to bring the technology towards reduced costs, and market-based incentives such as emissions trading can also make this a profitable option for the longer term.

Encouraging innovation: a strategic European energy technology plan

The development and deployment of new energy technologies is essential to deliver security of supply, sustainability and industrial competitiveness.

Energy related research has contributed strongly to energy efficiency (e.g. in car engines) and to energy diversity through renewable energy sources. However the magnitude of the challenges ahead requires increased efforts.

This necessitates a long term commitment. As an example research has allowed efficiency of coal power stations to be improved by 30 percent in the last thirty years. The Research Fund for Coal and Steel has contributed to funding this at EU level. Further technological developments would see significant reductions in CO_2 emissions.

Research can also bring commercial opportunities. Energy efficient and low carbon technologies constitute a rapidly growing international market that will be worth billions of Euros in the coming years. Europe must ensure that its industries are world leaders in these new generations of technologies and processes.

The 7th Framework Programme recognises that there is no single solution to our energy problems, but deals with a wide portfolio of technologies: renewable energy technologies, making clean coal and carbon capture and sequestration an industrial reality, developing economically viable biofuels for transports, new energy vectors such as hydrogen and environmentally friendly energy usage (e.g. fuel cells) and energy efficiency; as well as advanced nuclear fission and the development of fusion through the implementation of the ITER Agreement.

The EU needs an appropriately resourced strategic energy technology plan. This should accelerate the development of promising energy technologies, but should also help to create the conditions to bring such technologies efficiently and effectively to the EU and the world markets. Research in areas of high energy use – housing, transport, agriculture, agroindustries, and materials – should also be addressed. The proposed European Institute of Technology (EIT) could play an important role in helping achieve this.

The EU needs to consider ways to finance a strategic approach to energy research

The plan should strengthen the European research effort to prevent overlaps in national technology and research programmes and to put the focus on agreed EU-level goals. Industryled European technology platforms on biofuels, hydrogen and fuel cells, photovoltaics, clean coal and electricity networks help to develop commonly agreed research agendas and deployment strategies.

The EU needs to consider ways to finance a more strategic approach to energy research, taking further steps towards integrating and coordinating Community and national research and innovation programmes and budgets. Building upon the experience and output of European technology platforms, high-level stakeholders and decision-makers need to be mobilised to develop an EU vision for the transformation of the energy system and to maximise the efficiency of the overall research effort.

Where appropriate, particularly to develop "leading markets" for innovation, Europe should act through large-scale integrated actions with the necessary critical mass, mobilising private business, Member States

and the European Commission in public/private Partnerships or through the integration of National and Community Energy Research Programmes. The long-term energy-related ITER project and the internationally coordinated Generation IV initiative aiming at designing even safer and more sustainable reactors, are examples of concerted EU actions to achieve specific goals. Europe should also invest in other possible future forms of energy, such as hydrogen and fuel cells, carbon capture and storage, large-scale renewable technologies such as concentrated solar thermal, as well as even longer term prospects such as methane hydrates. Consideration should also be given on how to mobilise the resources of the European Investment Bank to promote close to market R&D in this area and how to enhance cooperation in areas of global concern.

Actions to accelerate technology development and drive down the costs of new energy technologies must be complemented by policy measures to open the market and to ensure the market penetration of existing technologies that are effective in addressing climate change.

An external energy policy would enable the EU to speak with one voice

Competing against entrenched technologies and huge locked-in investments in the current energy system, largely based on fossil fuels and centralised generation, new technologies face high entry barriers. The EU Emissions Trading Scheme, green certificates, feed-in tariffs and other measures can ensure that the implementation of environmentally friendly energy production, conversion and use is financially viable. Such measures can provide powerful policy signals to the market and create a stable climate in which industries can take the longterm investment decisions required. The Intelligent Energy-Europe Programme will also provide the necessary tools and mechanisms to overcome the non technical barriers to the take up of new and effective energy technologies.

Towards a coherent external energy policy

The energy challenges facing Europe need a coherent external policy to enable Europe to play a more effective international role in tackling common problems with energy partners worldwide. A coherent external policy is essential to deliver sustainable, competitive and secure energy. It would be a break from the past, and show Member States' commitment to common solutions to shared problems.

The first step is to agree at Community level on the aims of an External Energy Policy and on the actions needed at both Community and national level to achieve it. The effectiveness and coherence of the EU's external energy policy is dependent upon the progress with internal policies and, in particular, the creation of the internal market for energy. The abovementioned Strategic EU Energy Review would serve as the basis for establishing this common vision.

This would constitute a stocktaking and action plan for the European Council, monitoring progress and identifying new challenges and responses. Follow-up should take the form of regular formal political level discussions at Community level, involving Member States and the Commission in a manner to be developed. It would offer a single reference point, with an appropriate institutional format, for all actors in European energy at both Community and national level. This would permit not only the effective exchange of information but also a real co-ordination of approach: it would enable the EU, in effect, "to speak with the same voice".

The benefits of this approach for the external dimension would be particularly strong. It should cover a number of key goals and instruments:

A clear policy on securing and diversifying energy supplies

Such a policy is necessary both for the EU as a whole and for specific Member States or regions, and is especially appropriate for gas. To this end, the above mentioned Review could propose clearly identified priorities for the upgrading and construction of new infrastructure necessary for the security of EU energy supplies, notably new gas and oil pipelines and liquefied natural gas (LNG) terminals as well as the application of transit and third party access to existing pipelines. Examples include independent gas pipeline supplies from the Caspian region, North Africa and the Middle East into the heart of the EU, new LNG terminals serving markets that are presently characterised by a lack of competition between gas suppliers, and Central European oil pipelines aiming at facilitating Caspian oil supplies to the EU through Ukraine, Romania and Bulgaria. In addition, the Review could acknowledge the concrete political, financial and regulatory measures needed to actively support the undertaking of such projects by business. The new EU-Africa Strategy,

envisaging interconnections of energy systems as a priority area, could also help Europe to diversify its oil and gas supply sources.

Energy partnerships with producers, transit countries and other international actors

The EU and its energy partners are interdependent. This is reflected at bilateral and regional level in a number of specific EU energy dialogues with a number of producer and transit countries.[4] Equally, energy issues are a growing feature of the EU's political dialogues with other major energy consumers (such as the US, China and India), including through multilateral fora like the G8. These dialogues should be set within the common vision offered by the Review.

Dialogue with major energy producers/suppliers:

The EU has an established pattern of relations with major international energy suppliers including OPEC and the Gulf Cooperation Council. A new initiative is particularly opportune with regard to Russia, the EU's most important energy supplier. The EU, as Russia's largest energy buyer, is an essential and equal partner in this relationship. The development of a common external energy policy should mark a step change in this energy partnership at both Community and national level. A true partnership would offer security and predictability for both sides, paving the way for the necessary long-term investments in new capacity. It would also mean fair and reciprocal access to markets and infrastructure including in particular third party access to pipelines. Work should start on an energy initiative based on these principles. Subsequently the results could be integrated into the framework of EURussia relations due to replace the current EU-Russia Partnership and Cooperation agreement in 2007. In addition, efforts should be intensified in the G8 to secure rapid ratification by Russia of the Energy Charter Treaty and conclusion of the negotiations on the Transit Protocol.

Developing a pan-European Energy Community:

In line with the European Neighbourhood Policy and its Action Plans (and in addition to the current work undertaken through Partnership and Cooperation Agreements and Association Agreements), the EU has for some time been engaged in widening its energy market to include its neighbours and to bring them progressively closer to the EU's internal market.

Creating a "common regulatory space" around Europe, would imply progressively developing common trade, transit and environmental rules, market harmonisation and integration. This would create a predictable and transparent market to stimulate investment and growth, as well as security of supply, for the EU and its neighbours. Existing political dialogues, trade relations and Community financing instruments can be further developed and, for other partners, there is potential for new agreements or other types of initiative.

For example, by building on the Energy Community Treaty with partners in South-East Europe, as well as the development of the EU-Maghreb electricity market and the EU-Mashrek gas market, a pan-European energy Community could be created both through a new Treaty, and through bilateral agreements. Certain essential strategic partners, including Turkey and Ukraine, could be encouraged to join the South East European Energy Community Treaty. The Caspian and Mediterranean countries are important gas suppliers and transit routes. Algeria's increasing importance as a gas supplier to the EU could point to a specific energy partnership.

Creating a common regulatory space around Europe would stimulate supply security for the EU and its neighbours

In addition, as one of the EU's most important strategic energy partners, attention should be given to facilitating Norway's efforts to develop resources in the high north of Europe in a sustainable manner as well as facilitating its entry into the South East Europe Energy Community.

This framework would also offer a clearer framework to promote best long-term use of Community investment through Trans-European Energy Networks and their extensions to third country partners and to maximise the impact on energy security of EU resources devoted to the energy sector in third countries. This is of particular importance for the new Neighbourhood Instrument and for EIB and EBRD financing. In this context, twinning programmes and loan subsidies for external strategic energy infrastructure are essential.

Reacting effectively to external crisis situations

Consideration should be given on how best to react to external energy crises. Recent experiences with respect to both oil and gas have shown the need for the Community to be able to react quickly and in a

[4] Notably Russia, Norway, Ukraine, the Caspian basin, the Mediterranean countries, OPEC and the Gulf Co-operation Council.

fully co-ordinated manner to such events. The EU has no formal instrument dealing with external energy supplies. This could be addressed by a new more formal, targeted instrument to deal with emergency external supply events. This might involve, for example, a monitoring mechanism to provide early warning and to enhance response capabilities in the event of an external energy crisis.

Integrating energy into other policies with an external dimension

At the political level, a common European external energy policy will permit a better integration of energy objectives into broader relations with third countries and the policies which support them. That means increasing the focus in relations with global partners facing similar energy and environmental challenges – such as the US, Canada, China, Japan and India – on issues such as climate change, energy efficiency and renewable sources, research and development of new technologies, global market access and investment trends, with better results in multilateral fora such as the UN, the IEA and the G8. If these countries reduce the use of fossil fuels, it will also be beneficial for Europe's energy security.

The EU should widen the focus of foreign relations to include issues like climate change, energy efficiency and renewable energy

The EU could significantly step up bilateral and multi-lateral cooperation with these countries with the objective of encouraging the rational use of energy worldwide, of reducing pollution and encouraging industrial and technological cooperation on the development, demonstration and deployment of energy efficient technologies, renewable energy sources and clean fossil fuel technologies with carbon capture and geological storage. In particular, greater efforts need to be made towards widening the geographic scope of the EU Emissions Trading Scheme and, as mentioned above, as a first step the EU should propose and promote an international agreement on energy efficiency. In addition, more focus could be given to technological cooperation, in particular with other energy consuming countries.

Similarly, there is scope to make better use of trade policy tools to promote goals such as non-discriminatory energy transit and the development of a more secure investment climate. The EU should press for a better respect of existing WTO rules and principles in this field, and bilateral or regional initiatives should build on these. Such agreements can include provisions on market opening, investment, regulatory convergence on issues such as transit and access to pipelines, and competition. Reinforced market-based provisions on energy and trade-related energy issues would thus be incorporated in the EU's existing and future agreements with third countries.

Energy to promote development

For developing countries, access to energy is a key priority, and Sub-Saharan Africa has the lowest access in the world to modern energy services. At the same time, only 7 percent of Africa's hydropower potential is tapped. The EU should promote a twin-track approach through the European Union Energy Initiative and through raising the profile of energy efficiency in development programmes. Focusing on developing renewable energy and micro-generation projects, for instance, could help many countries reduce reliance on imported oil and improve the lives of millions. The implementation of the Kyoto Protocol clean development mechanism could spur investment in such energy projects in developing countries.

CONCLUSIONS

This Green Paper has set out the new energy realities facing Europe, outlined questions for debate and suggested possible actions at the European level. In taking the debate forward, it is essential to act in an integrated way. Each Member State will make choices based on its own national preferences. However, in a world of global interdependence, energy policy necessarily has a European dimension.

Europe's energy policy should have three main objectives:

- Sustainability: (i) developing competitive renewable sources of energy and other low carbon energy sources and carriers, particularly alternative transport fuels, (ii) curbing energy demand within Europe, and (iii) leading global efforts to halt climate change and improve local air quality.
- Competitiveness: (i) ensuring that energy market opening brings benefits to consumers and to the economy as a whole, while stimulating investment in clean energy production and energy efficiency, (ii) mitigating the impact of higher international energy prices on the EU economy and its citizens and (iii) keeping Europe at the cutting edge of energy technologies.

- Security of supply: tackling the EU's rising dependence on imported energy through (i) an integrated approach – reducing demand, diversifying the EU's energy mix with greater use of competitive indigenous and renewable energy, and diversifying sources and routes of supply of imported energy, (ii) creating the framework which will stimulate adequate investments to meet growing energy demand, (iii) better equipping the EU to cope with emergencies, (iv) improving the conditions for European companies seeking access to global resources, and (v) making sure that all citizens and business have access to energy.

To achieve these objectives, it is important to put them in an overall framework, in the first Strategic EU Energy Review. This could be augmented with a strategic objective which balanced the goals of sustainable energy use, competitiveness and security of supply; for example, by aiming for a minimum level of the overall EU energy mix to come from secure and low-carbon energy sources. This would combine the freedom of Member States to choose between different energy sources and the need for the EU as a whole to have an energy mix that, overall, meets its three core energy objectives.

This Green Paper puts forward a number of concrete proposals to meet these three objectives.

1. The EU needs to complete the internal gas and electricity markets. Action could include the following measures:

– The development of a European Grid, including through a European grid code. A European regulator and a European Centre for Energy Networks should also be considered.
– Improved interconnections.
– Creating the framework to stimulate new investment.
– More effective unbundling.
– Boosting competitiveness, including through better coordination between regulators, competition authorities and the Commission.

These must be addressed as a priority; the Commission will reach final conclusions on any additional measures that need to be taken to ensure the rapid completion of genuinely competitive, European-wide electricity and gas markets, and present concrete proposals by the end of this year.

2. The EU needs to ensure that its internal energy market guarantees security of supply and solidarity between Member States. Concrete measures should include:

– A review of the existing Community legislation on oil and gas stocks, to focus them on today's challenges.
– A European energy supply observatory, enhancing transparency on security of energy supply issues within the EU.
– Improved network security through increased cooperation between network operators and possibly a formal European grouping of network operators.
– Greater physical security of infrastructure, possibly through common standards.
– Improved transparency on energy stocks at the European level.

3. The Community needs a real Community-wide debate on the different energy sources, including costs and contributions to climate change, to enable us to be sure that, overall, the EU's energy mix pursues the objectives of security of supply, competitiveness and sustainable development.

The Grren Paper puts forward a number of proposals to achieve the three objectives of: sustainability, competitiveness, and security of supply

4. Europe needs to deal with the challenges of climate change in a manner compatible with its Lisbon objectives. The Commission could propose the following measures to the Council and Parliament:

(i) A clear goal to prioritise energy efficiency, with a goal of saving 20 percent of the energy that the EU would otherwise use by 2020 and agreeing a series of concrete measures to meet this objective, including:

– Efficiency campaigns, including on buildings.
– Harnessing financial instruments and mechanisms to stimulate investment.
– A renewed effort for transport.
– A Europe-wide "white certificates" trading system.
– Better information on the energy performance of some appliances, vehicles, and industrial equipment and possibly, minimum performance standards.

(ii) Adopt a long-term road-map for renewable energy sources, including:

– A renewed effort to meet existing targets.
– Consideration of which targets or objectives beyond 2010 are necessary.

– A new Community Directive on heating and cooling.
– A detailed plan to stabilise and gradually reduce the EU's dependence on imported oil.
– Initiatives to bring clean and renewable energy sources closer to markets.

5. A strategic energy technology plan, making best use of Europe's resources, building on European technology platforms and with the option of joint technology initiatives or joint undertakings to develop leading markets for energy innovation.

This should be presented as soon as possible to the European Council and Parliament
for endorsement.

6. A common external energy policy. In order to react to the challenges of high and volatile energy prices, increasing import dependency, strongly growing global energy demand and global warming, the EU needs to have a clearly defined external energy policy and to pursue it, at the same time at both national and Community level, with a single voice. To this end the Commission proposes:

– Identifying European priorities for the construction of new infrastructure necessary for the security of EU energy supplies.
– Developing a pan-European Energy Community Treaty.
– A new energy partnership with Russia.
– A new Community mechanism to enable rapid and co-ordinated reaction to emergency external energy supply situations impacting EU supplies.
– Deepening energy relations with major producers and consumers.
– An international agreement on energy efficiency.

Understanding the Effects of Exogenous Oil Supply Shocks

Lutz Kilian*

How do shortfalls in crude oil production caused by wars and other political events in the Middle East affect economic growth and inflation in major industrialized countries? Public discussion of this question has been shaped by the economic experience of the 1970s and early 1980s. The conventional wisdom leaves little doubt that oil supply shocks abroad were to blame for the economic malaise of the 1970s. This has led to the concern that history might repeat itself if a new oil supply shock were to occur, say in the form of a cutback of Iranian oil production and exports, as recently discussed in the media. Thus, understanding the effects of such politically motivated shortfalls in crude oil production is more important than ever.

Compared to two decades ago, we are now in a much better position to separate systematic from idiosyncratic features of oil supply crises, as the number of such events has steadily increased over time. Of particular interest are oil supply shocks associated with political turmoil in OPEC countries. Table 1 lists important political events that are thought to have triggered shortfalls of OPEC crude oil production. These events are typically treated as exogenous with respect to global macroeconomic conditions, which means that these events are believed to have evolved independently of the state of the business cycle in industrialized countries, and of variables such as exchange rates, interest rates, and inflation rates. This interpretation is not obvious in all cases.

For example, the decision to launch the Arab oil embargo of 1973/74 could also be viewed as an endogenous response to macroeconomic conditions, as detailed in Barsky and Kilian (2002, 2004). Nevertheless, for the purpose of this article we will follow the conventional view that the embargo was an exogenous political event.

Alternative approaches to identifying the effects of exogenous oil supply disruptions

How much are economic outcomes in industrialized countries affected by crude oil production shortfalls triggered by exogenous events in OPEC countries? A common feature of all methodologies designed to learn about the dynamic effects of exogenous oil supply shocks is that they relate changes in macroeconomic aggregates to some measure of the exogenous oil supply shock.

Oil prices are endogenous to global macroeconomic conditions

Oil supply shocks are usually considered to be the result of exogenous political events

Early studies sometimes treated increases in the price of oil as the measure of the exogenous oil supply disruption. This approach is misleading in general, as the price of oil like all commodity prices tends to respond to the global business cycle and fluctuations in interest rates and exchange rates. It is widely understood today that at least since late 1973 the price of oil has been fully endogenous to global macroeconomic conditions and cannot be treated as exogenous (see Rotemberg and Wood-

Table 1

Important Political Events in OPEC Countries

Date	Political Event
October 1973	Yom-Kippur War/ Arab Oil Embargo
October 1978	Iranian Revolution
September 1980	Iran-Iraq War
August 1990	Persian Gulf War
December 2002	Civil Unrest in Venezuela
March 2003	Iraq War

* University of Michigan and CEPR. This review draws extensively on results in various papers by the author.

ford 1996; Barsky and Kilian 2002, 2004; Hamilton 2003).

This seemingly trivial point has far-reaching implications. It is tempting, for example, for a policymaker to pose the question of what the effects of higher oil prices are on macroeconomic performance; yet this question is not well posed because it postulates a thought experiment, in which the price of oil changes, while holding all other variables constant. If in reality, the price of oil increases due to strong demand for oil from a booming world economy, then by construction not all other variables are held constant, invalidating the thought experiment. Thus, it is essential to decompose movements in the price of oil into well identified components that can be attributed to mutually uncorrelated structural shocks. Much of the recent literature on oil prices has attempted to address this problem one way or another.

Are at least the major oil price increases driven by exogenous political events?

Not all oil price shocks result from supply shortages but also from shifts in global demand

Some studies have noted that at least the major oil price fluctuations in the 1970s and 1980s were arguably driven by exogenous political events in the Middle East (see, e.g., Shapiro and Watson 1988). This insight was subsequently formalized by Hamilton (1996, 2003) who proposed a statistical measure of the net oil price increase relative to the recent past designed to capture those major oil price increases presumably caused by exogenous political events. That measure also produces a time series very similar to fitted values from more sophisticated nonlinear models of the price of oil (see, e.g., Lee, Ni and Ratti 1995, Hamilton 2003).

Such measures are problematic, however. First, although three of the largest oil price increases since the early 1970s occurred near periods of large exogenous shocks to oil production, not all exogenous oil supply shocks have been associated with net oil price increases. For example, the 2002/03 twin shocks associated with civil unrest in Venezuela and the Iraq War were not associated with a net oil price increase in real terms (see Kilian 2005). Second, there have been instances of oil price shocks, most notably the sharp increase in crude oil prices since 2003, that were apparently not related to any specific exogenous shock to OPEC oil supply. Thus, exogenous oil supply shocks are neither necessary nor sufficient for the occurrence of oil price shocks and we need to look for other possible explanations of oil price shocks.

How shifts in the demand for oil may cause oil price shocks

There is widespread agreement that the bulk of crude oil price increases since 2003 can be attributed to strong global demand for oil, driven in part by robust growth in many industrialized countries and in part by the increased appetite for oil of newly industrializing economies. It may seem puzzling at first that a shift in global demand for crude oil could be responsible for a large and rapid increase in the price of oil. The reason why even gradual shifts in demand may cause sharp increases in the price of crude oil, is that at times the production of crude oil is subject to capacity constraints. If the supply of crude oil is effectively limited, a steady increase in the global demand for oil may translate into large increases in the price of oil, before supply responds. Given the long lags in expanding productive capacity in the oil industry and the reluctance of oil companies to invest in new capacity, lest the increase in the price of oil prove temporary, the resulting oil price increases may persist for several years before corrective forces come into play. For example, it took about five years for significant increases in productive capacity to take place following the 1973/74 oil price shock.

Capacity constraints may be amplified by the fact that crude oil is not a homogenous commodity. For example, Saudi Arabia in recent years could have increased its output of crude oil, but only by producing more so-called "sour" varieties of crude oil rather than the "light sweet" crude oil most oil refineries are prepared to process. In this sense, part of the bottleneck may not be on the production side, but on the processing side of the oil market. While refineries may be adapted to different types of crude oil or new refineries may be built, this process is slow and costly. Thus, it is not surprising that in the short run the price of light sweet crude oil increased sharply in recent years.

The striking fact that oil price shocks may occur even in the absence of exogenous shocks to crude oil production also sheds new light on earlier oil price shock episodes. It is widely accepted that the oil price increases of 1973/74 and 1979/80, for example, were mainly caused by crude oil production cuts associated with the Yom Kippur war and the Arab

oil embargo in one case and with the Iranian revolution in the other. What has often been ignored is the possibility that the observed oil price increases may also have reflected increased demand for oil and other industrial commodities.

How important are shifts in the global demand for industrial commodities?

One way of gauging the importance of increased demand for industrial commodities is to focus on price increases for non-oil industrial commodities. The period leading up to the 1973 oil price increase, for example, coincided with strong global growth for industrial commodities, as Europe, Japan and the United States were all nearing the peak of their business cycles. In 1972–74, the prices of ordinary industrial commodities increased across the board. The price of scrap metal nearly quadrupled between late 1972 and early 1974, not unlike the price of crude oil (see Barsky and Kilian 2002), yet the National Commission on Supplies and Shortages (1976) found no evidence that these industrial commodity price increases were driven by exogenous supply shocks in commodity markets. Similarly, 1979/80 was a period of strong global growth that continued until the Volcker recession, and of rising industrial commodity prices.

It is also possible to construct measures of global demand for industrial commodities based on freight shipping rates (see Kilian 2006b). Again these measures suggest large and across the board increases in the demand for industrial commodities in 1973 and 1979 (as well as in the period since 2002), which one would expect to be mirrored by a surge in the demand for crude oil.

Quantity-based approaches to measuring exogenous oil supply shocks

Since observed movements in the price of crude oil reflect shifts in the demand for oil driven by macroeconomic conditions, one cannot simply assume that major oil price increases are driven by events such as wars and political conflicts in the Middle East. Hence, the fact that exogenous oil supply shocks are neither necessary nor sufficient for oil price shocks is not a puzzle.

An alternative, more promising approach is to identify the exogenous fluctuations in the supply of crude oil from quantity data rather than price data. Monthly data on crude oil production by country are available from the US Department of Energy. These data can be used to construct a time series of the exogenous fluctuations in OPEC crude oil production based on explicit assumptions about how OPEC oil production would have evolved in the absence of political turmoil in the Middle East. Such a direct measure of exogenous oil production shortfalls has recently been proposed by Kilian (2006a). This measure can be thought of as a refinement of traditional quantitative dummy approaches to measuring exogenous oil supply shocks (see Hamilton 2003). It allows us to have a fresh look at the historical experience of the industrialized countries during previous oil supply shocks.

In 1972/74, price increases of non-oil industrial commodities were not due to supply shocks but to cyclical demand growth

The next exogenous oil supply shock: A thought experiment

Using linear regression analysis one can estimate the effects of previous exogenous oil supply shocks on real GDP growth and consumer price inflation in industrialized countries. If we take these estimates as our guide in assessing the likely impact of future oil supply shocks, we can construct a benchmark for discussions of energy security. It is instructive to consider the expected outcomes for the largest European economies of a permanent elimination of Iranian oil supplies. Iranian crude oil production accounts for approximately 5 percent of world crude oil production. The Iranian case is a natural example, given recent discussions of an embargo and possible military action. Table 2 suggests that this shock would have considerable effects on real GDP growth

Table 2
Estimated Effects of a 5% Permanent Reduction in Oil Supply

	Expected Effect on Annual Real GDP Growth (%)		
	1st Year	2nd Year	3rd Year
Italy	0.2	– 1.9	– 0.2
France	0.0	– 1.4	– 0.4
Germany	0.3	– 2.6	– 0.6

	Expected Effect on Annual Consumer Price Inflation (%)		
	1st Year	2nd Year	3rd Year
Italy	1.2	0.2	– 0.0
France	1.2	0.6	0.2
Germany	1.6	1.4	1.0

and to a lesser extent on consumer price inflation in France, Italy and Germany. Table 2 does not include the U.K., since that country was a substantial crude oil producer during much of our sample period.

While there is essentially no response of real growth in year 1 following the shock, there is a substantial decline in real growth in year 2. Real growth per annum drops by about 2 percentage points in most countries. The projected declines in real growth in year 2 after the shock range from – 2.6 percentage points for Germany to – 1.4 percentage points for France. This reduction would be enough to induce a real contraction in many countries. In year 3, the effect on real growth remains negative, but is much smaller, as real growth reverts back to normal levels.

Table 2 also shows that all three countries would experience a one-time increase in consumer price inflation in the first year after the shock. The increase varies between 1.2 and 1.6 percentage points at annual rates. For France and Italy, there is no evidence that an exogenous oil supply shock would lead to sustained inflation. For Germany, the increase in inflation appears much more persistent. Hence, with the exception of Germany, there is no evidence that an exogenous oil supply shock would be stagflationary. Unlike the responses predicted for other European economies, the German response includes both a reduction in growth and an increase in inflation in year 2 after the shock. This evidence is suggestive of additional wage-price dynamics being triggered by the exogenous oil supply shock.

The effects of a *permanent* reduction in oil supplies by 5 percent are estimated to substantially reduce real GDP growth in the second year

Other considerations

Table 2 provides a useful baseline that represents our best guess of the effects of an exogenous cutback of Iranian oil production based on the evidence available since 1971. It is important to keep in mind, however, that there are a number of additional factors that could lower or raise the impact of such a shock.

Permanent versus temporary shocks

One important assumption in the thought experiment underlying the results in Table 2 has been that the reduction in Iranian oil supplies is permanent. While this is one possible outcome, it is not likely. There is a tendency to think of exogenous oil supply shocks as one-time adverse shocks. This need not be the case. Historically, exogenous production shortfalls have tended to be temporary. For example, the production cutbacks during the 1973/74 Arab oil embargo were quickly reversed in 1974. Similarly, crude oil production in Kuwait today has completely recovered from the effects of the invasion. When the exogenous production shortfall is temporary, by construction, negative shocks to oil production are followed by positive shocks, as the initial production shortfall is at least partially reversed over time. A complete assessment of a given oil supply shock episode therefore must involve the full sequence of exogenous oil supply shocks, as a given episode unfolds. The cumulative effect of such a sequence of shocks (some negative and some positive) may differ greatly from that of a one-time permanent shock.

Rather than speculate about the likely form that this sequence might take in the case of Iran, we illustrate this point using as examples the five historical episodes listed in Table 1. We treat the Venezuelan crisis and the 2003 Iraq War as one event, given their close proximity. The cumulative effect of these five exogenous oil supply shock sequences are shown in Table 3 by episode and country. Table 3a shows the average value of the annualized rate of consumer price inflation for each subsample and country (normalized relative to its long-run average such that a zero value would indicate average performance in that country and a positive value abnormally high inflation). In addition, the table also shows the average of the estimated cumulative effect of the exogenous oil supply shock on inflation for the same period, obtained from counterfactual historical simulations based on the same linear regression estimates used in constructing Table 2. The corresponding results for real GDP growth are shown in Table 3b.

Table 3a suggests the following findings: First, in the absence of the exogenous oil supply shocks that took place during 1973/74, 1978/79, 1980, 1990/91, and 2002/2003 the evolution of consumer price inflation in France, Germany and Italy would have been remarkably similar overall to its actual path. There is no evidence that the 1973/74, 1978/80 and 2002/03 oil supply shocks had more than a negligible impact on consumer price inflation in France, Germany or Italy. Nor is there evidence of such an effect in 1980–83 or 1990–93. Only for Germany is there some evidence that oil supply shocks can account for a

Table 3a

CPI Inflation Rates Relative to Long-Run Average and Average Estimated Effect of Exogenous Oil Supply Shocks

		Episodes of Exogenous Oil Supply Shocks				
		1973.IV to 1975.II	1978.IV to 1980.III	1980.IV to 1983.I	1990.III to 1993.III	2002.IV to 2004.III
Italy	Inflation	9.84	8.92	8.08	– 2.96	– 5.68
	Effect	0.01	0.40	0.20	0.52	0.44
France	Inflation	7.24	6.40	5.92	– 2.60	– 3.08
	Effect	0.16	0.64	0.40	0.84	0.60
Germany	Inflation	4.32	2.00	2.28	1.40	– 1.48
	Effect	0.24	0.84	1.28	1.36	0.44

substantial fraction of the observed rate of inflation after the outbreak of the Iran-Iraq War and again after the outbreak of the Persian Gulf War. The extent of the observed increase in inflation, however, is small by the standards of the 1970s.

This evidence is consistent with the view that the high inflation of the 1970s was caused by domestic policies rather than external shocks. Indeed, one of the striking features of the data is that the period of global economic stagnation and excessive inflation in the 1970s (also known as the Great Stagflation) in the wake of the first two major oil crises has never been repeated after subsequent oil supply shocks.

Second, as Table 3b shows, there is no evidence that the 1973/74, 1978/79 and 2002/03 oil supply shocks had a substantial impact on real GDP growth in France, Germany or Italy. This finding is consistent with an important role for demand-led oil price increases during these episodes. Although for some countries the 1980 and 1990/91 shocks did contribute to subsequent lower real growth, these effects were typically small. For example, only about one half of the abnormally low growth observed in Italy and France after the invasion of Kuwait can be attributed to exogenous oil production shocks. In the case of Germany, the stimulating effect of German re-unification more than offset the effect of the exogenous oil production shock, resulting in abnormally high growth for the same period.

These results drive home the point that in discussing the likely effects of future exogenous OPEC oil production shortfalls, one must examine the entire path of exogenous fluctuations in crude oil production rather than the initial shock only. In this sense, the standard analysis of dynamic multipliers as shown in Table 2 can be misleading.

The negative effects of past temporary oil supply shocks were largely offset by positive effects

The limitations of extrapolating from the past

A second important assumption underlying Table 2 has been that the responses of policy-makers and of the oil industry to the Iranian crisis will resemble their average responses in the past. To the extent that today's policymakers have more experience with and a better understanding of exogenous oil supply shocks (as well as more credibility with the public), one might conjecture that these shocks will have less of an effect than on average in the past. A perhaps more important factor is the ability of the oil industry to overcome supply constraints. It seems safe to assume that the structural increase in energy demand due to the newly industrializing economies will persist, making it important to exploit alterna-

Table 3b

Real GDP Growth Rates Relative to Long-Run Average and Average Estimated Effect of Exogenous Oil Supply Shocks

		Episodes of Exogenous Oil Supply Shocks				
		1973.IV to 1975.II	1978.IV to 1980.III	1980.IV to 1983.I	1990.III to 1993.III	2002.IV to 2004.III
Italy	Growth	– 2.00	2.08	– 1.68	– 1.96	– 1.52
	Effect	– 0.28	– 0.36	– 1.00	– 0.96	– 0.32
France	Growth	– 1.08	– 0.24	– 0.36	– 1.72	– 0.88
	Effect	– 0.08	– 0.20	– 0.88	– 0.84	– 0.20
Germany	Growth	– 3.36	0.16	– 2.00	2.32	– 1.36
	Effect	– 0.24	– 0.24	– 1.52	– 1.36	– 0.52

tive sources of oil or alternative energies. Certainly, the ability of the oil industry to expand greatly its global productive capacity in the early 1980s helped cushion the impact of subsequent exogenous oil supply shocks. In 2006, it is not clear to what extent additional oil supplies will be forthcoming in response to the current high price of crude oil. The constraint is less geological than geopolitical. On the other hand, compared to the 1970s and early 1980s, there have been important technological advances (such as the introduction of alternative fuels, wind and solar technology, energy conservation and higher fuel efficiency) that should help mitigate the consequences of future exogenous oil supply shocks. On balance, it is not clear which of these effects will dominate.

The role of shifts in precautionary demand

The third and most important qualification relates to the fact that exogenous production shortfalls, while important, capture only one aspect of an oil crisis. Another potentially important channel is associated with increased or decreased fears about future oil supplies. The latter channel actually is best thought of not as an oil supply shock but rather as a shock to the demand for oil in that increased uncertainty about future oil supplies will trigger increased precautionary demand for oil. The latter effect is captured by our analysis only to the extent that precautionary demand shifts in proportion to exogenous changes in actual crude oil production. Of course, it is easy to imagine that shifts in uncertainty could arise independently of actual oil production.

Effects of shifts in precautionary demand depend on the state of the world economy

These shifts and their effect on the price of oil can be large. While there are no good measures of precautionary demand in the oil market in general, there are episodes for which we can gauge these effects using price data. A good example is the Persian Gulf War episode. The invasion of Kuwait in August 1990 created an imminent and unprecedented military threat to the Saudi oil fields, which was not reflected in Saudi oil production that continued unabated. Thus, one would expect a sharp rise in the price of crude oil on this date, driven by increased fears about future Saudi oil supplies. The military threat to the Saudi oil fields was only averted in late 1990, as the Allies had moved enough troops to the region to forestall an invasion. Since there were no other important shifts in the global demand for oil at the time and since measures of exogenous oil supply shocks do not explain the sharp swing in oil prices, we may feel reasonably certain that the observed sharp increase in the price of oil in August 1990 and its decline half a year later were indeed driven by fluctuations in precautionary demand. By that metric we can attribute a price increase of about $15/barrel to precautionary demand.

Most other episodes do not involve well-defined dates on which uncertainty suddenly increased or declined. Nevertheless, one can speculate that the increase of $5 or $6 in the price of crude oil/barrel between the summer of 2002, when the possibility of another Iraq War became more concrete, and March 2003, right before hostilities broke out, represents the "war premium" associated with shifts in precautionary demand. This also is roughly the amount by which the price of oil fell after large-scale military action in Iraq ceased in mid-2003.

Of course, these crude estimates of the importance of shifts in precautionary demand are not independent of the state of the world economy. There have been substantial shifts in uncertainty in the past such as the surges in the tanker war in the Gulf region in 1984 and 1987, when at times more than 30 oil tankers per month were damaged or sunk in the Persian Gulf by Iranian and Iraqi naval and air force attacks. Those shifts seem to have had no perceptible effect on the price of crude oil, given the slack demand for crude oil in the world at the time. Nevertheless, it is clear that in the present economic climate an Iranian crisis could conceivably trigger an unprecedented "run" on crude oil, resulting in price increases as high as those in August 1990 or even higher if buyers expect strong global demand for oil to persist. This effect is not captured by the dynamic multipliers in Table 2. The extent of such a shift in precautionary demand and its persistence will depend, for example, on the likelihood of a prolonged regional conflict that could undermine oil production or shipping, on the perceived stability of the Arab Gulf states in such a conflict, and on whether Iran threatens to use nuclear weapons on Saudi oil fields.

Conclusion

This article provided a baseline for discussing the effects of oil production shortfalls triggered by political events in OPEC countries on macroeconomic aggregates in major European countries. This baseline was based on a careful analysis of exogenous shifts in crude oil production in OPEC countries

since the 1970s. The article also outlined some additional factors that must be taken into account in assessing the likely effect of future oil supply disruptions. While considerable progress has been made in recent years in understanding the nature of exogenous oil supply shocks and their effects on macroeconomic aggregates in industrialized countries, a central message of the article is that one cannot fully understand the effects of exogenous political events in the Middle East without a better understanding of the role of precautionary demand and the impact of shifts in expectations about future oil supplies on oil prices.

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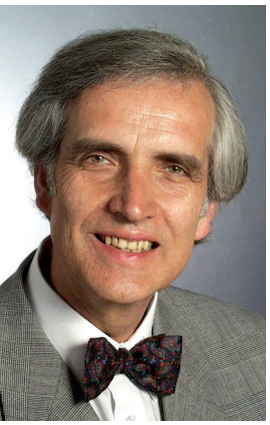

Energy efficiency – the forgotten side of supply security

Eberhard Jochem and Harald Bradke*

The energy demand of the world's countries is a derived demand, derived from people's direct needs like food, shelter, rooms with comfortable temperatures, health, mobility and communication that together with today's technology result in a demand for useful energy (e.g. heat, power, lighting). To be sure, far more than half of the world's population must make do with a standard of energy services which is lower than that necessary for humane conditions (UNDP et al. 2000, Ch. 6); in addition, about 2 billion people still have no access to electricity, not even for pumping water or to power hospital equipment. With today's technology, a humane lifestyle can be provided at around 35 GJ of primary energy per annum and capita, and those in Latin America, India or China, who have already reached that level, then pursue the goal of a western lifestyle with a present per capita primary energy demand of 165 GJ per annum in Europe.

High level of energy use – the dismantlement of supply security

In view of peaking crude oil production in the next 10 to 25 years and the change in the geopolitical line-up of the old and newly emerging superpowers – United States, China, and India – the question arises as to how much energy security will be threatened by the sheer level of energy demand in a few decades. This question is exacerbated because substitution in favour of alternative energy sources is proceeding too slowly. Hydro power, with a share of around 5 percent of world primary energy use, will hardly be able to maintain its share; nuclear power, which has a comparable share, has been marking time for two decades because of acceptance problems (Europe) or political reservations (proliferation, e.g. in North Korea and Iran; terrorism). Renewable energy sources are often more expensive than the use of fossil fuels, and their contribution to reducing air pollution and avoiding the adaptation costs caused by climate change are not taken into account by the energy markets, especially in newly industrializing economies.

Observable energy policies that – at high levels of primary energy use – put their faith in energy substitution have serious dynamic drawbacks that strangely enough are rarely addressed in discussions of supply security. The substitution of energy sources

- initially leads to natural gas and back to coal, i.e. to the rapid exploitation of seemingly more cost effective non-renewable fossil energy sources,
- then, due to the decline in crude oil production, to foreseeable rapid increases in energy prices, as this decline cannot be fully offset by coal (which can only be used in large plants at low CO_2 levels by applying carbon capture and storage technologies), the low market shares of nuclear energy, or renewable energy sources;
- finally, this strategy of energy substitution precludes the possibility of gaining time via more intensive innovations in the efficiency of materials and energy. If energy were used more efficiently over decades, then the substitution processes would progress less rapidly, and there would be more time for technological learning and economies of scale.

Succinctly put: politics has to decide (and does decide) whether (or to what extent) it wants to spend its funds on wars to secure crude oil and natural gas sources in the Near East and Africa, or on supporting the technology development of materials and energy efficiency. What are the orders of magnitude we are discussing?

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The size of the efficiency potential as a gain in security

For the next five decades, assuming that world population will increase from the present 6.3 billion to 9 billion people, an average economic growth of 2 percent per capita and year, and an improvement in energy efficiency of 0.8 percent per annum (an average value that has been observed in many countries over several decades without particular energy policy efforts and hence also called "autonomous technological progress"), then the global primary energy demand in 2055 would be two and half times today's level.

There are many analyses that show that energy efficiency could be doubled over such a period of time compared to the rate of autonomous technological progress assumed here (Jochem 2004). There is a high probability that this can even be done very profitably over several decades, even if energy prices do not continue to rise. The reason is that, in energy technology terms, industrialized countries incur very high energy losses in their use of energy at the various stages of transformation. These amount to about 25 to 30 percent in the transformation sector (all processes of transforming primary energy to final energy) with very high losses even in new thermal power plants (40 percent to 53 percent). They equal about one third when converting final energy into useful energy, with extremely high losses in the power systems of road motor vehicles (about 80 percent). At the level of useful energy, these are 30 to 35 percent with particularly large losses in buildings and industrial processes (see Table).

In exergetic terms, i.e. viewed in terms of their capability or temperature potential, the losses in the two transformation stages are even higher (on average a total of about 85 to 90 percent in an OECD country). According to this measurement criterion of the second major law of thermodynamics, the "oh so modern" industrial society is still functioning at the level of the iron age of energy history.

If it is therefore assumed that energy efficiency progress is doubled to 1.6 percent per annum, then global primary energy demand would only rise by two thirds instead of additional one and a half times by 2055. 23 years would be gained between the two conceivable developments, the maximum of crude oil production would be shifted substantially, and energy options would have time to develop and could also be supplied more cost effectively. As a consequence, energy security would be greatly increased.

Greater energy efficiency would shift out the time of maximum crude oil production

The possible efficiency gains cover a number of areas, some of which are not even addressed by energy policy even though they concern a broad range of innovations of new technologies and services:

- Substantially improved efficiency in *both stages of the transformation* of primary into final energy and final energy into useful energy, often with new technologies (e.g. co-generation of electricity and heat, fuel cell technology, substitution of burners by gas turbines, heat pumps or heat trans-

Energy services with the subsequent energy chain from useful to final and primary energy demand, Germany 2001 (exemplifying an industrialised country)

Demand for energy services					
Air conditioned rooms	Industrial products	Mobility (people and goods)	Automation, cooling, etc.	Illuminated areas	Information, communication
3.28 bill. m^2	e.g. 45 mill. tons of steel	e.g. 1070 bill. passanger-km		about 6 bill. m^2	about 20 mill. Internet connections
Useful energy required by energy services: a total of 4,715 peta joules (PJ), of which					
Space heat 2,158 PJ	Industry 1,367 PJ	Transportation 516 PJ	Electric drives 556 PJ	Lighting 16 PJ	PC, Internet 102 PJ
Final energy required by useful energy (e.g. electricity, natural gas, petrol): 9,184 PJ at today's technology and effectiveness (in % of energy transformation)					
76.5% 2,828 PJ	57.4% 2,394 PJ	19.5% 2,713 PJ	59.7% 935 PJ	8.4% 185 PJ	79% 129 PJ
Primary energy required for the production of final energy: a total of 14,590 PJ					
Crude oil and imported products 5,577 PJ	Natural gas 3,124 PJ	Black coal and brown coal 3,558 PJ	Nuclear energy 1,873 PJ	Hydo and wind power 111 PJ	others 346 PJ

Source: Federal Ministry for Economics and Labour, Energy data 2003, Berlin; Federal Statistical Office, Federal Ministry for Transportation, BMW, authors' calculations.

formers, sterling motors, or tri-generation of electricity, heat and cooling).

- A considerably reduced demand for useful energy per energy service (e.g. passive solar or low energy buildings, substitution of high-temperature thermal production processes by physical-chemical or biotechnology based processes, lighter design of movable parts and vehicles, recovery of motive energy using power electrics).
- Increased recycling and reuse of energy intensive materials as well as increased material efficiency through improved construction or material characteristics with the effect of substantially reducing the demand for primary energy per material service.
- More intensive use of durable capital and consumer goods through the leasing of machinery and equipment (e.g. in the construction sector), car-sharing and other product-related services. The intensification of use is in the order of a factor of three to six.
- The spatial configuration of new industrial and other settlement areas according to energy considerations as well as a better mix of settlement functions of housing, production, trade and leisure activities in order to prevent motorised mobility. This should be possible where the service sector dominates (two thirds of GDP in OECD-countries are generated by services) and where industrial production is almost non-polluting.

There are numerous areas of efficiency gains whose cost would be negative over two decades

The costs of additional efficiency potentials would tend to be negative in the coming two decades, i.e. there would actually be gains, as substantial, profitable hidden potentials would be realised. This is refuted by many people though, strangely enough, rarely by the consulting engineers who inspect plants and buildings. For example, over the past four years, the authors have observed 20 companies of various sizes and industries that have systematically exchanged positive experiences on energy efficiency in a regional learning network. On average, they have managed to improve their energy efficiency by 7 percent within four years and their specific CO_2 emissions by more than 10 percent at a net profit of 10 to 20 € per avoided ton of CO_2.

Reasons for neglecting and repressing efficiency potentials

The existence of such hidden yet profitable energy efficiency potentials is denied time and again by representatives of business associations, but has been proven by consulting engineers. When internal CO_2-certificate trading began, even large, energy-intensive companies like BP discovered efficiency potentials of more than 3 percent per annum over four years. There are numerous reasons for these missed opportunities (Jochem 2003):

- There are thousands of technologies and millions of decision-makers in households, companies, and offices involved in making investment decisions, dealing quickly with disruptions due to failed machinery and operating all kinds of machines, vehicles, heaters and energy-powered equipment. The diversity also encompasses technological aspects across the entire capital stock of an economy, decisions regarding new or replacement investments at the various technological levels of energy transformation and use, and decisions about material efficiency and material substitution. These also include the behavioural decisions with respect to the day-to-day operation made by almost all the members of a society. This diversity is perhaps the major reason why efficient energy and material use is neither attractive to the media nor conducive to a "natural" clear formation of interests. On the contrary, there are sufficient conflicts of interests between the producers of technology, planners, architects, building owners, leasing companies, primary contractors and energy suppliers.
- Technology producers could install highly efficient motors in their equipment, but customers usually only look at investment costs, not at life-cycle costs when making purchasing decisions. The same is true of tradesmen submitting proposals for highly efficient boiler plants, window systems or heat insulation.
- Investors decide – despite the long lifetimes of most energy transformers – according to the risk criterion of the payback period (e.g. up to three years) and thus ignore highly profitable investments with internal rates of return of up to 25 percent. Many households and small firms make their decisions based purely on investment costs without ever considering a life-cycle analysis.
- Planners and architects are paid according to standards that do not include knowledge about or the planning time needed for energy-efficient construction. The principal or the building owner must explicitly request this, usually without being able to assess the effects.

- Energy suppliers, too, want to make a sale. A more efficient solution is often not mentioned and customers' attention is drawn to a second-best solution instead; customers tend to be satisfied with this as they have no knowledge of the best solution themselves.
- Adverse effects on international competition is often put forward as an argument against internalising the external effects of energy use. However, this argument only applies to a fraction of energy-intensive industries (in the order of a few percent of a country's value added) and confuses the discussion of internalising external costs when using fossil energy sources.

To summarise: in a society with little consciousness of the issues of sustainability and resource conservation, not only the multitude of possible energy efficiency solutions, but also simply wrong decisions on the part of businesses due to industry traditions or conflicts of use, preferences, status decisions and lack of day-to-day market insights result in the opportunities for efficient energy use not being recognized or practically acted upon. This is also true of newly industrialising and developing countries that in their (understandable) quest for economic development tend to adopt the decision patterns of industrialised countries and possibly also their discarded technologies as second-hand purchases. These countries then follow poor building standards because of a lack of available capital that result in high heating costs in the winter and a high demand for air conditioning in the summer (Janischweski et al. 2003).

Conclusions and outlook on improved energy security via energy efficiency

Depending on energy use and energy source, object-related efficiency potentials range from a few percentage points (e.g. in very energy-intensive processes of the basic materials industries) up to 80 to 90 percent (e.g. in passive housing standards, modern lighting, switching to membrane technology in thermal separation processes). Overall, the rise in worldwide energy demand could be halved within 50 years. This would extend the production maximum of crude oil by one to two decades, reduce the costs of using renewable energy sources due to the lower energy demand per service and initiate a substantially broader innovation wave in all areas of business and society than if energy policy were concentrated solely on the supply of energy via substitution processes.

The multitude of efficiency potentials and obstacles results in a comparable number of instruments and measures. At first glance, this may seem an unmanageable task, causing politics to focus once again on energy supply and substitution possibilities. But this course of action surrenders several degrees of supply security and also the chance to steer development from the start in the direction of sustainable energy use. Energy and material efficiency transform the entire capital stock of an economy, not just the sector of energy suppliers with all its increasing risks to supply security. The security of supply objective of energy policy is not likely to be reached by military interventions or market theories, but by a highly efficient use of energy and materials on the part of a system relying on renewable energies to a large extent and offering a large portfolio of energy supply options.

Energy efficiency potentials are not utilised for short-term cost reasons

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Resources and energy security

Cho Khong*

Energy security is a topic that has attracted a flood of interest and responses, some alarmist in tone, others seemingly more measured. What are the factors that have come together to produce this heightened awareness of energy concerns? And standing at today's energy crossroads, which path will we take as we move into the 21st century? The issues around energy security, energy supply and geopolitics are complex. To understand them, we need to understand how oil and gas markets have moved, and the factors which have shaped this movement. And here the oil price provides a simple point of entry.

Supply, demand and price

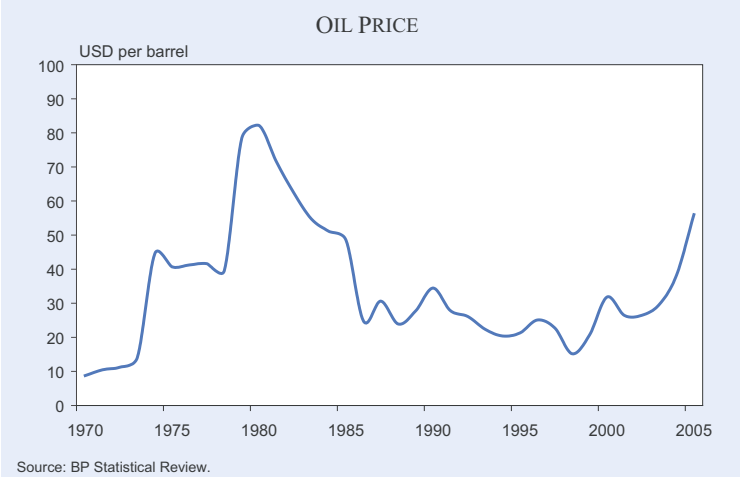
The world oil market is a very different thing today from what it was just a decade ago. The strength of global demand for oil has surprised everyone, including all the market analysts. At the same time, it became clear for a variety of reasons, that there is insufficient investment in additional production capacity. The oil price, reflecting surging demand and low supply growth, has turned sharply upwards, though in real price terms, we are still somewhat below the oil price peak reached in 1980 (see Figure 1). The oil price is high, though not at its highest point in real terms. But while the oil crisis of 1979-80 was clearly supply-driven, resulting from the change of regime in Iran and the Iran-Iraq war that followed, as was the oil crisis of 1973-74, resulting from a deliberate cut in OPEC production, there is no single explanation for today's rising oil price.

There is still plenty of spare capacity but concentrated in too few countries

On the one hand, it has finally sunk in that it has become increasingly difficult to locate additional large deposits of oil, shattering the complacency of consumers and consumer country governments alike. The new non-OPEC areas developed since 1980 have reached the limits of their productive capacity, there are few new frontier areas left to explore (most of these, such as the deep offshore, are highly technology and capital-intensive, or else, like Alaska, are geologically complex and have environmental and local sustainability implications), and the major part of resources are in the hands of national oil companies, only prepared to develop their reserves on their own terms and according to their own timetable. As a result, the major international oil companies are finding the search for oil increasingly uneconomical.

The paradox is that there is still plenty of spare capacity. But only two countries share the bulk of that spare capacity, Saudi Arabia, largely, and also the United Arab Emirates. This concentration of conventional oil reserves is the fundamental factor underlying concern over international oil security, with the Middle East dominating oil exports today and set to increase its dominance over the next twenty years.

Figure 1



Source: BP Statistical Review.

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Middle Eastern oil exports have indeed risen substantially since 2002, and Saudi Arabia is committed to increasing investment to help meet rising oil demand. Yet there is uncertainty over how far Saudi Arabia will be able to increase output, given the lack of information on its reserves. And there is uncertainty over how much additional money it will be prepared to spend on the world's behalf to develop the spare capacity that they have. Pierre Wack, the founder of the Shell scenario team in the early 1970s and who predicted the oil price shocks of that decade, once warned not to project one's beliefs and expectations onto others. To expect others to do what is in your interests and expectations would be, as Wack put it, an extremely unlikely miracle.[1]

The oil crises of 1973-74 and of 1979-80 led to worldwide recession and inflation. But today's crisis (with an appreciably lower real oil price compared to the 1980 peak) is associated with rising global GDP, modest inflation and a booming world economy. Perceptions have changed. Saudi Arabia still wants stable oil prices, but they now associate a much higher oil price level with stability and global economic growth, and they look to that higher oil price to deliver them the revenue that they need. From the vantage point of today, the rationale of low oil prices appears to have been undermined.

Then add in political risk. Thomas Friedman has argued that the price of oil is inversely related to domestic political stability in major oil producing countries.[2] Friedman points to a relationship which is strongly correlated, though (in my view) by no means inevitable. Nevertheless, what is of concern to the markets is the political unpredictability and potential instability of many of the major oil producers, marked by "predatory" regimes, problems of political legitimacy and of increased political risk.

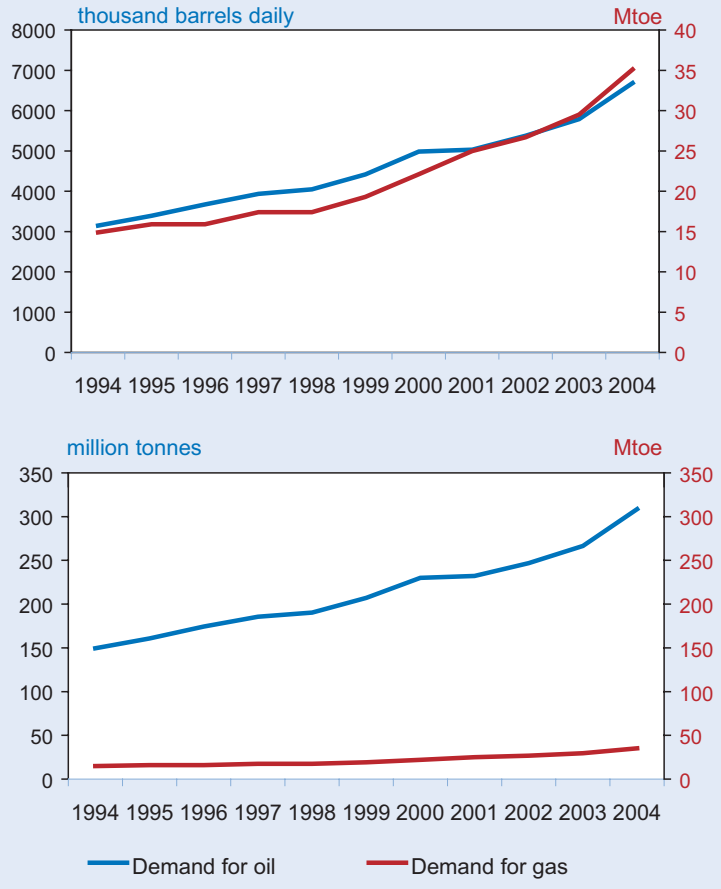
But if the system is constrained and uncertain on the supply side, there are even larger pressures on the demand side. Oil consumption has been driven by robust economic growth in China, India, a recovering Japan, the US, Europe, and even Africa over 2000 to 2004, which was unprecedented.

The single most important headline factor, though, particularly in looking at incremental oil demand growth, was China. While people expected energy demand to rise in China's growing export-oriented and increasingly market-focused economy, it was the size of the leap in China's oil and gas demand, particularly since 2003, that surprised the oil markets, turning out to be much stronger than anticipated (see Figure 2). Meanwhile, US oil demand, fuelled by a potent mix of declining real petrol prices and rising standards of living (which meant Americans spend-

Demand growth has come mainly from China

Figure 2

CHINESE OIL AND GAS DEMAND 1994–2004



Source: Shell International.

[1] Pierre Wack (1986), "The Gentle Art of Re-perceiving", Shell International Petroleum Company Limited, Group Planning, March, reprinted from *Harvard Business Review*, September/October 1985 and November/December 1985.
[2] Thomas L. Friedman (2006), "The First Law of Petropolitics", *Foreign Policy*, May/June, 28–36.

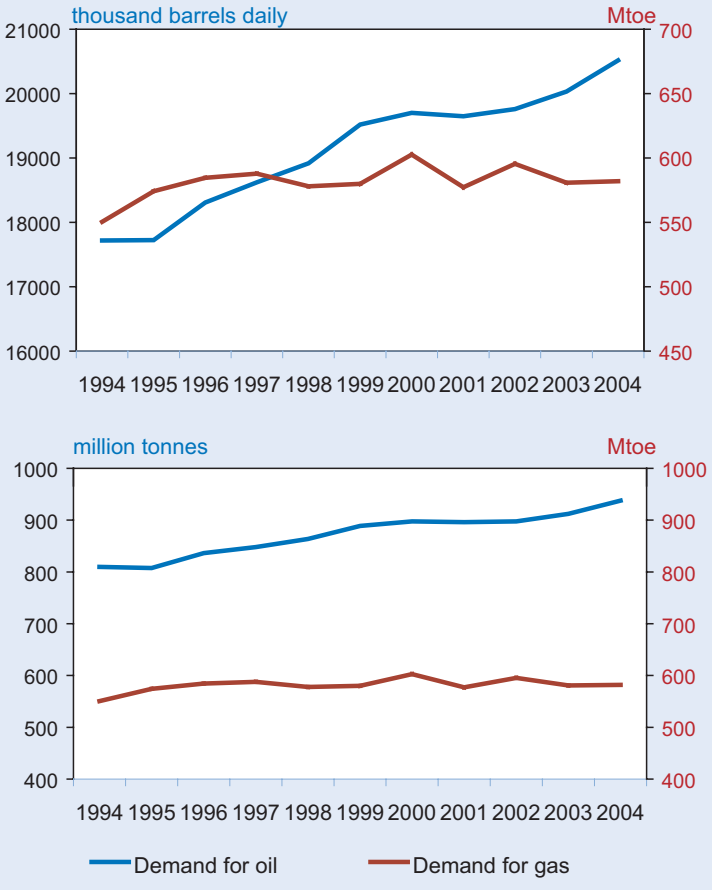
ing an increasingly smaller percentage of their rising incomes on energy), was not standing still either (see Figure 3). Indeed, US demand has proved fairly inelastic as oil prices have risen over the last few years, and US demand probably accounted for a larger share of the rise in oil prices in 2005 than any other consuming country. The other point to note is that the squeeze in oil markets has been matched by large price increases for iron ore, steel, copper, soy beans and a host of other commodities, all attributable to the demands of a booming global economy and in particular to Chinese consumption.

Put supply and demand together, and increasingly analysts are coming to the view that the price rise that we see today is structural, not cyclical, even if (as some expect) there may be some price moderation over the near term future. The issue is reliability and predictability at reasonable cost, and if neither can be expected, then we are in what some have called a new age of energy insecurity.[3]

For China, the bulk of oil imports come from distant regions

Figure 3

US OIL AND GAS DEMAND 1994–2004



Source: Shell International.

Distance and diversity

What are the principal parameters within which consuming governments have to analyse their energy security and to formulate a response in this new age? One key parameter is distance between their sources of energy supply and the main geographic consuming areas. Thus for China, which became a net oil importer in 1993 and whose oil import dependency now stands at around 50 percent of consumption and rapidly rising, more than half of its oil imports come from the Middle East, in particular the Persian Gulf, with Africa as its second largest supplier. And Chinese dependence on the Middle East is set to increase. This is a pattern of oil imports which is highly concentrated and in which the bulk of imports come from regions distant from China's main energy consuming regions on the Asia-Pacific seaboard, both reinforcing potential insecurity of supply. Indeed for China, there are only limited contiguous sources of supply. This maxim of distance between supply and demand also holds with China's domestic energy supply, as its domestic energy resources are also generally located far from its main consuming regions. This configuration of resources located at a distance from consumption, which applies to East Asia in general, including Japan and South Korea, and is distinctive in comparison with North America or Europe, the two other major oil consuming regions.

The same consideration of distance holds for East Asian gas supply as well. North America and Europe have well-developed regional grids for piped natural gas. North-East Asia has no such grid, relying instead on LNG, largely from the Persian Gulf, though also from Indonesia and Australia's North-West Shelf, for the bulk of its gas supplies. How a regional gas grid for East Asia might develop, what lines will be built first and who will control

[3] J. Robinson West (2005), *The Age of Energy Insecurity*, testimony to the Senate Committee on Commerce, Science and Transportation, September 21, Washington DC: PFC Energy, 2005.

access, are all key questions for regional governments which will shape their future relationships.

The other key parameter is concentration, or rather its opposite, diversity of energy supply. A fundamental principle of energy security is to spread your bets by diversifying your sources of supply. There is an increasing recognition by governments that diversification, through access to a range of supplies in order to reduce your vulnerability to any one of them, is key to their energy security.

Diversification has been a driver for the U.S. seeking to develop energy imports from West Africa and other regions outside of the Middle East. By 2015, the US National Intelligence Council expects Africa's share of US oil imports to climb from 16 to 25 percent, close to the proportion currently coming from the Middle East. Diversification has also been a driver of EU concerns to integrate energy security into a common foreign policy position, triggered by increasing European dependence on gas as part of its energy consumption and on reliance on Russia for gas supplies. This push to diversify gas imports was highlighted by Russia's miscalculation on gas supplies to Ukraine in December 2005 with its ramifications for onward gas supply to Western Europe, and is leading to renewed pressure to develop alternative pipeline routes from Central Asia and the Caspian, which bypass Russia.

The new great game

This brings us to the geopolitical power play of the new Great Game that has been developing. Growing concern by governments over energy security has revived traditional realist power dynamics in international relations. Oil and gas are critical imperatives, shaping the strategic concerns of states, with energy as central to national interests. Geopolitics, with its focus on spatial configurations of power, is key to this understanding. And the most influential proponent of this doctrine of geopolitics was Sir Halford Mackinder.[4] A principal reason why his ideas are being resurrected today is because of the growing concern by governments to position themselves and their interests in the heart of Mackinder's heartland thesis, Central Asia and the Caspian.

This region has the potential to become a major source of great power contention in this century. It has significant, if not over-large, hydrocarbon reserves of its own, and is surrounded by a number of major energy producers, Russia, Saudi Arabia, Iran and Iraq. Yet regional states are small and often insecure, creating an apparent power vacuum, sucking in the interests of powerful states from outside of the region. Russia seeks to maintain its hold over oil and gas exports from the region. Western Europe, as noted, is keen to develop alternative pipeline routes from the region through Turkey. And China has its own interests in seeking that some proportion of regional hydrocarbon exports go eastwards to China.

Behind the geopolitical concerns over Central Asia and the Caspian, there is a larger power play at work. China is very insecure over the Straits of Malacca, through which 80 percent of its oil imports passes, a figure which is set to rise as China becomes increasingly dependent on energy imports from the Middle East and West Africa. While the U.S. sees China as a potential emerging threat, China sees the U.S. as a potential existing threat to its energy security, because of its influence in oil producing regions like the Persian Gulf and because of its ability to block seaborne energy supplies through its naval forces and control of the high seas. Over the next few decades, this may lead China to develop a blue water naval capability and air reach that can secure sea lanes essential for its energy security. The value of doing so is debatable, however, given the cost; and such actions would also ratchet up the possibilities for confrontation with the U.S. and with Japan.

Central Asia and the Caspian may become the region for the great geopolitical power play

Meanwhile for today and in the foreseeable future, China will be looking for strategies that could effectively bypass the Straits of Malacca. Overland transport of energy supplies from Central Asia would therefore be worth a premium to China. And the agreement between Saudi Arabia to build, own and operate a strategic petroleum reserve in China helps ease both Saudi concerns that its oil exports might be cut off and Chinese concerns that its oil imports might be blocked. Storing oil forward in the market where it is to be consumed is therefore one strategy to be considered when seeking to overcome the parameter of distance in enhancing energy security.

There are also new areas, which cannot possibly have been imagined by Mackinder, where geopolitical

[4] Sir Halford Mackinder (1962), *Democratic Ideals and Reality*, New York: W. W. Norton [original publication 1919].

anxieties may in future come to weigh significantly on the strategic energy concerns of governments. The US current account deficit, for instance, had previously largely been funded by those countries exporting manufactured goods to the U.S.: Germany, Japan and China; with the last-named, rather than excessive domestic consumption, attracting most attention and blame by US popular opinion for the deficit. Rising energy prices meant, however, that the basis on which the US deficit is funded changed by summer 2005, when the major energy exporting countries to the U.S. started to fund a greater part of its current account imbalance than Germany, Japan and China. The question that arises is what will these energy exporters do with the petrodollars that they earn? Are the concerns, both political and economic, of energy exporting countries different from those of the manufactured goods exporters?

What we see, since the 9/11 terrorist attacks, is a concern by Middle Eastern governments to diversify their investments away from the U.S. This shift in attitude has been encouraged by US concerns in its "war on terror" to avoid over-dependence on Middle Eastern investments, hence the debacle over the failure of the investment attempt by Dubai Ports World to take over cargo management functions in certain US ports. It is unlikely that Middle Eastern governments see other regions for their investments as anything more than alternatives to balance over-dependence on the U.S., at least for the foreseeable future. What happens over the long term, however, is more uncertain.

Is the relinking of global economic growth and growth of energy demand temporary?

Looking ahead

The long term holds a number of imponderables that may upset the calculations and expectations on energy security that key players in the energy game hold today. In its 2005 global scenarios, Shell identified three energy discontinuities that cut across all the scenarios that it set out for the long term future.[5] Two of these relate directly to energy security; the third has an apparently indirect connection today, but becomes even more relevant to energy security over the long term.

The first discontinuity is an apparent relinking of global economic growth and growth in energy consumption, reversing the delinking between energy growth and GDP growth from the mid-1960s to 2000 as economic growth became less energy-intensive. The energy intensity of growth has increased over the last five years, which may be a hump created by the large developing countries as they move through an energy-intensive phase of their development, with the growth of their manufacturing industry and of infrastructural investment. Which growth path will these large developing countries follow and will they eventually start to reduce the energy intensity of their growth?

The new Chinese leadership appears determined to limit China's dependence on oil imports over the long term, through achieving a more balanced mix of energy sources and addressing the demand side of the equation, by improving energy efficiency and limiting oil consumption, as far as possible, to the transportation sector. If China's new energy policy succeeds, and if other developing countries follow the Chinese path, this would moderate demand pressures rather than continue to see them increase exponentially. Indeed, it may well be argued that the Chinese model of development is simply not sustainable in energy terms and we cannot assume exponentially rising demand for and consumption of hydrocarbon energy. Also, the possibility of a sea-change in the way the U.S. and Western Europe use fuel, particularly in transporting goods over long distances, cannot be discounted, and could result in significant savings in oil consumption.

The second discontinuity is tied to the concept of "peak oil", a controversial concept in itself, which does not mean oil running out. But it could mean hydrocarbon energy production starting to decline, rather than continuing to rise, if investments in both conventional and unconventional hydrocarbon resources are not made in time to offset the decline in existing known conventional oil and gas resources. The issue is not so much a reserves issue, as an issue of access to resources and investment in their development. The international oil companies are having to move to invest in more difficult production areas, such as the deep offshore, as easier areas are kept off-limits by major oil producing governments. This push into more difficult areas raises the cost of supply for conventional resources, putting an upward cost pressure on prices and driving up concerns over energy security. Developing unconventional resources could help ease that pressure, but this will require major investment in their development and the technology has still to be perfected. Should

[5] *Shell Global Scenarios to 2025: the Future Business Environment: Trends, Trade-offs and Choices,* London: Shell International Limited, 2005.

unconventional hydrocarbon reserves become significant, the energy map will change dramatically, focusing attention on where unconventional reserves are located and raising a whole new set of geopolitical uncertainties.

The third discontinuity is over climate change, which the scenarios assert will fundamentally change the policy mind-set of governments and peoples over the next 20 years. There will have to be a drastic change in our consumption of hydrocarbon resources if we are to keep atmospheric carbon dioxide below a level deemed potentially dangerous for climate change. If we accept this understanding on the dangers of environmental stress and global warming, the squeeze that we see today on energy supply, driving concerns over energy security and an emerging energy crunch, could come not because we cannot develop the oil and gas reserves, both conventional and unconventional, but for another reason, the fear of global warming. It is this fear that is driving development of renewable energy and of nuclear power, but both renewables and nuclear carry their own set of problems. For renewables, intermittency and conversion into liquid fuels pose major challenges, with transport as the hardest problem to solve. Large scale biofuels raise all sorts of issues around competition with food production and water use. And nuclear power has long planning lead times and unclear cost structures.

We should, of course, expect improvements in technology over the long term. But energy saving technology takes time to develop, there is a lot of inertia in energy systems, and the benefits of new technology will be slow to take effect.

Energy security – how to achieve it?

We have looked at the key parameters shaping concerns over energy security today, and we have seen how uncertain these parameters are when we look ahead into the future. How then may energy security be achieved?

One basic way to deliver energy security is through open markets and free trade, using an incentives-based approach to let competition and markets deliver energy supply. In theory, this approach would have the highest economic efficiency. And oil, and also gas at least in its liquefied form, is a fungible commodity with a standard global price. The problem with markets, though, is that they require everyone, including the major resource holders, to play by the same rules and they will lead to concentration, determined by cost, rather than diversity of supply.

Second, energy security can be achieved through diversifying supply sources and establishing interconnected delivery frameworks. Governments need to be pro-active in pushing energy security policies, taking a longer-term view than the markets and building up diversity of supply and a measure of spare capacity. Governments, however, will need to work wherever possible within a market framework and to keep their actions competitive, rather than conflicting with each other.

Third, energy security may be sought through establishing bilateral long-term contracts between producer and consumer, with point-to-point connections and government-to-government deals to secure supplies. This would be a very dirigiste approach, with strong government control directing the actions of national and international oil companies, requiring close political alignment.

Energy security may be achieved by free markets and diversified supply sources as well as bilateral long-term contracts

In practice, countries will use a mix of either the first and second, or the second and third approaches. Governments will be a key driver to achieve energy security in either mix of approaches.

The conclusion inescapably emerges that energy security and responding to resource pressures is, at the end of the day, a global issue which needs to be tackled through a long-term approach. Markets will need to work together with government support and direction. Diversity is key to delivering security, but we need not just diversity of supply, but also diversity of technologies, including the technology required for the development of non-hydrocarbon energy sources, and diversity of delivery systems. Here, concerns over resource pressures come together with concerns over sustainable growth; they are two sides of the same coin. Large-scale investments will be required to break the current log-jam on energy security, and long-term stable investment frameworks are needed to deliver those investments in order to tackle today's growing concerns over energy security.

What sorts of rich-country jobs (and how many) are at risk to globalization?

For now, middle-skilled jobs are the most vulnerable

Frank Levy and
Richard J. Murnane*

For a job to be offshored, it must have two characteristics:

- The job can be done anywhere.
- Relevant information can be exchanged between the client and offshore producer without big misunderstandings.

The first characteristic insures that industrialized countries will retain a variety of "low-skilled" service jobs that must be done on-site: janitors, security guards, restaurant helpers, nursing home attendants. These jobs, which are growing in number, are described as low-skilled and pay low wages because many people can do them.

The second characteristic – no misunderstandings – will help to send many middle-skilled jobs offshore. To see why, begin with the fact that information is inherently ambiguous. We resolve the ambiguity by applying the context of experience. When people have different experiences, an exchange of new information can create misunderstandings and work can go awry. I send an email requesting you to draw a stylish four-door sedan. We will have the same understanding of "four door sedan" but your understanding of "stylish" can be very different than mine. We may need face-to-face conversation to reach a common understanding.

In certain repetitive jobs – most of them middle-skilled – misunderstandings are overcome by describing the job in step-by-step rules that everyone learns. Rules provide an adequate description of the work because the employee performs exactly the same operations on every shoe or credit card statement.

If a job can be expressed in rules, it is a good candidate for offshoring because the rules can be explained to someone 9,000 miles away with minimal misunderstanding. The rules also make the job a good candidate to be programmed on a computer and there are many examples of this computer-offshoring overlap. Call center work that moves offshore is heavily scripted – "rule-like" – while other call center work is lost to speech recognition software. Assembly line jobs are lost to offshore manufacturers and to robots. Preparing basic tax returns is lost to offshore accountants and to software like *TurboTax* and *TaxCut*. These rules-based jobs – most of them middle-skilled – are in greatest danger of moving offshore, if they aren't computerized first.

In higher skilled jobs, rules are no longer possible because work is no longer uniform. Each piece of work may require new procedures, and monitoring the quality of the offshore producer becomes difficult. Manufactured shirts are expected to be uniform and a manufacturer's quality can be established by sampling a few shirts. But how do we establish a radiologist's quality when each medical image is potentially different? What about the quality of an architect or an attorney?

Because of these communication problems, most of the higher skilled jobs that have moved offshore are technical jobs in programming, engineering, financial analysis, etc. – jobs that combine a need for some expert judgment with a heavy component of rules and standardized procedures that allow people at both ends of the transaction to understand each other.

Over time, firms may find a way around this communication problem – enhanced telecommunications, rotating offshore producers through domestic sites to create shared experience. But in the near term, it is rules-based middle-skilled jobs that occupy the most tenuous positions.

[1] Levy and Murnane are professors at Massachusetts Institute of Technology and Harvard University, respectively. They are the authors of The New Division of Labor: How Computers are Creating the Next Job Market (Princeton University Press, paperback edition 2005). A summary of the books arguments is contained in the working paper, "How Computerized Work and Globalization Shape Human Skill Demands" which can be downloaded from web.mit.edu/flevy/www.

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ACTIVITIES THAT DO NOT REQUIRE PHYSICAL CONTACT OR GEOGRAPHICAL PROXIMITY ARE MOST AT RISK

ALAN S. BLINDER*

I beg to differ, though only modestly, with the Levy-Murnane view that the (mutually reinforcing) combination of globalization and computerization threatens jobs that can be routinized, but not jobs that involve what they call expert thinking and complex communication. To understand the similarities and differences, picture a Venn diagram with two overlapping circles.

Circle C (for *computerization*) encompasses all the jobs that computers either can do now or will be able to do in the future. As Levy and Murnane emphasize, these are largely routine (or routinizable) tasks, whether physical or mental – like assembly line work or rudimentary call center tasks where humans can be replaced by voice recognition systems. The upward march of technology virtually dictates that Circle C will expand year after year.

Circle O (for *offshoring*) encompasses all the jobs that can be done offshore – meaning in a country other than the one in which the good or service is sold – either now or in the future. This set includes the vast majority of manufacturing jobs, even those that involve highly complex thinking and communication, *plus* jobs in *impersonal services* – which I define as services that can be delivered across long distance with little or no diminution in quality. Some obvious examples are call centers and Internet retailing. Improvements in technology *and* the entrance of many developing countries (e.g., India and China) into the modern world virtually guarantee that Circle C will also expand over time.

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Levy and Murnane have focused our attention on Circle C; I am trying to call attention to Circle O.

Now, my main point is that these two circles are far from identical. There are jobs that can be computerized but cannot be transferred offshore (e.g., replacing parking lot attendants by machines), and there are jobs that can be done offshore but not computerized (e.g., security analysis and writing legal briefs). That is why I beg to differ with Professors Levy and Murnane.

But my second point is that the two circles do overlap considerably. Any activity that is routinizable *and does not require physical contact and/or geographic proximity* is presumably a candidate for offshoring. It is thus in both Circle C and Circle O. And there are a lot of such jobs, which is why I beg to differ only modestly.

Let's explore the differences briefly, relating them to the question at hand: the link between skills and wages. To begin, Levy and Murnane are almost certainly right that wages will be under pressure in routinizable jobs in which workers can be replaced by computers. Jobs that involve higher-order thinking, judgment, and communication skills are relatively immune from the competition of machines. Hence the view that better-skilled workers will fare better in the job market of the future makes sense, *other things equal.*

But other things will *not* be equal. Let's think now about the jobs that can be offshored but cannot be computerized. Because of advances in telecommunications and the Internet, plus the large number of well-educated, English-speaking people in India and elsewhere, more and more high-skill jobs that require expert thinking and/or complex communication (but not physical presence) will be deliverable remotely in the future. That includes many high-wage jobs that may never be routinized and performed by computers – such as preparing tax returns and writing software. People who perform these tasks in rich countries will find themselves competing with equally-qualified – and numerous – workers in poor countries. At the same time, holders of many low-wage jobs in rich

countries (such as child care and janitorial services) are immune to foreign competition because what they do requires personal delivery.

This analysis suggests that, in the rich countries, relative wages will *fall* in the impersonally-delivered services and rise in the personally-delivered services – once again, *other things equal.* The important point here is that the personal/impersonal distinction seems largely uncorrelated with the more familiar skilled/unskilled distinction. Just think of cab drivers and surgeons (both personal services) on the one hand versus call center operators and security analysts (both impersonal services) on the other.

Levy and Murnane are not wrong; they are right. If your job can be performed by a computer, your future job market prospects are in peril. But there is also a whole class of jobs – and a big class at that – for which job market competition comes not from computers but from educated workers in poor countries, whose services can be delivered electronically to any market in the world.

On the fringe of Europe: Iceland's currency dilemma

Tryggvi Herbertsson* and Gylfi Zoega**

Introduction

The United Kingdom approached its negotiations with the European Union (EU) in the 1960s and 1970s with some hesitation similar to what we witness today around the euro. There were those claiming that EU membership was essential for trade and prosperity while opposing voices insisted that it would impinge on political and economic sovereignty. The attitudes revealed by the groups opposed to further integration could be characterized as an "island mentality" in that the proponents have a strong urge to maintain the identity of the nation and its independence in most spheres, yet are afraid of being left out and excluded by their neighbours.

The island mentality is if anything stronger in Iceland where the same issues are currently being debated. The arguments proposed for and against joining the EU and adopting the euro mirror those raised in the UK but the debate is even more interesting because the choices faced are starker. Iceland has only 300 thousand inhabitants, which is roughly the population of the London suburbs of Ealing (305.019) and Camden (210.661) or the German cities of Bonn (302.200) and Karlsruhe (276.600). Iceland is to a greater extent than the UK dependent on trade, its labour market is even less integrated with continental Europe and its economic shocks are more asymmetric. A rather half-baked solution was concocted fourteen years ago when Iceland joined the *European Economic Area* – negotiated between the EU and seven EFTA states in 1992 – guaranteeing the freedom of movement of goods, services, labour and capital within the areas.[1,2]

In this article we will not discuss the costs and benefits of EU membership for Iceland. Instead, we focus on the choice of an optimal currency regime, which we find interesting due to the very small size of Iceland's economy and the fact that the health of the tiny Icelandic krona has recently started to play a role in world financial markets: the recent depreciation of the krona scared investors (the carry traders) out of many emerging market economies causing a contagion and depreciation of currencies in places such as Hungary, New Zealand, Turkey, and Latin America. Following a brief monetary history of Iceland, we first describe Iceland in light of the optimal currency area literature and then move on to what we find the more interesting aspects of this question relevant to microstates such as Iceland. These involve small government bureaucracy, imperfect competition in the service sector, monetary policy and international capital flows, banking supervision, and the risk premium. We conclude with a summary and comments about Iceland's future monetary arrangements.

Iceland's monetary history abridged

Iceland was settled in the 9th and 10th centuries and after early exploitation of its natural wealth (mainly forests) it remained poor for over a thousand years. The nation preserved in its memory vivid descriptions of the old Viking society – interesting for its lack of a formal state – its heroes and battles captured in the Sagas.[3] But its economy never took off, not until the end of the 19th century. In spite of a rather lively period of trade in the 16th century, technology remained stagnant, population did not grow and living standards did not improve, providing a good example of Malthusian population dynamics.

The use of money was limited during the thousand years of economic stagnation, to say the least. Barter was the rule.[4] The basic unit of account was wool. A certain quantity of wool ("alin") was used as a unit

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[1] The EFTA countries took on board Community legislation on consumer protection, the environment, and company law.

[2] Subsequently, three of the EFTA countries joined the EU and Switzerland decided in a referendum not to participate in the economic area. Currently, only Iceland, Liechtenstein and Norway belong to the free trade area without a formal membership of the EU.

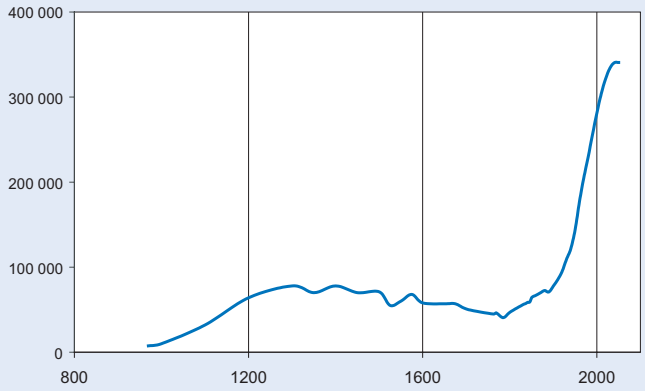
[3] Icelandic early (pre-independence) history can roughly be divided into four periods. First, there is the era of settlement (874 to 930) by Norwegian Vikings and their Irish slaves, which is followed by the Commonwealth (930 to 1262). In 1262 social unrest and resource constraints forced the Icelanders under the King of Norway and the country remained under his control until 1397. In 1397 the third period started when Iceland followed Norway into the so-called Kalmar Alliance formed by Denmark, Norway, and Sweden, and dominated by the first. This sets in a prolonged period of Danish influence. When that alliance was resolved in 1448, Iceland remained an integral part of Denmark until the establishment of home rule in 1904, autonomy in 1918, and full independence in 1944.

[4] See Júlíusson et al. (1992).

of account and its value pegged to silver. Silver served as a store of value but neither silver nor wool was much used in transactions. The value of land was measured in another unit – called a "hundred" – and its value fixed in terms of wool. Prior to 1873, the only money used had been Danish notes, first issued in 1713, but the Icelanders were not keen on those because they were difficult to store and the main function of money was as a store of value.

Figure 1

POPULATION IN ICELAND, 970–2050



Source: Steffensen (1975): 874–1702; Statistic Iceland (1997):1703–1995; United Nations Population Division's median variant population projections: 1996–2050.

This all sounds rather complicated, which it was, and there were serious economic consequences. First, trade was limited due to the lack of a medium of exchange. Second, price ratios were fixed for many centuries and did not respond to market forces.[5] Third, there was a profound lack of liquidity – which further hampered trade – and capital was limited, which made investment very difficult. The consequences for the standard of living on the island were dramatic. No data are available for GDP up to 1870, but there is evidence that suggests that the standard of living was considerably higher at the end of the settlement period than at the beginning of the 19th century. In effect the "take-off" of the Icelandic economy did not occur until the middle-to-late 19th century.[6]

Population growth in Iceland was dependent on the forces of nature until the economic take-off at the beginning of the 19th century. Earthquakes, volcanic eruptions, drift ice from the arctic, glacier bursts, harsh weather and epidemics affected population growth profoundly. During the early settlements the climate had been relatively warm and the cultivation of a variety of crops possible. The climate became harsher when temperatures declined resulting in what is sometimes referred to as "the little ice-age" from the end of the 11th century until the end of the 19th century. As a consequence, drift ice became more common, which then made the climate even more difficult to cope with.[7] It is estimated that there were approximately 32,000 inhabitants in Iceland at the end of the settlement period, 78,000 in the early 13th century but, due to various reasons described above, the population fell to almost 40 thousand people towards the end of the 17th century.[8] Figure 1 plots the population from the time of settlement to the forecasted value in 2050.[9]

Improvements in the country's monetary system played an important role in the take-off of the economy in the late 19th and early 20th century. Denmark introduced its krona as official currency in 1873 and in the same year the krona was introduced in Iceland as official currency. Around the same time foreign money started to come to the island; the British paid for horses and sheep with gold coins; Norwegians caught herring and whales and paid workers in money; and around the turn of the century a few shops started to accept money in exchange for goods. In spite of this, the financial system remained underdeveloped for a very long time, in fact until quite recently. The first bank was founded in the late 19th century. A private bank – Islandsbanki – was founded in 1904 and given the permission to issue money. This right was taken away from it in 1927 and given to a state-owned commercial bank that also had a note-issuing department, the exclusive right then finally granted a domestic central bank in 1961. The central bank was effectively under the control of the government

[5] Unfortunately, the relative price of fish in terms of agricultural commodities was artificially low so that the country did not take full advantage of its comparative advantage.
[6] This is based on the fact that conditions for farming deteriorated after 1300. These harsher conditions, among other thing, changed the population structure indicating malnutrition and poverty. See Steffensen (1958).
[7] Thorarinsson (1960).
[8] Much of the population figures are estimates and guesswork since the first general census was taken in Iceland in 1703, the first census along modern lines covering the whole country. See Thorarinsson (1961).
[9] Data on population 874 to 1702 comes from Steffensen (1975) and 1703 to 1995 from Statistics Iceland (1997). Data on population 1996 to 2050 are from United Nations Population Division's median variant population projections.

for the next forty years, until it was given independence by law in 2001.

Although wool had been exported from early on, substantial export activity did not appear until the 13th century with the advent of fishing on a larger scale. During the 12th century the price of fish in Europe had started to increase and fishing became a major occupation on the island after 1400, although it was not the sole occupation of anyone.[10]

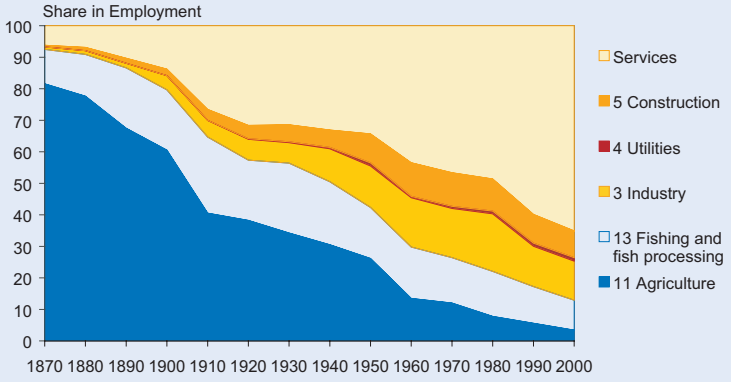
The take-off of the Icelandic economy can also be traced to the liberalization of trade in the19th century; and to the fact that warmer climate made agriculture easier, which freed up labour to start other industries and commerce. Better fishing technologies (such as sailing boats at the end of the 19th century and motor boats and trawlers at the beginning of the 20th) also contributed to increased growth. Economic growth rose dramatically when increased use of money, a greater supply of capital, free trade and new fishing technologies came together and allowed the country to utilise its comparative advantage in fishing. Increased income then had the effect of raising the demand for services, which gradually expanded from the beginning of the 20th century. Figure 2 shows the distribution of employment across industries in Iceland from 1870 to 2000.[11]

In spite of this, the financial system remained underdeveloped for decades to come. In the 1960s and 1970s the financial system had the appearance of modernity, yet banks were predominantly state owned and run by politicians, interest rates were decided by decree and usually lower than the inflation rate, capital was rationed and often distributed along political lines and rent seeking was rampant. The political parties were – and are to this day – represented on the Board of Governors of the central bank (appointed by the Prime Minister), and even more explicitly on the bank's Supervisory Board (elected by Parliament). Households invested in real estate in order to protect their savings and what little ended up in bank deposits was given out to firms that paid sharply negative interest rates. As a result, economic growth was mainly propelled by steadily increasing fish catches, generated by continuous investment in new fishing vessels as well as the extension of the fishing zone to 200 miles following disputes with the UK and Germany (the so-called cod wars!).

Financial market liberalisation – initially in response to steadily falling deposits in the banking system – not surprising in the light of negative real interest rates – started in the 1980s. The first step involved the indexation of financial obligations in 1979. Interest rates were subsequently made market determined. There followed the privatisation of commercial banks in the 1990s. The country now has private banking, international financial mobility, a central bank that is independent by law with an explicit inflation target, a public sector that – although not really performing counter-cyclical policy – is somewhat frugal and does run budget surpluses in good times. The contrast with the economy one hundred years earlier could not be starker; the supply of capital is abundant, people with ideas and ambition can get loans, there are no restrictions on foreign borrowing or investing and the country has, in a span of a few years, accumulated foreign assets that amount to 250 percent of its GDP. The country now ranks second on the Human Development Index,[12] and sixth in terms of GDP per capita. The only EU countries ranking higher in terms of PPP income per capita are Luxembourg and Ireland but

Figure 2

DISTRIBUTION OF WORKERS BETWEEN INDUSTRIES IN ICELAND 1870–2000



Source: Jónsson (1999); National Economic Institute.

[10] This was due both to the seasonality of fishing and laws that forced all workers who did not own land to be continuously registered on farms. These laws, abolished in 1893, heavily restricted labour mobility and entrepreneurship for many centuries. However, it is estimated that during the fishing season as much as half of the male workforce was engaged in fishing and fish processing.

[11] Jónsson (1999) and the *National Economic Institute.*

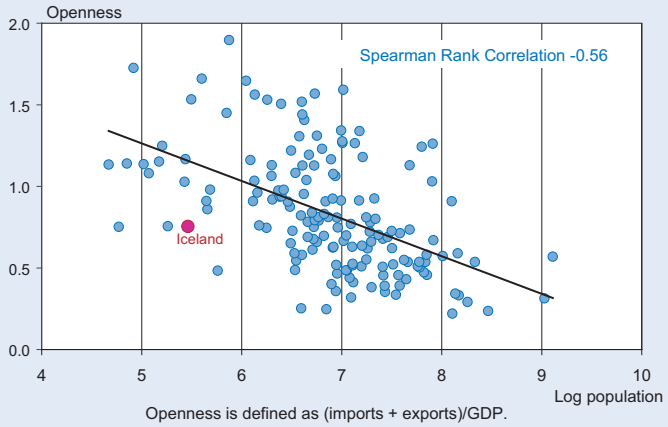
[12] The index is based on data on GDP per capita, life expectancy, average years of schooling and literacy rates. Source: UN Development Program.

they rank considerably lower on the human development index.[13]

Now we come to the main question posed in this paper: Should this affluent microstate have its own currency or would it be better off as part of the European Union using its common currency? Is it possible that an economy the size of Karlsruhe should have it own currency? This is an important question for Iceland because if the question is answered in the negative, then applying for EU membership and adopting its single currency might best serve Iceland.

Figure 3

PARTIAL RELATIONSHIP BETWEEN POPULATION SIZE AND OPENNESS IN A SAMPLE OF 160 COUNTRIES, 2003



Openness is defined as (imports + exports)/GDP.

Source: World Bank Data Bank.

Optimum currency area considerations

We start with the obvious benefits of adopting the euro and then turn to the costs in light of the optimum-currency-area literature.[14]

Foreign trade as a fraction of GDP is surprisingly low in Iceland. Also, exports are still dominated by the fishing sector – although its share in total exports has fallen sharply in the past 15 years or so[15] – followed by aluminium production, financial services, and tourism.[16] Figure 3 shows openness as a function of size for a cross section of countries. Note that Iceland is an outlier in the figure in that it is less open than what one would expect based on its size.

The question arises whether adopting the euro would increase Iceland's trade with the rest of the world.[17] In a path-breaking study, Rose (2000) used a cross section of countries to test for the effect of exchange-rate fluctuations and currency union on the volume of trade. He found that while the former had a small negative effect, the latter had a big positive effect, i.e. it is not the fixed exchange rates per se that promote trade but the feature of a currency union as a whole. Breedon and Pétursson (2004) also find that international trade would increase considerably in Iceland if the country were to join the EU.

Experience from the euro zone tells us that trade within the zone has increased significantly since the adoption of the euro. In fact, data for France and Germany show that within two years from the adoption of the euro, their trade with other EU countries had risen between 3 and 5 percent of GDP (Layard et al. 2002). These results are confirmed by Micco, Stein, and Ordoñez (2002) who find that between 1992 and 2001 the boost to intra-EMU trade was about 18 to 35 percent; Bun and Klaassen (2002, p. 1) also find that the euro significantly increased trade, with a long-run effect of about 40 percent.[18] Baldwin (2006) finds support for the "Rose effect" by looking at both EMU and non-EMU currency unions and concludes that the euro has already increased intra-euro area trade significantly by 5 to 10 percent, which is however somewhat less than the initial Rose estimates.

The potential benefits of maintaining an independent, floating currency are also very clear. Not surprisingly, the business cycles of Iceland and continental Europe are not symmetric; the former being mainly driven by variation in the catch of fish and its price and that of aluminium in world markets. Also

[13] Ranked 11th to 15th alongside Denmark, Finland and the UK.
[14] A recent book of ours does exactly this by considering both the possible benefits as well as the costs in light of this theory. See Herbertsson and Zoega (2005).
[15] The share of fish products in the value of total exports is now just over 55 percent but was in the range 75 to 80 percent as late as 1990 and hovered around 90 percent for much of the 20th century.
[16] One possible reason for the low ratio of exports to GDP is the high value added of the export industry. Exporting fish products involves exporting a much higher value-added than exporting many industrial goods or services.
[17] There is a substantial theoretical literature on this topic. Ethier (1973) and Demer (1991) found that exchange rate fluctuations should reduce trade while others have reached different results. Bacchetta and van Wincoop (2001) used a general equilibrium analysis and came to inconclusive results; exchange rate fluctuations could either increase or reduce trade.
[18] However, Berger and Nitsch (2005) find that considering a longer time horizon makes the effect of the euro on the trade volumes disappear.

not surprisingly, the mobility of labour between Iceland and the euro zone is limited, although rising. In addition to the asymmetric shocks caused by fluctuations in the fish catch and the terms of trade, the government has followed a policy of encouraging foreign direct investment in energy-intensive sectors, such as the production of aluminium. Such investment projects are often huge in relation to the overall size of the economy because the increased energy production requires new hydro- or geothermal facilities. This is another source of asymmetric demand shocks.

Flexible labour markets should make the adoption of the euro easier. The labour market in Iceland is very flexible by European standards when it comes to its institutional structure. It may not seem impossible that it offers sufficient flexibility to cushion the effect of asymmetric shocks even in the absence of an independent monetary policy. The Table compares Iceland to the other OECD economies in terms of several labour market institutions. Taxes on labour are low (sum of income taxes and payroll taxes) since the state relies to an unusually large extent on indirect taxation for its revenue. The tax wedge in Iceland is similar to that in the US, the UK, Australia, Canada, Ireland, New Zealand and Portugal. Turning to the benefit system, the level of unemployment benefits is very low, comparable to the Anglo-Saxon world but duration is high.[19] Union density is high as is coverage but the unions are coordinated so that they do take the macroeconomic consequences of their actions into account. Negotiated wages often serve as de-facto minimum wages in that paid wages can never be lower but often employers choose to pay higher wages. The union leadership has in the past fifteen years or so acted in a very responsible manner, taking productivity developments and macroeconomic data into account when formulating their wage demands. We should note that public sector unions have been more aggressive than those for the private sector. So, overall, in spite of apparently strong unions, they

[19] Benefits have so far not been related to previous income. However, new legislation being proposed in Parliament does tie benefits to past income up to a certain level.

Labour market institutions

	Tax wedge	Replace ratio	Duration	Union density	Union coverage	Union coord.	Empl. protection
Australia	28.6	32	1	35	99	1.5	2.4
Austria	44.9	55	0.68	39	80	2.0	1.1
Belgium	54.2	66	0.78	–	90	2.0	2.1
Canada	32.3	64	0.42	36	36	1.0	0.6
Denmark	41.5	59	1.00	76	69	2.0	1.5
Finland	43.8	64	0.63	80	95	2.5	2.1
France	47.4	71	0.47	10	95	1.5	3.1
Germany	50.7	61	0.75	27	92	2.5	2.8
Iceland	**29.7**	**49**	**1**	**84**	**95**	**3.0**	**0.9**
Ireland	23.8	29	0.77	43	–	3.0	1.0
Italy	45.7	52	0	37	82	2.5	1.0
Japan	26.6	63	0	22	21	2.5	3.3
Netherlands	43.6	71	0.64	24	85	3.0	2.6
New Zealand	20.7	37	1	21	70	1.0	2.9
Norway	36.9	66	0.60	55	31	2.0	2.4
Portugal	32.6	78	0.58	25	71	2.0	1.0
Spain	38	70	0.29	18	78	2.0	3.7
Sweden	48	81	0.02	87	89	2.0	3.2
Switzerland	28.8	72	0.31	23	53	1.5	2.4
U.K.	31.2	45	0.96	35	40	1.0	1.3
USA	29.6	56	0.22	14	17	1.0	0.5

Source: OECD, Nickell (2003) and Herbertsson and Zoega (2005).
Numbers refer to late 1990s. The *tax wedge* measures the sum of payroll contributions (by employee and employer alike) and income taxes (minus transfers) as a proportion of total labour costs. The *unemployment benefits replacement ratio* measures the ratio of benefits and average wages at the start of an unemployment spell for a single individual. The *duration of unemployment benefits* is measured by the weighted average of the replacement ratio in year two and year four of an unemployment spell divided by the ratio for the first year. *Union density* measures the fraction of the labour force belonging to a labour union while *coverage* measures the fraction of workers who get paid on the basis of union contracts. *Coordination* measures the extent to which the macroeconomic effects of wage contracts are taken into account, an index from 1 to 3 where 3 gives maximum coordination. *Employment protection* is measured on an index from 0 to 4 where the number 4 measures maximum protection.

have not affected employment adversely in recent times. Finally, employment protection is limited and workers can generally be laid off with a three months notice.[20]

With flexible institutions one might expect some flexibility when it comes to hiring, firing and wage setting. While hiring and firing occurs seamlessly, there is more doubt about the flexibility of money wages. A recent paper by one of us documents the results of a survey of business managers where they are asked if they would respond to an economic downturn by cutting the wages of their employees.[21] Only 9.4 percent responded affirmatively while 90.6 percent said they would not do so. The survey results indicate that firms have a clear preference for some workers over others and that in a recession they prefer having the initiative and firing the least desirable workers instead of cutting wages across the board and leaving it to the workers to decide whether to stay.[22] The most important reasons for not wanting to cut wages have to do with a desire to retain experienced and productive workers to limit the volume of overall turnover for the workforce. It follows that money wages can be (downward) rigid in spite of the absence of institutional impediments to wage changes.

The preceding discussion shows that euro adoption has both economic benefits and costs when considering Mundell's criteria: trade would in all likelihood increase and this would be very helpful for such a small economy; but the combination of large and asymmetric demand shocks, imperfect labour mobility and the downward rigidity of money wages may cause employment to become more cyclical and perhaps result in increased structural unemployment. Of course, structural relationships could change if the country joined the EU and adopted the euro. We will later describe how labour market institutions and union behaviour may change under these circumstances.

One could summarise the preceding discussion by saying that the debate among economists has been inconclusive and politics is supposed to take over. Instead of going down that route – which is clearly not our area of expertise – we will now discuss some further economic reasons for Iceland either adopting or rejecting the euro.

Microstates, micro-bureaucracies and global markets

Small government bureaucracies

Institutional independence requires efficient and capable local bureaucracies. Running an effective monetary policy and fiscal policy is dependent on competent decision-making. The same can be said about most other functions of the state. The writing and passing of new laws requires a mature and sizable law profession, law enforcement requires competent policing and so forth. The competence of the bureaucracy is possibly related to the size of the population, *ceteris paribus*. If the population of Karlsruhe or the borough of Camden, London, to take an example, had to come up with experts in monetary economics and central banking as well as all other areas of public policy, one might not be that surprised to find out that the average competence of each selected individual was lower than that of their UK or German counterparts. How can Camden compete with the UK and Karlsruhe with Germany in this respect?

So what we called the island mentality at the beginning of this paper is bound to lead to practical problems in a very small economy. While independence may be deemed desirable, the day-to-day policy making may be fraught with problems. The question is how small countries have to be in order to run into such problems. We are not aware of any empirical work explaining differences in the performance of bureaucracies with country size. In Iceland, as in all other countries, different bureaucracies are in need of competent, properly educated individuals and a regulatory framework that both allows them to have an influence and induces them to do their best. The same applies to the university and many industries. It must be difficult for a small group of professionals to gather the necessary statistics, to analyse them, draw reasonable conclusions and give proper advice and then to find a central bank governor who is trained to think independently about the quality of the advice he receives and the optimal timing of interest rate decisions. An increasingly integrated world with large capital flows and carry trade would make this task even more of a challenge.

[20] Mass layoffs do require the employer to consult with labour unions and local authorities but these consultations are not costly for firms and never impinge on the eventual decision to fire workers

[21] See Karlsson and Zoega (2005).

[22] This may be due to wage compression within firms, which make productivity differences exceed wage differences across workers, hence making the most productive workers most desirable.

Perhaps Iceland is just big enough to be able to have efficient bureaucracies. World Bank data shows that in a sample of 207 countries there are 43 with populations between 100 thousand and 1.3 million inhabitants. Of these, 26 are island economies. Perhaps surprisingly, average per capita GDP in these small countries in 1999 was 9,600 dollars while the comparable figure for the sample of 207 countries was 6,900 dollars. Moreover, the average growth rates were comparable between the two groups.[23] However, these numbers are only indicative and do not reflect directly on the quality of monetary policy decisions.

The same problem may arise when it comes to the writing and passing of new laws. In the past, this problem was partly solved in Iceland by importing Danish legislation (Denmark was after all the old colonial power) and adapting it to local conditions. Recently, the European Economic Area agreement has brought in a lot of EU legislation and regulation. Sometimes, importing foreign ideas takes more subtle forms, a good example of which is the independence of the central bank (by law since March 2001) and its inflation-targeting policy, which mimics Bank of England practices. But day-to-day decision-making requires local experience, knowledge and competence that cannot be imported.

Corruption and political influence on decision-making

In a very small country it is unavoidable that most people working in closely related areas know each other personally. More or less all economists working in the public sector formulating policy in Iceland are personally acquainted and the acquaintances usually reach far into other areas as well. Unofficial contacts take on prominence not seen in larger countries. The question must arise whether these are impediments to proper decision-making or, alternatively, help the system function more efficiently. As a matter of fact, Iceland ranks high in the world in terms of non-corruption and comes first in terms of freedom of the press.[24] A possible reason for this is that reputation takes on more importance in such a small society; improper behaviour may leave a stain more permanent than if done in a larger country. However, the distinction between efficiency-enhancing unofficial contacts and rent-seeking contacts may sometimes be not so clear in practice. In a recent paper, Knack and Azfar (2003) find no robust relationship between country size and corruption.

Financial stability under fixed vs. flexible exchange rates

We now come to the question whether having a competent bureaucracy in a microstate is sufficient for the effective conduct of monetary policy in an increasingly integrated world, as well as financial stability. Someone might suspect that a micro-currency such as the Icelandic krona might be an easy prey for the world's currency speculators, dwarfing the advantages of having an independent currency by excessive exchange-rate fluctuations and threatening the stability of the financial system.

There are three traditional routes to financial instability that have manifested themselves in recent financial crises in the world: financial liberalization with weak prudential regulation and supervision; severe fiscal imbalances; and imprudent monetary policy. Fortunately, none of these routes appear to describe the recent or current situation in Iceland.[25]

Iceland has frequently experienced large current account deficits, but rapid adjustment has taken place in the past without significantly stressing the Icelandic financial system. The economy has adjusted to financial liberalization, while prudential regulation and supervision is generally up to the task. Fiscal imbalances are not a problem in Iceland; quite the opposite, with Iceland having a good fiscal position with low net government debt (less than 2 percent of GDP in 2006) and a fully funded pension system with assets amounting to more than 120 percent of GDP. Furthermore, recent inflationary episodes cannot be traced to lax monetary policy, which has had some success – at least until quite recently – in offsetting demand and keeping inflation near the inflation target (particularly when housing prices are excluded from the inflation measure). However, Iceland has persistently run very large current account deficits, but current account deficits by themselves do not lead to financial instability.

Economies with a liberalized capital account and fixed exchange rates are more vulnerable than economies with flexible rates. This is not only because

[23] See Thorvaldur Gylfason, "Size and Growth: Small States in the Global Economy," lecture at Harvard University, May 2002.
[24] According to *Transparency International.*

[25] Tryggvi Thor Herbertsson and Fredric S. Mishkin (2006). *Financial Stability in Iceland:* Reykjavik, Chamber of Commerce.

imbalances are more likely to build up with fixed exchange rates but also because prices are sticky and as a consequence real exchange rate adjustments are much slower than with floating rates. This can lead to stagnation, deterioration in balance sheets of firms and households and a more fragile financial system: Italy is possibly a case in point as Nouriel Roubini pointed out at the 2006 World Economic Forum Meeting. Stanley Fisher has drawn attention to the fact that each of the major international capital market-related crises since 1994 – Mexico in 1994, Thailand, Indonesia, and Korea in 1997, Russia and Brazil in 1998, and Argentina and Turkey in 2000 – have in some way involved a fixed or pegged exchange rate regime. At the same time, countries that did not have pegged rates – among them South Africa, Israel, and Mexico in 1998 – avoided crises that afflicted emerging market countries with pegged exchange rates.[26]

However, joining the Euro zone may contribute to a more robust financial system. Since 2000, the banking system has been transformed from a local depositary system with assets amounting to approximately the country's GDP to an international financial intermediator system with assets over five times GDP. This has pushed the banks to finance themselves on the international capital market, which might pose an increased risk to the financial system. Iceland's small size and openness make it more vulnerable because small changes in international financial flows as a percentage of overall flows in financial markets can have a huge impact on Iceland's asset prices and particularly the exchange rate. Self-fulfilling prophecies, in which concerns about an Icelandic financial crisis could lead to massive withdrawals of Icelandic assets that would then cause a financial crisis, cannot be ruled out. High yielding currencies like the krona are particularly prone to this risk because of the carry trade. This risk would be eliminated under a credible fixed exchange rate regime.

Welfare

Iceland's choice of a currency arrangement may also have microeconomic implications. Here we consider the implications for the price level and interest rates.

[26] Fredric S. Miskhin (2006). *The Next Great Globalization: How Disadvantaged Nations Can Harness Their Financial Systems to Get Rich,* Princeton, NJ: Princeton University Press, (forthcoming).

Imperfect competitions in goods markets

At the beginning of the 1990s, food prices were estimated to be around 55 to 65 percent higher in Norway, Sweden, and Finland than on average in the EU. In 2005, prices were still 50 percent higher in Norway but about 15 percent in Sweden and Finland, which entered the EU in 1995. Prices had, however, already fallen somewhat before the countries entered the union, partly because they reformed their agricultures before joining and partly because of lower value added taxes on food.

The OECD estimates that prices of agricultural products in Iceland were on average 120 percent higher in the period 2002 to 2004 than world prices. A comparable figure for the EU was 30 percent. It is estimated that the food bill of the average Icelandic household could drop by as much as 5 percent if the country joined the EU due to lower prices of agricultural products. It is of course possible that the Icelanders could accomplish this without membership of the EU, and without adopting the euro, simply by reforming their agricultural system and allowing more competition from abroad. However, EU membership could provide the necessary political cover for such drastic and probably controversial actions.

The risk premium and interest rates

It is fairly obvious that small currencies like the Icelandic krona are more fragile than big currencies such as the euro. As a consequence, world capital markets have to charge a higher risk premium on small currencies other things being equal. As a matter of fact, this is reflected in credit default swap spreads (CDS spreads) that the Icelandic credit system enjoys.

Until recently, risk was not properly priced in financial markets. For example, the CDS spread on Icelandic bank bonds was only around 20 basis points, which meant that you could buy Icelandic bank bonds and a 20 basis point insurance in the credit market and you would have a paper which would bear approximately the same estimated risk as US treasury bonds. It is obvious that the risk was not priced correctly. In recent months, credit markets have started to demand a higher risk premium. The CDS spreads are at the moment around 70 basis points, a premium possibly reflecting better the true risk associated with the krona. Further-

more, it is likely that foreign banks might set up subsidiaries in Iceland with the introduction of the common currency, and thereby suppress the interest rates even further, some say by an additional 50 basis points.

Politics

The literature on optimum currency areas has often neglected the implications of the Lucas critique for the debate. Decision rules of agents in the labour market – as well as the government in power – may vary systematically with changes in the monetary regime, hence one cannot keep behaviour – such as unions' objective functions and the government's fiscal policy – constant while contemplating giving up monetary authority and joining a single currency.[27]

Endogenous labour market institutions

Although unions in the private sector in Iceland have in recent years played a fairly constructive role, usually taking macroeconomic factors into account, this may change. Also, public sector unions have in recent years been more militant. In a monetary union, labour unions may change their behaviour. Cukierman and Lippi (1999) argue that a centralised labour union that dislikes inflation is likely to restrain real-wage demands with an independent currency in order to keep unemployment down and hence reduce the incentive to inflate. In a monetary union, this tendency is diminished as the union now has less to fear from a supranational central bank. This poses an externality problem: A large union in any member country imposes a negative externality on other countries by demanding higher real wages resulting in higher domestic unemployment. The externality is felt in higher rates of inflation in other countries. Similarly, there is an external benefit to wage moderation by a large, national union. An opposing effect takes the form of a large union in one country being able, through wage moderation, to induce companies to relocate from other countries, hence raising domestic employment and reducing foreign employment. A fall in domestic wages leads over time to an outward shift in the labour-demand schedule, which can later generate both higher wages and employment. This effect would tend to reduce real wages everywhere and raise employment. It is not clear which of the two effects is stronger.

How would EU membership constrain Iceland's government?

Since Iceland's labour market is already quite flexible, incentives for labour-market reforms may not be that important. There are of course Sibert and Sutherland (1997), who argue that the incentive for labour-market reform is likely to be reduced when monetary independence is lost.[28] The pressure is reduced in a monetary union because the European central bank also takes into account unemployment in other countries. High structural unemployment in one country imposes a negative externality in the form of an inflation bias on other countries, and a low level of structural unemployment in any one country imposes a positive externality on other countries in the monetary union because of a reduced inflation bias. The externality arises because of the centralised nature of monetary policy and the decentralised nature of labour-market policy.[29]

A counterargument is due to Calmfors (1998), who argues that monetary union would hasten labour market reforms. He starts out by assuming that the business cycle could become more severe within the monetary union due to loss of monetary policy and incomplete price- and wage flexibility. With cyclical unemployment more volatile, pressures for reforms meant to reduce structural unemployment are likely to build if there is increasing marginal disutility of unemployment in the minds of policy makers or labour-market participants. A higher variance of cyclical unemployment reduces expected utility in such a setting but reducing average – or structural –

[27] Hochreiter and Winckler (1995) test the Mundell conditions for Austria in the late 1970s and find that these fail in terms of the asymmetry of shocks, real-wage rigidity and factor mobility. However, from looking at the 1980s and early 1990s, they find that wages (and unit labour costs) behaved differently than in the 1970s in the sense that wage settlements responded to low growth and structural problems in the 1990s but rose at a rate which exceeded productivity growth in the 1970s.

[28] This occurs if the incentive to inflate is larger at higher rates of equilibrium unemployment because voters do not differentiate between a high cyclical and a high structural unemployment – the pressure to inflate is higher at high levels of structural unemployment. For this reason, the pressure to undertake fundamental labour-market reforms is higher in countries that have their own monetary policy, as this is likely to reduce the temptation to inflate.

[29] Another argument in the same direction is due to Calmfors (1998) who emphasizes the complementarity of labour-market reforms and monetary policy. Successful reforms lead to a fall in equilibrium unemployment but actual unemployment only gradually converges to this new equilibrium. The speed of adjustment depends on the speed at which real wages can be reduced. This can come about through either an absolute decline in nominal wages and/or an increase in the general price level. Of the two, an increase in the price level is likely to reduce real wages faster as resistance to nominal-wage cuts appear to be endemic in market economies, perhaps because of workers' concern about relative wages. Since an independent monetary policy can be used to reduce real wages through a higher price level, such countries are more likely to embark on reforms.

unemployment raises expected utility for a given variance of cyclical unemployment.

A more promising change of behaviour by the Icelandic government would take the form of a more activist fiscal policy – now its discretionary part is quite neutral and automatic stabilisers left to do the work – and also a greater aversion to publicly planned investment projects such as those in the energy intensive sectors. Hence, the need for an independent monetary policy may diminish if the country joins the EU and adopts the euro, but of course this might be an optimistic view keeping in mind the current fiscal situation of some member states and the level of the real exchange rate in Portugal, Spain, and Italy.

Concluding remarks

We have found, not surprisingly, that Iceland does not satisfy Mundell's optimum currency area criteria; it has asymmetric shocks, imperfect labour mobility, and downward rigidity of money wages. However, Mundell was not oblivious to the gains from a single currency in the form of increased trade and lower transaction costs, quite the contrary. In light of Europe's experience with the euro raising trade volumes, Iceland should benefit from its adoption but possibly paying the cost in terms of greater employment fluctuations.

The benefits of an independent monetary policy are dependent on a well functioning central bank, government bureaucracies and political structures. These might be more difficult to generate in microstates such as Iceland. Furthermore, it might be beneficial for Iceland to adopt the European currency to avoid the turbulence surrounding speculations (the carry trade) in international financial markets.

In terms of growth potentials and welfare, the euro could be expected to bring lower long-term interest rates, perhaps in the range of 50 to 100 basis points. This would of course increase capital investment and labour productivity. The euro might lower consumer prices by facilitating a comparison with other euro countries. Not surprisingly, a few firms often dominate markets in microstates, especially when it comes to services. The adoption of the euro might lead to lower domestic prices through not only price comparisons but also the entry of European firms in sectors such as banking, insurance, and retailing.

In sum, the quality of monetary policy decision-making has to be convincing for anyone to be willing to sacrifice increased trade, lower interest rates, and perhaps lower consumer prices that would likely follow the adoption of the euro. The verdict on this is still out!

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Globalisation and Inflation

In its latest World Economic Outlook, the International Monetary Fund looked at the relationship between globalisation and inflation.[1] It arrived at the following conclusions:

- Over the medium term, inflation is determined by the objectives of central banks' monetary policy, such as inflation targeting. The impact of globalisation on inflation will, therefore, be temporary unless it changes the overarching objectives of monetary policy. This is unlikely in industrialised countries, given their already low inflation targets. In emerging market and developing countries, however, greater openness may have been an important factor in lowering inflation.
- The direct effect of globalisation on inflation via import prices has generally been small in industrialised countries, although import price declines due to global increases in spare capacity have had sizable effects over one- to two-year periods.
- Globalisation has helped reduce the sensitivity of inflation to domestic capacity constraints in advanced economies, for example, through the impact on labour markets and wages.
- Globalisation has had a significant effect on relative prices in industrialised countries with the largest declines in relative prices in sectors that are most exposed to foreign competition, particularly in low-tech and low-skill sectors. In the high-tech manufacturing and services sectors, productivity growth has also contributed to changes in relative prices.

To summarise: Globalisation has certainly had a dampening effect on inflation in the industrialised countries in recent years and has allowed for a "more measured monetary policy tightening" to date.

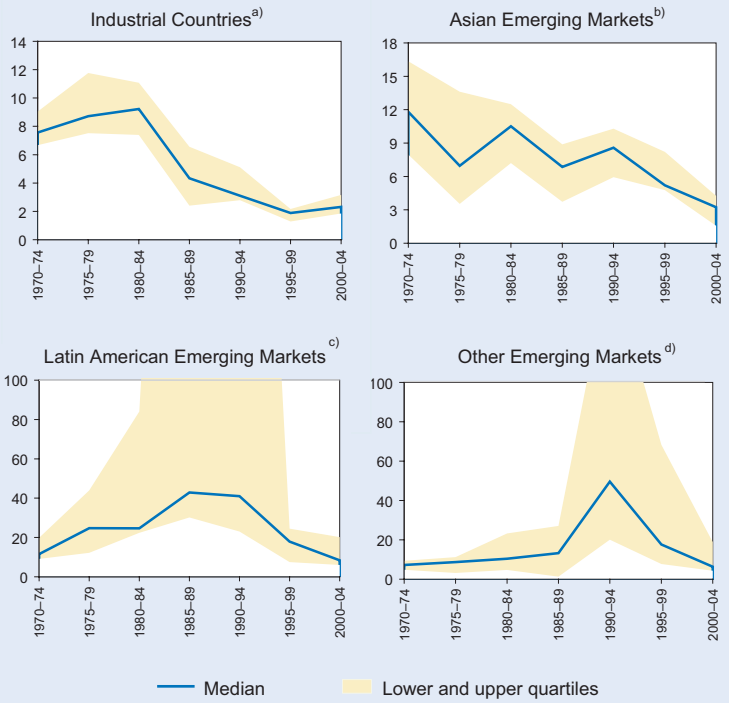
How will globalisation affect inflation in the future?
According to the IMF, ongoing trade integration will continue to put downward pressure on prices in many industries, as China's share in world trade, for example, may double over the next decade. Moreover, international trade in services will also accelerate, leading to declining relative prices in certain sectors.

On the other hand, strong global growth and declining economic slack have reduced the restraining impact of import prices on inflation. With strong global growth expected to continue, a further upturn in import prices may result in stronger inflationary pressures going forward. The possibility of further commodity price increases adds to these upside risks.

HCS

Inflation

Distribution of five-year averages of year-on-year CPI inflation across countries



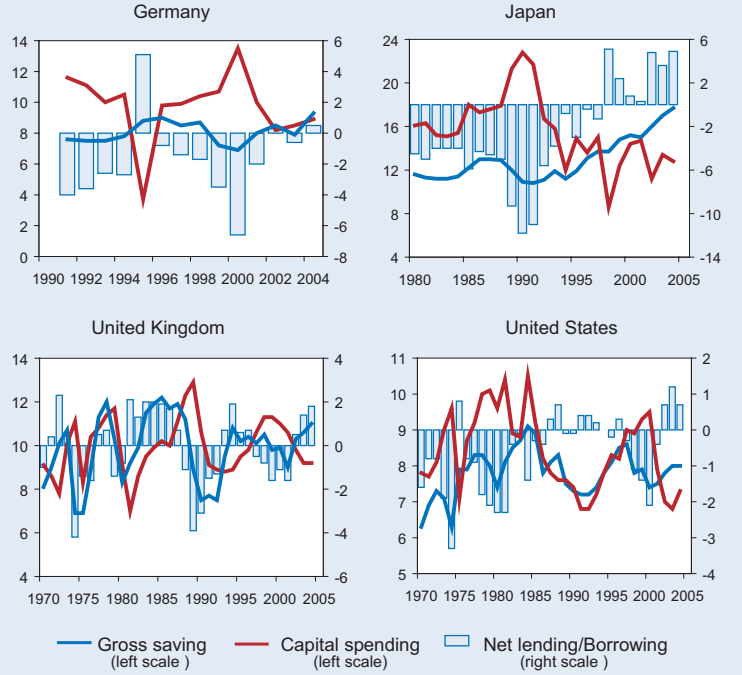
a) Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.
b) China, India, Indonesia, Korea, Malaysia, Philippines, Thailand
c) Argentinia, Brazil, Chile, Colombia, Dominican Republic, Ecuador, Mexico, Peru, Venezuela
d) Czech Republic, Egypt, Hungary, Poland, Romania, Russia, South Africa, Turkey.

Source: IMF staff calculations.

[1] International Monetary Fund, World Economic Outlook, April 2006, Washington, DC, Ch. 3.

Awash with cash: Corporate excess savings in G-7 countries

The corporate sector in the G-7 countries has moved from being a net borrower to a substantial net saver in recent years. It has followed the earlier move by emerging market economies to a net saver status after the Asian financial crises of the late 1990s. Taken together, these developments have substantially altered the financial landscape of the global economy. According to the IMF[1], these changes are one factor behind the relatively low level of long-term interest rates at present.



Source: Eurostat; national authorities; IMF calculations.

What are the reasons for this change in behaviour of G-7 corporations? For the non-financial corporate sector, the IMF arrives at the following explanations:

- Operating profits are not abnormally high, although they have been boosted by low interest rates and a generalised reduction in corporate tax payments. If companies consider these factors unlikely to be sustained in the future, they may hold back on investment and instead raise their savings.
- Technological change has reduced the relative price of capital goods, reducing the nominal spending needed to achieve a given volume of capital.
- Companies have increased their purchases of assets abroad, shifting resources from domestic capital accumulation.
- Companies have increased their desired cash holdings, partly as a reaction to the more uncertain operating environment, the increasing role of intangible assets in a knowledge-based economy, and possibly the uncertainties associated with having to meet currently unfunded pension liabilities.

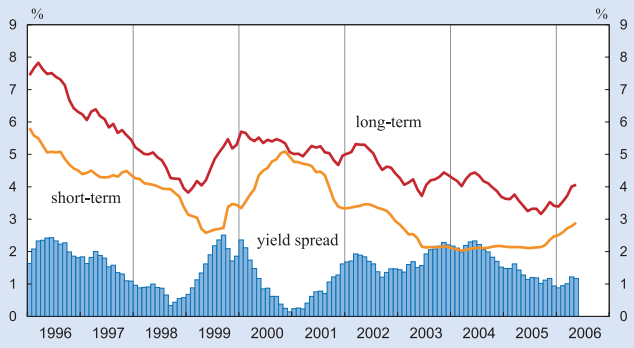
The IMF concludes that the corporate sector in industrial countries will not return to the large negative financing positions of the past. Nevertheless, excess savings are unlikely to be sustained at current record levels, particularly if the degree of slack in the advanced economies continues to decline – thereby encouraging stronger investment spending – or corporate profitability weakens. Therefore, high corporate saving should not be relied on to offset the low saving of the household and government sectors and keep long-term interest rates at present levels. Indeed, without some increase in household and government saving in the coming years, changing corporate behaviour will likely start to put upward pressure on interest rates and could exacerbate the current pattern of global imbalances by lowering total private saving in deficit countries.

HCS

[1] International Monetary Fund, World Economic Outlook, April 2006, Washington, DC, Ch. IV.

FINANCIAL CONDITIONS IN THE EURO AREA

NOMINAL INTEREST RATES [a)]

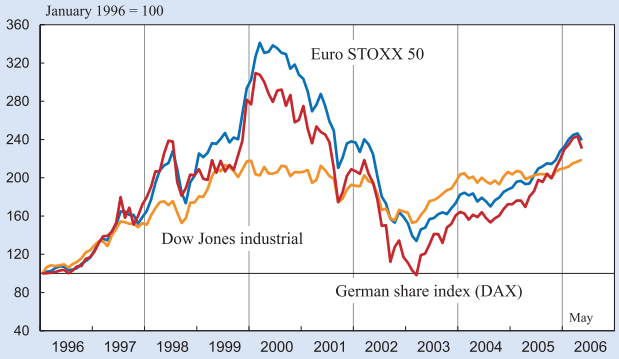


a) Weighted averages (GDP weights).

Sources: European Central Bank.

In anticipation of a rise in ECB key interest rates in June, money market rates continued to rise between March and May 2006. In May, the 3-month EURIBOR averaged 2.89%. Effective June 15th, the ECB raised its key rates by another 25 basis points.
Since the increase of interest rates at the long end was less pronounced than that at the short end, the yield spread narrowed compared to April. Ten-year bond yields averaged 4.06% in May 2006. The yield spread thus amounted to 1.17 points.

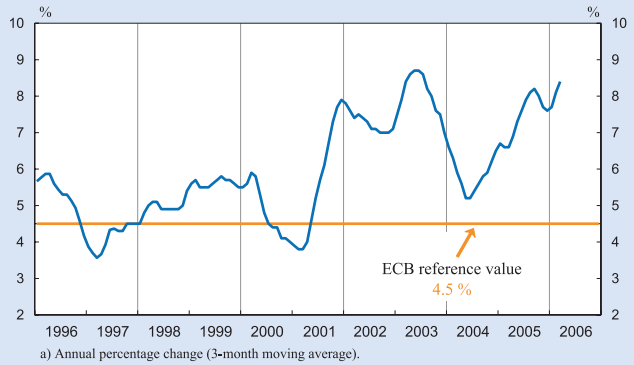
STOCK MARKET INDICES



Source: Deutsche Bundesbank, Dow Jones & Co., Inc.

The German stock index DAX peaked in April, averaging 6,009 points, but declined in May. The Euro STOXX rose in parallel, averaging 3,841 in April and 3,727 in May. Compared to the performance of these two European indices, the Dow Jones Industrial continued to rise in May, averaging 11,334 points.

CHANGE IN M3 [a)]

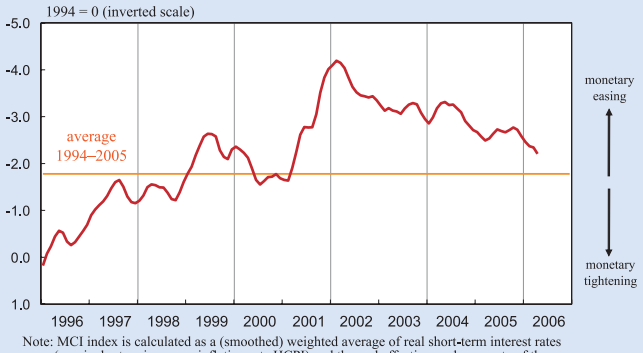


a) Annual percentage change (3-month moving average).

Sources: European Central Bank.

The first four months of 2006 saw a renewed strengthening of monetary growth which more than reversed the moderation observed in the fourth quarter of 2005. Annual M3 growth in the first quarter of 2006 amounted to 7.9%. It had risen to 8.5% in March and further to 8.8% in April, a level that was last recorded in mid-2003. The three-month moving average of the annual M3 growth rates over the period from February to April 2006 stood at 8.4%, compared with 8.1% in the previous three-month period.

MONETARY CONDITIONS INDEX

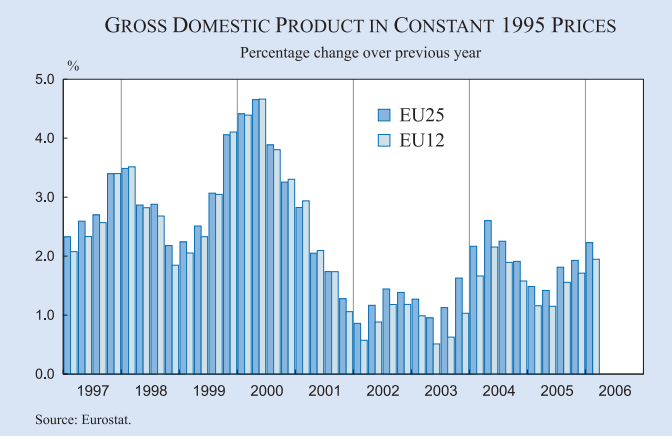


Note: MCI index is calculated as a (smoothed) weighted average of real short-term interest rates (nominal rate minus core inflation rate HCPI) and the real effective exchange rate of the euro.

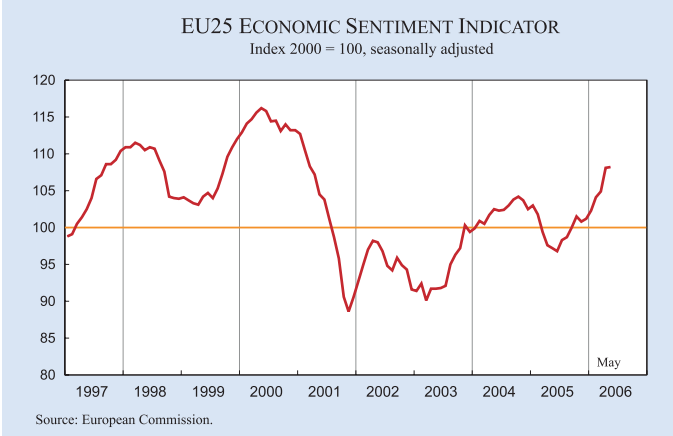
Sources: European Central Bank, calculations by the Ifo Institute.

In April, the monetary conditions index has continued its decline that had started in late 2005, signalling greater monetary tightening. This is the result of rising real short-term interest rates and a rising real effective exchange rate of the euro.

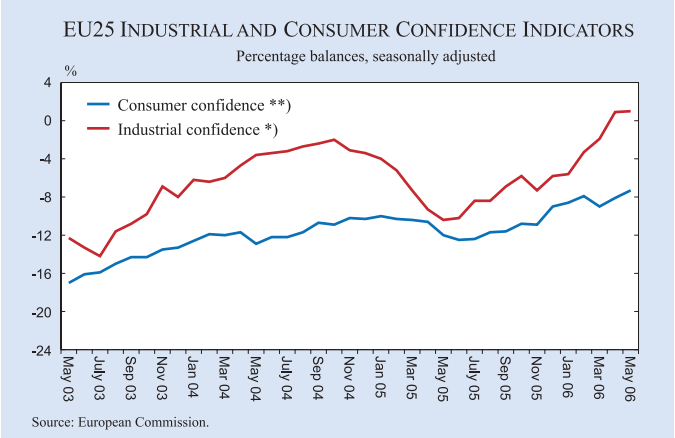
EU SURVEY RESULTS



EU25 real GDP grew by 0.7% in the first quarter of 2006 and euro area real GDP by 0.6%, compared to the previous quarter. In the fourth quarter of 2005, growth rates had been 0.4% in the EU25 and 0.3% in the euro area.
Compared to the first quarter of 2005, GDP rose by 2.2% in the EU25 and by 1.9% in the euro area, after 1.9% and 1.7% respectively in the previous quarter.

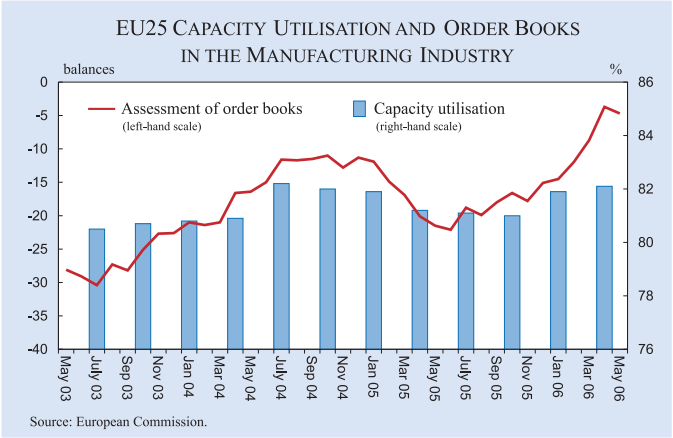


The upward movement of the EU Economic Sentiment Indicator, which had begun in the summer of 2005, slowed down to 0.1 of a point in May, while sentiment in the euro area increased by 1.0 point. Germany and Spain recorded a substantial improvement of 1.4 and 1.7 points respectively.



* The industrial confidence indicator is an average of responses (balances) to the questions on production expectations, order-books and stocks (the latter with inverted sign).
** New consumer confidence indicators, calculated as an arithmetic average of the following questions: financial and general economic situation (over the next 12 months), unemployment expectations (over the next 12 months) and savings (over the next 12 months). Seasonally adjusted data.

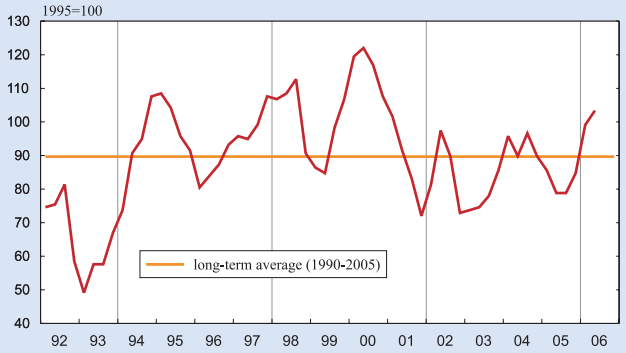
The EU industrial confidence indicator remained unchanged in May after a substantial improvement in April. The biggest improvement was registered by Spain (4 points). It remained unchanged in Germany, France and Italy, and fell in the UK (3 points). The EU consumer confidence indicator rose by yet another point in May. At the country level, developments were mixed. While consumers in Germany and Italy reported an increase in confidence of 3 points, and in France by 2 points, consumers in the other large EU countries have become less confident.



The unchanged industrial confidence indicator was the combined result of improved production expectations and a slightly more negative assessment of order books. Capacity utilisation rose to 82.1% in the second quarter of 2006 from 81.9 in the first quarter.

EURO AREA INDICATORS

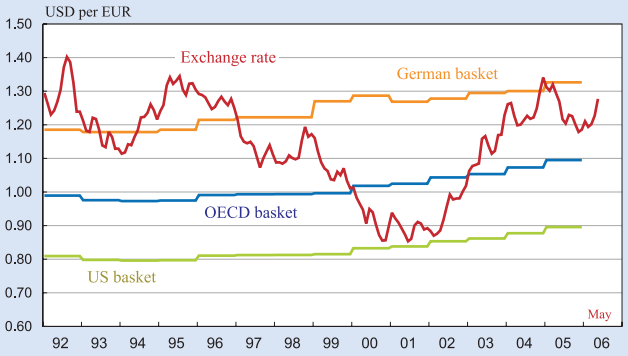
IFO ECONOMIC CLIMATE FOR THE EURO AREA



Source: Ifo World Economic Survey (WES) QII/2006.

The Ifo indicator for the economic climate of the euro area rose in the second quarter of 2006, achieving a five-year high at 103.4 points. For the first time since 2001, the present economic situation was assessed as "satisfactory". The outlook for the coming six months remained clearly optimistic in all countries. The economic recovery in the euro area has further solidified.

EXCHANGE RATE OF THE EURO AND PPPS

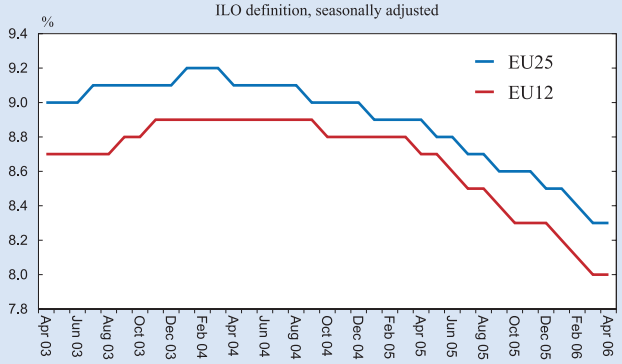


Sources: European Central Bank, Federal Statistical Office, OECD and calculations by the Ifo Institute.

The exchange rate of the euro against the US dollar, which had peaked at 1.34 $/€ in December 2004, averaged 1.28 $/€ in May 2006, a clear recovery over the preceding 11 months.

UNEMPLOYMENT RATE

ILO definition, seasonally adjusted

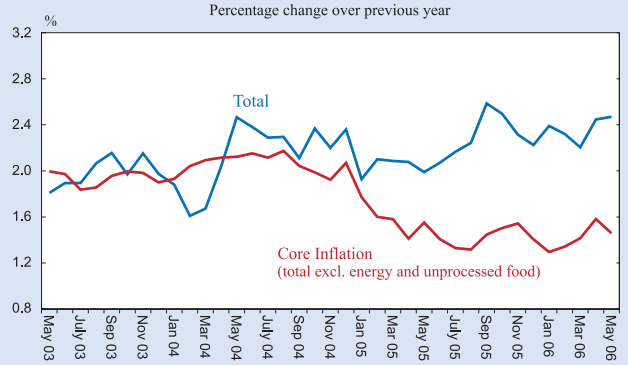


Source: Eurostat.

Euro-area unemployment (seasonally adjusted) remained unchanged compared to the previous month at 8.0% in April. The year earlier rate had been 8.7%. EU25 unemployment stood at 8.3% in April 2006, unchanged compared to March, but 0.6 points lower than a year earlier. The lowest rates were registered in the Netherlands (3.8%), Denmark (4.34% in March), Ireland (4.3%), Luxembourg (4.8%) and Austria (4.9%). Unemployment rates were highest, but declining throughout, in Poland (16.5%), Slovakia (15.5%), Greece (9.6%), France (8.9%), and Malta (8.5%).

INFLATION RATE (HICP)

Percentage change over previous year



Source: Eurostat.

Euro area annual inflation (HICP) was 2.5% in May 2006, up from 2.4% in April. A year earlier the rate had been 2.0%. The lowest annual rates were observed in Poland (1.5%), Finland (1.7%), the Netherlands (1.8%) and Sweden (1.9%), and the highest rates in Latvia (7.1%), Slovakia (4.8%), Estonia (4.6%) and Spain (4.1%). Year-on-year core inflation (excluding energy and unprocessed foods), fell to 1.5% in May 2006 from 1.6% in April.

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