Oil Prices and the World Economy

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High oil prices have been associated with bouts of inflation and economic instability over the last 30 years. Consequently, the rise of oil prices in recent months has generated concern. We argue that the inflationary consequences of a rise in oil prices depend upon the policy response of the monetary authorities. They can ameliorate the short-term impacts on output, but only at the cost of higher inflation. In the short term, the size and distribution of output effects from an increase in oil prices depends on the intensity of oil use in production and on the speed at which oil producers spend their revenue. In the medium term, higher oil prices change the terms of trade between the OECD and the rest of the world and hence reduce the equilibrium level of output within the OECD. In this paper the authors first discuss oil market developments and survey previous studies on the impacts of oil price increases. In a next step, the NiGEM model is used to evaluate the impact of temporary and permanent rises in oil prices on the world economy under various policy responses, and the impact of a decline in the speed of oil revenue recycling is analyzed.

1 Introduction

Changes in oil prices have been associated with major developments in the world economy, and are often seen as a trigger for inflation and recession. The increases in oil prices in 1974 and then again in 1979 were important factors in producing a slowdown in the world economy at a time when inflation was rising. Recent rises in oil prices have caused concern. Although they have not been on as large a scale as in the 1970s, oil price surges are frequently seen as a possible threat to our lower-inflation world. However, the oil intensity of output has fallen markedly, and hence we might expect the effects of a rise in oil prices to be different now than they were in the 1970s and 1980s. Another reason why we might expect there to be differences between the 1970s and the current conjuncture has to do with central banks' responses to higher oil prices, and we can explore these using our model, NiGEM.

In this paper, we examine the impacts of oil price increases on output and inflation, and discuss how these effects differ between individual European countries, including in our analysis results on Poland, Hungary and the Czech Republic. We argue that the consequences of oil price shocks for inflation and output depend largely on the monetary policy stance adopted in response to them. In addition we show that the impact of oil price increases on output depends in part on the oil intensity of production, which has fallen at different rates in different countries in the last two decades. We also demonstrate that in a world where economic agents form rational expectations about the future there is a difference between the short-term impacts of temporary and permanent shocks. Monetary policy may now be better designed to keep inflation low, and hence oil prices may not set off the sort of wage-price spirals that developed in the 1970s.

In order to evaluate the role of monetary policymaking, we undertake three experiments. In the first case, henceforth referred to as the base case, we raise oil prices by 20% permanently. In the following two simulations, we examine

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the effects of changing the response of the U.S. and EU monetary authorities. The effects of oil price increases depend on the flexibility of the oil-importing economies, and in particular on the degree of real wage resistance, which may have changed a great deal in the last 25 years, partly in response to the costs associated with the first oil price shock. Besides monetary policy and labor market dynamics, the impacts of oil price increases on the OECD also depend upon the speed at which oil exporters' revenues are recycled into demand for goods and services. If the whole process is slow, then aggregate demand may temporarily fall as a result of the changes in financial flows. In order to evaluate its importance, we undertake a simulation where the speed of recycling oil revenues into imports of goods and services is slowed to 1970s levels.

The rest of the paper is structured as follows. Section 2 provides an overview of oil consumption, production and supply patterns over the past three decades. Section 3 reviews previous studies which have attempted to quantify the impact of increasing oil prices on the world economy. Section 4 details the results of our simulations explained above and section 5 offers our concluding remarks.

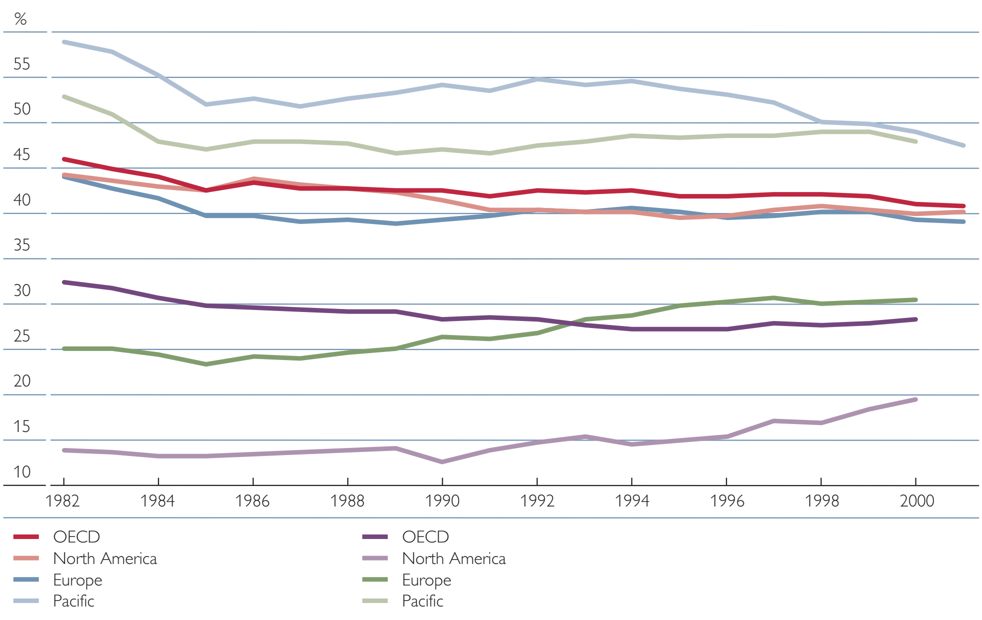
2 Patterns of Oil Consumption, Production and Supply

2.1 Patterns of Oil Consumption – Historical Perspective

The level of oil dependence varies greatly among regions and countries. Chart 1 details oil dependence as a share of all energy consumed by major regional blocks. In general, more developed countries are more oil dependent – some 40% of OECD energy needs were met by oil in 2003, as compared to only 28% for non-OECD countries. This is not surprising, as manufacturing and transport consume the largest share of petroleum products. Japan has the highest proportion of its energy needs served by oil, deriving close to 50% of its

Chart 1

Oil as a Percentage of Total Energy Supply



Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, Monthly Oil Market Report (May 2004), NIESR calculations.

energy from oil in 2001, but this is down from almost 60% in the early 1980s. By contrast, China is one of the least oil-dependent countries, with oil meeting less than 20% of the country's energy consumption in 2000. As the country continues to industrialize, its oil needs exhibit a growing trend, as can be seen from chart 1. Other Asian countries follow a trend similar to China, although they have a much greater share of oil in their energy supply – over 30% at the beginning of the current decade.

With the notable exception of Japan, most other OECD economies exhibit similar and relatively constant levels of oil dependence in their total energy supply. Both North America and Europe rely on oil for about 40% of their energy needs, and this share has been relatively stable over the past several decades. Partly in response to the second oil price shock of the late 1970s, European countries decreased their oil dependence from over 45% of energy consumption in 1982 to under 40% within four years. In North America, particularly in the United States, the share of oil in total energy consumption did not exhibit noticeable declines until the early 1990s.

Among developing nations, the countries of Latin America remain most dependent on oil for their energy needs, as close to half of the region's energy came from oil in 2000. As in the OECD, the share of oil declined slightly in response to the second oil shock of the late 1970s, and has remained constant for two decades. As middle-income economies, South American countries are much less energy efficient than their OECD counterparts, yet are industrialized, with large numbers of private motor vehicles and fairly developed commercial transport. This combination of factors largely accounts for a relatively high share of oil in meeting energy needs.

Several of the transition economies of Central and Eastern Europe are relatively less dependent on oil for their energy needs than many of their more developed counterparts. This has mostly to do with their continued dependence on coal as a source of energy. For example, the Czech Republic met over 50% of its energy needs from coal as late as 2000, while serving about 20% of its energy needs with oil – a share that has remained relatively constant over the past 30 years. By contrast, Hungary is relatively more oil-dependent, deriving about 27% of its energy from oil; this figure is down significantly from 1973, when almost 40% of Hungarian energy was derived from oil.

Table 1

Average Annual Growth of Oil Consumption

	1974–1980	1981–1990	1991–2000	2001–2003	1974–2003
	Change in %				
North America	0.2	0.1	1.5	0.8	0.7
Europe	–0.7	–0.7	1.1	0.2	0.0
Pacific	–0.1	1.4	1.9	0.0	1.1
Total OECD	–0.2	0.0	1.4	0.5	0.5
China	8.2	3.2	7.8	4.8	6.0
Other Asia	5.3	5.0	5.2	2.7	4.9
Latin America	3.0	0.9	3.5	–1.4	2.0
Middle East	7.4	3.8	4.7	3.4	4.9
Africa	5.0	3.1	2.4	2.7	3.3
Total	1.3	0.5	1.5	1.1	1.1

Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, Monthly Oil Market Report (May 2004), NIESR calculations.

Over the past 30 years world annual consumption of petroleum products has increased by almost 40%, from 57.4 million barrels per day in 1973 to about 78.7 million barrels per day in 2003. However, growth in the demand for oil varied significantly over this period. As indicated in table 1, total consumption of petroleum and related products has increased by just over 1% per annum over the past 30 years, with growth oscillating between 0.5% on average during the 1980s and 1.5% per annum on average during the following decade.

In addition to varying over time, patterns of oil consumption also exhibit significant regional and country differences. Driven by a substantial decline in demand from Europe, oil consumption in OECD countries expanded by about 0.5% per annum on average over the entire period and failed to grow at all until the early 1990s. In contrast, demand for oil and related products from developing countries was noticeably more robust, particularly as China and India continued to grow at a rapid pace. Consumption in Latin America has declined in the last several years, driven primarily by severe recession in Argentina as a result of the country's debt default. Despite growing at a significantly faster pace, in 2003 demand from non-OECD countries accounted for less than 40% of the total petroleum products consumed during that year. Nevertheless, the share of OECD consumption has declined somewhat from almost 74% of total consumption in 1973 to below 62% in 2003. The most notable shifts in oil consumption occurred from the countries of the former Soviet Union to China and other Asia, which includes the rising consumption of oil in India.

Table 2

Patterns of Oil Consumption in Central European Transition Economies

	Pretransition 1982–1989	Transition recessions[1] 1990–1993	Recent trends 1994–2001	Total 1982–2001
Czech Republic	–0.6	–7.6	2.3	–0.8
Hungary	–1.6	–2.2	–1.6	–1.7
Poland	1.8	–4.1	4.6	1.7

Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, NIESR calculations.

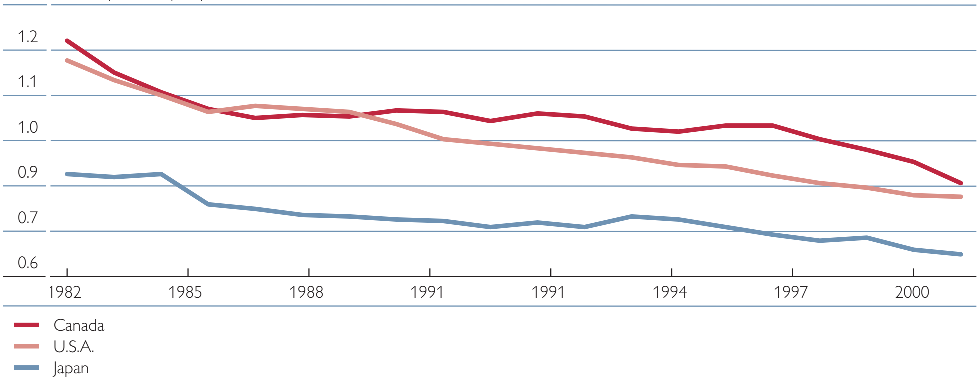
[1] *Hungary began its transition somewhat earlier than the other former Warsaw Pact countries, and the country's transition process was somewhat more gradual than in Poland and in the Czech Republic. Here, we calculate Hungary's transition as beginning in 1988, not in 1990 as is the case for the other two countries.*

Over the past two decades patterns of oil consumption in transition economies have changed markedly, as these countries experienced a significant reorientation of production from centrally planned to market economies. During the 1980s oil consumption declined slightly in the Czech Republic and in Hungary, while increasing by an average of almost 2% annually in Poland. Following the fall of the Berlin Wall and the ensuing reorientation of productive capacity, much of the region underwent several years of recession, which was quite severe in some cases. Not surprisingly, the region's oil consumption declined significantly in the early 1990s. The Czech Republic exhibited the biggest drop, with its oil demand declining by almost 8% annually. In Poland, the decline was less severe, at just over 4% a year. In Hungary, where transition to a market economy began earlier and hence has been less rapid, oil consumption declined by a more moderate 2% per annum. Once economic growth resumed, oil demand in the Czech Republic and in Poland began to increase, while oil consumption in Hungary continued on the pattern of the 1980s, with demand declining by about 1.5% annually.

Chart 2a

Oil Intensities of the G-7 and Transition Economies

Million barrels per unit of output[1]

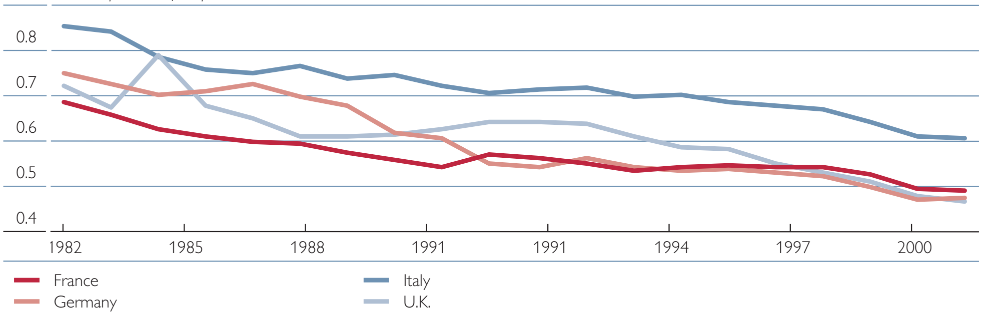


Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, NiGEM database, NIESR calculations.
[1] Measured in USD billion at PPP exchange rates, 1995 prices.

Chart 2b

Oil Intensities of the G-7 and Transition Economies

Million barrels per unit of output[1]

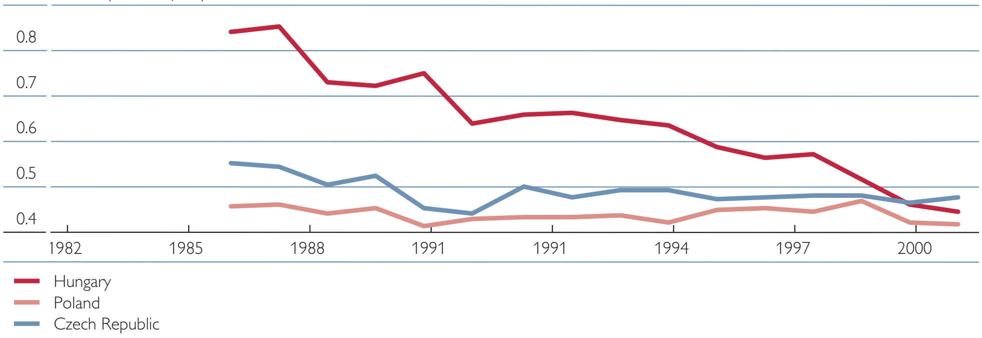


Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, NiGEM database, NIESR calculations.
[1] Measured in USD billion at PPP exchange rates, 1995 prices.

Chart 2c

Oil Intensities of the G-7 and Transition Economies

Million barrels per unit of output[1]



Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, NiGEM database, NIESR calculations.
[1] Measured in USD billion at PPP exchange rates, 1995 prices.

Over the past several decades, oil intensity – defined as the amount of oil used to produce a unit of output at purchasing power parities[3] – has declined substantially in many European countries. In the United Kingdom and Germany, oil intensity has fallen by a third in the last 20 years, and by slightly less in Italy and France. As chart 2 shows, oil intensities in the three largest European economies are now at very similar levels. Notable exceptions to this European trend include Portugal and Spain, both of which underwent a period of relatively rapid economic expansion as they converged toward income levels prevalent in the European Union. In several European countries, such as in Sweden and Austria, the oil intensity of the economy was already low and remained fairly constant over the past two decades, suggesting that there is a lower bound to how oil-efficient a developed economy can be.

When measured at PPP exchange rates, the oil intensity of the new Member States is on a par with other European economies, as shown in chart 2. Of the three most advanced transition economies, Hungary is the only one to have improved its oil efficiency markedly over the past couple of decades. In 2001 Hungary used almost half as much oil to produce a unit of output as it did in the mid-1980s. In contrast, both Poland and the Czech Republic maintained a fairly constant level of oil intensity throughout the period. However, it is important to note that their economies were already relatively oil-efficient in the mid-1980s.

In contrast to significant declines in oil intensity in the majority of European countries, developments in oil intensity in North America followed a different pattern. While the U.S.A. requires a quarter less oil to produce a unit of output as compared to its petroleum needs in the early 1980s, for much of the 1990s Canada's oil intensity fluctuated around the same level as in the mid-1980s, as shown in chart 2. Oil intensity in the United States is around 40% higher than in the three largest European economies, and is around the level achieved in the mid-1980s. Japanese oil consumption measured at PPP remains relatively high, although it is between European and U.S. levels. However, the sustained difference we have seen between PPP and the market exchange rate of the Japanese yen has meant that increases in the cost of oil have had less impact on Japan than would be suggested by oil intensity at PPP exchange rates.

During the first quarter of 2004, demand for petroleum products increased significantly from the relatively low levels of the past several years. This was attributable partly to the economic recovery that has taken hold in most parts of the world. Thus, petroleum demand in Europe expanded by almost 2% per annum in the first quarter, with France and the U.K. recording double-digit growth, at 12.8% and 10.1% per annum, respectively. Much of this gain was in diesel, which may reflect stronger economic recovery and the resulting increase in trucking activity. As in Europe, demand for diesel in North America expanded rapidly during the first quarter of 2004.

[3] *A unit of output is measured in USD billion at 1995 prices. The transition economies are not near to PPP exchange rates, but rather significantly below them, with ratios in our 1995 base year of around 2.1 for Hungary and Poland, and 2.4 for the Czech Republic. Oil imports therefore represent more of these countries' imports than their oil intensity would suggest. Hence oil prices will have a significantly greater effect on these economies than the figures suggest.*

2.2 Patterns of Oil Production and Supply

Over the past three decades, world oil supply has expanded by about 1% per annum on average. OPEC output grew by 0.2% annually on average after 1973, while non-OPEC output expanded by an average of 1.9% annually over the same period. During the 1970s and 1980s, when OPEC sharply reduced its oil output, non-OPEC oil exporters, mainly from the countries of the former Soviet Union and Central America, expanded their output to meet the aggregate demand for oil. In the 1990s, with the collapse of the Soviet Union and robust growth of oil output from the Middle East, output from non-OPEC exporters expanded by just over 0.5% per annum before returning to the long-term average annual growth rate of around 2% by the end of the 1990s.

Table 3

Aggregate Oil Supply (1973 to 2003)

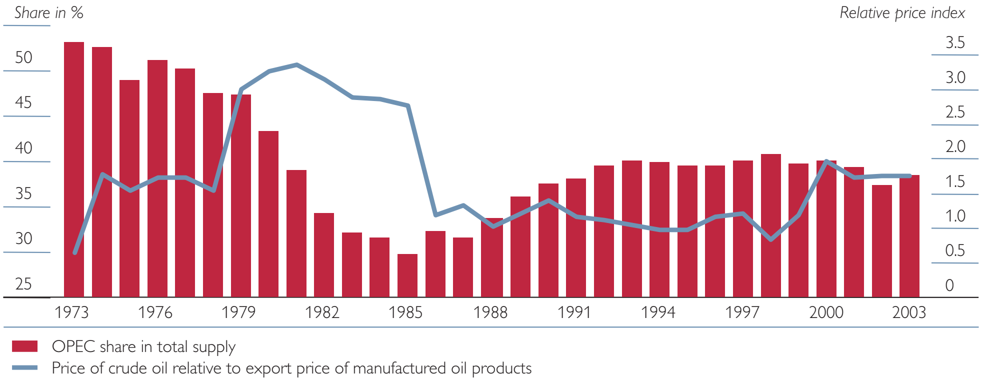
	OPEC	Non-OPEC	Total
	Million barrels per day		
1973	31.2	27.7	58.9
2003	30.5	48.9	79.4
	Annual change in %		
1973–1979	0.4	4.0	2.1
1980–1989	–2.3	1.9	0.0
1990–1999	2.2	0.6	1.2
2000–2003	1.0	2.2	1.7
1973–2003	0.2	1.9	1.0

Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, Monthly Oil Market Report (May 2004), NIESR calculations.

After falling in the mid-1980s, world oil prices in real terms have remained well below their peaks of the 1970s and early 1980s. However, over the last 3 years they have been higher than in the previous 15 years. As is evident from chart 3, OPEC's share of total oil supply tends to move inversely with oil price fluctuations. As prices for crude oil rose sharply in the wake of the second oil price shock in the early 1980s, OPEC's share of world oil production declined rapidly – from over 50% in 1973 to under 30% by 1985. By the early 1990s, OPEC's market share had recovered to around 40% of the world total and fluctuated around that figure for the remainder of the period under consideration. With respect to non-OPEC oil exporters, production in the former Soviet

Chart 3

Movement of Oil Prices and OPEC's Share in World Oil Supply



Source: IEA Annual Statistical Supplements to the Oil Market Report 2002 and 1998, NiGEM database, NIESR calculations.

Union slumped following the collapse of communism in 1989, while supply from Latin American producers nearly doubled, from 1.8 million barrels per day in 1985 to 3.9 in 2003. However, supply from the former Soviet Union has now recovered strongly, and in 2003 exports amounted to about 30% of those from OPEC countries.

During most of the past three decades, aggregate oil supply and the amount demanded moved inversely with oil prices, with changes in supply dominating developments. However, over the past several years this relationship appears to have transformed, suggesting that there has been a structural change in oil demand. Since the beginning of the current decade, the movements of supply do not appear to have been the major factor affecting prices, and the price of crude oil does not appear to fluctuate inversely with changes in amount demanded. Lower industry stocks of crude oil, particularly in the United States, combined with strong demand in Asia and heightened geopolitical instability in the Middle East, will have tended to exert upward pressure on prices and may account for the bulk of price changes of the past three years (Kaufmann, 2003).

3 Quantifying the Impact of Oil Prices on Output and Inflation (Based on Existing Studies)

We look at three major studies as representative of the work on oil prices. The first uses a large, calibrated and estimated macromodel of the world economy developed at the IMF. The results are representative of those achieved by other models, and the authors bring out the importance of labor market flexibility in absorbing an oil price shock. They also discuss the role of monetary policy in mediating the shock, emphasizing that the monetary policy response partly determines the effect on prices. The second and third studies look at the role of monetary policy and at the structure of effects from oil prices using VARs. Although this method is informative, it has to be used with care, as the impacts of oil prices depend on policy responses, which can change markedly over time and may differ in the future from the average response from the data period.

3.1 Model-Based Results

Hunt, Isard and Laxton (2002) conduct simulations using the IMF's multicountry model, MULTIMOD, and summarize their work in Hunt et al. (2001). The first set of simulations describes responses of real GDP and inflation to oil price shocks of different duration. The second compares the model's responses to transitory and more persistent oil price shocks under two alternative structures of the wage-price nexus. The third set of simulations illustrates how asymmetric responses by microeconomic agents to changes in their real wages might help explain the nonlinear relationship between oil prices and macroeconomic activity observed by Hooker (1996), Hamilton (2000) and others. They also discuss the implications of delaying the response to the shock until it is clear whether it is temporary or permanent.

3.1.1 Responses to Shocks of Different Duration

The authors analyze three shocks. Under the temporary shock, the price of oil goes up by 50% in the first year and returns to baseline in the second year. They also look at a more persistent shock, with oil prices increasing to 50% above baseline for the first two years and then declining at a steady rate to reach the baseline level again in the sixth year. The third shock involves a permanent 50% increase in oil prices. Their results also suggest that oil price shocks have significantly different effects in different countries. The simulated effects are larger in the United States than in the United Kingdom, given the greater responsiveness of expected inflation to oil price increases in the United States. The similarity of responses in the United States and the euro area reflects the combination of a significantly higher degree of resistance to real income declines in the U.S.A. with a significantly greater responsiveness of expectations to oil price changes in the euro area.

3.1.2 The Strength of the Pass-Through into Core Inflation

Hunt et al. (2002) undertake a set of simulations to help explain why oil price shocks during the 1980s and 1990s had little apparent influence on core inflation in the U.S.A. They do this by either allowing or preventing oil price shocks to pass through into core inflation and hence to change the labor market response to a shock. They conclude that when the shock is temporary, the responses of output and inflation under the two different wage-price structures are similar; the most significant differences are in the core inflation outcomes for countries that have relatively large estimated real wage catch-up effects, as in the United States. Many of the shocks to oil prices that occurred during the 1980s and the 1990s lasted only one or two quarters and may therefore not have been important. It seems reasonable to assume that downward pressure on real incomes that lasts for a year or longer would start to have observable effects on the outcomes of the wage bargaining process. In a world with many shocks occurring simultaneously, economic agents may not perceive a short-lived price spike as important.

3.1.3 Asymmetry in Real Income Catch-Up Effects

Empirical evidence suggests that oil prices and economic activity are negatively correlated, but oil price increases tend to be followed by larger changes in activity than oil price declines. Workers may respond asymmetrically to oil price increases and declines, pushing for higher wages to resist the declines in their real consumption power that result from positive oil price shocks, but not resisting the increases in real consumption power that result from oil price declines. To test this asymmetry, the authors focus on permanent 50% changes in oil prices. Their results indicate that the degree to which output and inflation respond asymmetrically to oil price changes – as indicated by the ratio of the effects of the positive shock to the effects of the negative shock – varies among the different countries. Since the transmission of oil price effects through the expectations channel is modeled symmetrically, the different degrees of asymmetry among the individual countries can be largely attributed to differences in the strength of the real wage catch-up effect; the asymmetries are most pronounced in the United States.

The simulations suggest that negative oil price shocks create downward pressure on core inflation through the expectations channel, allowing monetary policy to ease and thereby stimulating the economy. However, asymmetry in the real wage catch-up term appears to be a potentially significant and plausible explanation of the observed nonlinear relationship between oil prices and macroeconomic activity. As noted by Hamilton (2000), another plausible explanation of the observed nonlinearity is that the distribution of the exogenous component of historically observed oil price changes has been asymmetric, with most exogenous changes in oil prices consisting of price increases associated with petroleum supply disruptions.

3.1.4 The Implications of a Delayed Monetary Policy Response

Uncertainty about the extent to which oil prices may come down in the period ahead as well as uncertainty about the effects of the higher oil prices on core inflation may suggest that there should not be a rapid response to higher oil prices until their macroeconomic effects are more apparent. To illustrate the possible benefits and potential dangers of delaying the policy response to higher oil prices, the authors allow oil price innovations to pass through into core inflation and consider the implications of both symmetric and asymmetric real wage catch-up effects.

The manner in which monetary policy responds to various shocks to the economy can have an important influence on inflation expectations. The main potential danger of delaying the response to an oil price increase stems from the possibility that delay may weaken the credibility of announced or perceived policy objectives and have an adverse effect on inflation expectations. To account for credibility issues, the authors compare simulations based on two alternative formulations of how delayed monetary policy reactions might affect inflation expectations. In the first instance, they adopt the extreme assumption that delay has no effect on the inflation expectations generation process. In the second formulation, an endogenous element to private agents' perception of the inflation target that enters the monetary policy reaction function is added to the inflation expectations generation process. The inflation target perceived by private agents influences their expectations about future inflation, which in turn influences actual inflation outcomes.

Table 4 shows the dynamic adjustment paths for output, core inflation and the policy interest rate under symmetric and asymmetric real income catch-up effects. In both cases the shock is the persistent 50% rise in oil prices for two years that erodes over the next three years. The results of delaying the policy response vary across countries. Delaying the policy reaction has expansionary effects on aggregate demand and GDP in the short run, but leads to a much sharper interest rate response by the third year, with subsequent contractionary effects on GDP. If the central bank delays policy responses for a year and a half, then efforts to restore macroeconomic stability result in short-term interest rates being higher in the third year if expectations of inflation respond endogenously. They reach levels about 2% and 1.5% above baseline in the United States and in the euro area, respectively. While sharp interest rate increases might be regarded as successful in averting major cumulative inflation pressures in these hypothetical scenarios, in reality the scope for such an aggressive tightening of monetary policy may be constrained by political pressures. Furthermore, substantial tightening of monetary policy may bring about an undesirable slowdown in output.

Table 4

Delayed Monetary Policy Response Simulations – Summary Statistics

	Real GDP		CPI		Core price level	
	Symmetric real wage catch-up	Asymmetric real wage catch-up	Symmetric real wage catch-up	Asymmetric real wage catch-up	Symmetric real wage catch-up	Asymmetric real wage catch-up
	Cumulative change in % after 10 years					
U.S.A.						
Immediate response	0.2	−0.6	0.5	0.8	0.4	0.8
Delayed response	0.1	−0.8	2.9	3.1	2.8	3.1
Delayed response erodes credibility	−0.3	−1.3	4.2	4.6	4.2	4.5
Euro area						
Immediate response	0.7	0.2	0.3	0.4	0.2	0.3
Delayed response	0.3	0.0	2.3	2.4	2.2	2.4
Delayed response erodes credibility	0.2	−0.1	2.8	2.9	2.8	2.9

Source: National Institute Economic Review (January 2002, p. 99).

3.2 VAR-Based Studies

Bernanke, Gertler and Watson (1997) develop a VAR-based technique for decomposing the overall economic effects of a given exogenous shock into the portion attributable directly to the shock and the part arising from the policy response to the shock. The authors find that a substantial part of the recessionary impact of an oil price shock results from the endogenous tightening of monetary policy rather than from the actual increase in oil prices. After establishing that essentially all U.S. recessions of the past 30 years have been preceded by both oil price increases and a tightening of monetary policy, Bernanke et al. choose the net oil price increase measure proposed by Hamilton (1996a, 1996b) as their principal measure of oil price shocks. Using monthly data on U.S. GDP from January 1965 through December 1995, the authors estimate a VAR (vector autoregression) using one constant and seven lags. The estimated model includes a set of macroeconomic variables, including the price of oil as a dependent variable, with a set of market interest rates – including the three-month treasury bill rate and the ten-year treasury bond rate along with the federal funds rate.

To show the effects on the economy of an oil price shock including the endogenous response of monetary policy, the base scenario considers a response to a 1% innovation in the nominal price of oil in the seven-variable system. The funds rate does not enter directly into the equations from output, prices, commodity prices or the oil indicator. In the second scenario, the funds rate is fixed at its base values throughout the simulation, and it exerts its macroeconomic effects through the short- and long-term interest rates included in the system. In the third scenario – anticipated policy – the response of monetary policy to the oil shock and the changes induced by the shock in output, prices, etc. is shut off, with the expectations components of interest rates determined separately.

The absence of an endogenously restrictive monetary policy results in higher output and prices. Quantitatively, the effects are large, in that a nonresponsive monetary policy suffices to eliminate most of the output effect of an oil price shock, particularly after the first eight to ten months. The anticipated policy simulation results in modestly higher output and prices than under the second scenario. The differences in results occur largely because the anticipated policy simulation involves a negative short-run response in both the short- and long-term premiums, and thus lower interest rates in the short run. Next, the authors repeat the anticipated policy simulation described above, this time allowing the funds rate to affect the macroeconomic variables only through its effects on the expectations component of market rates. This alternative simulation attributes somewhat less of the recession that follows an oil shock to the monetary policy response, but endogenous monetary policy still accounts for two-thirds to three-quarters of the total effect of the oil price shock on output.

Finally, the following three major oil price shocks are examined: OPEC 1, OPEC 2, and the Iraqi invasion of Kuwait, focusing on the behavior of output, the overall price level and the funds rate for the five-year periods surrounding each episode – 1972–76, 1979–83, 1988–92. The first scenario – federal funds endogenous – is intended to isolate the portion of each recession that results solely from the oil price shocks and the associated monetary policy response. The second scenario – federal funds exogenous – models a situation in which oil prices equal their historical values, all other shocks are shut off and the nominal funds rate is arbitrarily fixed at a value close to its initial value in the period. The results of these two simulations are compared with the actual historical path of each variable.

This exercise demonstrates that the 1974–75 recession is generally not well explained by the oil price shock. The pattern of shocks reveals instead that the major culprit were non-oil commodity prices because their sharp rise before the recession stimulated a sharp monetary policy response. The federal funds exogenous scenario, in which the funds rate responds to neither commodity price nor oil price shocks, exhibits no recession at all, suggesting that endogenous monetary policy, responding to both oil price and commodity price shocks, played an important role in this episode.

The results for the period from 1979 to 1983 support the conventional explanation that this recession was generated by the oil price shock. However, if the monetary policy reaction to the oil price shock is excluded, the period from 1979 to 1983 exhibits only a modest slowdown, not a major recession. The experiment for the period from 1988 to 1992 shows that shutting off the policy response to oil price shocks produces a higher path of output and prices than otherwise, without explaining why the substantial easing of actual policy from late 1990 did not move the actual path of output closer to the alternative policy scenario.

Jiménez-Rodríguez and Sánchez (2004) extend the analysis of the effects of the oil price shock on real GDP growth to several OECD countries – individual G-7 countries and the euro area as a whole – using a variety of econometric specifications. Among the nonlinear model specifications, the asymmetric specification distinguishes between increases and declines in oil prices. The second model, developed by Lee et al. (1995), is based on a transformation on the oil price that standardizes the estimated residuals of the autoregressive model by its conditional variability. Finally, the third specification uses Hamilton’s (1996) oil price variable defined as the amount by which oil prices in quarter t exceed the maximum value over the preceding four quarters. The results are obtained using quarterly data from the third quarter of 1972 through the fourth quarter of 2001.

Jiménez-Rodríguez and Sánchez (2004) find that the output growth in all countries but Japan responds negatively to an increase in oil prices. The largest negative impact on GDP occurs in the fourth quarter after the shock in all countries but France and Italy, where it takes place in the third quarter after the shock. The effects of the shock die out almost completely after three years in all countries. An increase of 100% in real oil prices yields a negative accumulated effect of GDP growth of around 5% in the United States and in Germany, 4% in Italy, 3% in France, 2% in the euro area as a whole and 1% in Canada. The appreciation of the real exchange rate in the U.S.A. and Germany contributes to the larger negative impacts on economic activity in these countries. France, Italy and the euro area also exhibit considerable negative impacts on their real GDP although the depreciation of their real effective exchange rates partly offsets the shock. The results of this study also indicate that an oil price shock increases inflation and long-term interest rates in all countries except Germany and drives up short-term interest rates in all countries with the exception of the United States, Germany and the euro area. As expected, the oil price shock contributes to the decline in real wages observed in these countries.

4 Simulating Oil Price Shocks Using a Large Econometric Model

We undertake some experiments analyzing the impacts of both permanent and temporary increases in the oil price using our model, NiGEM. We stress the short- and long-run effects of permanent shocks and discuss the role of policy reactions to oil prices. These will determine both the short-run output and price effects and will also strongly influence the long-run impact on prices. The long-run effects on output should depend on the impacts on real interest rates, the elasticity of substitution in the production function and the oil intensity of production. We first describe the model and then monetary policy reactions embedded in the model. We raise oil prices by 20% for two years in our temporary experiment, and permanently in each of our other experiments, and these latter experiments change the terms of trade between the OECD and oil producers. This in turn changes the saving-investment balance in the OECD, as for a given level of output and oil use more goods have to be exported to OPEC and hence fewer are available for domestic consumption. For every level of income in the steady state, consumption must be less and this can only be achieved with higher real interest rates. These will impact on output by changing the capital to labor ratio.[4] We look at the overall effects of this shock on output and prices in the OECD, the United States, the U.K., the euro area and in selected other countries, including the Czech Republic, Hungary and Poland. We then analyze the effects of changing monetary policy responses and the speed of recycling oil revenues into OPEC imports of goods and services.

[4] *The oil intensity of output falls marginally, as oil imports fall more than total output. However, oil does not enter the production function.*

4.1 The NiGEM Model

Over the last 16 years, NIESR has developed the global macromodel NiGEM for use in forecasting and monetary policy analysis. NiGEM is an estimated model, which uses a "new-Keynesian" framework in that agents are presumed to be forward looking, but nominal rigidities slow the process of adjustment to external events. All countries in the OECD are modeled separately, and there are models of the new Member States, of China and of all other regions of the world including OPEC and Developing Europe. All economies are linked through the effects of trade and competitiveness. There are also links between countries in their financial markets via the structure and composition of wealth, emphasizing the role and origin of foreign assets and liabilities. The model has complete demand and supply sides, and there is an extensive monetary and financial sector. In scenarios we can choose any number of environments, and there are forward-looking wages, consumption and exchange rates, while long-term interest rates are the forward convolution of short-term interest rates. NiGEM contains rational expectations as its normal scenario mode.

Trade. These equations depend upon demand and relative competitiveness effects, and the latter are defined in similar ways across countries. It is assumed that exporters compete against others who export to the same market via relative prices and that demand is given by the imports in the markets to which the country has previously exported, while imports depend on import prices relative to domestic prices and on demand. As exports depend on imports, they will rise together in the model. Systems of trade equations are "closed" to ensure that the world balance of trade adds up, at least to its normal degree of accuracy, in any simulation. The equations are estimated in equilibrium correction form.

Financial markets. In scenario mode, forward-looking nominal long rates and real long rates are the forward convolutions of expected short-term nominal and real interest rates, respectively. Forward-looking exchange rates have to look one period forward along the arbitrage relation involving domestic and foreign short-term interest rates. Forward-looking equity prices are solved out from the discounted sum of expected discounted profits. The discount factor is made up of the nominal interest rate and the risk premium on equity holding decisions.

Wealth and asset accumulation. The wealth and accumulation system allows for flows of saving onto wealth and for revaluations of existing stocks of assets in line with their prices determined as above. In the medium term, personal sector liabilities are assumed to rise in line with nominal personal incomes, and if there are no revaluations, gross financial wealth will increase by the nominal value of net private sector saving plus the net increase in nominal liabilities.

Consumption and personal income. Consumption decisions are presumed to depend on income and total wealth in the long run, and follow the pattern discussed in Barrell and Davis (2004), who study a panel of G-5 countries. Total wealth is composed of both financial wealth and tangible (housing) wealth where the latter data are available (where housing wealth is absent, house prices play a separate role). The dynamics of adjustment to the long run are data based, and differ between countries to take account of differences in the relative importance of types of wealth and of liquidity constraints. Personal incomes are built up from components. Employment income comes from the labor market models. Profits and interest payments come from the production models, government models and models of foreign assets. Taxes and transfers come from the public sector models.

Production. For each country there is an underlying CES production function which constitutes the theoretical background for the specification of the factor demand equations for employment and the capital stock, and which form the basis for unit total costs and the measure of capacity utilization which then feed into the price system. The capital stock adjustment equation depends upon the long-run equilibrium capital stock, and the user cost of capital is influenced by the forward-looking real long-term rate as well as by taxes and by depreciation. The speed of adjustment to equilibrium in the investment/capital stock adjustment equations also depends upon the short-term real interest rate, with this effect being similar across countries.

Labor markets. Employers have the power to manage, and hence the bargain in the labor market is over the real wage. In the long run, wages rise in line with productivity, all else equal. Given the determinants of the trajectory for real wages, if unemployment rises, then real wages fall relative to trend and conversely. The equations were estimated in an equilibrium correction format with dynamics estimated around the long run. Both the determinants of equilibrium and the dynamics of adjustment can change over time and adjustment, especially in Europe, is slow. We assume that labor markets embody rational expectations, based either on the model or policy-related learning about inflation, and we assume that wage bargainers use consistent expectations either for the immediate period ahead or over a longer-term horizon.

Trend GDP. Trend GDP is determined by the production function and the labor market, with a role for real interest rates through the capital stock. We have complete capital stocks, working-age populations and work forces where data are available. The resulting estimates of trend GDP feed into a number of relationships in the model both directly and through the output gap, which depends upon it. Trend output calculations depend upon future as well as past data, and they are made in a forward-looking way in scenarios and can change in response to shocks.

Public sector. Each country has a set of equations for the public sector. Both direct and indirect taxes depend upon their respective tax bases and on the tax rate. Corporate taxes also depend upon the corporate tax rate and the level of profits, but with lags related to the complex collection process. Government spending on current goods and services and investment spending depend in part on current plans, and by default rise with trend output. Transfer payments depend upon unemployment and the dependency ratio as well as on policy. Government interest payments are determined by a perpetual inventory model based on the flow deficit and the stock of debt, with the appropriate structure of short- and long-term interest payments on the debt stock.

Monetary policy rules. We assume that the monetary authorities target something that stabilizes the price level or the inflation rate in the long term. The speed of response by the authorities affects the model properties. A typical policy for a central bank may be to target some nominal aggregate such as nominal GDP or the money stock, which may rise in line with nominal GDP in the long run. A standard monetary policy rule would be to change the interest rate according to some proportion of the targeted variable's deviation from its desired path. For example, a proportionate control rule on nominal GDP or the money stock would be:

$$r_t = \lambda_1(\log(P_tY_t) - \log(P_tY_t)^*) \quad (1)$$

where *P* equals the price level and *Y* is real output with a star denoting target variables.

However, a nominal target only stabilizes inflation in the long run, and policymakers are likely to be concerned with keeping inflation at some desired level in the short term. During the 1990s several countries moved to a new monetary policy regime of inflation targeting and announced a formal inflation targeting framework where decisions are guided by the deviation of inflation from some target level. We might write a similar rule with the money stock replaced by the inflation rate. This would give a simple proportional rule on the inflation rate (we may use either the current or the expected inflation rate; in this paper we use expected rates):

$$r_t = \gamma_1(\triangle \log P_{t+j} - \triangle \log P_{t+j}{}^*) \quad (2)$$

where j indicates the lead or lag in the feedback.

We presume that the European Central Bank (ECB) uses a combination of these two approaches. A combined policy of nominal aggregate targeting and inflation rate targeting would then give:

$$r_t = \gamma_1(\log(P_tY_t) - \log(P_tY_t)^*) + \gamma_2(\triangle \log P_{t+j} - \triangle \log P_{t+j}{}^*) \quad (3)$$

Our default has $\gamma_1 = 0.5$, $\gamma_2 = 0.75$. The coefficient on inflation does not need to exceed one, as the first term contains an integral controller on inflation in the price level. We change these parameters in order to emulate a looser monetary stance. The rules on the model use the Consumer Price Index (CPI) inflation rate. We choose the combined rule as our default monetary policy rule because we assume that it represents the mixed framework that is used by the ECB. In this paper we also use the industry standard Taylor rule. We may write the rule as:

$$r_t = \gamma_1(\log Y_t - \log Y_t{}^*) + \gamma_2(\triangle \log P_{t+j} - \triangle \log P_{t+j}{}^*) + \gamma_0 \quad (4)$$

We set $\gamma_1 = 0.5$, $\gamma_2 = 1.5$, which are the industry standards; γ_0 is the steady state real rate of interest.

We can divide these rules into two classes.[5] Rules 1 and 3 will return the price level (approximately) to base as long as the shock does not change equilibrium output.[6] If the shock does change equilibrium output in the long run and the rule is used mechanically, in the long run the price level will be higher in inverse proportion to the lower level of output. Rules 2 and 4 will stabilize the price level, but not at base, even if equilibrium output is not changed. Both rules treat past inflation as a bygone, and any inflation above target will feed into the price level. The stronger the feedback on inflation, the smaller the target miss in each period and hence the smaller the increase in the price level in

[5] *Some of these issues are discussed in Barrell, Dury and Hurst (2000).*

[6] *The outturn will be closer to base in the case of rule 3, where we have a derivative controller (inflation) as well, and in both cases the outturn will be closer to base if feedback on the nominal aggregate is increased.*

response to an inflationary shock. The long-run effect of a shock on the price level will depend also on the degree of nominal inertia in the wage-price system. In addition, increasing the interest sensitivity of the economy reduces the long-run impact of a shock on the price level, as monetary policy opens up a bigger output gap and hence reduces inflationary pressure.

4.2 A Standard Simulation of a Permanent 20% Rise in Oil Prices

We assume that all producers and consumers are aware that the increase in the oil price is permanent and that they change their behavior in a forward-looking way. In particular, financial markets are forward looking, and the impacts of any anticipated increase in interest rates are reflected immediately in higher long-term interest rates and lower equity and bond prices. This will reduce wealth and hence consumption. Prices rise everywhere, but they rise most in the United States, where lump-sum taxes on gasoline are much lower than in Europe. Hence a given rise in crude prices produces a larger percentage rise in pump prices and therefore in consumer prices, and in part because the wage-price system reacts more rapidly than in Europe or the U.K. In addition the oil intensity of output in the U.S.A. is about 40% higher than in the euro area and the U.K., and hence the impacts on prices are likely to be more marked. In all countries we assume that policy follows our default rules, which involve targeting the inflation rate and a nominal aggregate, so that rule differences are not the cause of outcome differences at this stage.

Table 5

Output Effects of a Permanent 20% Rise in Oil Prices[1]

	Euro area	OECD	U.K.	U.S.A.
2004	−0.31	−0.28	−0.17	−0.29
2005	−0.31	−0.42	−0.22	−0.55
2006	−0.27	−0.49	−0.22	−0.70
2014–2018	−0.53	−0.59	−0.35	−0.45

Source: NiGEM model simulations.
[1] Difference from base in percentage points.

Table 6

Inflation Effects of a Permanent 20% Rise in Oil Prices[1]

	Euro area	OECD	U.K.	U.S.A.
2004	0.13	0.18	0.04	0.26
2005	0.08	0.28	0.09	0.48
2006	0.01	0.20	0.07	0.32
2007	0.04	0.11	0.06	0.09

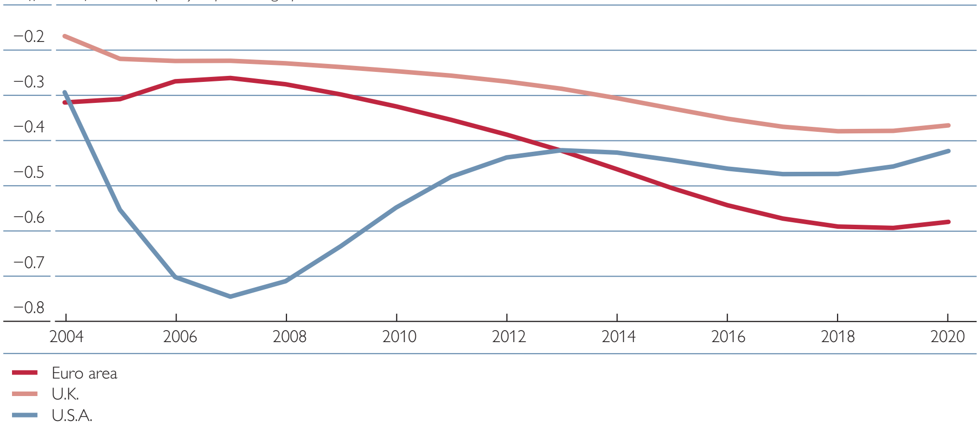
Source: NiGEM model simulations.
[1] Difference from base in percentage points.

In the long run, output falls in the United States, Europe and the euro area. The short-run output effects are largest in the U.S.A., in part because of its higher oil intensity and also because the inflation effect is larger and hence the monetary response is more immediate. As a result, real long rates rise rather more than in the euro area, as we can see from chart 6. In addition the pattern of oil exporters' demand affects the pattern of output effects. First, it takes some time for revenues to be recycled and second, oil producers' demands for imports of goods and services are more concentrated on European than U.S. producers. The long-run fall in output comes from the impact of the change

Chart 4

Output Effects of a Permanent 20% Rise in Oil Prices

Difference from base (GDP) in percentage points

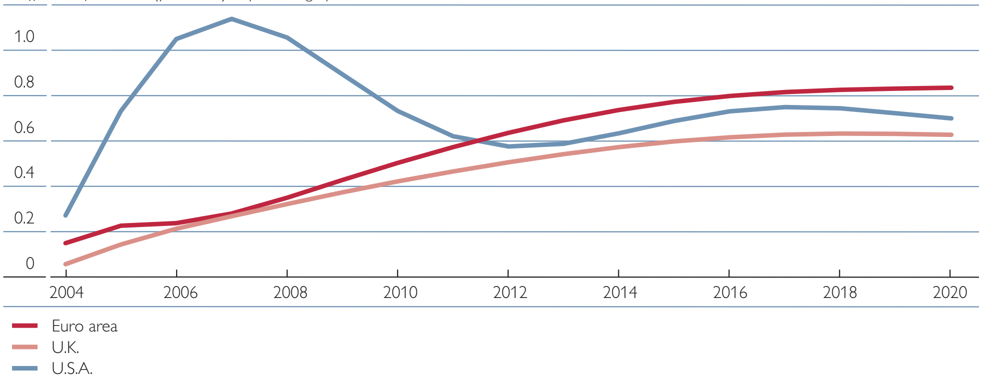


Source: NiGEM model simulations.

Chart 5

Price Effects of a Permanent 20% Rise in Oil Prices

Difference from base (price level) in percentage points

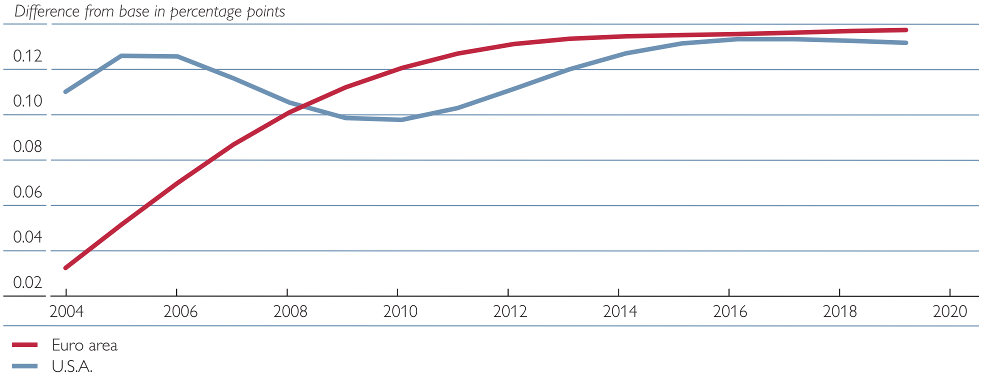


Source: NiGEM model simulations.

Chart 6

Effects of a Permanent 20% Rise in Oil Prices on Long Real Rates

Difference from base in percentage points



Source: NiGEM model simulations.

in the terms of trade between the OECD and OPEC. Although OPEC revenue is recycled (more quickly than in the 1970s), the OECD has to produce more goods for a given level of consumption, and this changes the saving-investment balance and reduces saving for every level of output in the steady state. Hence the real interest rate rises in the long run, and the steady state level of output falls because the equilibrium capital stock falls. The long-run effect on output is similar everywhere as long-term real interest rates rise everywhere, and the long-run output effects are independent of the policy response chosen.

Within Europe, the output effects differ between countries, and they are generally higher in countries with a higher oil intensity in production.[7] In particular, the negative effects on output are highest in the three new Member States we include because oil imports represent a much higher percentage of GDP in these countries than in the other OECD countries. In general, at 2001 exchange rates (latest year for which data are available free of charge) the oil intensity of these economies was about twice that of the United States, although at PPPs their intensity was below that measured in the U.S.A. Price effects are also more marked in the new Member States for similar reasons.

Table 7

Intra-European Output Effects of a Permanent 20% Rise in Oil Prices[1]

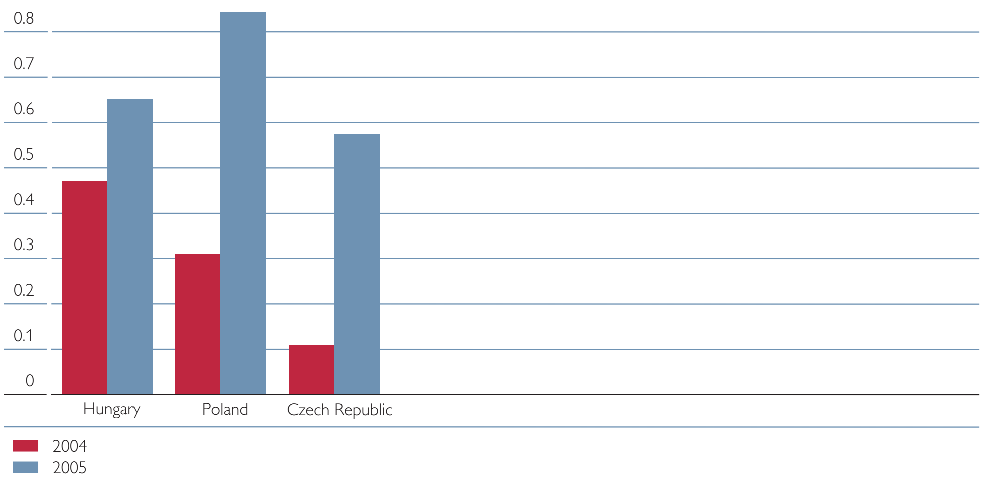
	Belgium	France	Germany	Italy	Netherlands	Spain	Czech Republic	Finland	Hungary	Austria	Poland	Sweden
2004	−0.42	−0.22	−0.36	−0.22	−0.38	−0.20	−1.45	−0.42	−1.02	−0.50	−0.66	−0.28
2005	−0.38	−0.28	−0.24	−0.30	−0.31	−0.29	−1.54	−0.45	−1.47	−0.21	−1.05	−0.29

Source: NiGEM model simulations.
[1] Difference from base (GDP) in percentage points.

Chart 7

Effects of a Permanent 20% Rise in Oil Prices on Price Levels in the New Member States

Difference from base (price level) in %



Source: NiGEM model simulations.

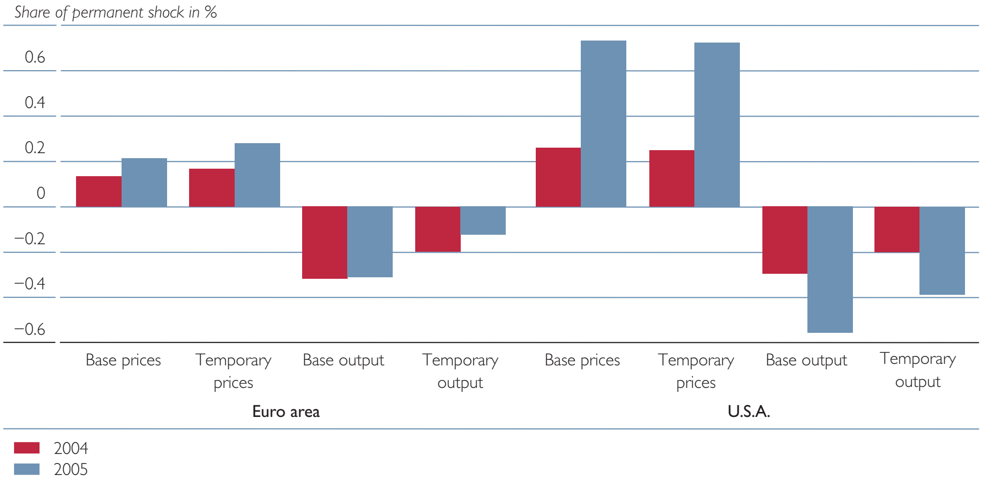
[7] *The correlation between impacts of the shock on GDP and the oil intensity of production measured at 2001 exchange rates (not PPP) is –0.56 among the 19 OECD countries we analyze, excluding oil-producing Mexico, and –0.57 if we include China and the non-oil exporting Latin American countries.*

4.3 Comparing Temporary and Permanent Shocks

We can undertake an analysis of the differing impacts of permanent and temporary shocks in our model because we have forward-looking expectations. The temporary shock we analyze is sustained for two years and is of the same initial magnitude as the permanent one. A temporary shock raises costs in much the same way as a permanent one does, but it does not induce any changes to the model's steady state solution and hence does not involve a rise of long-term real interest rates. If real interest rates do not change, the contractionary impacts of the shock are less even in the short run. Forward-looking agents bring the knowledge of the temporary nature of the shock into their decisions, and investment falls less. As we can see from chart 8, the output effect of a temporary 20% oil price shock is about 30% lower than it would have been if the shock were perceived to be permanent. As a result, a smaller output gap opens up, especially in Europe, and hence inflationary pressures are higher. The impacts of oil prices on inflation come from the direct impact on costs initially, and they are offset by the impacts of a reduction in output. The smaller the reduction in output, the smaller the offset to inflation from the impact on the output gap. As we see here, and especially in Europe, inflation is marginally higher when the shock is perceived to be temporary. The impacts across some European countries within EMU and in the new Member States are given in table 8, which shows that the contractionary impacts remain higher in the new Member States.

Chart 8

Comparison of Effects from Permanent and Temporary Oil Shocks



Source: NiGEM model simulations.

Table 8

Intra-European Output Effects of a Temporary (Two-Year) 20% Rise in Oil Prices[1]

	Belgium	France	Germany	Italy	Netherlands	Spain	Czech Republic	Finland	Hungary	Austria	Poland	Sweden
2004	−0.25	−0.15	−0.21	−0.15	−0.21	−0.12	−1.20	−0.24	−0.85	−0.29	−0.57	−0.15
2005	−0.09	−0.18	−0.02	−0.18	−0.08	−0.16	−1.27	−0.17	−1.18	0.00	−0.92	−0.09

Source: NiGEM model simulations.
[1] *Difference from base (GDP) in percentage points.*

4.4 Changing the Rules

We undertake two experiments where we change the rules, allowing a more accommodating monetary response to the shock. Such a response is indeed what we (and Bernanke et al., 1997) think caused the high inflation of the 1970s following high oil prices. Central banks may have tried to keep real interest rates constant in a situation when it was impossible for them to do this, and hence inflation resulted. As we see, it is possible for policymakers to ameliorate the short-run output effects of an oil price increase, but only at the cost of higher inflation in the short run and higher prices in the long run. The output effects in the long run remain largely unchanged.

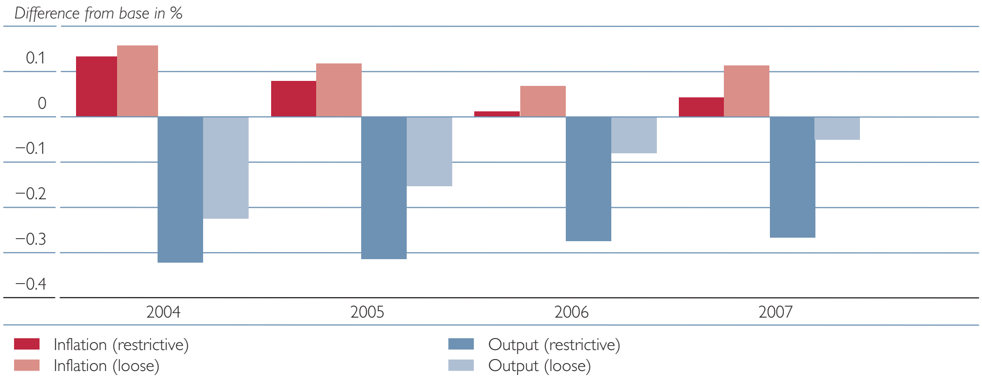
Chart 9

The Impact of Monetary Policy in the U.S.A.

Source: NiGEM model simulations.

Chart 10

The Impact of Monetary Policy in Europe



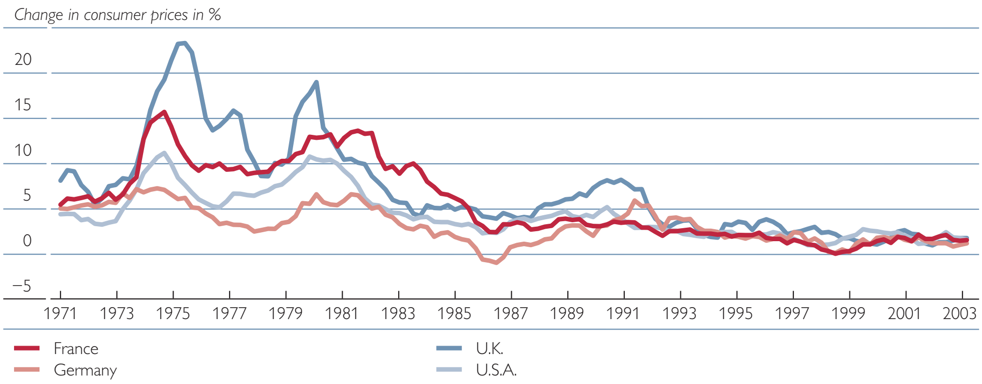
Source: NiGEM model simulations.

Our first experiment involves shifting the United States to use a standard Taylor rule in response to the output shock. As a result, interest rates do not rise so sharply, and as we can see from chart 9, the output effects in the first four years are about half the size they would have been under our default rules. Inflation effects are markedly higher, and the price level ends up about 6% above base, as compared to around 1% in our base case. Inflation in the euro area is little affected, but output effects there are about two-thirds the size of those observed in the base case.

We can repeat this experiment for the euro area, but instead of using a Taylor rule, we change the feedback coefficients in the two-pillar strategy, cutting each of them to around a third of our base case level, as discussed above. The output effects reported in chart 10 are two-thirds the size of the base case in the first year and about half the size over the first four years of the run. Inflation effects rise noticeably, as we would expect. Output effects in the United States are almost 10% less than in our base case, and the price effect is similar. It is clear that we need to know the response of the authorities to an oil price shock before we can know what the effects are. If the real oil price were to double, as it did in the 1970s, and the authorities were to act in a lax way in the U.S.A. (and the U.K.), as they did, then we might expect prices to rise by 30% or more in those countries. This seems a reasonable description of what happened in the U.S.A. and U.K. in the 1970s, but not a good description of what happened in Germany, as we can see from chart 11.

Chart 11

Inflation



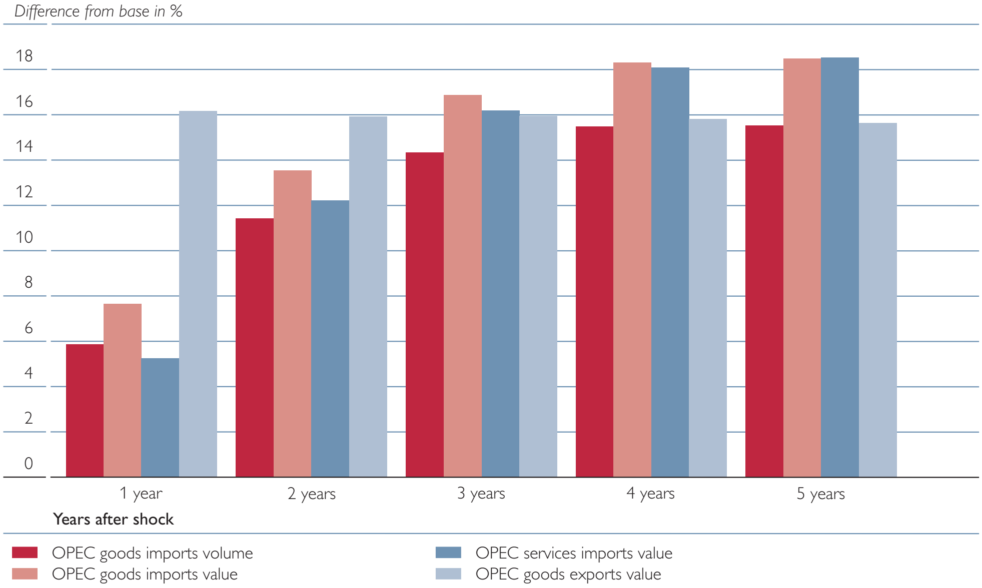
Source: NiGEM database.

4.5 The Effects of Revenue Recycling by Oil Producers

Oil producers receive significant revenues from oil sales, and when the price rises, they have three options for these revenues. They may spend them on imports of goods into their own country, on imports of services (where spending takes place in other countries), or the money can be accumulated into net foreign assets. In the latter case the money is recycled, but in a sticky price world with sluggish adjustment, accumulation of assets takes time to feed through financial markets into spending by others. On NiGEM we assume that oil producers spend their export revenue on imports of goods and services, and that they have a long-run structural capital flow that absorbs some revenue. If revenue rises, it is recycled into goods and services, but with a delay, as we can see from chart 12. In the long run, if export values rise by 20%, imports of both goods and services rise by 20%. However, initially the increase in spending is well below the increase in revenues, and hence spending is diverted in the world economy from goods and services, and output will be reduced because of low demand. The longer the period before the spending builds up, the greater the impact of an oil price rise on output within the OECD countries.

Chart 12

OPEC Trade after a 20% Oil Price Shock



Source: NiGEM model simulations.

We undertake an experiment to evaluate the importance of the speed at which oil producers recycle their revenues into goods and services. In our model, revenue not spent builds up into assets, and these become liabilities of another country. As a result, asset prices change, and this would eventually increase spending, but only slowly. We analyze the effect of halving the recycling of revenues into spending on goods and services by changing the dynamics of adjustment for oil importers' imports equations.[8] Chart 13 plots the output effects in our baseline experiment alongside the effects in a slower spending scenario under the same policy rules. The output effects of the 20% rise in oil prices are almost 50% higher in the OECD as a whole and in the euro area in particular. The effects on the U.S.A. and to a lesser extent on the U.K. are relatively similar under the two scenarios. The 1970s and even the early 1980s may have seen worse impacts from oil price shocks than those we experience now, as OPEC has itself changed and become more geared to spending revenue quickly. If this were to change, the output effects in our model simulations would have to be larger.

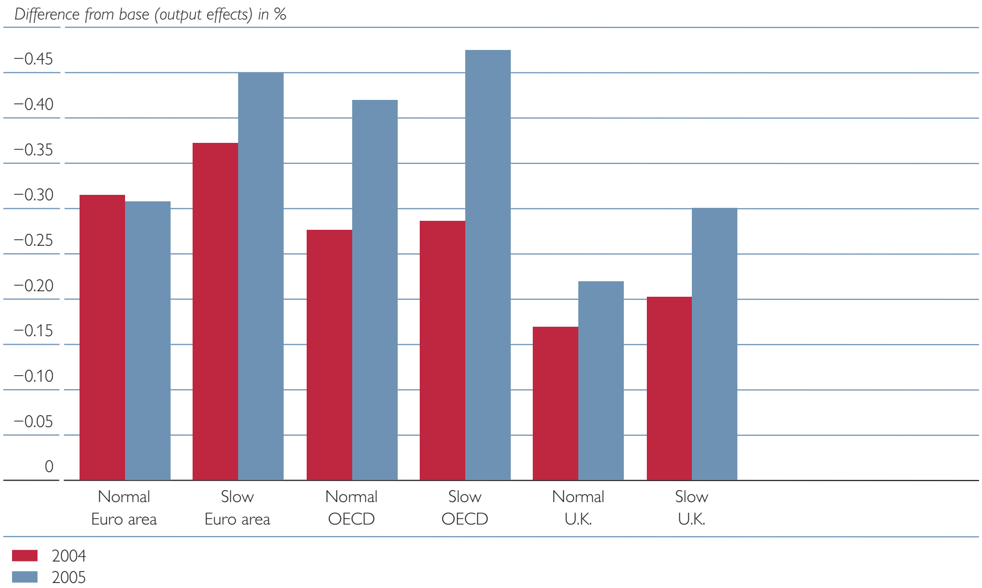
The effects of a slowdown in oil producers' spending on imports of goods and services could hit the new Member States rather more than the other Europeans. As we can see from table 9, which reports the difference between output effects in our base case and where we slow oil exporters' revenue spending, output effects are worse for all European countries. The impacts of slower spending of oil revenues builds up into the second year, where the difference in output effects rises to a maximum of –0.26 for the core European countries and reaches only –0.16 for Germany. However, if oil revenues are recycled more

[8] *Our spending equation for OPEC imports of goods exhibits a significant break in 1985, and before that date the speed of recycling into goods and services imports was around half of that seen since.*

slowly, the new Member States (in this case Hungary, the Czech Republic and to a lesser extent Poland) are noticeably more affected. This reflects their relatively high continuing dependence on trade with the former Soviet Union. Our model results reflect the decline in the importance of such trade, and the additional effects from low rates of revenue spending on the Czech Republic and Hungary are likely to be significantly larger than for the rest of Europe.

Chart 13

Movement of Oil Prices and OPEC's Share in World Oil Supply



Source: NiGEM model simulations.

Table 9

Additional Intra-European Ouptut Effects of a 20% Permanent Rise in Oil Prices[1]

under the Assumption that Oil Producers Spend Revenues More Slowly

	Belgium	France	Germany	Italy	Netherlands	Spain	Czech Republic	Finland	Hungary	Austria	Poland	Sweden
2004	–0.06	–0.05	–0.06	–0.05	–0.05	–0.02	–0.31	–0.07	–0.18	–0.14	–0.10	–0.04
2005	–0.21	–0.10	–0.16	–0.12	–0.13	–0.07	–0.74	–0.18	–0.41	–0.26	–0.24	–0.10

Source: NiGEM model simulations.
[1] Difference from base (GDP) in percentage points.

5 Conclusions

It is common to ask what the effects of a rise in oil prices are on the world economy. We analyze such a rise of around USD 7.5 a barrel from the beginning of 2004. Permanent oil price shocks should always reduce output in the long run, as they change the OECD's terms of trade and raise the real interest rate. However, although we can produce estimates of output and inflation effects that are of use in the monetary policy discussion, we have to add warnings to those. The most important warning concerns the policy response from central banks. The short-run impacts on output can be largely or even completely offset by monetary policymakers, but only at the cost of higher inflation in the short run and higher prices in the long run. Monetary authorities can, for instance, halve the short-run output effects and double the inflationary consequences if they choose to do so, while the output effects in the long run remain largely unchanged.

The impacts of oil shocks also depend on whether the shocks are temporary or permanent. A permanent shock should change the equilibrium real rate of interest and equilibrium output. In a forward-looking world, real interest rates will rise more if the shock is seen to be permanent, and hence output will decline more in the short run for a given monetary response. Hence the inflation consequences of a permanent shock are likely to be smaller than those of a sustained, but temporary shock. Analyses of oil shocks undertaken on the assumption that financial and labor markets are myopic and do not use rational expectations of the future will give misleading results, especially as they will be unable to distinguish between the effects of a shock that is expected to be permanent and one that is expected to be temporary.

The oil intensity of output also affects the impact of oil shocks; over the last 20 years, the oil intensity of output has declined significantly, however. Hence we would expect oil shocks to have less impact now than in the 1970s. In addition, the output effects of an oil shock in the OECD countries depend upon the behavior of oil-exporting countries. If they do not spend revenues quickly, output effects in the OECD countries will be larger in the short run. This may indeed further explain why the impact of the 1970s oil shocks on output seemed large, as spending of oil revenues on goods and services then took place more slowly than it has since 1985. Models and tools that cannot take account of this difference may produce misleading results.

All these conclusions indicate that great care should be taken in using "ready reckoners" for the effects of oil prices on output and inflation. Such estimates should always be seen as conditional on the assumptions made by the investigators and on the tools they use.

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