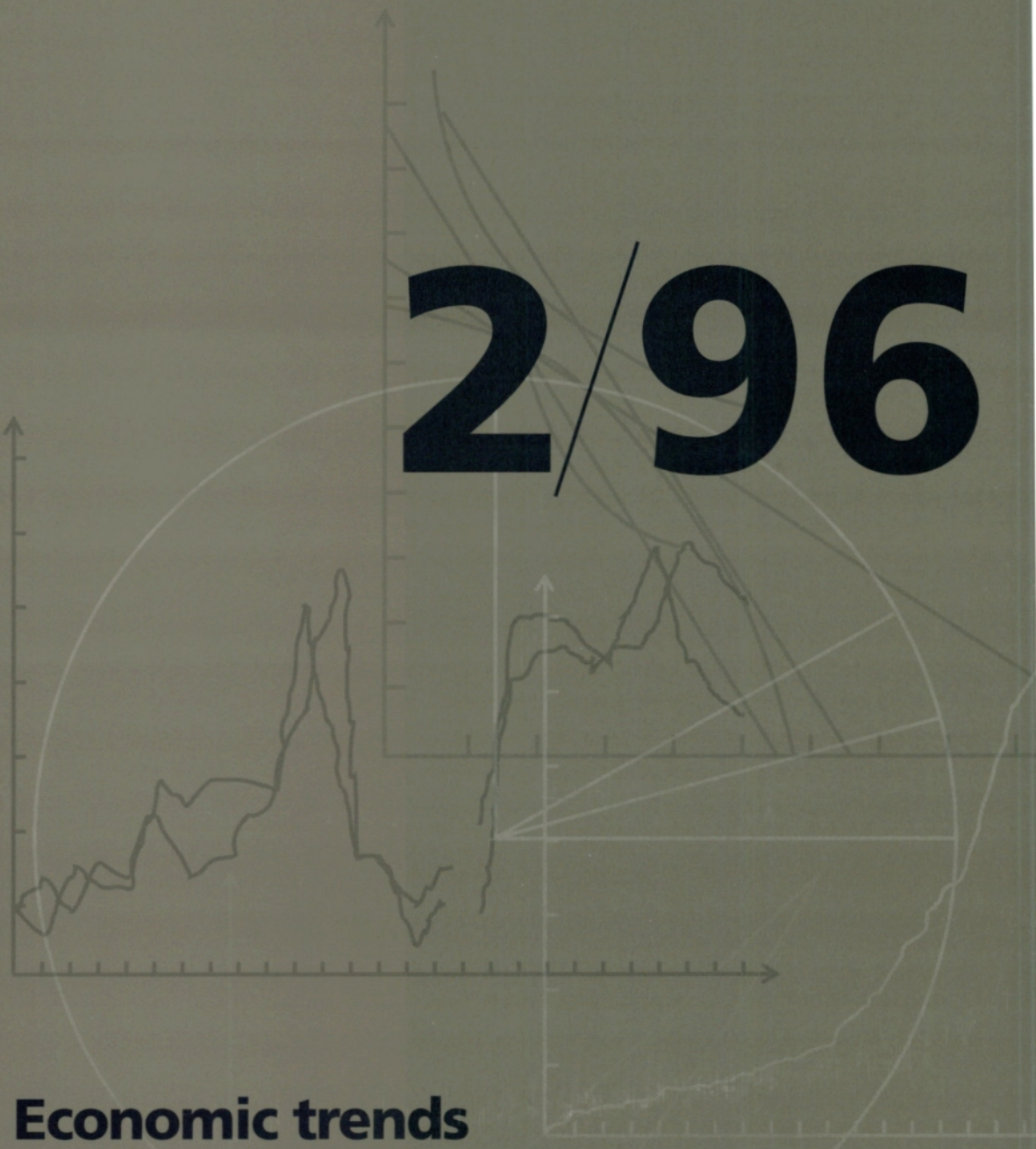
Economic Survey

Statistics Norway

2/96



Economic trends

- National accounts for 1 quarter
- Overview of international and Norwegian economic developments
- Forecasts for the Norwegian economy for 1996 and 1997

Articles

- Carbon taxation and CO_2 emissions in Norway
- European integration, energy demand and emissions to air

Economic Survey 2/96

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Economic Survey

is published four times a year by the Research Department of Statistics Norway. The Research Department was established in 1950. The Department has about 90-100 employees (January 1996). The Research Department is today organized in four divisions. Head of Department is *Olav Bjerkholt.*

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Symbols in Tables	Symbol
Data not available	..
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Economic trends

Following signs of somewhat slower output and demand growth in 1995, preliminary national accounts figures for the first quarter of this year indicate that the upturn in the Norwegian economy continues at an approximately unchanged pace. On the demand side, the expansion was particularly fuelled by traditional merchandise exports and household consumption, while manufacturing was the mainland industry which exhibited the sharpest growth.

Special supply-side conditions in Norway had a positive influence on export figures for the first quarter of 1996, but this does not provide a full explanation for the upswing. Traditional merchandise exports have also risen sharply, and on a broad basis, to countries where growth appears to be moving on an upward trend, such as the US and the UK. If cyclical developments in the US follow a traditional pattern, the US economy is likely to generate a further impetus to growth in the period ahead. The picture is somewhat bleaker for continental Europe. In a number of countries the discrepancy between the current budget situation and the Maastricht treaty's convergence criteria on government finances points to a continuation of a contractionary fiscal policy. Short-term interest rates are also now at such a low level that there is little likelihood of additional stimulus from monetary policy. The cyclical impetus from Europe will therefore probably be weaker in the period ahead than during the Norwegian upturn in 1993/1994.

Higher growth in household consumption in the first quarter can primarily be ascribed to the vigorous rise in car purchases, spurred by the change in excise duties from the beginning of the year. Brisk growth in real wages, however, may contribute to a further rise in private consumption through the year. Several factors have contributed to higher wage growth between 1995 and 1996, including the high level of profits in manufacturing industry the last few years.

Main indicators for the Norwegian economy
Growth from previous year. Per cent

	1995	1996	1997
GDP	3.3	4.3	2.2
Consumption in households and non-profit organizations	2.6	3.3	2.5
Unemployment rate[1)]	4.9	4.5	4.3
Consumer price index	2.4	1.4	2.0

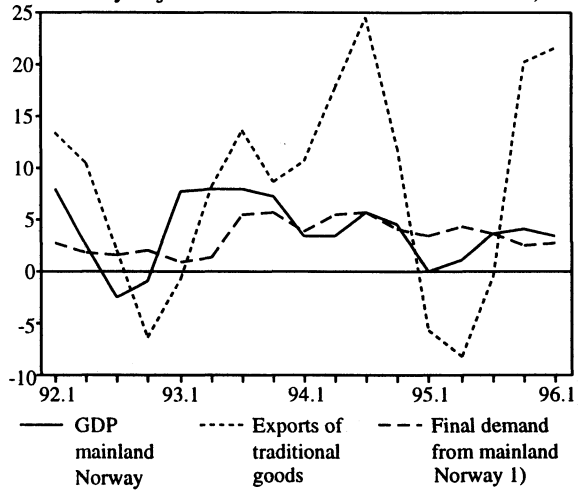
1) Level in per cent.

Improved profits in manufacturing industry are also part of the reason for continued growth in manufacturing investment this year, albeit at a more moderate pace than the level recorded between 1994 and 1995. In addition, a rise in oil investment and a sharp increase in public sector investment will contribute to growth in the Norwegian economy this year.

The current account of the balance of payments has shown substantial surpluses for several years. A steep growth in oil and gas exports will contribute to a further improvement in the balance of payments in 1996 as well as relatively high general-government budget surpluses.

Norway has seen a gradual decline in unemployment over the past few years without visible signs of escalating price inflation. Even though wage growth will be slightly higher this year and in 1997 compared with last year, inflation is still likely to be moderate. This year inflation in Norway will be noticeably lower both than the average among the main trading partners and in the EU. In 1997, price inflation in Norway is likely to remain on a par with or lower than the level abroad. With a continued upturn in the Norwegian economy, however, unemployment towards the end of 1997 may be reduced to a level where wage formation will be influenced by conditions in the labour market to a greater extent than earlier.

Cyclical development
(Per cent growth from previous quarter.
Seasonally adjusted and smoothed. Annual rates.)



1) Excl. oil and ocean transport.
Source: Statistics Norway.

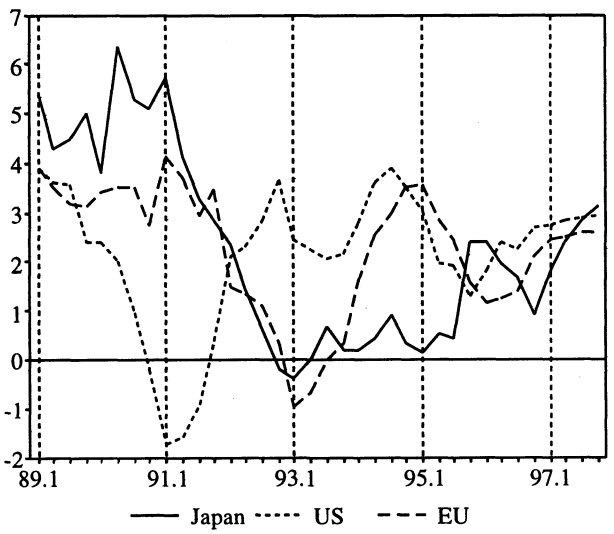
International economy

Following a cyclical upturn in 1994 and at the beginning of 1995, continental Europe experienced a slowdown last autumn. A lack of domestic growth impulses after exports were reduced was probably the main reason for this development. In the first quarter of 1996 there were some signs of improvement, particularly in France, but 1996 is still likely to be a cyclically sluggish year for continental European countries. This must be viewed against the background of high real interest rates and a tight fiscal policy. Central bank rates have been reduced to an historically very low level, and there is little likelihood of further cuts in interest rates. Last year the US avoided a traditional cyclical trough with a fall in GDP, and moderate growth is expected this year, while experience from earlier business cycles indicates that there may be a basis for slightly higher growth next year. The tight fiscal policy, however, suggests that the expansion will not be particularly robust. In Japan, there are also clear signs of an improvement in the economic situation, although it is unlikely that this economy will see a resumption of the high growth rates recorded in the 1980s, partly because there is now a need for fiscal policy tightening. The upturn in the US and Japan may contribute to somewhat higher growth in Europe next year.

GDP expanded by 1.9 per cent in *Germany* in 1995, all of which took place in the first half of the year. As a result of a decline in investment and stockbuilding, GDP fell from the third to fourth quarter. Movements in short-term indicators point to a continued slackening in output in the first quarter of 1996, partly due to the very cold winter which hampered activity. Some domestic indicators, however, point to a slightly more positive trend in the period ahead, and the depreciation of the Deutsche Mark and output rise in non-European countries are also expected to result in higher export growth. GDP growth will probably be low this year, but is set to pick up in 1997. Output in *France* also fell from the third to fourth quarter of 1995 as a result of strikes in the public sector. However, preliminary national accounts figures for the first quarter of this year show that economic activity has picked up sharply, and lower interest rates are expected to generate a further stimulus to the economy. Even though production in *Italy* fell in the fourth quarter of 1995, GDP expanded by 3 per cent from 1994 to 1995. The upturn was primarily fuelled by domestic demand, particularly investment. Private consumption exhibited a sluggish trend through the first half of 1995 and national accounts figures show that consumption drifted down in the last quarter of 1995. The weak real wage development and the high level of unemployment indicate that consumption is not likely to pick up this year. A relatively modest rise in GDP is projected for 1996, with possibilities of slightly higher growth next year. In the *UK*, GDP grew by 2.5 per cent in 1995. GDP growth this year may be slightly lower as a result of a reduced contribution from net exports in the wake of weaker trends in continental Europe. Higher growth in private consumption, stimulated by expected tax reliefs in an election year and in exports to the US, may contribute to a rise in GDP of more than 3 per cent next year.

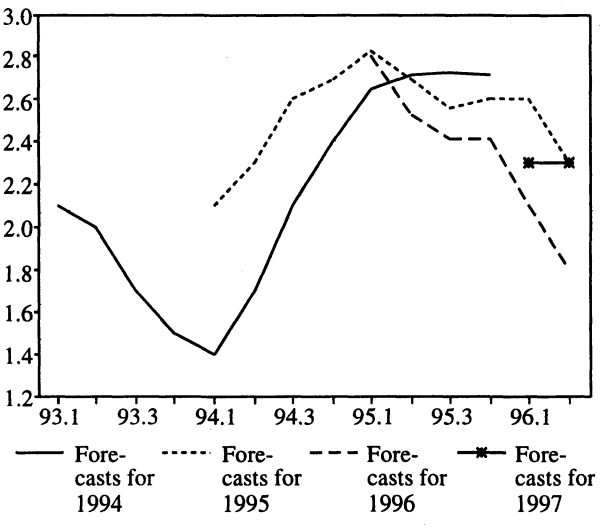
Revised national accounts figures, based on a new method of calculation, show that GDP in the *US* expanded by 2.0 per cent in 1995. High growth rates were recorded by exports and private investment in machinery and equipment. Preliminary figures for the first quarter of 1996 show that GDP growth edged up to 2.3 per cent (s.a.a.r.), with dome-

GDP-growth in US, Japan and EU (per cent)
Measured from the same quarter the previous year



Source: NIESR and Statistics Norway.

GDP-growth forecasts for Norway's main trading partners for 1994 - 1997 given on different dates



Source: Consensus Forecasts.

stic demand components making the greatest contribution to the expansion. GDP growth in the first three months of this year was relatively buoyant considering the fact that severe weather, a strike at General Motors and the government shutdown curbed the level of activity. Short-term data for April and May point to continued moderate growth in the US economy. Our projections indicate that higher growth in private consumption will be the main driving force in economic activity in the period ahead. For 1996 as a whole, GDP is expected to rise by a little less than 2.5 per cent, while it is assumed that GDP growth may approach 3 per cent in 1997.

In *Japan*, it appears that the long-awaited recovery started in the fourth quarter of 1995. For 1995 as a whole, GDP grew by 0.9 per cent, but the growth rate in the fourth quarter was as high as 3.6 per cent (s.a.a.r.). Growth was primarily spurred by public consumption and investment, a result of the many economic stimulus packages launched by the Japanese authorities during the four-year recession. Last year, however, private investment also advanced after declining for three years, and private consumption picked up in the second half of 1995. Short-term data for the first quarter of 1996 indicate that the recovery in the Japanese economy is now becoming more firmly entrenched; for example, unemployment fell by 0.3 percentage point from its, by Japanese standards, record level of 3.4 per cent. As the effect of government measures gradually wanes, private domestic demand is expected to take over as the main driving force in the economy. However, net exports will probably make a positive contribution as a result of the depreciation of the yen which has taken place since last autumn. GDP growth is projected to expand by a little less than 2 per cent in 1996, rising to about 2.5 per cent in 1997.

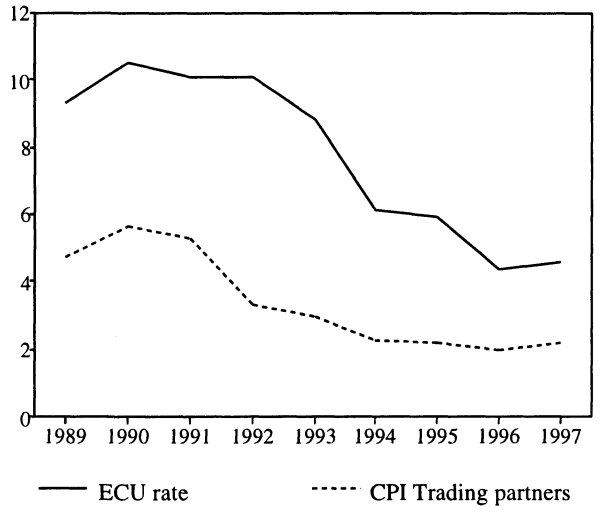
National accounts figures show that 1995 was a peak year for *Sweden*, with GDP growing by 3 per cent. A sharp rise in exports and private fixed investment made a positive contribution to growth. As a result of lower activity among trading partners, export growth is expected to slow this year accompanied by a slightly lower rise in investment. With a continued sluggish trend in private consumption, considerably lower economic activity is thus likely in 1996. The forecasts point to GDP growth of less than 1 per cent. Based on a projected upswing in major industrial countries, it appears that the growth rate may edge up to about 2 per cent in 1997. In *Denmark*, GDP expanded by 2.6 per cent last year. Growth tapered off through the year, primarily as a result of the slowdown in the German economy which had a negative impact on Danish exports. Private consumption has been an important driving force behind the vigorous growth in Denmark the last two years, but consumption growth is expected to slacken substantially this year. This must be viewed in connection with lower growth in household income (particularly interest income) and a projected rise in the saving ratio. However, wage growth will probably be slightly higher next year, and an international economic upturn will also have a favourable impact on exports. All in all, the forecasts point to a rise in GDP of

Economic forecasts for Norway's main trading partners
Annual per cent change

	1995	1996	1997
USA			
GDP	2.0	2.3	2.8
Private consumption deflator	2.3	2.2	2.7
Short term interest rate (level)	5.9	5.4	6.2
General government budget deficit[1)]	-1.9	-1.5	-1.3
Japan			
GDP	0.9	1.8	2.5
Private consumption deflator	-0.4	0.4	1.3
Short term interest rate (level)	1.2	0.7	1.6
General government budget deficit[1)]	-4.3	-5.4	-4.8
Germany			
GDP	1.9	0.8	2.3
Private consumption deflator	2.0	1.6	1.6
Short term interest rate (level)	4.5	3.3	3.7
General government budget deficit[1)]	-3.6	-3.6	-3.0
France			
GDP	2.2	1.4	2.3
Private consumption deflator	1.7	2.4	2.1
Short term interest rate (level)	6.6	4.2	4.3
General government budget deficit[1)]	-5.3	-4.5	-3.6
United Kingdom			
GDP	2.5	2.4	3.3
Private consumption deflator	3.4	2.3	2.5
Short term interest rate (level)	6.7	6.0	5.9
General government budget deficit[1)]	-5.5	-4.0	-3.4
Italy			
GDP	3.0	1.4	2.1
Private consumption deflator	5.4	4.5	4.1
Short term interest rate (level)	9.0	7.7	7.4
General government budget deficit[1)]	-7.9	-6.7	-5.9
Sweden			
GDP	3.0	0.9	2.0
Private consumption deflator	2.9	1.6	2.1
Short term interest rate (level)	8.7	7.1	6.8
General government budget deficit[1)]	-8.1	-4.9	-3.3
Denmark			
GDP	2.6	0.9	2.2
Private consumption deflator	1.8	2.4	2.8
Short term interest rate (per cent)	8.3	7.7	7.9
General government budget deficit[1)]	-1.5	-2.1	-1.6
The Netherlands			
GDP	2.4	2.0	2.6
Private consumption deflator	2.0	2.5	2.2
Short term interest rate (level)	4.4	3.2	3.7
General government budget deficit[1)]	-3.5	-3.2	-2.9
Memorandum items:			
GDP trading partners	2.3	1.6	2.5
CPI trading partners	2.2	2.0	2.2
ECU interest rate	5.9	4.4	4.6

1) Per cent of GDP
Sources: NIESR and calculations by Statistics Norway. National sources for Sweden and Denmark.

3 month ECU rate and growth in consumer prices for Norway's trading partners. Per cent



Source: Statistics Norway.

less than 1 per cent in 1996 and a little more than 2 per cent in 1997.

The forecasts indicate that *price inflation* among Norway's main trading partners will be about 2 per cent both in 1996 and 1997. In European countries, the low level of activity and high unemployment is generally contributing to moderate inflation, with the projections for the rise in consumer prices ranging between 1.5 and 2.5 per cent for most countries. One exception is Italy where the increase in consumer prices was as high as 5.4 per cent last year, although the inflation rate in Italy now seems to be edging down. The forecasts indicate that inflation may be reduced to about 4 per cent in 1997, but higher wage growth – following a slower rise in real wages the last two years – may prevent a further decline in the inflation rate. Inflation in Sweden was an average 2.9 per cent in 1995, but moved on a downward trend throughout last year. The VAT rate was reduced from 21 to 12 per cent from 1 January 1996, which has resulted in a further drop in the 12-month rise in prices to less than 2 per cent. The VAT reduction, however, was more than offset by increases in other indirect taxes, including a higher property tax, which is expected to push up consumer price inflation by a quarter of a percentage point in both 1996 and 1997. As a result of the low level of activity in the Swedish economy this year, inflation will nevertheless be about 1 1/2 per cent. In line with the projected rise in production, the forecasts point to inflation of more than 2 per cent next year. Inflation in the US still shows few signs of quickening and is expected to be moderate this year. However, the rate will probably pick up slightly in 1997 as a result of the projected expansion in economic activity. Following a period of falling prices in Japan, the year-on-year rise in prices was 0.3 per cent in April. Inflation will probably edge up as output gradually expands.

As a result of lower economic activity in continental Europe, *monetary policy* has gradually become less contractionary over the last six months. In Germany, the central bank lowered both key rates by half a percentage point in April this year even though money supply growth far exceeded the target range. The discount rate is now at an historically low level and no further interest-rate cuts are expected. In France, the central bank has gradually reduced official rates since December. The intervention rate was lowered by altogether 1.2 percentage points in this period. The reduction in interest rates was possible because German rates have been lowered and because the franc has appreciated against the Deutsche Mark. Long-term rates have also fallen and are now on a par with German rates, which may indicate that market participants expect monetary union between these countries. In Italy, the central bank's interest rate has been constant for a long time. Market rates have nevertheless fallen markedly the past year; short rates declined by 2 percentage points and long-term rates fell by almost 3 percentage points. The new Government in Italy is aiming at a further decline in interest rates and has the goal of rejoining the ERM. The central bank in Sweden has cut its repo rate a number of times since the beginning of 1996, most recently to 6.3 per cent on 4 June. The interest-rate cuts must be viewed in connection with the bank's inflation target (of 1-3 per cent) and the substantial decline in the inflation rate since last autumn. In the UK, the base rate has been reduced on four occasions (each by 0.25 percentage point) over the past six months and now stands at 5.75 per cent. The reason is probably that inflation is low and there are no visible signs of price pressure in the economy. Even though nominal short-term rates are now very low in Europe, real long-term rates - which also play an important role in economic developments - are still at a high level. This is related to very low price inflation as well as the fact that interest rates are also influenced by developments in the US capital market.

The US Federal funds rate has been reduced three times since July last year, most recently to 5.25 per cent in January 1996. As a result of signs of an upturn in the economy, the Federal Reserve is expected to conduct a tighter monetary policy. Subdued price pressures, however, do not provide grounds for immediate intervention on the part of the authorities. Historically, the Federal Reserve has not changed interest rates just before a presidential election, and we therefore expect the funds rate to remain at its current level until after the election in November. Short-term rates are likely to rise in 1997. In Japan, the economic slump over the past three years has been met with gradual reductions in the discount rate, most recently to a record-low 0.5 per cent in September 1995. The recovery which now seems to be under way is fragile at the moment, and the central bank is not expected to tighten policy until the recovery is more pronounced.

Fiscal policy in Europe is largely focused on satisfying the convergence criteria set out in the Maastricht treaty, thereby paving the way for monetary union. With lower economic activity it now appears to be more difficult than expec-

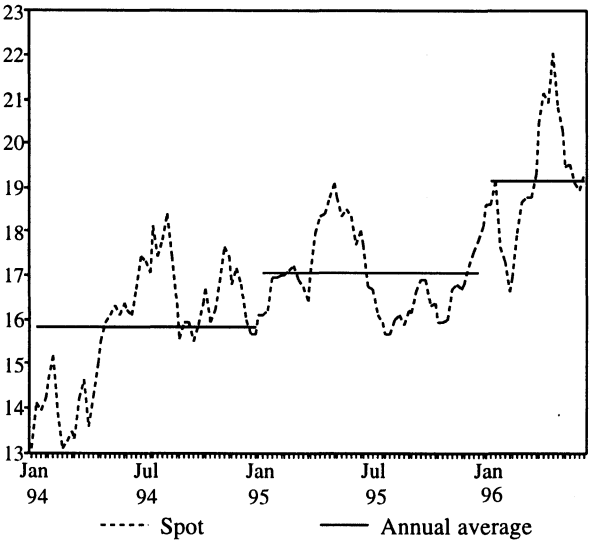
ted to satisfy these criteria by the deadline and several countries have tightened fiscal policy. The Government in Germany has presented a savings package which contains a number of proposals to curb public spending. All in all, the package entails a reduction in expenditure of DM 70 billion, equivalent to about 2 per cent of GDP. The proposals call for a gradual rise in the retirement age for women from 60 to 63 years and a reduction of sick pay from 100 per cent to 80 per cent of basic wages. The package also presupposes zero nominal growth in public sector wages, which has met with considerable resistance from trade unions. In France, fiscal policy was tightened as early as June last year in the form of tax hikes and spending cuts, equivalent to 0.7 per cent of GDP. The measures were followed up in November by a plan to reduce social security payments. The proposal was modified slightly following major protests and public-sector strikes. Further tax increases are not being considered, but the Government plans to keep government expenditure constant in nominal terms from 1996 to 1997, which entails a real tightening of 2 per cent. In Italy, the new administration has a target of reducing the budget deficit to 5.9 per cent of GDP in 1996, but this may prove difficult to achieve. In Sweden, the authorities have been tightening policy for several years, and this has contributed to strengthening government finances. The budget deficit fell by about 3 percentage points last year, but is still equivalent to 8 per cent of GDP. Further increases in taxes and user fees, as well as a reduction in transfers to households, have therefore been proposed, and this is expected to reduce the deficit to close to 3 per cent of GDP in 1997. It is assumed that the UK is the only country where fiscal policy will be expansionary in the period ahead. This must be viewed in connection with the approaching general election and the country's opt-out protocol, which means that the UK is not obligated to join EMU.

In the US, fiscal policy is still being tightened, and as a result of higher than expected tax revenues it now appears that the Federal budget deficit for this fiscal year will be about $ 120 billion, the lowest since 1981. Even though much attention has been focused on the government deficit in the US, the situation, as shown in the table, is considerably more favourable than for the majority of EU countries. Japan's budget balance has deteriorated substantially as a result of the many economic stimulus packages launched by the authorities during the protracted recession. As activity gradually picks up, policy is expected to be tightened and it is likely that VAT will be raised from 3 to 5 per cent in April 1997. Further measures other than those already planned are probably necessary to prevent Japan's general-government net debt of about 10 per cent of GDP from rising dramatically in the long run.

The oil market

The price of crude oil has been relatively high so far this year. In mid-April the spot price of Brent Blend climbed to $ 22 p/b, the highest level since October 1991. The rise in prices is primarily ascribable to weather conditions. Cold weather has contributed to higher than expected consumption, particularly in North America and Europe. Production has also been limited by severe weather conditions, not least in the British sector of the North Sea. As a result, oil stocks are now lower than the normal average level, and the price is probably more sensitive to disturbances on the demand and supply side than usual.

Spot price, Brent Blend
Dollar per barrel



Source: Petroleum Intelligence Weekly

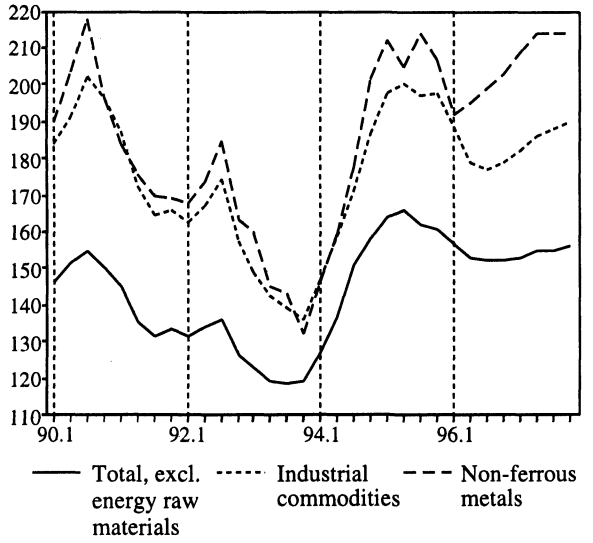
There have been speculations for some time as to what extent Iraq would be given permission to sell oil on the world market again, following a boycott of more than five years. At the beginning of May the UN and Iraq signed an agreement which permits exports of Iraqi oil equivalent to $ 2 billion over a six-month period on the condition that revenues are only used for humanitarian purposes. There is some uncertainty as to how OPEC will respond to this, but it is unlikely that the organization will reduce quotas for other member countries by an amount corresponding to the rise in production in Iraq. The agreement also appears to have had a negative influence on oil prices, with prices falling to about $ 18 p/b after the agreement was signed.

Even though market conditions have been favourable for oil producers the last six months, IEA's expectations of market balance in 1996 indicate that the supply of oil from non-OPEC countries will continue to expand at a faster pace than global demand. In isolation, this should imply lower oil prices in the period ahead. The need to rebuild oil stocks following the high consumption last winter points in the opposite direction.

Other commodity markets

Prices of commodities, excluding energy, rose sharply through 1994, peaked in the summer of 1995 and have since edged down. According to the HWWA commodity price index, commodity prices (excluding energy) fell by 4.1 per cent in the 12 months to April 1996. Even though

Commodity prices on the world market
Dollar based indices. 1975 = 100



Source: HWWA-Institut fur Wirtschaftsforschung.

the cyclical situation has deteriorated considerably the last six months, it still appears that commodity prices will remain fairly constant in the period ahead. This entails a projected decline in the average price of about 6 per cent from 1995 to 1996. With the prospect of brisker economic growth next year, a slight rise in commodity prices is likely in 1997.

Forest and farm-based industrial commodities posted the greatest decline in prices, dropping about 20 per cent. Prices of wood products, for example, have fallen considerably, primarily as a result of low activity in residential construction, particularly in Germany but also in the UK and France. Over the past year pulp prices have fallen sharply as a result of a decline in the volume of new orders in North America and Europe. The price of wool and cotton also edged down last autumn, and it appears that the sluggish trend will continue.

Metal prices have also dropped considerably the past year. Prices of non-ferrous metals have fallen by a little more than 6 per cent since April last year. Aluminium and copper prices accounted for much of the decline, and the fall in prices must be viewed in connection with sluggish economic trends in continental Europe. At the beginning of 1996, however, prices of aluminium and copper flattened out. Whereas prices of tin, zinc and nickel have exhibited a relatively stable trend the last six months, the price of lead rose considerably, probably due to higher demand for batteries as a result of the severe winter in Europe and the US.

Steel production reached a record level last year after rising by 3 per cent from 1994 to 1995. The rise in production was fuelled by favourable demand conditions, and the price of steel increased by 10 per cent in the same period. The market has been weak this past winter, however, both as a result of the cold weather and the unfavourable economic situation in Europe, and prices are not expected to rise as much this year.

Prices of food and beverages have moved up the past year, primarily as a result of a steep rise in grain prices. The price of barley has shown the sharpest increase, but prices of maize, rice and wheat have also risen at a relatively brisk pace. Grain prices started to rise in the second half of 1995 when it was apparent that the grain harvest would be poor in important producer countries such as Australia. Wheat production in the US was adversely affected by a drought last winter, exerting strong upward pressure on wheat prices. Structural conditions, such as the scaling back of agricultural land in Europe and steadily rising demand from developing countries, have also influenced developments in the grain market. Stocks are now at a very low level and it will take very little before prices increase further. In the slightly longer run, however, high prices are expected to stimulate increased production.

Norwegian economy

Developments thus far in 1996

According to preliminary figures from the quarterly national accounts, GDP expanded by a seasonally adjusted 1.6 per cent from the fourth quarter of 1995 the to first quarter of this year. Growth from 1994 to 1995 is estimated at 3.3 per cent. Mainland GDP grew by 0.8 per cent in the first quarter, approximately on a par with growth through last year. Demand from mainland Norway rose by a seasonally adjusted 1 per cent from the fourth quarter of 1995 to first quarter of 1996.

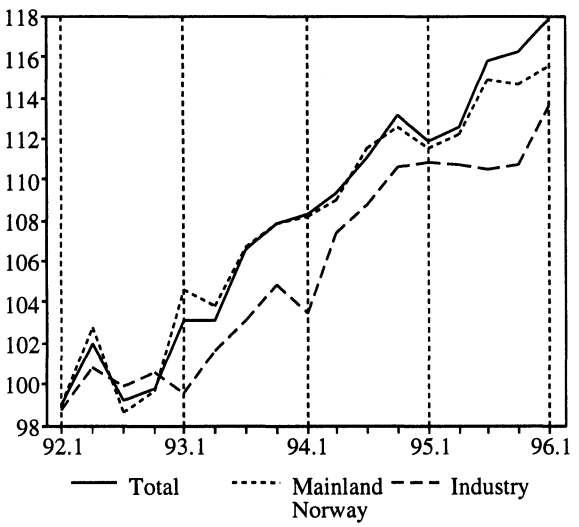
Output growth was particularly fuelled by manufacturing industry in the first quarter. Following stagnation and signs of a decline in manufacturing production through 1995, preliminary figures for the first quarter of 1996 show a seasonally adjusted rise of 2.7 per cent, which is higher than underlying growth through 1993 and 1994. Production in other goods-producing industries showed little change in the first quarter of 1996 after rising markedly in the fourth quarter of last year. Activity in service industries as a whole exhibited a relatively sluggish trend in the first quarter.

The growth in manufacturing production must be viewed in connection with developments in traditional merchandise exports. After moving on a fairly weak trend through 1995, these exports picked up markedly in the first quarter of 1996, both in value and volume terms, and the positive trend continued in April. As a result of maintenance work at the Mongstad refinery towards the end of last year, exports of refined petroleum products rose sharply from the fourth quarter of 1996 to first quarter of this year. Excluding these products, traditional merchandise exports showed a seasonally adjusted rise of a little less than 8 per cent. It appears that exports to the US and UK showed a pronounced rise, which is logical inasmuch as these countries are now recording the strongest growth among Norway's main trading partners. Exports to Germany exhibited a weak trend, which also seems reasonable in light of the marked slowdown there. Prices of traditional export goods, seasonally adjusted, appear to have edged down from the fourth quarter of 1996 to first quarter of this year, following modest changes through the second half of 1995.

Consumption in households and non-profit organizations ("private consumption") also showed a vigorous rise in the first quarter of this year after exhibiting a sluggish trend in the fourth quarter of 1995. Developments must be viewed in connection with changes in car taxes and the temporary rise in the deposit refund for scrapped cars for this year. Household purchases of transport equipment rose by nearly 40 per cent, seasonally adjusted, between the fourth quarter of 1995 and first quarter of this year after declining about 8 per cent in the previous quarter. Seasonally adjusted new car registrations for April and May show a modest rise from the level in the first quarter. The growth for other consumption groups was only a seasonally adjusted 0.3 per cent in the first quarter, or about the same as in the fourth quarter of 1995.

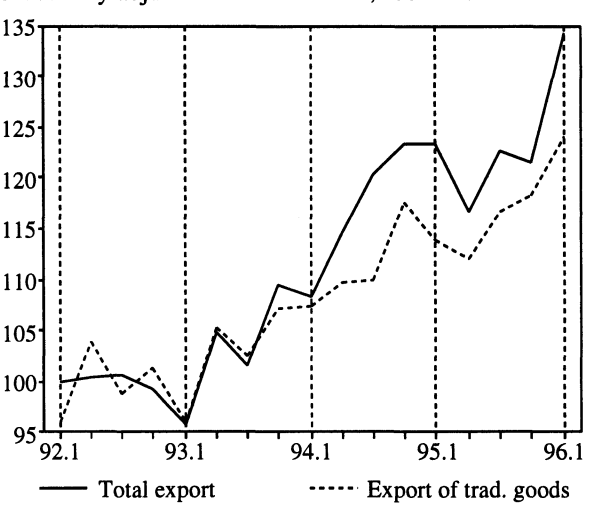
Preliminary estimates indicate that mainland investment growth slowed somewhat from the fourth quarter of 1995 to the first quarter of 1996 after declining through last year. Manufacturing investment, however, showed continued growth, and the investment intentions survey for the second quarter of 1996 indicates that this investment will remain high in the period ahead. General-government in-

Gross domestic product
Seasonally adjusted volume indices, 1992=100



Source: Statistics Norway-

Exports
Seasonally adjusted volume indices, 1992=100



Source: Statistics Norway.

Macroeconomic indicators[1)]
Growth from previous period unless otherwise noted. Per cent

			Seasonally adjusted			
	1994	1995	95.2	95.3	95.4	96.1
Demand and output						
Consumption in households and non-profit organizations	4.1	2.6	1.6	1.8	-0.2	1.9
General government consumption	0.7	0.2	0.8	0.5	0.2	0.3
Gross fixed investment	8.7	9.6	6.7	0.2	3.7	-7.0
- mainland Norway	17.2	13.5	0.4	1.0	0.9	-0.7
- petroleum activities	-7.3	-13.1	0.9	3.1	15.1	-19.9
Final domestic demand from mainland Norway[2)]	5.2	3.8	1.2	1.4	0.1	1.0
Exports	8.2	3.8	-1.7	4.2	1.4	4.8
- crude oil and natural gas	11.6	8.4	-0.6	3.8	10.3	1.1
- traditional goods	13.1	4.1	-5.5	5.2	-1.0	10.5
Imports	6.9	5.1	3.7	-0.5	3.0	-0.9
- traditional goods	15.3	9.1	3.2	1.4	0.8	5.6
Gross domestic product	5.0	3.3	0.6	2.9	0.4	1.5
- mainland Norway	4.3	2.7	0.6	2.4	-0.2	0.8
Labour market[3)]						
Man-hours worked	0.9	1.2	0.3	0.2	1.4	0.1
Employed persons	1.2	2.1	0.5	0.7	0.9	0.8
Labour force	0.9	1.6	0.2	0.3	0.4	1.3
Unemployment rate, level	5.4	4.9	5.2	4.7	4.3	4.8
Prices						
Consumer price index[4)]	1.4	2.6	2.7	2.3	2.2	0.9
Export prices, traditional goods	1.1	7.1	-1.9	0.0	-0.4	-1.0
Import prices, traditional goods	0.3	0.7	-0.1	-0.2	-0.0	-1.4
Balance of payment						
Current balance, bill. NKr	21.0	28.4	5.1	8.5	3.8	17.5
Memorandum items (unadjusted, level)						
Eurokrone rate (3 month NIBOR)	5.7	5.4	5.5	5.3	5.2	5.1
Average borrowing rate[5)]	8.3	7.8	7.8	7.7	7.6	
Crude oil price, NKr[6)]	111.3	107.8	113	102	106.3	119.1
Importweighted krone exchange rate (1993=100)	101.4	99.1	99.2	98.1	99.1	99.2

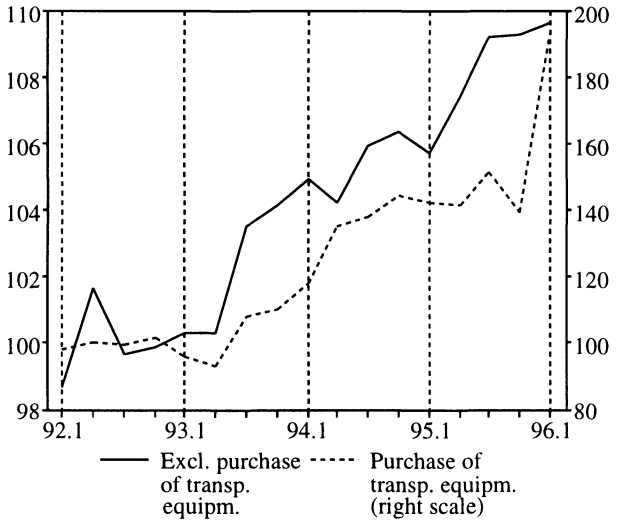
1) Figures for 1994 and 1995 may deviate somewhat from those published in Economic Survey 1/96 due to new information.
2) Consumption in households and non-profit organizations + general government consumption + gross fixed capital formation in mainland Norway.
3) Based on monthly figures, seasonally adjusted.
4) Percentage change from previous year.
5) Households' borrowing rate in private financial institutions
6) Average Norwegian oil production.
Source: Statistics Norway.

vestment also rose, and the school reform will contribute to further growth through the remainder of the year. Investment in private services declined considerably in the first quarter of this year after rising briskly through 1995, and the decline in housing investment persisted. The development in housing investment reflects a downward trend in the figures for housing starts through 1995. This is probably related to a shortage of serviced sites as prices of resale homes continue to rise. The square metre price of existing homes sold through estate agents in the first quarter of this year was in real terms a good 5 per cent above the average for last year. According to Statistics Norway's price statistics, the real price of existing homes increased by about 5 per cent in 1995 following a rise of more than 11 per cent the previous year. Seasonally adjusted figures from building statistics up to end-April 1996 show a stabilization of housing starts (measured in square metres) at the level from the fourth quarter of 1995.

Petroleum investment fell markedly in the first quarter of 1996 after declining by 13 per cent at an annual rate from 1994 to 1995. Investment statistics for the second quarter, however, indicate that petroleum investment will pick up over the next quarters, and on an annual basis is likely to show a growth of about 6 per cent.

Inventory investment was approximately unchanged from the first quarter of 1995 to the first quarter of 1996. In the national accounts this investment is measured as the difference between supply and use, i.e. the difference between production and imports on the one hand and deliveries to product inputs, exports, consumption and investment on the other. Inventory investment has risen markedly over the last three years, which may indicate that the national accounts figures have overestimated supply or underestimated demand. This does now appear to be the case for 1996, however.

Consumption in households
Seasonally adjusted volume indices, 1992=100

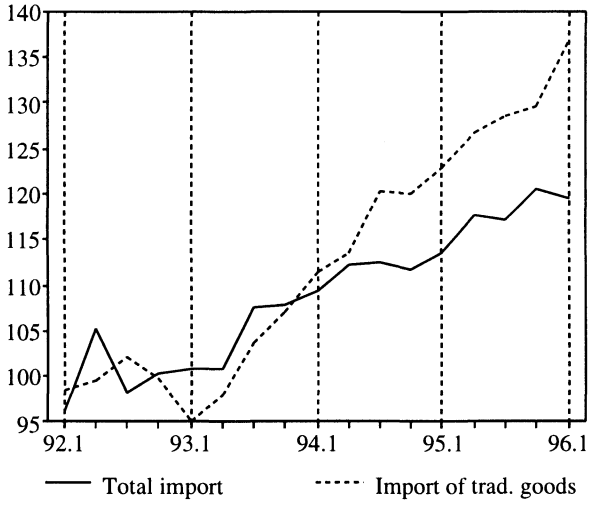


Source: Statistics Norway.

Gross fixed capital formation, Mainland Norway
Seasonally adjusted volume indices, 1992=100

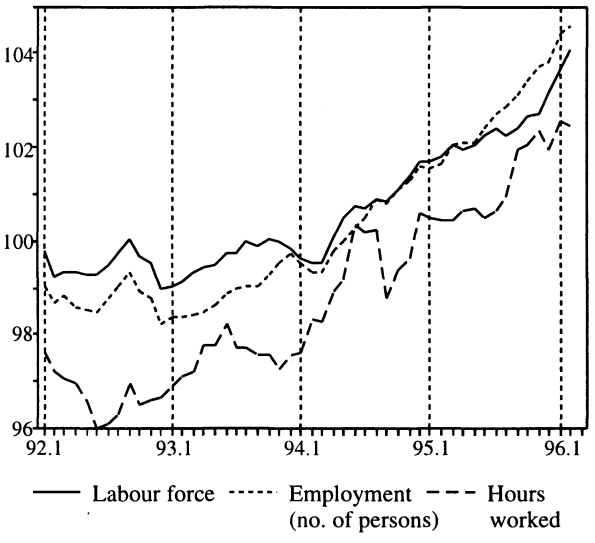
Source: Statistics Norway.

Imports
Seasonally adjusted volume indices, 1992=100



Source: Stastistics Norway.

Labour force and employment
Seasonally adjusted and smoothed indices. 1990=100



Source: Statistics Norway.

Traditional merchandise imports (measured in volume) showed brisk growth in the first quarter of 1996 following signs of levelling off through 1995. Imports of engineering goods, which through 1995 rose at a noticeably faster pace than total traditional merchandise imports, accelerated in the first quarter. Furthermore, imports of passenger cars and other motor vehicles surged. Prices of traditional import goods fell moderately from the fourth quarter of 1995 to the first quarter of 1996 (seasonally adjusted), and the terms of trade for trade in traditional gods thus showed little change in this period.

According to revised national accounts figures for 1995, employment rose by 2.1 per cent last year following a growth of 1.2 per cent the previous year. Figures from Statistics Norway's labour force survey (LFS) show that employment continued to rise briskly in the first quarter of 1996. The labour force, which over the past two years has risen at a noticeably slower pace than employment, also showed steep growth. According to the LFS, the number of unemployed, which probably was erratically low in the fourth quarter of 1995, increased again in the first quarter of 1996. On a seasonally adjusted basis, about 4.8 per cent of the labour force was unemployed, about the same level as in the third quarter of last year. The Directorate of Labour's figures for the sum of registered unemployed and persons participating in labour market measures, excluding rehabilitation, declined in the months to end-May this year

and are now almost down to the average level for 1990. The number of new vacancies at employment offices has so far this year been a good 4 per cent above the level in the second half of 1995 (seasonally adjusted). The total number of vacancies has declined by 18 per cent in the same period, which must be viewed in connection with the sharp rise in the labour force.

The consumer price index rose by 1.0 per cent in the 12 months to April 1996, and as an average for January-April the index was 0.9 per cent above the level in the same period last year. In the second half of 1995 the year-on-year rise in prices varied between 2.1 and 2.4 per cent. The decline in the 12-month rise from 1995 to the first four months of 1996 is partly related to the increase in the VAT rate in January 1995, while no equivalent change was made this year. In January last year there was also a pronounced rise in household electricity prices, while these prices thus far in 1996 have shown little change. Moreover, the change in car taxes has resulted in lower car prices, while low prices for clothing and footwear even following the end of the normal winter seasonal sales period contributed to curbing the year-on-year rise in the consumer price index in March and April as well. The rise in prices is therefore again noticeably lower in Norway than in the ECU area, and below the average for our main trading partners.

The results of the wage settlement so far indicate that wage growth will be higher this year than in the previous three years. The settlement for public sector employees will probably result in a growth in annual wages of about 4 per cent. With the same contribution from wage drift as in 1995, the results of the settlements for groups covered by the Norwegian Federation of Trade Unions and the Confederation of Norwegian Business and Industry so far indicate that wage growth for manufacturing workers will be of the same magnitude. Other groups have also reached agreements that will result in a higher increase in wages in 1996 than in the previous three years. With noticeably lower price inflation this year compared with 1995, real wages are set to show a sharp rise.

Changes in domestic interest rates in 1995 generated a noticeably weaker impetus to the Norwegian economy than in 1993 and 1994. Financial institutions' interest rates generally shadowed the moderate decline in money market rates through 1995, and at the end of the fourth quarter last year households' average borrowing rate was a good half a percentage point lower than at the end of the fourth quarter of 1994. Since the beginning of 1996 to end-May money market rates have fallen by a little less than half a percentage point, indicating a further reduction in financial institutions' lending and deposit rates from the level in the fourth quarter of last year. The decline in money market rates partly reflects developments in European rates and partly Norges Bank's temporary abandonment of its efforts to maintain a markedly positive interest-rate differential against the ECU. Short-term rates in Norway, however, are still higher than corresponding ECU rates, and so far this year the Norwegian krone has appreciated by approximately 1 1/2 percentage point against the ECU, at the same time that Norges Bank has purchased foreign exchange corresponding to more than NKr 20 billion.

The current account of the balance of payments showed a surplus of a little more than NKr 17 billion in the first quarter, while the surplus for 1995 as a whole is estimated at a good NKr 28 billion, equivalent to 3.3 per cent of GDP. The current-account surplus in the first quarter was nearly NKr 6.5 billion higher than the level in the same period one year earlier. The improvement is entirely ascribable to the rise in the value of merchandise exports, particularly exports of petroleum. The deficit on the interest and transfers balance was at about the same level in the first quarter of 1996 as in the same period one year earlier.

Outlook for 1996 and 1997[1]

It now appears that growth in the Norwegian economy may be slightly stronger in 1996 than last year. A pronounced rise in the level of real wages will probably boost consumption growth to well over 3 per cent. Demand from the public sector will rise appreciably faster than in 1995, and petroleum investment will also generate a positive growth impetus this year. The start of an upswing in the US may help to push up traditional merchandise exports this year, and next year Norway's other main trading partners will probably also record higher growth. On an annual basis, unemployment will be about 4.5 per cent this year and slightly lower in 1997. Consumer price inflation will remain subdued both in 1996 and 1997, and probably below the average for our main trading partners. The surplus on the current account in both 1996 and 1997 will be substantially higher than in 1995.

The projections presented here show a slightly stronger upturn in the Norwegian economy than the picture described in Economic Survey 1/96. Projected growth in mainland GDP has been revised upwards by 0.7 percentage point. The upswing in the economy, however, is expected to be accompanied by somewhat stronger productivity gains, and the employment situation remains approximately unchanged. Even though wage growth will be higher than assumed earlier, stronger productivity gains entail that our forecast for price inflation in 1997 is the same as in Economic Survey 1/96.

Lower growth abroad, but upswing in Norwegian exports

The growth projections for Norway's main trading partners in Europe have been revised downwards in recent months, while growth in the US is rising. Moreover, in the first quarter there was a sharp rise in Norwegian exports of manufactured goods to the US and countries outside Europe (primarily in Asia), but also to the UK. Norwegian

1 The projections are derived from Statistics Norway's macroeconomic model, MODAG.

exports largely consist of raw materials, including metals, for which demand usually increases at an early stage of an international upturn. Developments in Norwegian exports in the first quarter may be an indication that such an upturn is now under way. The projections for Norway's traditional merchandise exports are based on a slightly higher growth in Norwegian export markets through 1996 and into 1997. Market growth at an annual rate is estimated at 4.3 per cent in 1996 and 7.0 per cent next year.

Education reform results in higher public sector investment

Our assumptions concerning fiscal policy are based on the Revised National Budget (RNB). While the RNB's estimate for growth in general-government consumption does not deviate very much from the estimate in the Final Budget Bill, it appears that general-government fixed investment will be substantially higher in 1996 than projected earlier. According to the RNB, this upward revision is due to the greater than anticipated need for investment in order to implement the planned school reform (children will start school at the age of 6 instead of 7). The proposed elimination of VAT compensation on food from 1 July is incorporated in the projection, and in isolation is assumed to push up consumer price inflation by 0.1 per cent on an annual basis both in 1996 and in 1997.

Higher petroleum investment in 1996

Total petroleum investment is now expected to expand by a fairly substantial margin in 1996 and at a higher rate than expected at the beginning of the year. The level of investment, however, will still be noticeably lower than in 1994. Even with this sharp rise in total petroleum investment in 1996, the demand impetus for the mainland economy will not increase substantially because imports will account for a higher share of petroleum investment. Total petroleum investment in 1997 is now projected to edge down, and the share of this investment that is imported will probably continue to rise.

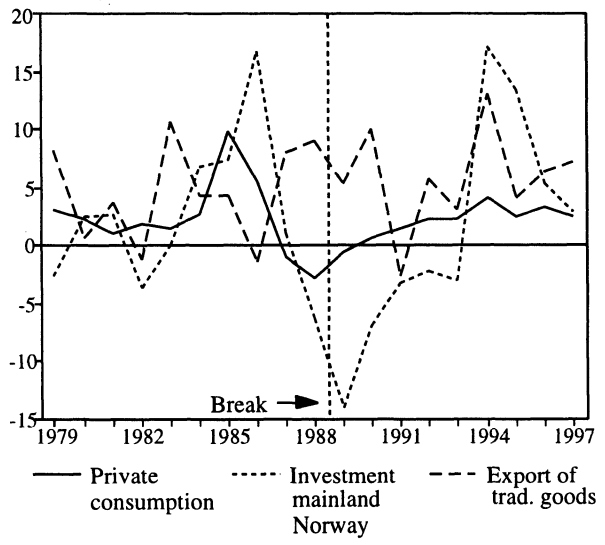
Both oil and gas production is expected to increase sharply from 1995 to 1996. In 1997, only gas production will show any increase of significance. Crude oil prices so far this year have been higher than in a long time, partly as a result of exceptionally low temperatures in Europe and the US. Our projections are based on the assumption that the price of oil will be NKr 120 p/b in 1996 and NKr 115 in 1997.

Stronger growth in demand

Whereas at the beginning of the year we expected growth in important demand components in 1996 to be slightly weaker than in 1995, the situation is now reversed. It appears that already in 1996 we will record higher growth in traditional merchandise exports even though GDP projections for our main export markets have been revised downwards. At the same time, public sector demand and petroleum investment will rise at a faster pace than assumed earlier. The growth rates for traditional merchandise exports are expected to rise further in 1997 in line with the expectation of a new international upswing.

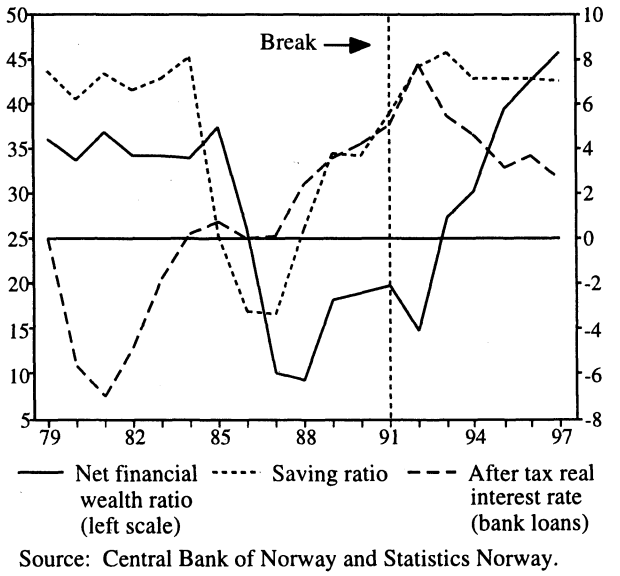
Private consumption will expand at a noticeably faster rate in 1996 than in 1995. Car purchases in the first few months of 1996 have risen far more than assumed earlier, and it is not unlikely that these purchases will show a rise of more than 30 per cent on an annual basis. The rise in car purchases probably reflects both indirect tax changes at the beginning of 1996, the temporary increase in the deposit refund for scrapped cars and the need to replace the stock of cars at a time when many households are recording a substantial increase in purchasing power. A continued decline in

Consumption, capital formation and exports 1979 - 1997
Percentage growth. Forecasts for 1996 and 1997



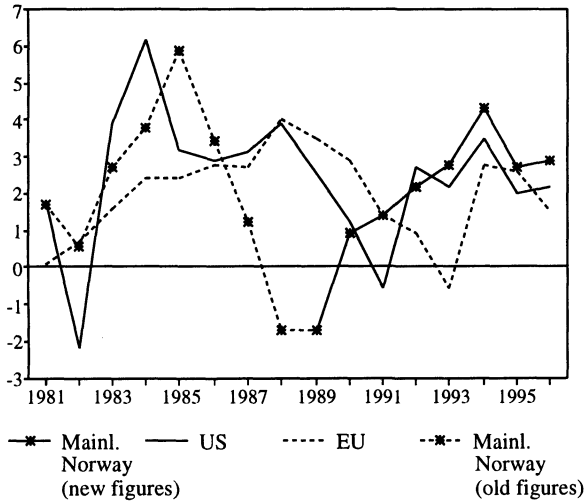
Source: Statistics Norway.

Household financial indicators 1979 - 1997
Per cent. Forecasts for 1996 and 1997



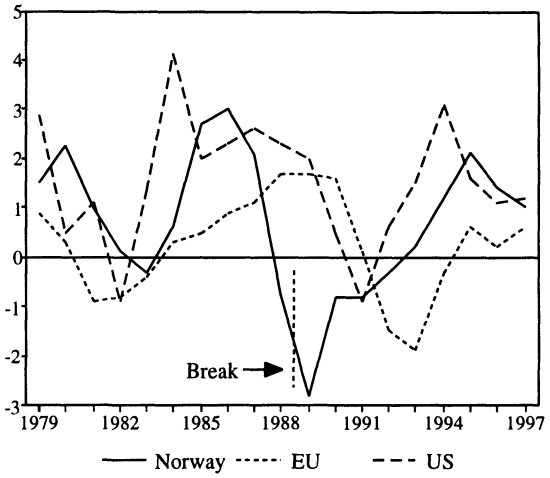
Source: Central Bank of Norway and Statistics Norway.

Gross domestic product 1979 - 1997
Percentage growth. Forecasts for 1996 and 1997



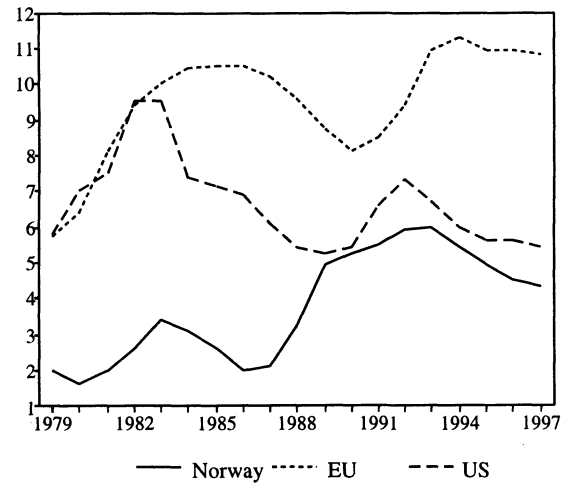
Sources: Statistics Norway, OECD and European Commission.

Employment 1979 - 1997
Percentage growth. Forecasts for 1996 and 1997



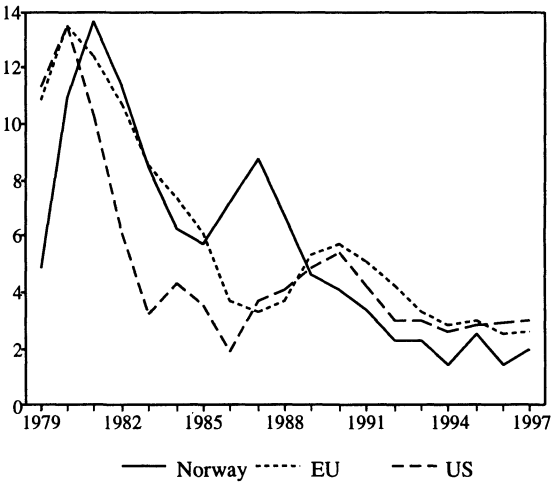
Sources: Statistics Norway, OECD and European Commission.

Unemployment 1979 - 1997
Percent. Forecasts for 1996 and 1997



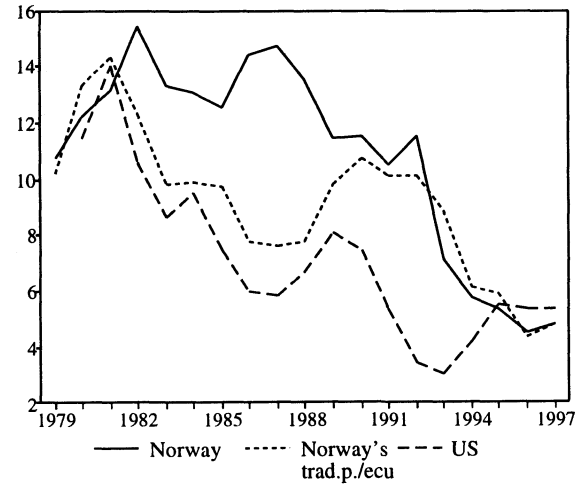
Sources: Statistics Norway, OECD and European Commission.

Consumer prices 1979 - 1997
Percentage growth. Forecasts for 1996 and 1997



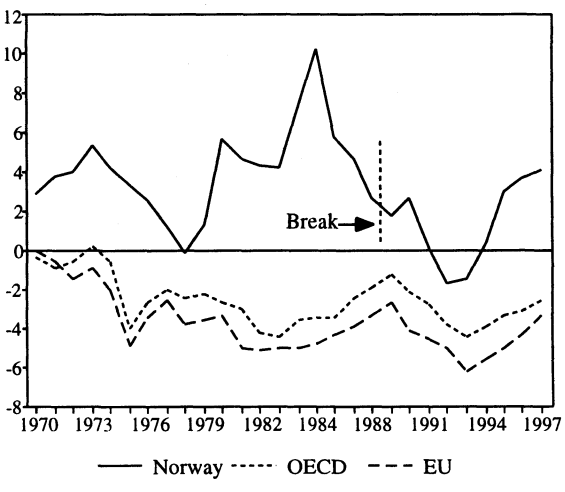
Sources: Statistics Norway, OECD and European Commission.

3 months eurorates 1979 - 1997
Percent. Forecasts for 1996 and 1997



Sources: Statistics Norway, OECD and European Commission.

General government net lending 1970 - 1997
Per cent of GDP. Forecasts for 1996 og 1997



Source: OECD, European Commission and Statistics Norway.

Main economic indicators
Percentage change from previous year unless otherwise noted

	Accounts 1995	SN 1996	NB[1] 1996	MoF[2] 1996	SN 1997	NB[1] 1997	MoF[2] 1997
Demand and output							
Consumption in households and non-profit organizations	2.6	3.3	3 1/4	3.5	2.5	2 1/2	2.1
General government consumption	0.2	1.7	1 1/4	1.7	1.2	11/2	1.1
Gross fixed investment	9.7	6.3	5	7.3	1.9	1 1/2	0.9
-mainland Norway	13.5	5.3	7	8.8	2.9	2	1.8
-petroleum activities	-13.1	6.2	0	1.3	-1.1	0	-2.5
Demand from mainland Norway[3]	3.8	3.3	3 1/2	..	2.3	2	..
Change in stocks[4]	1.2	0	0	-0.1	0	..	..
Exports	3.8	8.0	7 1/2	7.2	4.1	3 1/4	4.4
- crude oil and natural gas	8.4	15.0	14 1/2	15.2	1.3	2 3/4	4.4
- traditional goods	4.1	6.3	3 1/2	3.7	7.2	4	4.6
Imports	5.1	6.6	5	4.8	4.1	3 1/4	2.5
- traditional goods	9.1	5.9	5 1/4	5.8	3.7	4 1/4	2.4
Gross domestic product	3.3	4.3	4	4.5	2.2	2	2.3
- mainland Norway	2.7	3.0	2 3/4	3.0	2.3	2	2.0
Labour market							
Persons employed	2.1	1.4	1 1/2	1 1/2	1.0	3/4	1
Unemployment rate (level)	4.9	4.5	4 1/4	4 1/4	4.3	4	..
Prices and wages							
Wages per man-hour	3.3	4.0	3 1/4	3.8	3.8	3 1/2	..
Consumer price index	2.4	1.4	1 1/4	1 1/4	2.0	2	..
Export prices, traditional goods	7.1	-1.7	-1/2	1.4	2.5	1 3/4	..
Import prices, traditional goods	0.7	1.1	1 1/4	1.8	1.6	1 3/4	..
Balance of payment							
Current balance (bill. NKr)	28.4	44	35	52	45	65	57
Current balance (per cent of GDP)	3.1	4.5	3 1/2	..	4.4	4	..
Memorandum items:							
Money market rate (level)	5.4	4.5	..	..	4.8	..	..
Average borrowing rate (level)[5]	7.8	7.2	..	..	7.0	..	..
Crude oil price NKr (level)[6]	105.9	120	105	115	115	108	107
International market growth	4.9	4.3	..	7 1/2	7.0	..	..
Importweighted krone exchange rate[7]	-2.5	-0.5	0	..	0	..	..

1) NB: Forecast according to Norges Bank, Penger og kreditt 1996/1.
2) MoF: Ministry of Finance's foreccasts. Revised national budget 1996.
3) Consumption in households and non-profit organizations + general government consumption + gross fixed capital formation in mailand Norway.
4) Per cent of GDP
5) Households' borrowing rate in private financial institutions.
6) Average, Norwegian oil production.
7) Positive sign implies depreciation.

the rate of inflation thus far in 1996 and wage settlements which provided higher pay increases than many had expected will result in higher growth in real income. Private consumption is projected to show more moderate growth in 1997 as a result of slower income growth and a decline in car purchases from a high level in 1996.

Gross fixed investment in mainland Norway will expand at a noticeably slower pace in 1996 than in 1995, but the projections have been revised upwards compared with earlier estimates. The increase in the projection for general-government investment alone will contribute 1.5 per cent to growth in mainland fixed investment. As a result of higher growth in exports and private consumption, private enterprises will probably also increase their investment with the aim of boosting production capacity. The negative trend in housing investment through 1995 appears to continue. However, a decline in 1996 is expected to be reversed to a moderate rise next year. Preliminary statistics for projected manufacturing investment point to growth of a little more than 10 per cent in 1996 and about 15 per cent in 1997. Investment growth in private enterprises, excluding manufacturing, is expected to be slightly lower in 1997. Construction of the Gardermoen airport will generate a substantial growth impetus to the Norwegian economy in 1996, but this is not likely to be the case next year.

Brisker output growth

The higher growth in private consumption will not result in a substantial rise in domestic production since imported cars account for a large share of the upturn. However, the

Effect of lower unemployment on wages

In the MODAG model's description of wage formation there is a relationship between hourly wages in manufacturing and (among other things) the unemployment rate. According to this relationship, lower unemployment will result in higher wages, but it takes several years before the effects are exhausted. According to the model, a decline in unemployment will only have marginal effects on wages, if unemployment is initially high, whereas a further tightening in the labour market will result in higher wage increases, if unemployment is low. In order to illustrate key aspects of wage formation we have made a partial calculation of the wage relationship for manufacturing industry alone. This means that we do not provide any indication of the total effects of e.g. a policy which actually results in lower unemployment. This would require calculations on the full model. The table below shows the short-term and long-term increases in hourly wages in manufacturing with a hypothetical reduction of 1 percentage point in the unemployment rate, at various levels of unemployment.

Increase in hourly wages in manufacturing through a partial reduction in unemployment of one percentage point at various unemployment levels. Per cent

Unemployment rate in per cent prior to change	Percentage change in wages	
	1st year	Long term
6	0.1	0.3
5	0.2	0.6
4	0.4	1.4
3	1.1	3.9
2	7.8	28.0

upward revision of the projection for traditional merchandise exports will result in sharply higher growth in manufacturing industry's gross output. Higher petroleum investment in 1996 and 1997 will be accompanied by higher import shares, entailing that demand growth for the mainland economy will be modest. In the revised national accounts figures for 1994 and 1995 the contribution to growth from inventory investment is less than previously estimated, but still positive. The figures for changes in inventories in the national accounts capture, in addition to real changes in inventories, various statistical deviations, and we have no satisfactory interpretation of movements in the figures for changes in inventories. Our projections are based on the same growth in inventories as in 1995 and accordingly there is no impulse to growth from this "demand" component. Mainland GDP is projected to rise by 3.0 per cent in 1996 and 2.3 per cent in 1997. As a result of vigorous growth in petroleum production in 1996, total GDP is expected to expand by 4.3 per cent in 1996 and rise at about the same rate as mainland GDP in 1997.

Decline in unemployment

The buoyant growth in the Norwegian economy has resulted in a substantial rise in employment. As the situation in the labour market improves, however, a greater number of people join the labour force. Unemployment has therefore been reduced by a smaller margin than the increase in employment alone might imply. Total labour force participation for women is now higher than ever, while participation rates for men are still considerably lower than the level recorded throughout the 1980s. This indicates that there is a potential for continued high growth in the labour supply. Our projections for 1996 show a growth in the labour force of a good 1 per cent, or about 25 000 persons, falling to 17 000 in 1997, while purely demographic factors imply an annual rise of 10-15 000.

Even though output growth is expected to be higher than envisaged earlier, our projection for growth in the number of persons employed in 1996 only shows a marginal rise since we assume that higher output growth will be accompanied by higher productivity gains. Employment is projected to expand by about 1 1/2 per cent in 1996 and a little less in 1997. Based on our assumptions on changes in the supply of labour, unemployment may be reduced to 4.5 per cent in 1996 and 4.3 per cent in 1997.

Prices and wages

Price inflation in Norway, measured by the year-on-year rise in the consumer price index, fell in the first few months of this year. Lower car taxes and no price adjustment for several other important commodity taxes in 1996 helped to curb inflation. A slight appreciation of the Norwegian krone so far this year is also reducing the external inflationary impetus. An expected increase in electricity prices during the summer as a result of little precipitation dureing the last year, as well as the elimination of VAT compensation on food have the opposite effect. Wage growth in 1996 will be higher than in 1995, but the effect on prices will be offset by productivity gains per man-hour, which will show a faster rise this year and in 1997 than in 1995. As higher wage growth spreads to the entire economy and productivity gains stabilize, the rise in consumer prices may be slightly higher in 1997 than this year - about 2 per cent. An assumption of unchanged indirect tax rates (in real terms) from the second half of 1996 to 1997 also contributes to slightly higher inflation in 1997 than in 1996.

The spring wage settlement resulted in somewhat higher pay increases than expected earlier. On an annual basis, wage growth for the entire economy is now projected at 4 per cent this year, with slightly higher wage growth in manufacturing industry. According to Statistics Norway's macroeconomic models, unemployment is still so high that changes in unemployment will have a limited influence on wage growth. According to the models, the effects of a tighter labour market on wages will not be substantial until unemployment is reduced to less than 3 per cent, cf. box.

In 1995, wage growth in manufacturing industry was about 2.5 per cent lower than the historically based relationship between productivity, prices of manufactured goods and the wage level would imply. Even with the expected inc-

rease in wage growth for 1996, wage costs as a share of manufacturing industry's total revenues (factor income) will still be low in an historical context, given our assement of prices and productivity. Based on expectations of a rise in export prices for important Norwegian manufactured goods and continued moderate productivity gains, wage growth in manufacturing industry is expected to remain unchanged from 1996 to 1997. Wages in the rest of the economy will probably to a large extent shadow movements in manufacturing industry, but it is assumed that wage growth in manufacturing industry will be slightly higher than the average for the economy as a whole in both years. Real wages for the entire economy are projected to expand by a good 2 1/2 per cent in 1996 and 1 1/2 per cent next year.

Rising current-account surplus

The surplus on the current account amounted to NKr 28 billion, or 3.1 per cent of GDP, in 1995. The trade surplus will widen considerably in 1996 as a result of higher exports of oil and gas and traditional merchandise exports. Imports will show brisk growth in 1996, but the growth rate will abate in 1997. The estimate for oil prices has been increased since our last projection. We will also see a noticeable improvement in the interest and transfers balance in the projection period as a result of the increase in Norway's net foreign assets. The current-account surplus will probably amount to NKr 45 billion in both 1996 and 1997. The general-government surplus will also rise, partly because a substantial portion of the higher export earnings from oil and gas accrues to the state in the form of oil taxes.

Norway: Trends in selected macroeconomic variables
At fixed 1993 prices. Billion Nkr

	Unadjusted		Seasonally adjusted*							
	1994	1995	94.2	94.3	94.4	95.1	95.2	95.3	95.4	96.1
Consumption in households and non-profit organizations	428584	439735	106063	107815	108449	107720	109428	111423	111164	113229
Direct purchases abroad by resident households	17286	17298	4376	4497	4311	3947	4355	4616	4381	4032
- Direct purchases in Norway by non-resident households	-15613	-14700	-4036	-4063	-3518	-3988	-3569	-3510	-3634	-3667
General government consumption	180868	181182	45118	45424	45076	44897	45246	45470	45570	45711
Gross fixed capital formation	179759	187837	46571	45348	44007	46774	46925	44954	49184	45820
Oil	52972	46014	15726	12490	11414	10834	10935	11271	12973	10390
Shipping	4826	3373	1556	1099	-296	1681	1595	-1067	1164	643
Mainland Norway	121961	138449	29289	31759	32890	34259	34394	34749	35047	34787
Manufacturing and mining	10698	15158	2467	2877	3028	3417	3889	3866	3986	4332
Production of other goods	11250	11731	2951	2741	2811	3044	2939	2798	2903	2863
General government	27706	27562	6842	6906	7053	7128	6891	7079	6464	7104
Dwellings	23526	26510	5671	6176	6531	6777	6710	6536	6487	6272
Other services	48781	57488	11358	13059	13466	13893	13965	14471	15207	14216
Stocks	13506	23997	2365	4885	3557	3140	6320	8385	6150	5650
Gross capital formation	193266	211834	48936	50233	47565	49914	53245	53339	55335	51470
Final domestic use of goods and services	802717	832751	200117	203472	2011090	202531	207919	210231	212068	210409
Demand from mainland Norway	731413	759366	180470	184998	186415	186876	189068	191641	191781	193727
Exports	341828	354689	84356	84517	90417	87672	86168	89801	91021	95373
Traditional goods	127108	132372	31364	32951	33722	33778	31927	33589	33251	36731
Crude oil and natural gas	116112	125818	28786	27216	31232	30206	30034	31176	34402	34769
Ships and oil platforms	10416	10954	1805	2402	4183	2039	3031	3722	2136	1923
Services	88191	85544	22402	21949	21279	21650	21175	21313	21233	21950
Total use of goods and services	1144545	1187439	28473	287989	291507	290203	294087	300032	303090	305782
Imports	279766	294127	70397	70580	70164	71184	73809	73462	75673	74991
Traditional goods	184085	200845	44975	47611	47528	48639	50219	50899	51288	54148
Crude oil	943	1244	229	251	228	349	382	328	185	214
Ships and oil platforms	12446	13250	3745	1894	2351	3198	2566	2425	5061	2019
Services	82292	78787	21449	20824	20057	18997	20641	19809	19139	18611
Gross domestic production (GDP)	864780	893312	214076	217409	221343	219020	220278	226570	227417	230791
Mainland Norway	725221	745023	179157	183342	185025	183270	184394	188862	188470	189891
Oil activities and shipping	139559	148290	34920	34067	36318	35749	35885	37709	38947	40899
Mainland industry	651036	666373	161692	164378	165535	163934	165586	168793	168058	169013
Manufacturing and mining	101380	104322	25313	25637	26055	26130	26082	26030	26079	26787
Production of other goods	69487	75588	16927	17503	18006	18602	18625	18765	19542	19488
General government	134578	135321	33435	33789	33803	33358	33659	34034	34270	34153
Private services	345591	351141	86017	87450	87671	85844	87220	89964	88168	88585
Correction items	74185	78649	17465	18964	19490	19336	18807	20069	20411	20878

* See "Technical comments".

Norway: Trends in selected macroeconomic variables
Percentage volume change in 1992-prices

	Unadjusted		Seasonally adjusted*							
	1994	1995	94.2	94.3	94.4	95.1	95.2	95.3	95.4	96.1
Consumption in households and non-profit organizations	4.1	2.6	-0.2	1.7	0.6	-0.7	1.6	1.8	-0.2	1.9
Direct purchases abroad by resident households	8.6	0.1	6.7	2.8	-4.1	-8.5	10.3	6.0	-5.1	-8.0
- Direct purchases in Norway by non-resident households	13.5	-5.8	1.0	0.7	-13.4	13.4	-10.5	-1.7	3.5	0.9
General government consumption	0.7	0.2	-0.3	0.7	-0.8	-0.4	0.8	0.5	0.2	0.3
Gross fixed capital formation	6.9	4.5	6.2	-2.6	-3.0	6.3	0.3	-4.2	9.4	-6.8
Oil	-7.3	-13.1	17.9	-20.6	-8.6	-5.1	0.9	3.1	15.1	-19.9
Shipping	-30.5	-30.1	..	..	..	..	..	..	..	..
Mainland Norway	17.2	13.5	4.5	8.4	3.6	4.2	0.4	1.0	0.9	-0.7
Manufacturing and mining	8.3	41.7	6.1	16.6	5.3	12.8	13.8	-0.6	3.1	8.7
Production of other goods	2.5	4.3	9.2	-7.1	2.6	8.3	-3.5	-4.8	3.8	-1.4
General government	1.6	-0.5	-0.9	0.9	2.1	1.1	-3.3	2.7	-8.7	9.9
Dwellings	34.9	12.7	10.1	8.9	5.8	3.8	-1.0	-2.6	-0.7	-3.3
Other services	26.6	17.8	3.8	15.0	3.1	3.2	0.5	3.6	5.1	-6.5
Stocks	40.2	77.7	..	..	..	..	..	..	..	..
Gross capital formation	8.7	9.6	5.2	2.6	-5.3	4.9	6.7	0.2	3.7	-7.0
Final domestic use of goods and services	4.4	3.7	1.0	1.7	-1.2	0.7	2.7	1.1	0.9	-0.8
Demand from mainland Norway	5.2	3.8	0.5	2.5	0.8	0.2	1.2	1.4	0.1	1.0
Exports	8.2	3.8	2.2	0.2	7.0	-3.0	-1.7	4.2	1.4	4.8
Traditional goods	13.1	4.1	5.9	5.1	2.3	0.2	-5.5	5.2	-1.0	10.5
Crude oil and natural gas	11.6	8.4	-0.3	-5.5	14.8	-3.3	-0.6	3.8	10.3	1.1
Ships and oil platforms	-12.0	5.2	..	..	..	..	..	..	..	..
Services	0.6	-3.0	1.8	-2.0	-3.0	1.7	-2.2	0.7	-0.4	3.4
Total use of goods and services	5.5	3.7	1.4	1.2	1.2	-0.4	1.3	2.0	1.0	0.9
Imports	6.9	5.1	2.6	0.3	-0.6	1.5	3.7	-0.5	3.0	-0.9
Traditional goods	15.3	9.1	2.0	5.9	-0.2	2.3	3.2	1.4	0.8	5.6
Crude oil	-17.5	32.0	-2.6	9.6	-9.2	53.1	9.5	-14.1	-43.7	15.6
Ships and oil platforms	-33.9	6.5	..	..	..	..	..	..	..	..
Services	0.4	-4.3	8.1	-2.9	-3.7	-5.3	8.7	-4.0	-3.4	-2.8
Gross domestic production (GDP)	5.0	3.3	1.0	1.6	1.8	-1.0	0.6	2.9	0.4	1.5
Mainland Norway	4.3	2.7	0.8	2.3	0.9	-0.9	0.6	2.4	-0.2	0.8
Oil activities and shipping	8.8	6.3	1.9	-2.4	6.6	-1.6	0.4	5.1	3.3	5.0
Mainland industry	4.0	2.4	1.4	1.7	0.7	-1.0	1.0	1.9	-0.4	0.6
Manufacturing and mining	5.4	2.9	3.8	1.3	1.6	0.3	-0.2	-0.2	0.2	2.7
Production of other goods	0.8	8.8	-0.4	3.4	2.9	3.3	0.1	0.7	4.1	-0.3
General government	1.1	0.6	-0.3	1.1	0.0	-1.3	0.9	1.1	0.7	-0.3
Private services	5.4	1.6	1.8	1.7	0.3	-2.1	1.6	3.1	-2.0	0.5
Correction items	7.5	6.0	-4.4	8.6	2.8	-0.8	-2.7	6.7	1.7	2.3

* See "Technical comments".

Norway: Price indices for selected macroeconomic variables

		Percentage change from the same periode the previous year				Growth from previous quarter seasonally adjusted. Per cent*			
	1995	95.2	95.3	95.4	96.1	95.2	95.3	95.4	96.1
Consumption in household and non-profit organizations	2.5	2.3	2.2	2.5	0.6	-0.1	0.5	0.5	-0.6
General government consumption	3.5	3.5	3.2	3.1	3.3	0.4	0.5	0.8	1.9
Gross fixed capital formation	3.1	2.8	3.6	3.2	3.4	0.5	1.3	0.1	1.4
- mainland Norway	3.0	2.8	3.1	3.5	3.3	1.0	0.1	0.9	1.0
Final domestic use of goods and services	2.7	2.6	2.4	2.9	1.3	0.4	1.5	-0.8	0.5
-demand from mainland Norway	2.8	2.7	2.6	2.9	1.7	0.3	0.4	0.7	0.3
Exports	2.2	3.2	-0.4	0.4	0.5	-0.0	-2.5	0.8	2.2
- traditional merchandise exports	7.1	8.2	6.0	3.8	-3.2	-1.9	0.0	-0.4	-1.0
Total use of goods and services	2.5	2.8	1.6	2.2	1.0	0.3	0.3	-0.3	1.0
Imports	0.9	0.9	0.9	0.8	0.6	-0.7	0.7	0.2	-0.9
- traditional merchandise imports	0.7	1.2	0.4	0.4	0.4	-0.1	-0.1	-0.0	-1.4
Gross domestic product (GDP)	3.1	3.4	1.8	2.6	1.2	0.7	0.2	-0.5	1.6
- mainland Norway	4.2	4.2	3.6	3.9	0.7	0.6	1.1	-0.5	0.4

* See "Technical comments".

Technical comments on the quarterly accounts figures

Statistics Norway is currently undertaking an extensive revision of the national accounts. Revised figures for the years 1988-1995 were published in Statistics Weekly no. 18 1996 and in Økonomiske analyser 4/96. The figures for 1994 and 1995 may deviate somewhat from figures published earlier due to new information.

Quarterly calculations: The calculations are made on a less detailed level than the calculations for the annual national accounts, and are based on more simplified procedures.

Base year and linking the data: In the quarterly national accounts all volume measures are currently calculated at constant 1993 prices using weights from that year. The choice of base year influences the constant-price figures and thus the annual rates of change in volume (growth rates). For the sake of comparison, all tables present growth rates with 1993 as the base year (common year of recalculation). This is done by recalculating constant-price figures for the years prior to 1993 at 1993 prices. The recalculation of prices is carried out at the sectoral level of the quarterly national accounts.

At the moment the figures from the new quarterly national accounts (QNA) only go back to the first quarter of 1993, which is too short a period for seasonal adjustment. Based on the new annual figures for the period 1988-1993, provisional quarterly figures on an aggregated level have been prepared for Statistics Norway's macroeconometric model MODAG. These figures are linked backwards in time to the quarterly figures from the old national accounts, and forward in time to the new quarterly accounts from the QNA for seasonal adjustment. The new seasonally adjusted series are more aggregated than the figures in the quarterly national accounts. In this issue of Economic Survey it has therefore not been possible to provide seasonally adjusted estimates for all variables which previously were presented in this way. This applies, for example, to the old classification of competition within manufacturing industry and the old distribution of private consumption on goods and services.

The seasonally adjusted stocks figures are calculated as the difference between total supply on the one side and the sum of consumption, exports and gross fixed capital formation on the other.

Economic policy calendar 1996

February

5. The Ministry of Industry and Energy rejects an application by Akershus Energiverk to acquire Oppegård Energiverk for NKr 120 million. The decision is of fundamental importance and will shape the development of the energy industry in the years ahead. The authorities decided against the acquisition by Akershus Energiverk, which is a large producer of electricity, of Oppegård Energiverk, which is a pure distribution company, in order to prevent a situation in which one company gains control over the entire distribution chain from producer to consumer.

9. Sparebanken NOR presents its annual accounts for 1995 showing a profit of NKr 1.4 billion. This is an increase of about NKr 600 million from the previous year.

13. Simek in Flekkefjord signs a contract with the Danish company A.P. Møller/Maersk Supply Service which, combined with options on two additional vessels, is valued at about NKr 900 million. The company shall first supply two anchoring vessels each valued at NKr 225 million.

14. Posten (the national postal service) records a profit of NKr 343 million for 1995, in spite of the loss of NKr 1.2 billion on the operation of post offices and rural postal service routes.

14. Den norske Bank presents its annual accounts showing an operating profit after taxes of NKr 2.66 billion, approximately unchanged from the previous year.

14. Schibsted Trygg buys a new printing press from Rockwell Goss. The contract is worth NKr 525 million.

16. Acting Central Bank Governor Kjell Storvik gives his annual address. The main emphasis is placed on the importance of giving priority to saving rather than increasing public consumption in order to safeguard the future of the welfare state.

17. Telenor presents its annual accounts showing after-tax profits in 1995 of NKr 2.1 billion, approximately unchanged from the previous year.

17. Kværner Kimek signs a letter of intent to equip Russian trawlers for an amount equivalent to NKr 0.5 billion. The agreement covers 20 trawlers to be built in Arkhangelsk and fitted by Kimek in Kirkenes.

20. The National Insurance Scheme presents figures showing that sick pay disbursements rose by 6.4 per cent between 1994 and 1995. The total cost of sick leave comes to NKr 11.4 billion, or 9 per cent of the National Insurance Scheme's expenditure.

20. Fosen Mekaniske Verksted AS wins a contract worth NKr 747 million for delivery of a passenger ferry to the Greek shipping company Minoan.

20. Norsk Hydro posts an after-tax operating profit of NKr 10.7 billion, representing nearly a 50 per cent increase from the previous year.

21. SAS records an operating profit of NKr 3 billion, which is the company's best result ever.

22. Postbanken presents its annual accounts for the first time after the merger of Norges Postbank and Postgiro, with a reduction in profits from NKr 454.5 million in 1994 to NKr 131.5 million in 1995.

23. The drilling rig "Byfjord Dolphin" wins a contract worth NKr 350 million with Amarada Hess Norge AS and a consortium of Norwegian operators.

23. Naturgass AS applies for a licence to construct two gas-generated power plants in the western part of Norway, one in Kårstø in Rogaland and one in Kollsnes in Hordaland.

23. Council of State appoints Kjell Storvik to the post of central bank governor and chairman of Norges Bank's Executive Board for a six-year term. Mr Storvik had been serving as acting central bank governor.

March

1. The paper and pulp group Norske Skog posts a pre-tax profit of NKr 2.34 billion for 1995, representing a sixfold increase from the previous year.

4. Kværner Engineering acquires the British group Trafalgar House. At a price of NKr 8.9 billion, the acquisition is the largest made by a Norwegian company.

5. Resource Group International (RGI) buys shares in Aker for NKr 500 million. The company now owns shares in Aker for NKr 1.3 billion, or about 30 per cent of total shares.

7. With effect from 8 March, Norges Bank lowers its deposit rate from 4.75 to 4.50 per cent and the overnight lending rate from 6.75 to 6.5 per cent.

12. Leirvik Sveis signs a letter of intent with Haugesund Mekaniske Verksted for NKr 225 million for the construction of the combined accommodation and equipment module for the Visund platform. Kværner Energy wins a contract for two gas turbine generators for the platform, worth NKr 130 million.

13. Norway and the EU agree on the tariff rates to be applied to processed agricultural products which were previously covered by the free trade agreement from 1973.

14. Smedvig AS signs a drilling contract with Norsk Hydro for drilling operations in the North Sea using the vessels "West Vanguard" and "West Delta". The value of the contract comes to NKr 1.56 billion for a period of seven years, with the possibility of extending the contract for another seven years.

16. The Directorate of Public Construction and Property is awarded the contract to build the regional college in Agder outside of Kristiansand. The project is to be completed by the end of 2000 and will cost NKr 500 million in 1996-kroner.

22. The Central Unit for Investigation of Environmental and Economic Crime drops the case against former Central Bank Governor Torstein Moland in connection with his ownership interests in the limited partnership KS Airbus. The case resulted in his resignation as central bank governor.

26. Russia's President Boris Jeltsin visits Norway. In talks with Prime Minister Gro Harlem Brundtland, he informs that the modernization of the nickel plant in Petsjenganikel will commence. The plant shall be exempt from duties on equipment that has to be imported in connection with the modernization. Kværner Engineering and Elkem Technology have together with the Swedish company Boliden won the bid to rebuild the plant.

27. Kværner leads a group that is awarded a contract worth NKr 900 million to build Europe's first paper pulp plant based exclusively on recycled paper. Kværner's share of the contract comes to about NKr 500 million.

April

1. The central government accounts for 1995, budgeted with a deficit of NKr 17.3 billion in autumn 1994, show a surplus of NKr 4.1 billion. This means that an additional NKr 2.1 billion can be allocated to the Government Petroleum Fund in 1995. The improvement primarily reflects an increase in revenues from taxation of wealth and income in addition to social security payments. Higher consumption has also resulted in increased VAT revenues.

2. Kværner Rosenberg in Stavanger wins a contract to build a new rig for Odfjel Drilling. The hull of the rig shall be completed first, for a total cost of NKr 330-340 million. If the rig is to be fitted for deep-water drilling, total costs could amount to over NKr 1.3 billion.

10. The Ulstein Group signs a contract to build two new offshore vessels for the shipping company Swire Pacific Offshore in Singapore. The contract, including an option on the construction of four new vessels, is worth NKr 300 million.

10. Kværner's oil and gas division wins a contract to deliver subsea production equipment for the Visund field. The contract is worth NKr 435 million.

11. Statkraft buys 5.1 per cent of the shares (8.1 per cent of voting rights) in the Swedish company Sydkraft for about NKr 1.3 billion, giving Statkraft a stake in five Swedish nuclear power plants.

17. The Ugland Group in Grimstad wins a contract to transport oil from the Balder field, generating revenues of about NKr 1.5 billion.

17. Employees in the hotel and restaurant industry strike following a breakdown in negotiations between employees and management.

19. The Ministry of Defence approves a contract between the Norwegian Defence and Raufoss Technology AS to deliver training missiles for M72 tank weapons and ammunition for lighter arms. The contract is worth NKr 311 million.

19. Jotun decides to build new plants for paint and lacquer in Thailand, involving a total investment of NKr 260 million.

19. SAS announces investment plans involving NKr 400 million to reduce noise levels in all DC-9 aircraft for environmental reasons.

22. Statoil orders a new MST vessel from Samsung Heavy Industries in South Korea. The contract is worth NKr 100 million.

25. Schibsted buys 49.9 per cent of the Swedish newspaper Aftonbladet for NKr 370 million from the Swedish Federation of Trade Unions. Schibsted accepts that the Swedish Federation of Trade Unions shall retain control over the appointment of the newspaper's chief editor.

May

2. The 600 000 employees in the public sector are granted an annual pay increase of about 4 per cent. The various public sector unions accept the offer of a general pay increase of NKr 6 000. For municipalities, an additional pot of 1.8 per cent has been set aside for central adjustment purposes from 1 August. The local municipal negotiations result in an increase of 0.5 per cent from 1 October. For the central government sector, 1.3 per cent has been set aside for central adjustments from 1 August and 0.45 per cent for local adjustments from 1 September.

4. The outcome of the wage settlement in the textiles and wearing apparel industries gives employees a pay increase of NKr 3 per hour.

4. The Federation of Offshore Workers Trade Union (OFS) launches a sympathy strike. The industrial action

comes in response to the refusal on the part of the Confederation of Norwegian Business and Industry to give OFS a separate agreement for four maintenance firms. Half of total oil production and one third of gas production are affected.

7. Kværner Warnow Werft Gmbh wins a contract to build four container ships for the German shipping company Peter Döhle Schiffahrts-KG. The contract is worth about NKr 1.2 billion.

8. Kværner Oil & Gas wins a contract with the Brazilian oil company Petrobras for a value of $ 43 million. The contract is for subsea installations at a depth of 1000 metres.

9. Aukra Industrier wins two new contracts for a total value of almost NKr 300 million, for the construction of one trawler and one offshore vessel.

9. Farmers refuse to supply products for three days after the collapse in agricultural negotiations with the central government. The farmers' organizations demand NKr 975 million, whereas the central government has offered NKr 120 million as an increase in income plus a one-off payment of NKr 150 million through increased land support.

9. The Federation of Offshore Workers Trade Union (OFS) calls off its sympathy strike without achieving a separate agreement for maintenance firms. The action resulted in a loss of income of between NKr 750 and 800 million.

9. The Revised National Budget is presented. The budget is less tight than previously estimated and public expenditure, which showed zero growth in the Final Budget Bill, is increased by 1 per cent. The expenditure is to be covered by a reduction in transfers to local government and the removal of VAT compensation for food, which combined result in savings of about NKr 1.2 billion.

9. The governor of the central bank expresses concern about some features of the economy, pointing to the sharp growth in real wages and the reduced tightening in fiscal policy. His statements prompt a marked rise in Norwegian interest rates in spite of the fall in interest rates in much of Europe and the US.

10. Biomar, which is owned by Norsk Hydro, signs the world's largest fishmeal contract with Norsildmel in Bergen. Norsildmel will deliver fishmeal to Biomar for NKr 700 million over a three-year period.

10. Workers in the engineering industry reject the outcome of negotiations between the employers' association and the employees' union and 36 600 industrial workers go on strike. Shipbuilding, offshore installations and the engineering industry are affected. The strike may have serious consequences for the German and Swedish car industry.

10. The Government will permit a tax relief for pension savings in banks, unit trusts or life insurance companies. The saver can decide how the capital is to be invested, but loses the return guarantee provided for under the current pension insurance scheme.

14. As a result of the industrial conflict in the engineering industry (see 10 May), a number of companies affected by the strike announce layoffs. The companies include Raufoss Automotive and Raufoss Technology, where about 600 workers are laid off, and Hydro Aluminium which lays off about 200 workers.

14. Norsk Hydro and Elf Atochem sign a letter of intent with The Qatar General Petroleum Corporation to build a petrochemical plant for between $ 400 and 600 million. The government of Qatar will have a 57 per cent stake in the project, Hydro 30 per cent and Elf 13 per cent. The plant is expected to be operational from 1999.

20. The Minister of Industry and Energy, Jens Stoltenberg, opens the pipeline Europipe in Dornum, Germany. The Europipe line, which is to transport gas from the Troll field to the continent, makes Norway Europe's second largest gas supplier. Europipe has a capacity of 13 billion cubic metres per year.

23. The strike in the engineering industry comes to an end (see 10 May). The new agreement proposed, which is to be put to the vote on 14 June, provides for a reduction in the retirement age to 62, whereas the pay increase is stipulated at NKr 1.50 per hour as was proposed in the first negotiating result.

23. Alcatel Telecom Norway wins a long-term contract with Telenor for the maintenance of 1000 exchanges delivered by Alcatel. The contract is worth between NKr 400 and 600 million.

23. Orkla Media signs an agreement to acquire a majority stake in the Polish newspaper Rzeczpospolita and their printing company for NKr 298 million. The newspaper, which is one of Poland's leading dailies, had a circulation of 233 000 in 1995.

23. Scandinavian Fittings and Flanges AS signs a contract with Statoil to deliver pipes and flanges for a value of about NKr 500 million.

23. Transocean signs one of the largest rig contracts with Amerada Hess. The contract, including options, amounts to NKr 2.5 billion.

24. Umoe Sterkoder in Kristiansand is awarded a contract for building a Swath ship for Smedvik. The ship will be leased to Statoil for a five-year period for the installation and maintenance of wells on the Åsgård field. Of the total contract value, NKr 760-770 million will be used for the construction and fitting of the ship.

25. Simek in Flekkefjord wins a new contract with A.P. Møller/Maersk Supply Service. The Danish shipping company has exercised options on two supply vessels in addition to the two sister ships which were ordered in February (see 13 February). The new contract is worth about NKr 450 million, bringing the total value of the contract to NKr 900 million.

25. The Odfjell Group in Bergen orders a new chemical tanker from Kvaerner Govan in Glasgow. The contract is worth £ 50 million, and Kværner has a stake of 49 per cent.

30. Kværner wins a contract with Statoil worth NKr 215 million for the development, procurement and manufacture of a separation package for the development of the Åsgård field. The project will provide employment for 200 workers at most.

31. Minister of Health Gudmund Hernes presents a proposal to the Storting on a new financing system for hospitals. The proposal entails that 40 per cent of hospital revenues shall be linked directly to actual treatment, whereas the remaining 60 per cent shall be financed by cash limits.

June

1. The Norwegian Oil and Petrochemical Trade Union (Nopef) designates 225 members to go on strike after a breakdown in mediation between Nopef and the Oil Service Companies' National Federation. All exploration activity and production drilling using floating rigs on the Norwegian shelf are affected. It is announced that an additional 525 members will join the strike if an escalation is decided.

Carbon taxation and some effects on CO_2 emissions in Norway 1987-1994

Bodil Merethe Larsen and Runa Nesbakken

Several countries have introduced taxes on fossil fuels with the aim of reducing atmospheric emissions, partly because of local environmental goals and partly to participate in a global effort to reduce emissions of greenhouse gases. Many macroeconomic studies, based on both global and national models, have analysed how emissions can be reduced with the help of taxes and the consequent reduction in GDP following the introduction of such taxes. Norway has had a CO_2 tax for five years, thereby providing a unique opportunity to evaluate the effects of this tax on emissions. The paper gives a counterfactual analysis of energy consumption and emissions if no CO_2 taxes had been introduced, compared with the actual situation in which such taxes exist. The effect of a CO_2 tax on oil consumption, and thus CO_2 emissions, is studied on the basis of partial economic models for various sectors of the Norwegian economy. The study indicates that the CO_2 tax has had an impact on CO_2 emissions in Norway.

Introduction

The objective of most OECD countries is to stabilise CO_2 emissions at the 1989 or 1990 level. In large developing countries, such as China and India, there are no such emission targets. The use of taxes on petroleum products is one of several possible instruments that may result in a reduced use of fossil fuels and thus reduced emissions. Taxes is considered an appropriate instrument for reducing CO_2 emissions, partly because there is a clear relationship between emissions and the use of fossil fuels, with a direct influence on the various emission sources. In the OECD, only Norway, Sweden, Denmark, Finland and the Netherlands have explicitly introduced CO_2 taxes in the economy. CO_2 taxes are highest in Norway and Sweden. Taxes on fossil fuels are common in most countries, but these taxes were introduced on fiscal grounds rather than as instruments for reducing CO_2 emissions. In countries with no CO_2 taxes, the climate policy includes energy regulations and regulatory measures to improve energy efficiency. Because only a few countries have introduced CO_2 taxes so far, counterfactual analyses of such taxes in Norway may be of interest to countries that are evaluating the possibility of introducing or increasing such taxes.

Many analyses have been made of how taxes can reduce emissions of pollutants and the costs of this policy. Most of these are macroeconometric studies concerned with the reduction in GDP following the introduction of an emission tax, see e.g. Jorgenson and Wilcoxen (1993) and Manne and Richels (1991). Some studies discuss a "climate cost function", i.e. a path showing the model correlation between different emission goals and GDP reductions, see e.g. OECD (1992) and Johnsen, Larsen and Mysen (1996). Norway has now had CO_2 taxes for five years, thereby providing a unique opportunity to evaluate the effects of these taxes on emissions. This paper provides a counterfactual analysis of energy consumption and emissions if no CO_2 taxes had been introduced, compared with the actual situation in which such taxes exist. The counterfactual analysis is carried out for selected sectors. Emphasis is placed on exposing the mechanisms on a more disaggregated level than would have been possible using large macroeconomic models. A counterfactual analysis of the entire economy using a macroeconomic model would have been extremely comprehensive. Moreover, existing macroeconomic models are not suitable for shedding light on the problem for some sectors of the Norwegian economy, e.g. the petroleum sector. Parts of the economy are also exempt from CO_2 taxes. Furthermore, we are not concerned with GDP effects here, since the macroeconomy is assumed to remain unchanged. The analysis focuses on emissions from stationary sources in mainland manufacturing industry and from services as well as emissions from stationary and mobile sources in households, i.e. about 40 per cent of total taxable Norwegian CO_2 emissions.

The paper first discusses the methodology for analysing the effect of a CO_2 tax. This is followed by a historical survey of actual developments in CO_2 emissions and taxes in Norway in the period 1987-1994 to serve as a background for the analysis. The results are then presented, with a summary at the end.

Method

The effects of CO_2 taxes are often discussed on the basis of annual variations in total emissions or emissions per unit of GDP. A comparison of changes in taxes and emissions over time is not sufficient to determine any correlation between taxes and emissions, because a number of other factors also influence emissions. Examples of these are new technologies, changes in income, general price changes, changes in industry structure, the pattern of consumption and variation in temperature. Economic models

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are suitable tools in order to isolate the effects of the CO_2 tax. Various models have been used in this analysis. The effect of a CO_2 tax on oil consumption, and thus CO_2 emissions, is studied using partial economic models for various sectors of the Norwegian economy[1]. In general, the models used describe the demand for energy and the distribution of electricity and fossil fuels as estimated functions of, among other things, the prices of the various forms of energy. In the analysis all observed variables are incorporated in the models as actual data for the period 1987 to 1993. This applies to sector variables like electricity consumption, the consumption of fossil fuels and total energy consumption. Observed prices of the various forms of energy are also included as exogenous variables. For each year the model is then calibrated via an additive residual for each sector. This is done in order to isolate the effect of changes in oil prices from all other effects, such as temperatures, stock purchases, random variations, etc. The calibration entails that when the model is simulated, the actual energy data for the period are replicated. The CO_2 tax for each year is then removed from the oil price, and the energy equations are simulated with the oil price excluding the CO_2 tax. This counterfactual path provides a basis for comparing actual consumption of fossil fuels and other energy consumption with estimated consumption without the CO_2 tax.

The models used are presented in some more detail below. The analysis focuses on emissions from various sources[2]. Emissions from stationary sources are emissions caused by the use of oil for heating, and these emissions are studied on the basis of one model for manufacturing and services and one model for households. Emissions from mobile sources are emissions from all types of transport, and a model for transport in households is presented. Emissions from transport in sectors of industry as well as emissions from the petroleum sector are not analysed because we have no suitable models for analysing the effects of taxes in these sectors. Furthermore, emissions from processes (e.g. petrol vapours and emissions from the reduction of ores to metals) are exempt from the tax, entailing that these sources are not studied. The dispensation arrangements imply that the CO_2 taxes cover about 60 per cent of CO_2 emissions in Norway.

Model for the stationary use of energy in manufacturing and services industry

In this counterfactual analysis, a period of six years is studied. In other words, we study the effect of the CO_2 tax in the medium term in which dynamics are important. To study the effects on energy use when the relative prices of energy change, a model which takes account of the short-term effects is used. Estimated equations for energy demand are used to study the effects of the CO_2 tax on the consumption of electricity and oil in the production sectors. The energy equations are further documented in Mysen (1991) and Cappelen (1992). The demand for energy by a sector is modelled as a CES aggregate of electricity and fossil fuels,

$$(1)\quad U=\left[A^{\frac{-\mu}{\lambda}}E^{\frac{\gamma+\mu}{\gamma}}+(1-A)^{-\frac{\mu}{\lambda}}F^{\frac{\lambda+\mu}{\lambda}}\right]^{\frac{\lambda}{\lambda+\mu}}$$

where U is total energy consumption, E is electricity consumption, F is oil consumption and A is a distribution parameter. The estimated error correction model is

$$(2)\quad \Delta\ln\left(\frac{E}{F}\right)_t=\alpha+\beta\Delta\ln\left(\frac{P_E}{P_F}\right)_t+\mu\ln\left(\frac{E}{F}\right)_{t-1}-\lambda\ln\left(\frac{P_E}{P_F}\right)_{t-1}+\eta_t,$$

where $-\beta$ is the short-run elasticity of substitution and $-\gamma/\mu$ is the long-run elasticity of substitution. The elasticity of substitution denotes the percentage change in the factor proportion (electricity/oil) when the factor price ratio changes by 1 per cent. Δ in front of a variable denotes the change in the variable's value from time t-1 to t. Adjustment lags are included in the error correction model. An adjustment of the factor ratio which entails some lags can be justified on the ground that a swift change in the factor ratio is more costly than a slower change. For the production of pulp and paper products as well as metal products and machinery, the short run effect of a change in relative prices on the factor relationship between electricity and oil is significant, i.e. there is a swift reaction to the introduction of environmental policy instruments in these sectors. Equations (1) and (2) determine the consumption of electricity and fossil fuels as a function of prices and total energy consumption. As a simplification, this analysis is confined to the switch from using oil to using electricity (the substitution effect) as a result of the tax. Thus the analysis does not take into account that a change in the CO_2 tax can also influence total energy consumption. Each sector is studied partially. The price of heating oil is used, and it is assumed that the price is the same for all sectors. Table 1 shows the elasticities in the model used.

Model for the stationary use of energy in households

The analysis of the effects of the CO_2 tax on households' CO_2 emissions from stationary sources is based on Nesbakken and Strøm (1993), who studied households' energy consumption for residential heating in 1990. The analysis, which is in the tradition of Dubin and McFadden (1984) and Hanemann (1984), uses data from a sample of 565

1 The effect on CO_2 emissions in the period 1987-1993 is studied by looking at the sum of the CO_2 tax and basic tax on mineral oil (i.e. all fuel oil and transport oil except petrol). The CO_2 tax comes in addition to the existing basic tax, although it should be noted that the basic tax was removed in 1993.

2 The models provide results for oil consumption, but since there is a linear relationship between oil consumption and CO_2 emissions, this is immaterial.

Table 1. Estimated elasticities of substitution between electricity and oil

Sector	'Short run' elasticity of substitution (short run parameter)	'Long run' elasticity of substitution (adjustment lag parameter)
Production of agricultural commodities	0,00	-0,23
Production of consumption goods	-0,19	-0,24
Production of intermediate products	0,00	-0,74
Production of pulp and paper products	-1,21	0,00
Production of industrial chemicals	0,00	-0,06
Production of metal products, machinery and equipment	-0,24	0,00
Production of ships and oil production platforms	0,00	-0,05
Wholesale and retail trade	-0,07	-0,23
Other private services	0,00	-0,14
Defence	0,00	-0,25
Education and research	0,00	-0,29
Health services	0,00	-0,34
Other government services	0,00	-0,80

Source: Mysen (1991).

households[3], and is based on an assumption that households determine energy consumption in two stages. First, the heating technology to be employed by the household is determined, and second the energy consumption. The results of the analysis show that energy prices, income, costs of heating equipment and characteristics of the household and dwelling are important in the choice of heating equipment and the use of this, i.e. for the energy consumption.

Estimated relationships between energy consumption and other variables from the analysis above were used to study the effects of the CO_2 tax on energy consumption in households. In the model, households can choose between five combinations of heating equipment, e.g. equipment based on electricity and oil or equipment based on electricity and firewood. Energy consumption for the entire household sector is calculated on the basis of energy consumption for representative households within the five categories of heating technology. Energy consumption is computed with and without the CO_2 tax for each year from 1987 to 1993.

The CO_2 tax only influences the energy price for households that have used heating equipment based on oil or kerosene, inasmuch as the model does not allow us to study changes in the choice of technology or the choice of energy type as a result of (changes in) the CO_2 tax. The fact that the model does not permit substitution between energy types has two different consequences for estimated oil consumption, each having opposite effects. One effect is an underestimation of the effect on oil consumption in that households cannot reduce oil consumption and replace this with electricity. The other effect arises because the price of energy rises in relation to other prices, entailing that households must reduce energy consumption in order to maintain the same level of costs as previously. In the model this reduction must take place in oil consumption since other energy consumption is constant. In isolation, this entails an overestimation of the reduction in oil consumption. All in all, it is uncertain whether the reduction in oil consumption as a result of the CO_2 tax is overestimated or underestimated.

Model for the use of transportation fuel in households

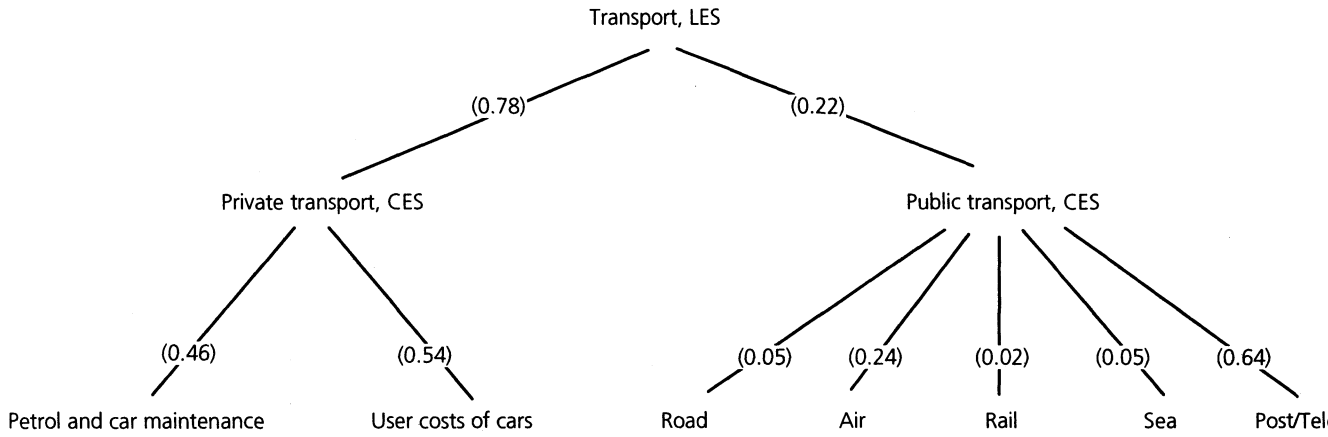
The effects of the CO_2 tax on mobile fuel consumption in households are studied by using the consumption system of the macroeconomic equilibrium model MSG-EE[4]. The model contains relatively detailed, empirically-based relationships between the demand for different transport types (measured in value terms). Figure 1 provides an overview of the utility tree for transport in the demand model, where LES denotes a branch of utility with a functional form corresponding to a linear expenditure system and CES denotes a branch of utility with a constant elasticity of substitution. Total transport is a LES aggregate of private transport (with a marginal budget share of 0.78) and public transport (budget share of 0.22). Public transport is a LES aggregate of five transport types, in which the budget share for postal and telecommunication services dominates (0.64) along with air transport services (0.24). Private transport is modelled as a CES aggregate of the user cost of car capital (distribution parameter 0.54) and operating expenses (fuel, spare parts, insurance and repairs, with a distribution parameter of 0.46) in which the relative price determines the distribution. The system makes it possible to study the effects of a CO_2 tax on households' use of transport, the composition of the various types of transport as well as fuel consumption. The analysis is partial in the sense that only the transport component of the model is studied, and total consumption and other consumer goods are not influenced.

First, the price of petrol including all taxes for the period 1988 to 1993 is used in the analysis. The CO_2 tax is then removed from the fuel price, and the system is simulated with the new price. The consumption component of the model is calibrated for each year in the period 1988 to 1991, i.e. all variables included in the transport component of the consumption system are in accord with actual realised data in this period. Consumption data do not exist for the level we required for the years 1992 and 1993, and the variables are therefore held constant at the 1991 level

3 The data were obtained from the Energy Survey 1990, see Ljones et al. (1992). Households that used central heating, i.e. about 7 per cent of households, were not included in the analysis. Approximately 60 per cent of households with central heating used oil as the form of energy. Because this oil share is higher than the oil share for households included in the analysis, the effect on oil consumption is slightly underestimated as a result of the exclusion of central heating.

4 MSG-EE is an acronym for Multi Sectoral Growth - Energy and Environment. The model is described in Alfsen et al. (1996). The consumption system is further documented in Aasness and Holtsmark (1993).

Figur 1. Utility tree for the intermediate level LES and bottom level CES and LES for transport in MSG-EE (marginal budget shares in parentheses)



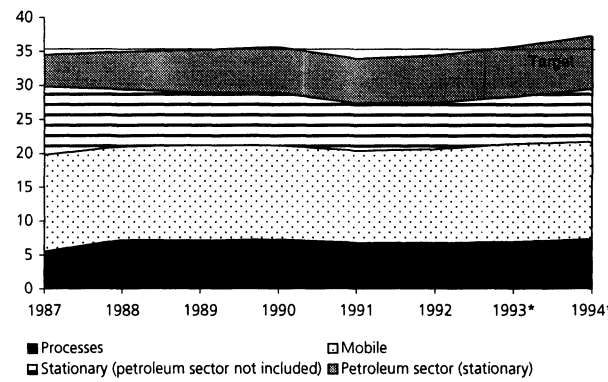
in 1992 and 1993. Moreover, it is assumed that the CO_2 tax is only imposed on household consumption of petrol. Changes in the prices of e.g. road transport services as a result of the rise in costs in the road sector (as a result of the CO_2 tax on fuel in this sector) are not taken into account.

CO2 emissions and CO2 taxes in Norway 1987-1994

In this section we present actual CO_2 emissions and CO_2 taxes, which were the basis for quantifying the effect of removing the tax. Norway has a target of stabilising CO_2 emissions at the 1989 level by the turn of the millennium. Total emissions of CO_2 in Norway increased steadily at the end of the 1980s (see figure 2). From 1990 to 1991, however, emissions were reduced by about 5 per cent. Since the CO_2 tax was introduced in 1991, one could easily be led to conclude that this was ascribable to the CO_2 tax. There are, however, many factors which influence CO_2 emissions. Emissions from stationary and mobile sources depend on the level of economic activity. Moreover, many consumers can switch between oil and electricity for heating. The extent of this flexibility will be decisive as to how households and firms adapt to a CO_2 tax. Electricity prices, oil prices and taxes will influence emissions of CO_2 from stationary sources. Emissions from mobile sources also depend on oil prices and taxes, but here there is little scope for substituting other energy goods for fossil fuel. Households accounts for a large share of CO_2 emissions from mobile sources. Incomes, prices and consumer habits in households are decisive for these emissions.

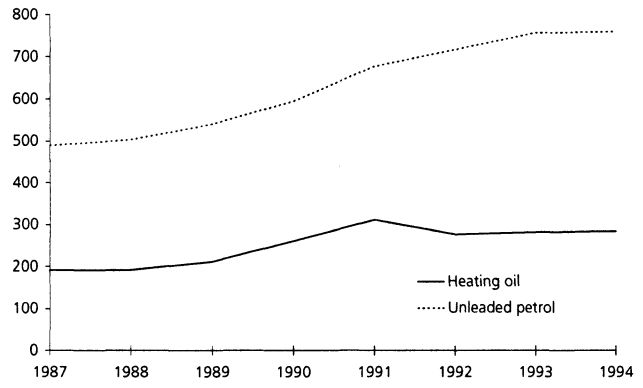
Stationary emissions have increased in the period. In particular, the petroleum sector's emissions have risen sharply, while other stationary emissions have been reduced. The petroleum sector was the sector in Norway which had the highest CO_2 emissions in 1993 (20 per cent of total CO_2 emissions), and with emissions rising sharply between 1987 and 1993 the sector contributed to explaining much of the increase in total emissions. The prices of oil products have risen far more sharply than the consumer price index in the period being studied although the price of crude oil was somewhat reduced. The price of heating oil rose to a peak level in 1991, the same year the CO_2 tax was at its highest level (see figures 3 and 4). Developments in stationary emissions (excluding the petroleum sector) compared with changes in the price of heating oil and the CO_2 tax also indicate that non-price factors are important for changes in emissions. The petroleum sector's emissions have also risen after 1991 even though the CO_2 tax has not been reduced since its introduction in 1991. Political decisions on depletion rates have been more important than the taxes. Because the emissions in various sectors depend on various factors, it is important to study sectors on an individual basis. The study of stationary emissions is therefore focused on selected sectors. We have not attempted to analyse the effect of the CO_2 tax on the continental shelf, but studies (ECON, 1994) indicate that there has been a shift to more energy-efficient equipment on the platforms as a result of the CO_2 tax. Mobile emissions are approximately constant in the period even though the price of

Figure 2. Emissions of CO_2, 1987-94. Million tonnes



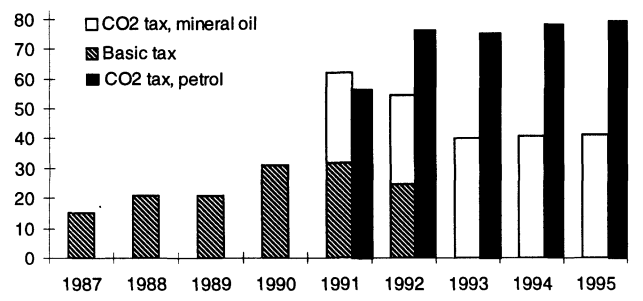
Stationary emissions from households are small in Norway, due to the large use of hydro electricity for heating.

Figure 3. Price on fuel oil and petrol (including all taxes), 1987-94. Øre[1] per litre



1) One USD is approximately 6.5 Norwegian kroner (650 øre).

Figure 4. CO_2 taxes on mineral oil and petrol, 1987-95. Øre per litre



The figure shows total taxes on mineral oil (i.e. basic tax and CO_2 tax) and CO_2 tax on petrol which is used in the analysis, assuming an exact numerical effect of the CO_2 taxes on the oil price. Any possible effect of the CO_2 tax on crude oil price is ignored, which seems reasonable when analysing a national CO_2 tax. The CO_2 taxes share of the oil prices are approximately 15 per cent for heating oil and 10 per cent for petrol.

petrol, and to some extent the CO_2 tax as well, have risen sharply. Because developments in emissions from mobile sources can differ for the various sectors, it is interesting to study the sectors individually. We have chosen to focus on household emissions from the use of passenger cars.

Estimated changes in emissions as a result of the CO_2 tax

Stationary sources accounted for about 40 per cent of total CO_2 emissions in the period 1987 to 1994. CO_2 emissions from stationary sources in households as a share of total Norwegian CO_2 emissions were about 6 per cent in 1987, falling to about 3 per cent in 1993. The analysis of manufacturing industry and services covers sectors that accounted for about 40 per cent of total emissions from stationary sources in manufacturing and services[5], or the equivalent of about 15 per cent of total Norwegian CO_2 emissions. Emissions of CO_2 from mobile sources constitute about 40 per cent of total CO_2 emissions. Household consumption of petrol generates about 12 per cent of total Norwegian CO_2 emissions.

Stationary use of energy in manufacturing and services industry

The effect of a CO_2 tax on oil consumption varies between sectors. The paper and pulp industry stands out with considerable possibilities for substitution compared with other sectors. Estimated oil consumption in the paper and pulp sector would have been 14 per cent higher (equivalent to 7 700 tonnes of oil) without taxes (basic tax and CO_2 tax) compared with actual oil consumption in 1993. In 1993 the oil price would have been 11 per cent lower without taxes. In 1991 the difference in price with and without taxes would have been 17 per cent, and estimated oil consumption would have been 21 per cent (or 16 700 tonnes of oil) higher without taxes.

There are also relatively good possibilities for substituting electricity for oil in the production of intermediate products and other government services, but this takes place over a longer horizon. In these sectors, estimated oil consumption in 1993 was 11 per cent and 10 per cent, respectively, higher without the CO_2 tax than when the tax was included. In the other sectors the effect of the CO_2 tax on oil consumption was less. The effect was particularly small in sectors which produce ships and platforms, industrial chemicals and other private services. In these sectors there are very limited possibilities for substitution between electricity and oil for heating.

The calculations show that the CO_2 tax and the basic tax on heating oil have resulted in a switch from the use of oil to the use of electricity for heating purposes in manufacturing industry and services. In the sectors studied, the total estimated decline in oil consumption as a result of the taxes varied between 24 000 tonnes in 1987 and 49 000 tonnes in 1991. This corresponds to estimated reductions in CO_2 emissions of between 75 000 tonnes and 157 000 tonnes per year (0.2 - 0.5 per cent of total emissions).

Stationary use of energy in households

Energy consumption in households is linked to the choice of heating equipment. Only a small share of the households used equipment for oil and electricity or equipment for oil, electricity and firewood (9 and 8 per cent, respectively). The share of oil in energy consumption in these two groups was 47 and 29 per cent, respectively.

The estimated effect of the CO_2 tax on households' *total* energy consumption for residential heating was only between 0.1 and 0.5 per cent in the period 1987-1993. This is primarily due to the low share of oil in total energy consumption in households. The share for oil was 30 per cent in 1987, but was gradually reduced to 15-16 per cent in

5 The sectors petroleum production, petroleum refining and manufacture of metals are not included in the analysis.

1992 and 1993. We are particularly interested in the extent of change in total stationary oil consumption in households, and thus in emissions, as a result of the tax. According to the calculations, households' total consumption of liquid fuel was reduced by a little more than 3 per cent a year in 1991 and 1992 when the taxes were highest. This corresponds to reductions in CO_2 emissions of between 32 000 and 35 000 tonnes a year.

Mobile use of energy in households

In our model context, a change in the price of petrol influences the composition and the level of private transport. Both the consumption of fuel, and to some extent the stock of cars, in households are lower due to the CO_2 tax. The change in the price of petrol entails that the price of total transport changes, which influences the consumption of total transport, and thus also the consumption of total public transport. When total public transport is changed, the five different types of transport included also change. The effect varies between transport types because the marginal budget share varies. According to the calculations, household transport with private cars (fixed and variable costs, cf. figure 1) would have been between 2 and 3 per cent higher per year in the period 1991 to 1993 without the CO_2 tax. Part of the reduction in household private transport was compensated by an increase in all types of public transport. In particular, the consumption of postal and telecommunication services and air transport increased as a result of the relatively high elasticities of substitution for these transport types. The consumption of tram and train journeys, on the other hand, showed little increase. Total public transport increased by about 0.5 per cent a year. The total transport volume for households was reduced by between 1.5 and 1.9 per cent a year as a result of the CO_2 tax. The effect on petrol consumption was between 2 and 3 per cent. According to this analysis, CO_2 emissions from the use of cars by households was reduced by 94 000 tonnes in 1991 as a result of the CO_2 tax, rising to 119 000 tonnes in 1992 and 113 000 tonnes in 1993.

Summary of results and conclusions

The figures 5-8 show CO_2 emissions with and without taxes (CO_2 tax and basic tax) for those parts of the economy that have been analysed. Figure 9 shows total emissions which have been studied, and thus comprise emissions from stationary sources in households, emissions from stationary sources in large parts of the manufacturing industry and private and public services as well as mobile sources in households (use of passenger cars). The CO_2 emissions that are analysed in this paper are reduced gradually from 31 per cent of total Norwegian CO_2 emissions in 1987 to 21 per cent in 1993 (mainly due to higher emissions from the petroleum sector). Since only about 60 per cent of the CO_2 emissions were subject to tax in the period 1991 to 1993, the emissions studied accounted for between 41 and 35 per cent of total taxable CO_2 emissions in this period. The most important sources that are not covered are emissions from processes, emissions from the

Figure 5. Oil consumption for stationary purposes in the paper industry with and without CO_2 taxes. 1000 tonnes

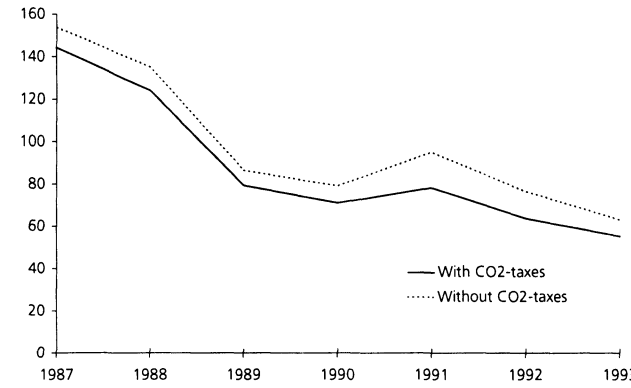


Figure 6. Oil consumption for stationary purposes in other private services with and without CO_2 taxes. 1000 tonnes

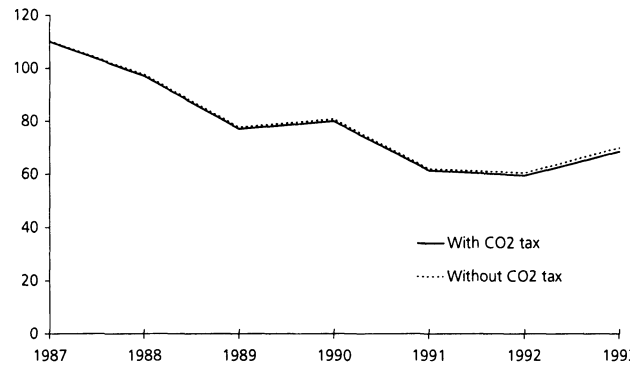


Figure 7. Oil and kerosene consumption in households with and without CO_2- and basic tax. 1000 tonnes

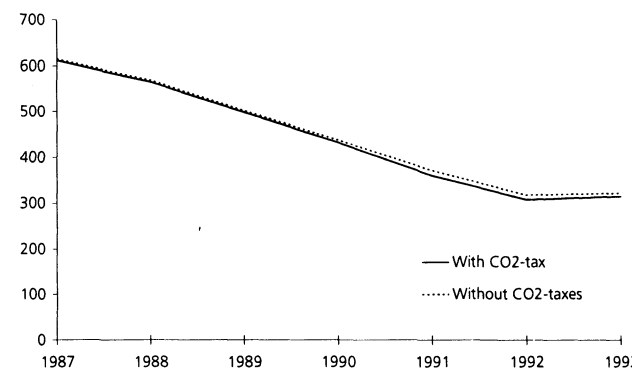


Figure 8. Consumption of petrol in the households with and without CO_2 tax. Million tonnes

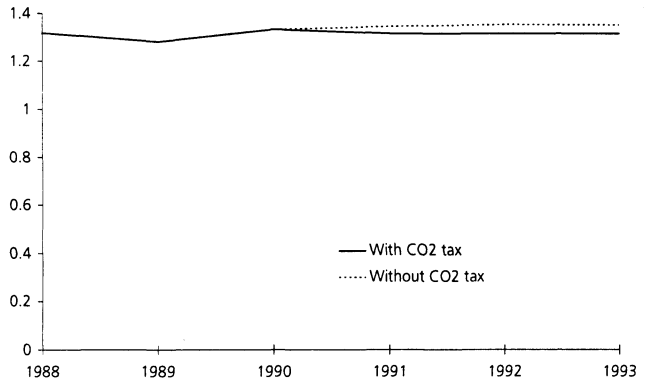
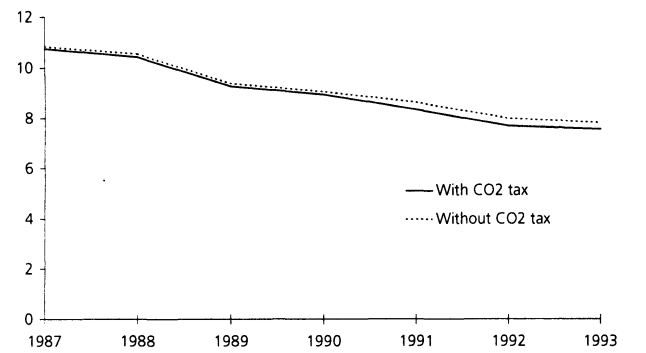


Figure 9. Total CO_2 emissions[1] with and without CO_2-tax and basic tax, 1987 - 93. Million tonnes



1) Mobile emissions from the production sectors, emissions from processes and about half of the emissions from stationary sources in the production sectors (including the petroleum sector) are not included. Total CO_2 emissions in Norway varied between about 34 and 38 million tonnes in this period.

petroleum sector and emissions from mobile sources outside the household sector. The petroleum sector accounts for about half of the taxable CO_2 emissions that are not included in figure 9.

The total effect of the CO_2 taxes on CO_2 emissions studied in this analysis was 3-4 per cent for the period 1991-1993. By way of comparison, the price of heating oil and petrol changed by about 15 per cent and 10 per cent, respectively, as a result of the taxes. The calculations thus indicate that the CO_2 taxes have had an effect on CO_2 emissions for the part of the economy studied.

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European integration, energy demand and emissions to air[1]

Knut H. Alfsen and Pål Boug

The question of how much the European economic and political integration process matters for future development in energy demand, emissions to air of key pollutants and transboundary transport of sulphur and nitrogen is a difficult one, since different forces act in different directions. We address this question in this article by comparing two simulated energy scenarios based on the Sectoral European Energy Model (SEEM); one scenario based on the assumption of further European integration versus another scenario where fragmentation is assumed to prevail. Both scenarios are based on exogenously given assumptions of economic growth, technological development and energy price development, and cover the period from 1991 to 2020. The focus of the report is on consequences for future demand for fossil fuels, emissions of CO_2, SO_2 and NO_x, and transport and deposition of sulphur and nitrogen. Simulations of SO_2 and NO_x emissions and depositions are carried out by linking the SEEM model to IIASA's RAINS model.

Average annual growth in GDP in the integration scenario is 2.3 per cent, while demand for fossil fuels, emissions of CO_2, SO_2 and NO_x, and nitrogen deposition all show average annual growth rates from 1. 7 to 1.9 per cent. Deposition of sulphur grows at the slightly lower rate of 1.4 per cent per year in this scenario. In the fragmentation scenario all growth rates are reduced by 0.5-0.7 percentage points, except the rate of annual average growth in SO_2 emissions which is reduced by 0.8 percentage point. The results vary considerably, however, over countries, sectors and fuel types.

Introduction

European integration has been on the agenda for a long time. The Maastricht treaty and the extension of EU12 to EU15 in recent years are only the last events in a process that have been going on since the foundation of the European Coal and Steel Community in 1950. Whether this momentum towards greater integration can be kept up also in the next few decades is however uncertain. The problem addressed in this paper is how further integration or, alternatively, fragmentation may affect the future of European demand for fossil fuels and related environmental problems. In particular we study how emissions of carbon dioxide (CO_2), and emissions, transport and deposition of the two most important acid compounds; sulphur dioxide (SO_2) and nitrogen oxides (NO_x) are affected by the assumption of further integration and fragmentation, respectively.

Based on two alternative economic growth paths covering the period from 1991 to 2020, and reflecting further European integration on the one hand and fragmentation in Europe on the other, we first employ a Sectoral European Energy Model (SEEM) to calculate likely impacts on the energy markets. Secondly, based on projected energy demand, emissions of the greenhouse gas carbon dioxide (CO_2) are calculated by the SEEM model, while IIASA's RAINS model is utilized in calculating emissions, atmospheric transport and deposition of SO_2 and NO_x. The inputs to the RAINS model are the energy consumption paths generated by the SEEM model.

The SEEM model

The Sectoral European Energy Model (SEEM)[2] is a simulation model for energy demand projections for 13 countries in Western Europe. The model consists of separate model blocks for each of the following countries:

- Four major energy consumers: Germany, France, United Kingdom, and Italy;
- Four Nordic countries: Denmark, Sweden, Finland and Norway;
- Five other countries: Spain, the Netherlands, Belgium, Austria, and Switzerland.

[1] Acknowledgement: This paper is based on results from the project "Energy scenarios for a changing Europe" carried out by Statistics Norway in co-operation with ECN, The Netherlands. Financial support from Statoil, The Dutch Ministry of Planning and The Norwegian Ministry of the Environment is acknowledged. Further details can be found in van Oostvoorn *et al.* (1995), Alfsen *et al.* (1996) and Boug and Brubakk (1996).

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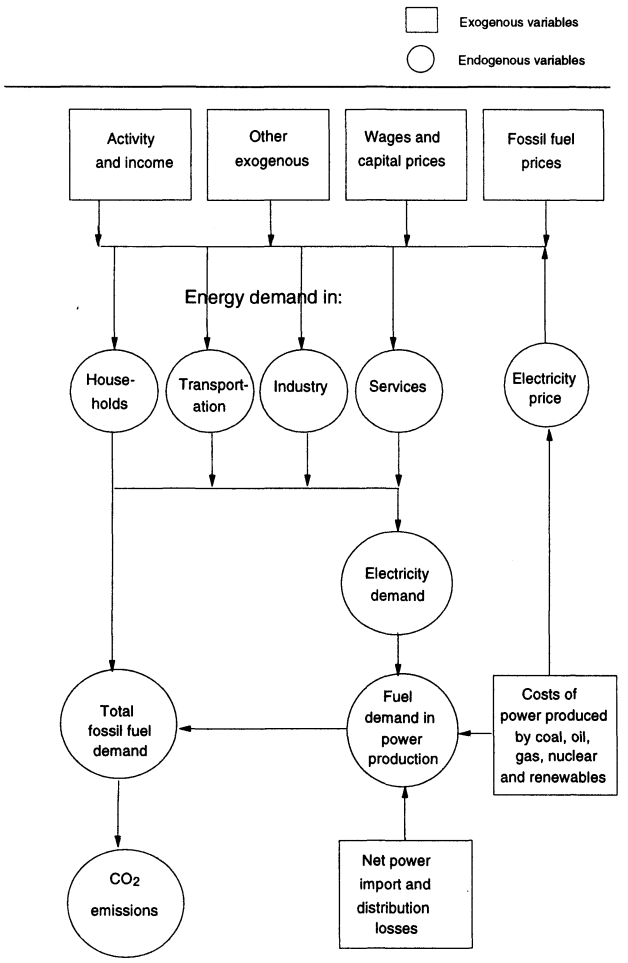
[2] SEEM, version 2.0, has been developed in co-operation with the Netherlands Energy Research Foundation ECN and Statistics Norway. Documentation can be found in Brubakk *et al.* (1995) and Boug (1995). Studies based on a previous version of the model have been published by Birkelund *et al.* (1993, 1994) and Alfsen *et al.* (1995).

Figure 1. SEEM model structure



Together, these countries consumed about 90 per cent of the total energy use in the OECD Europe in 1991.

Neither inter-country trade nor supply of primary energy is modelled within SEEM. Supply of electric power is, however, part of the model. In each country there are five sectors: manufacturing industries and service industries (hereafter referred to as industry and services), households, transport[3] and power production. Energy carriers covered in SEEM are coal, oil, gas, electricity and various transport fuels. Demands for nuclear and renewable fuels are treated as given in the model.

The model is partial in the sense that it determines the demand for energy based on exogenous prices, taxes and production and consumption activity levels. Hence, the focus is on the demand side of the energy markets, with the assumption that demand equals realised consumption. However, both the demand and the supply side of the Electricity generating sector is included in the model. Cost minimising behaviour is assumed for all sectors. Parameters characterizing the behaviour of the sectors are estimated on empirical data or based on research results published in international journals. For all estimations and the calibration of the energy use and prices to the base year (1991), data from the International Energy Agency (IEA, 1993a, b) were used.

Figure 1 depicts the structure of the model block for one country. In a first step the model determines the demand for coal, oil, natural gas and electricity in the end user sectors, based on exogenous information on activity levels, income, and technology, in addition to production factor prices.

In the *electricity generation* sector the need for domestic production of power is derived, given an exogenous matrix of net power import and a constant percentage of distribution losses. The electricity requirements can be produced in several ways: By thermal power plants using coal, oil or natural gas as inputs, by nuclear power plants and/or by plants using renewables (now mainly hydro power). Nuclear and renewable power production are exogenously given in the model and in this study kept constant across the two scenarios. The different thermal power technologies' share of the total electricity generation depends on their relative costs of production. Based on the production costs of electricity, margins and taxes, the model calculates electricity end-user prices in all sectors. Adding the use of fossil fuels in the end user sectors to fossil fuel inputs in thermal power production yields the total demand for each fossil fuel. In a submodel, demand for coal, oil and natural gas are converted into estimates of CO_2 emissions.

The *industry* sector is described by a two-level fuel-share model. The upper level determines the cost minimising combination of the three aggregate production factors; capital, labour and energy, while the lower level determines the cost minimising combination of the different fuels included in the energy aggregate, i.e. the optimal proportion (fuel shares) of coal, oil, natural gas and electricity. At both levels Cobb-Douglas production functions have been used. To allow for sluggish adjustment of capital input to price changes, demand is lagged according to a partial adjustment hypothesis. Hicks-neutral technical progress is specified at the upper level. The fuel demand equations at the lower level are calibrated using information about the cost shares of the different fuels. At the upper level the calibration is based on elasticities found in other studies.

For *service industries* we have estimated a fuel-share model similar to that of the industry sector by postulating Constant Elasticity of Substitution (CES) production functions for the energy aggregates. We allow for a nested model in *three* levels (compared to two in the industry sector) for countries with substantial use of all four energy sources, i.e. coal, oil, gas and electricity. At the upper level, electricity and an aggregate of oil, gas and coal are separate inputs. This is based on a hypothesis that the use of electricity contributes to production in a profoundly different way than fossil fuels. While the latter are used for

[3] Fuel demand for transport purposes has been grouped into one sector

space heating mainly, electricity is mostly used in appliances like computers and lighting for which energy substitution is impossible. The energy demand functions at the upper level are log-linear, with calibrated parameters. At the intermediate level, the fossil fuel aggregate is produced by a CES technology utilizing an aggregate of oil and gas, and of solids. At the lower level the oil and gas aggregate is produced, also by a CES technology. The intermediate and lower level parameters are estimated.

The *household* sector model is equal to the services sector model, except that at the upper level "private consumption" and "prices of other goods" substitute for the production activity level and factor costs others than energy costs as explanatory variables, respectively. Also in the households, electricity and fossil fuel prices are variables which determine the households' demand for electricity and fossil fuel aggregate at the upper level. The modelling and parameterisation of the lower levels are similar to the service sector model.

The *transport* sector model is divided into *passenger transport, freight transport,* and *air transport.* Fuel efficiencies in the transport sectors are based on linear penetration of new technologies.

Air transport is treated separately because most air transport is combined passenger and freight transport. Demand for fuel (kerosene) is modelled as a function of the price of kerosene and gross domestic production.

For *passenger transport* both private and public transport are considered; more specifically cars (gasoline, gasoil and gas), trains (electricity and gasoil) and busses (diesel) are distinguished. At the upper level of the passenger transport model total demand for person kilometres is a function of consumer expenditures and a transport price index. At the lower level the demand for transport is split into the different modes in proportions depending on fuel prices and capital prices of the respective modes. This determines demand for person kilometres by transport mode. Given figures for car occupancy and efficiency, the corresponding fuel use is then computed.

The *freight transport* is modelled at the upper level by assuming that the development of domestic production determines total demand for tonnes kilometres. Given exogenous assumptions on mode shares and fuel efficiency, the demand for the different fuels are then calculated.

We calculate the emissions of SO_2 an NO_x by inserting energy trajectories from the SEEM model into IIASA's RAINS model (Alcamo *et al.* 1990, Kolsrud, 1996). The simulated SEEM figures are suitably transformed to take into account differences in definitions of sectors and fuels between the two models. Utilizing the technology assumptions incorporated in the Official Energy Pathway (OEP) scenario of RAINS, we can then calculate SO_2 and NO_x emissions and also use the atmospheric transport module to find the deposition pattern associated with our energy scenarios [4].

Model input

The simulations are, as mentioned, based on two exogenously given economic growth paths. Here, we only present some of the main features of these paths. For a fuller discussion and a presentation of the reasoning behind the scenarios, see van Oostvoorn *et al.* (1995).

Ongoing Western European integration (IS)

This scenario is based on the assumption that the ongoing European integration process will continue more or less according to the time schedule in the Maastricht treaty. Because of perceived positive economic perspectives we assume that the EU will be joined by Switzerland and Norway around the turn of the century. Hence, the integration process concerns all 13 Western European countries covered by SEEM. Furthermore, we assume an association of all central European countries (the so called Visegrad countries) around year 2000, improving trade possibilities and access to foreign investments. The integration process will result in the completion of all the objectives of the internal market, so free movement of all goods, persons and capital will be realised.

We expect that the completion of the internal market will have a moderate, but positive, overall effect on economic productivity and income in EU. Funds for structural improvements in the Southern European EU countries presumably will contribute to a more equal development pattern. We assume that the European Monetary Union will result in a single currency (ECU) and the establishment of a Central bank before the year 2000. A stable monetary situation without continuously changing exchange rates will be reached at that time, increasing economic prospects further.

Of crucial importance to the issue analysed in this report is that an energy tax harmonisation is assumed to take place in the model countries. The tax is harmonised towards the average tax levels presently found in the four largest countries; Germany, France, United Kingdom and Italy.

Western European fragmentation (FS)

This scenario is based on the assumption that the EU integration is halted from now on. National disagreements

[4] As explained in Alfsen *et al.* (1995) and Kolsrud (1996), SEEM does not provide values for all the energy variables entering the RAINS model. In addition, the Official Energy Pathway scenario of the RAINS model, that provides the technology parameters relevant to the SO_2 and NO_x emission calculations, has a time horizon to year 2000. After this time, we have kept the technology parameters constant in our simulations. This allows us to study the partial effects of changing energy consumption pattern, and to interpret the results in purely economic terms. Furthermore, the energy variables not provided by SEEM are forecasted using total demand for solid, liquid and gaseous fossil fuels simulated by SEEM as relevant indicators.

Table 1. Average annual growth in economic activity in the integration (IS) and fragmentation (FS) scenarios. 1991-2020. Per cent

	GDP		Industrial production		Production of services		Private consumption	
	IS	FS	IS	FS	IS	FS	IS	FS
Austria	2.4	2.1	2.4	2.1	2.5	2.2	2.5	2.0
Belgium	2.3	1.9	2.3	1.9	2.4	2.0	2.4	1.8
Denmark	2.2	1.8	2.1	1.6	2.3	1.9	2.2	1.6
Finland	2.3	0.5	2.3	0.5	2.4	0.5	2.3	0.5
France	2.3	1.9	2.3	1.9	2.4	2.0	2.3	1.8
Germany	2.3	2.1	2.3	2.1	2.4	2.2	2.4	2.0
Italy	2.6	1.7	2.5	1.7	2.7	1.8	2.6	1.6
Netherlands	2.2	1.8	2.1	1.6	2.3	1.9	2.2	1.6
Norway	2.4	2.0	2.4	2.0	2.5	2.1	2.5	1.9
Spain	2.6	1.7	2.5	1.7	2.7	1.8	2.6	1.6
Sweden	2.3	1.6	2.3	1.6	2.4	1.5	2.4	1.4
Switzerland	2.3	2.1	2.3	2.1	2.4	2.2	2.4	2.0
United Kingdom	2.2	1.0	2.1	1.1	2.3	1.0	2.1	1.0
Average	2.3	1.7	2.3	1.7	2.4	1.8	2.4	1.6

This scenario is based on the assumption that the EU integration is halted from now on. National disagreements dominate further EU unification, resulting in a more fragmented Western Europe. As a result, we assume that overall average economic growth in Western Europe is lower than in the integration scenario, and that differences in growth rates between Western European countries are greater than in the integration scenario.

Completion of the internal market will not progress further. Instead increasing protectionism in sensitive sectors such as agriculture, coal mining, gas distribution, and electricity generation in many EU-countries might be expected, and national intervention in energy markets will prevail. Also permanent or even increasing inequalities in the national taxation systems will occur over the next decades. As a result of monetary uncertainties, cross-country investments will decline and international trade will stagnate reltive to the integration scenario, and thus hamper the relative economic growth performance in all Western European countries.

No energy tax harmonisation is assumed to take place in this scenario.

Economic growth

Based on the foregoing considerations the assumptions on economic growth shown in table 1 have been adopted for the simulation period 1991 - 2020. In the table, the annual growth of GDP, production in Industry and Services, and Private consumption are averaged over the three subperiods 1991 - 2000, 2000 - 2010, and 2010 - 2020.

Energy prices

In the integration scenario we assume that a successful economic transition in Russia will take place, resulting in development of new oil and gas fields and the associated transport infrastructure, and that this will keep oil and gas prices low. Together with the structural developments in Western Europe this will lead to decreasing gas prices. At about 2005 the gas price is expected to be uncoupled from the oil price. However in the fragmentation scenario, we assume a monotonous, but modest, increase in oil and gas prices, due to lack of new investments and thus exports from Russia. After about 2015 the resulting gas prices reach values above oil prices from the Middle East.

Figure 2. Fossil fuel import prices. Average over SEEM countries

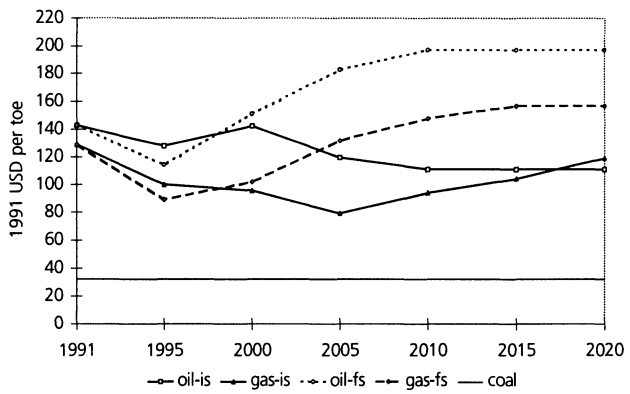


Figure 2 shows the development in oil and gas import prices according to the two scenarios. We assume that the coal import price for EU countries will remain stable at the present level in both scenarios. For further discussion of the energy price scenario, see van Oostvoorn *et al.* (1995) and Boug and Brubakk (1996).

Autonomous efficiency improvement

Our assumptions on autonomous efficiency improvement are rather conservative in both scenarios, due to relative

Table 2. Annual change in autonomous technical efficiency. 1991-2020. Per cent

	Industry	Services	Households
IS	0.6	0.4	0.4
FS	0.3	0.2	0.2

improvement in IS is expected to be larger than in FS, because of higher economic growth, thus inducing faster turnover and more competition. Furthermore, it is expected that industry is more efficiency oriented, thus more improvement can be realised here than in services or households.

In southern countries like Spain and Italy it is expected that the initial efficiency is below Western European averages. Therefore, in these countries annually realised efficiency improvements can be relatively higher, particularly in industry. Summarising, table 2 shows the country averages of the autonomous efficiency improvements adopted in the simulations.

Simulation results

Demand for fossil fuels

The development in fossil fuel consumption can be summarily explained by changes in:

- economic activity
- technological improvements
- fuel import prices
- fuel taxes

The relative impacts of these factors in going from the integration (IS) to the fragmentation (FS) scenario is shown in table 3.

Since we have assumed higher economic growth in IS than in FS (approximately 2.3 per cent per year vs. 1.7 per cent), this tends to lower the demand for all fuels in FS compared to IS. This is marked by "-" in the table. The technology assumptions work the opposite way. We have assumed higher (autonomous) energy savings and fuel efficiency improvements in the integration scenario, implying that, at constant fuel prices, the energy intensity will become higher in FS, i.e. more fuel is used per output ("+" in the table). Roughly speaking, the activity effect and the technology effect tend to more or less offset each other when it comes to the overall effect on total fuel demand.

Table 3. Impacts on energy consumption of various factors in going from IS to FS

	Oil	Gas	Coal	Total
Economic growth	-	-	-	-
Technology	+	+	+	+
Fuel import prices	--	-	+	--
Fuel tax harmonisation	+	-	0	0
Total	--	--	+	--

(+ indicates higher fuel demand in FS than in IS)

From figure 2 it is clear that the oil and gas prices are lower in the integration scenario than in the fragmentation scenario, resulting in lower oil and gas consumption in FS than in IS. The price differences are especially high for oil after 2005, so the effects have time to work out completely despite lag effects in the model. This results in a double "--" for the oil demand difference between FS and IS in the table. Although the coal import price stays constant in both

Figure 3. Demand for gas. Thousand tonnes oil equivalents (ktoe)

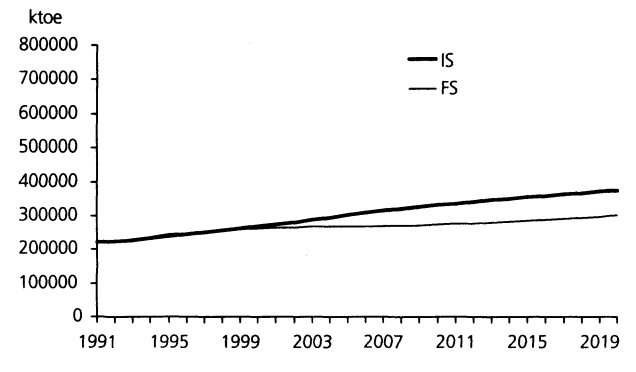


Figure 4. Demand for oil. Thousand tonnes oil equivalents (ktoe)

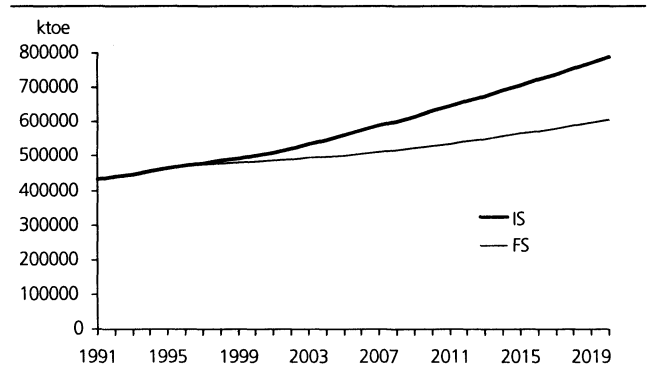
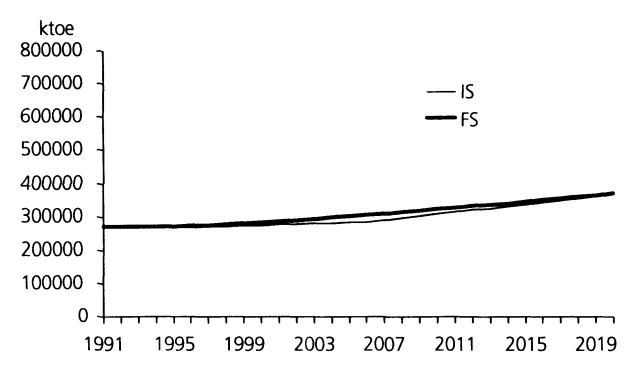


Figure 5. Demand for coal. Thousand tonnes oil equivalents (ktoe)



scenarios, it is more favourable compared to oil and gas prices in the FS scenario. Thus, the fuel price effect is that coal demand is higher in FS than in IS.

The fourth major difference in input between the scenarios is the tax harmonisation implemented in the integration scenario. Due to extremely high taxes on natural gas used in households in some countries where gas consumption is high (Italy is the main example), removal of the harmonisation leads to reduced gas consumption at the aggregate level. The effect on oil is opposite (but weak), mainly because some of the large countries today have gasoline taxes slightly below the average of the four big countries. Overall, the effect of the tax harmonisation must be considered to be weak.

The figures 3 - 5 show the simulated time paths of aggregated demand for natural gas, oil and coal in the integration and the fragmentation scenarios.

From the figures and table 4 below, we note that in the integration scenario oil demand is expected to show the fastest growth, closely followed by gas. Coal demand show only half the growth rate of the two other fossil fuels. In considering the effects of fragmentation, we note a reduction in the growth rate of oil and gas of almost 1 percentage point, while demand for coal actually increases slightly. The explanation for this is that under the adverse economic conditions in the fragmentation scenario and without a deregulation of the national coal industries, the coal price is competitive with the other fuels. Also, since electricity demand drops in the fragmentation scenario relative to the integration scenario, less investments are made in thermal power supply, postponing the introduction of gas fired power plants.

We note that the demand for fossil fuels grows faster in the southern countries, Italy in particular, than in most of the other countries in the integration scenario. The south, to-

Table 4. Fossil fuel demand in 1991 (ktoe) and average annual growth rates in the integration (IS) and fragmentation (FS) scenarios. 1991-2020

	1991 (ktoe)			Annual average growth 1991-2020 IS (Per cent)			Annual average growth 1991-2020 FS (Per cent)		
Country	Gas	Oil	Coal	Gas	Oil	Coal	Gas	Oil	Coal
AU: Austria	5 096	9 545	4 299	2.1	2.1	1.6	1.6	1.8	1.8
BE: Belgium	8 430	15 188	9 584	1.4	0.7	1.0	0.8	0.6	1.2
BR: Germany	49 959	104 365	112 695	1.4	1.4	0.9	1.0	1.3	1.1
CH: Switzerland	2 038	12 628	722	1.5	1.7	1.0	1.4	1.6	1.2
DK: Denmark	1 512	7 340	7 687	1.0	1.8	1.5	0.4	0.9	1.0
FR: France	26 396	68 025	19 286	2.1	1.9	1.7	1.6	1.4	1.7
GB: United Kingdom	41 615	65 458	64 834	1.4	1.3	0.8	0.4	0.2	0.7
IT: Italy	47 352	73 505	14 654	2.7	3.5	1.5	1.5	1.5	1.9
NL: The Netherlands	30 248	12 433	8 370	1.6	1.4	0.7	1.1	0.9	1.0
NO: Norway	-	8 060	854	.	1.8	1.3	.	1.3	1.5
SF: Finland	2 352	8 600	5 983	1.4	0.9	1.1	-0.2	-0.1	0.2
SP: Spain	4 833	37 456	19 144	1.2	2.9	1.2	0.6	1.4	0.8
SW: Sweden	507	10 962	2 745	1.2	2.5	2.1	0.6	1.0	0.9
Total	220 338	433 566	270 856	1.9	2.1	1.0	1.1	1.2	1.1

Table 5. Demand for fossil fuels by sector in 1991 (ktoe) and average annual growth in the integration (IS) and fragmentation (FS) scenarios. 1991-2020

	1991 (ktoe)			Annual average growth 1991-2020 IS (Per cent)			Annual average growth 1991-2020 FS (Per cent)		
Country	Gas	Oil	Coal	Gas	Oil	Coal	Gas	Oil	Coal
EL: Electricity production	35 938	46 980	197 153	1.6	3.2	0.9	1.2	1.0	1.0
HO: Households	84 435	56 091	14 236	2.2	1.6	1.7	1.2	0.8	1.1
IN: Manufacturing industries	69 307	49 363	55 539	1.4	2.0	1.2	0.6	0.0	1.1
SE: Service industries	26 769	40 093	3 928	1.9	1.2	3.0	1.6	1.3	2.5
ST: Stationary consumption	216 449	192 527	270 856	1.8	2.1	1.0	1.1	0.8	1.1
FC: Final consumption	180 511	145 546	73 703	1.9	1.9	1.4	1.1	1.2	1.2
MO: Mobile consumption	3 889	241 040	-	2.3	2.1		1.2	1.4	
Total	220 338	433 567	270 856	1.9	2.1	1.0	1.1	1.2	1.1

We note that the demand for fossil fuels grows faster in the southern countries, Italy in particular, than in most of the other countries in the integration scenario. The south, together with Finland, are also hardest hit (i.e. show the largest reductions in energy use) by fragmentation.

The sectoral demand for fossil fuels shown in table 5 indicates that the growth rates are more equal across sectors than across fuel types or countries, cf. table 4. However, with an annual average growth rate in total demand of approximately 2 per cent, we find that energy use for transportation and household demand for fossil fuels in the integration scenario grow somewhat faster than demand from the other sectors. In comparison, industry shows a growth rate of 1.5 per cent. In the fragmentation scenario we note that demand from the service sector remains relatively unaffected by the scenario assumptions, and displays only a slight decrease relative to the integration scenario.

The difference in oil demand between IS and FS is largest in the electricity generation sector. This is mainly explained by the low taxes in the integration scenario, and thus heavily decreasing prices in the electricity sector. Furthermore, especially in the UK and Italy, a major difference between activity growth is assumed, resulting in a large demand for electricity in IS. The gap in oil demand in the industry sector between IS and FS is also rather large. This can be explained by low tax rates combined with relatively high elasticities.

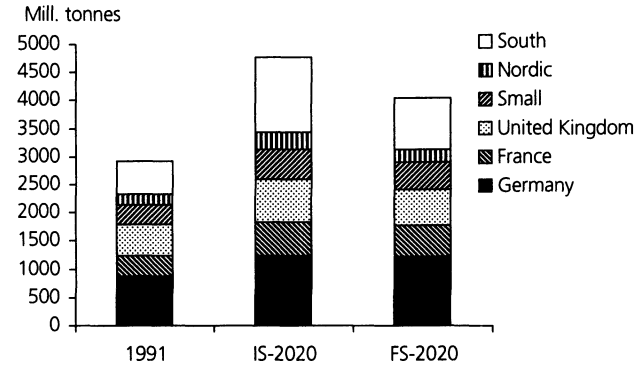
For sectoral gas demand the services sector shows only a small difference between IS and FS. This is due to high taxes which dampen the differences in gas import prices between the two scenarios. In the household sector the tax rates are also relatively high. However, reaction on energy demand is much larger, because income elasticities in that sector are much greater than in the service sector.

The sectoral demand for coal is dominated by the electricity generating sector. In contrast to the other fuels, demand for coal is slightly increased in going from the integration to the fragmentation scenario. As mentioned before, this is mainly due to a slower replacement of old coal fired power plants in the fragmentation scenario.

Emission of CO_2

Emissions of CO_2 are determined by the carbon content of each fuel. The emission factors employed in this study are as follows: Gaseous fuels: 2.4, liquid fuels: 3.1 and solid fuels: 3.9, all measured in (metric) tonnes of CO_2 per tonnes oil equivalents (t.o.e.). Figures 6 - 8 show emission levels in 1991 and in year 2020 in the two scenarios from groups of countries, by fuel types and by sectors. Average annual growth in CO_2 emissions is 1.7 per cent in the integration scenario and 1.1 per cent in the fragmentation scenario. Total CO_2 emissions grow somewhat slower than total demand for fossil fuels, since both oil and gas (with relatively low emission coefficients) grow faster than demand for coal (with a relatively high emission coefficient). In the integration scenario Germany reduces its share of emissions, while Italy increases its share. In the fragmentation scenario the 1991-shares are more or less restored in 2020, expect for United Kingdom which reduces its share from 19 per cent to 16 per cent in both scenarios.

Figure 6. Emissions of CO_2 by group of countries



Note: The country aggregates are defined as follows: Austria, Switzerland, Belgium and the Netherlands are the "Small" countries. The "Southern" countries consist of Italy and Spain, while the "Nordic" countries are Denmark, Finland, Sweden and Norway.

Figure 7. Emissions of CO_2 by type of fuels

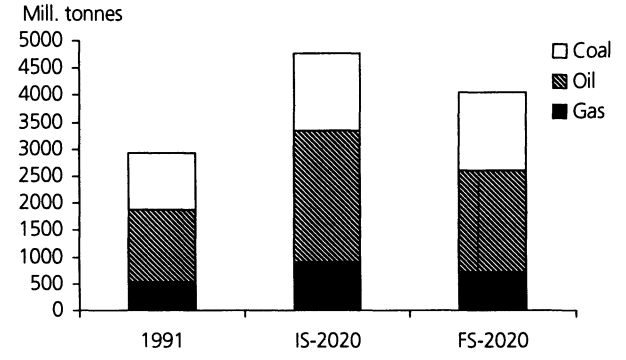
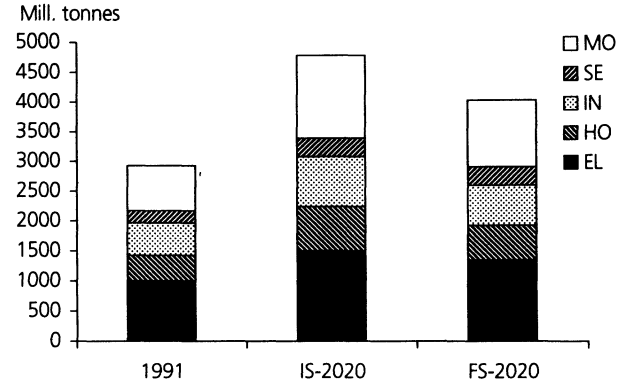


Figure 8. Emissions of CO_2 by sectors



Note: MO=Mobile, SE=Service industries, IN=Manufacturing industries, HO=Households, EL=Electricity production

With respect to type of fuel, we find that the share of oil related emissions, and to a much smaller extend the gas related emissions, increase in the integration scenario, while the base year shares are restored in the fragmentation scenario in 2020.

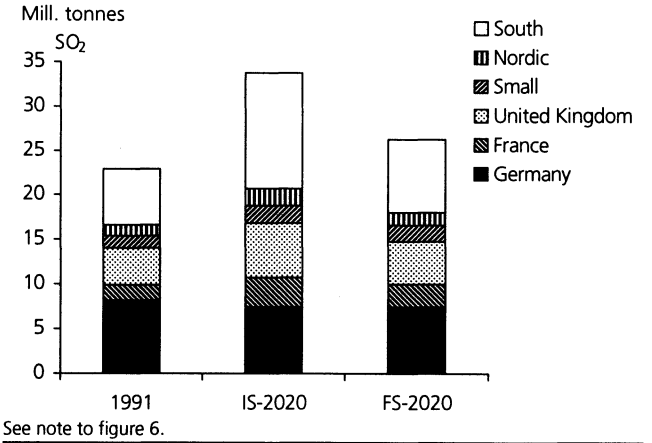
Electricity generation and transport are the dominating sectors with respect to CO_2 emissions. Since transport activities are assumed to grow relatively fast in both scenarios, its share increases from 26 per cent in 1991 to 29 per cent in year 2020 in the integration scenario and 28 per cent in the fragmentation scenario. Electricity generation reduces its share from 34 per cent in 1991 to 31 and 33 per cent in year 2020 in the IS and FS scenarios, respectively.

Emissions of SO_2 and NO_x

Unlike CO_2 emissions, the emission of SO_2 and NO_x depends on how the fossil fuels are burned (combustion technology) as well as the amount of cleaning of exhaust gases that takes place. These emissions will therefore not necessarily follow the pattern of fossil fuel demand. Also, in the case of sulphur emissions, these are dominated by the demand for coal which is more sulphurous than the other fossil fuels. The simulation results are shown in figure 9 and 10.

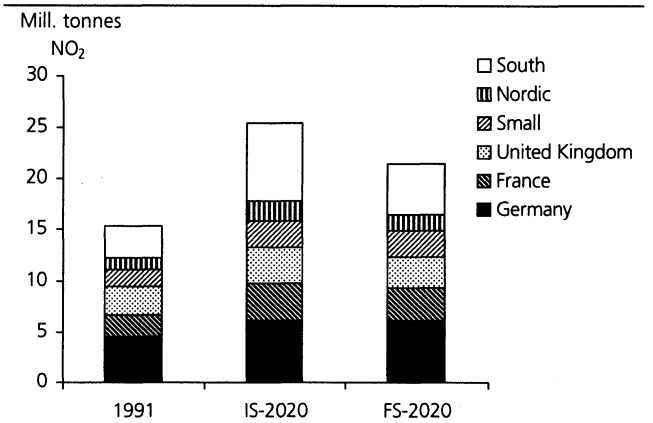
Total SO_2 emissions are growing at an annual average rate of 1.3 per cent in the integration scenario versus only 0.5 per cent in the fragmentation scenario, see figure 9. These comparatively low growth rates are due to the fact that SO_2 emissions from Germany are declining in both scenarios. This is explained by the forecasted large reduction in

Figure 9. SO_2 emissions in 1991 and 2020 by country groups



See note to figure 6.

Figure 10. NO_x emissions in 1991 and 2020 by country groups



See note to figure 6.

Table 6. Shares of emissions in 1991 and average annual growth rates from 1991 to 2020 in the integration (IS) and the fragmentation (FS) scenarios by fuel type. Per cent

	SO_2 emission Shares 1991	Average annual growth 1991-2020		NO_x emissions Shares 1991	Average annual growth 1991-2020	
		IS	FS		IS	FS
Gas	-	-	-	5	1.7	1.0
Oil	36	2.9	1.0	71	2.2	1.4
Coal	61	0.1	0.2	20	0.7	0.8
Other[a)]	4	0.2	0.0	3	-0.1	-0.1
Total	100	1.3	0.5	100	1.8	1.2

a) Other includes emissions from non-combustion processes and from use of alternative technologies.

Table 7. Shares of emissions in 1991 and average annual growth rates from 1991 to 2020 in the integration (IS) and the fragmentation (FS) scenarios by RAINS' sectors. Per cent

	SO_2 emission Shares 1991	Average annual growth 1991-2020		NO_x emissions Shares 1991	Average annual growth 1991-2020	
		IS	FS		IS	FS
Conversion	8	2.9	1.2	2	2.3	1.2
Power prod.	68	1.0	0.4	21	1.1	0.7
Domestic	10	1.4	0.4	5	1.8	1.1
Traffic	3	2.6	1.6	65	2.1	1.5
Industry	11	1.7	0.3	6	1.5	0.7
Total	100	1.3	0.5	100	1.7	1.2

coal used in the eastern part of the country. The other big contributor to SO_2 emissions is the southern block, i.e. Italy and Spain. High economic growth rates in the integration scenario lead to high emissions. In 2020 their combined emission share is almost 40 per cent, up from 28 per cent in the base year 1991. Even in the fragmentation scenario, where their economic growth is closer to the average growth of all countries, Italy and Spain increase their share of SO_2 emissions from 28 per cent to 32 per cent.

Total NO_x emissions grow more in line with total energy demand, see figure 10. While SO_2 emissions were determined by the use of coal and oil primarily in the power producing sector, transport oil use is an important determinant for the NO_x emissions. The southern countries also in this case increase their shares of emissions from 20 per cent in 1991 to 30 per cent in 2020 in the integration scenario and more modestly to 23 per cent in the fragmentation scenario.

Further information on the SO_2 and NO_x emissions are given in the tables 6 and 7. Both oil and coal use contribute significantly to the SO_2 emissions. The coal use is not much affected by neither integration nor fragmentation, and coal emissions grow in both scenarios at a modest average rate close to 0.1 per cent per year. Oil contributes more to SO_2 and NO_x emissions in the future than in 1991 in both scenarios, but most prominently in the integration scenario.

From table 7 we note that most of the SO_2 emissions are coming from the power producing sector, and that this is the case also in the future in both scenarios although other sectors' contribution are likely to grow somewhat. The use of oil is the most prominent cause of NO_x emissions in the SEEM countries, in particular for transport purposes. The dominant role of transport is likely to increase in the future.

Deposition of SO_2 and NO_x

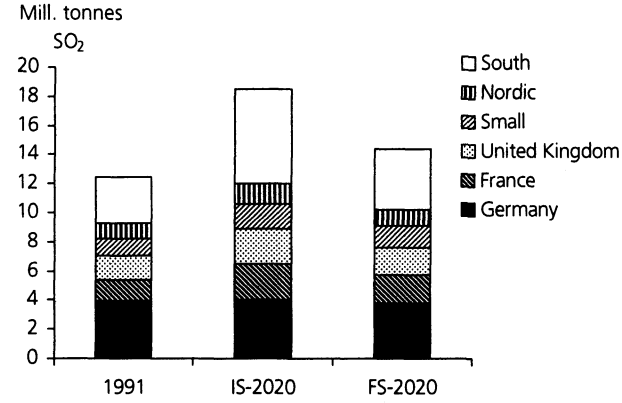
Deposition of sulphur and oxidised nitrogen is calculated using the above emission figures and the transport matrices for 1991, as given by Sandnes (1993). The SEEM countries only constitute a subset of the countries covered by RAINS and the transport matrices. Here we only consider the contribution to depositions in the SEEM countries coming from the SEEM countries. Table 8 shows the average annual growth rates. The growth rates are very similar to the corresponding growth in total emissions.

The figures 11 and 12 show the deposition of oxidised sulphur and nitrogen in groups of SEEM countries coming from these same groups in 1991 and in 2020. France and the southern countries experience the strongest growth in sulphur depositions, while depositions in Germany are more or less stable. With regards to nitrogen deposition, the growth rates are more equal across countries, but still with strongest growth in France and the other southern countries. United Kingdom has the lowest growth in nitrogen depositions. This relative growth pattern is very stable across the two scenarios.

Table 8. Average annual growth rates in deposition of oxidised sulphur and nitrogen. 1991-2020. Per cent

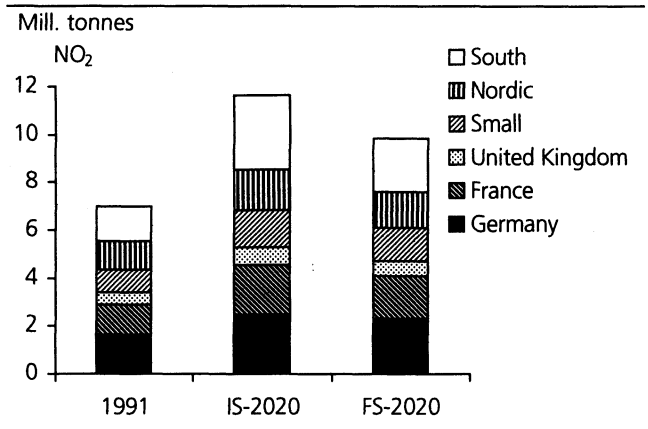
	SO_2	NO_x
IS	1.4	1.8
FS	0.5	1.2

Figure 11. Sulphur deposition in 1991 and 2020



See note to figure 6.

Figure 12. Nitrogen deposition in 1991 and 2020



See note to figure 6.

Table 9 shows how the ratios between depositions and emissions develop from 1991 to 2020 in the two scenarios.

Overall, we find the ratios of deposition to emission to be larger for sulphur than for nitrogen with relatively more of the sulphur emissions being deposited in the SEEM countries. France, the small countries in central Europe and the Nordic countries receive the most relative to their own emissions. At the opposite end of the scale we find that United Kingdom, Germany and the southern countries of Italy and Spain receive about half or less of what they

Table 9. The ratio between deposition and emission of oxidised sulphur and nitrogen in the integration (IS) and fragmentation (FS) scenario by country groups

	SO_2			NO_2		
	1991	IS-2020	FS-2020	1991	IS-2020	FS-2020
Germany	0.48	0.54	0.51	0.37	0.40	0.38
France	0.87	0.77	0.76	0.58	0.57	0.54
United Kingdom	0.40	0.39	0.40	0.19	0.21	0.21
Small	0.86	0.83	0.77	0.57	0.60	0.55
Nordic	0.84	0.74	0.81	0.95	0.86	0.93
South	0.52	0.50	0.51	0.47	0.42	0.46
Total	0.54	0.55	0.55	0.45	0.46	0.46

emit. With regards to nitrogen, the Nordic countries receive the most relative to their own emissions, while United Kingdom is the largest contributor to depositions in other SEEM countries.
In the integration scenario we find that Germany receives relatively more SO_2 compared to its emissions, while the opposite is the case for France and the Nordic countries. Only small changes in the deposition/emission ratios are experienced by the other country groups. With respect to nitrogen, the most prominent changes over time in the integration scenario are the reductions in relative depositions in both southern and Nordic countries.

Going from the integration to the fragmentation scenario, we find a decline in the relative deposition of both sulphur and nitrogen in the small country group, while the relative depositions increase in the Nordic group.

Conclusion

Several models in the literature have analysed energy scenarios for Western Europe, e.g. Global 2100 (Manne and Richels, 1992), GREEN (Burniaux *et al.*, 1992) and ECON-ENERGY (Haugland *et al.*, 1992). However, in these models Western Europe is treated as a single block. In contrast, the SEEM model is more detailed, since it models energy demand and emissions to air from each of the countries covered. The SEEM model is also unique in that it allows for a linkage to the RAINS modelling system.

The SEEM simulations in this paper have been based on two exogenously given economic growth scenarios with the following main characteristics:

- The economy shows only modest growth in the integration scenario, strongest in the south. The growth rate is even lower in the fragmentation scenario. The southern countries experience the largest reduction in economic growth, while the growth in Germany is almost unaffected in going from the integration to the fragmentation scenario.

With respect to the issue analysed in this paper, i.e. the effect of integration or fragmentation in Europe on future energy demand, emissions to air and deposition of acid compounds, we have found that:

- Overall the demand for fossil fuels grows at an average annual rate of 1.8 per cent in the integration scenario and 1.1 per cent in the fragmentation scenario. Average annual growth in demand for oil and gas in the integration scenario is around 2 per cent per year, while demand for coal grows at a rate close to 1 per cent per year. In the fragmentation scenario the demand for coal is slightly higher, while the average annual growth in demand for oil and gas is reduced to approximately 1 percentage point.

- Growth in CO_2 emissions follows the growth in overall demand for fossil fuels. The power generating sector and the transport sector are the two most important contributors to CO_2 emissions, each with an emission share of around 30 per cent.

- SO_2 emissions are dominated by oil and coal use in the power generating sector. Italy, United Kingdom and Germany are the largest contributors. The average annual growth rates of total SO_2 emissions in the integration and the fragmentation scenarios are 1.3 and 0.5 per cent, respectively. The stronger growth in the integration scenario is due to higher demand for oil.

- NO_x emissions are more evenly distributed among the countries, and are strongly dominated by emissions from transportation. This is also the sector with the strongest economic growth. Overall we find that the average annual growth rates of NO_x emissions are close to the growth in demand for fossil fuels and CO_2 emissions, i.e. 1.8 and 1.2 per cent in the integration and the fragmentation scenario, respectively.

- With regards to depositions of SO_2 and NO_x, they follow the emission pattern quite closely, with slow or no growth in sulphur deposition in Germany and relatively high growth in the southern countries. Growth in nitrogen depositions are more evenly distributed among the countries.

The main driving forces behind these results are: 1) the development in energy prices which in turn are heavily in-

fluenced by the development in Russia's oil and gas balances and the difference in energy taxes in the two scenarios, 2) the level of economic growth in the two scenarios, and 3) the technological development. These are all exogenous input to the SEEM model, which then calculates the consequences for fossil fuel demands and CO_2 emissions. Linking the simulated energy paths to the RAINS model then allowed us to calculate emissions and depositions of SO_2 and NO_2.

With respect to further work, we would like to point out the following. The data used for estimating and calibrating elasticities and other parameters in the model can always be improved. Furthermore, the model's treatment of energy trade is simplistic. Finally, being a partial energy model, SEEM lacks explicit modelling of the linkages to economic growth. Further work in all of these areas could improve the ability of the model apparatus to address the many future challenges facing EU and neighbouring countries in Europe in the years ahead.

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Reasearch publications in English

New titles

Reports

Knut H. Alfsen, Pål Boug and Dag Kolsrud:
Energy demand, carbon emissions and acid rain. Consequences of a changing Western Europe
Reports 96/12, 1996. pp. 26.
ISBN 82-537-4285-1

Employing a multisector energy demand model of thirteen Western European countries (SEEM) together with the RAINS model developed by IIASA, we in this report address the question of how much the European economic and political integration process matters for future development in energy demand, emissions to air of key pollutants and transboundary transport of sulphur and nitrogen. We do this by comparing two simulation scenarios; one scenario based on the assumption of further European integration versus another scenario where fragmentation is assumed to prevail. Both scenarios cover the period from 1991 to 2020. The focus of the report is on consequences for future demand for fossil fuels, emissions of CO_2, SO_2 and NO_x, and transport and deposition of sulphur and nitrogen.

Average annual growth in GDP in the integration scenario is 2.3 per cent, while demand for energy, emissions of CO_2, SO_2 and NO_x, and nitrogen deposition all show average annual growth rates from 1.7 to 1.9 per cent. Deposition of sulphur grows at the slightly lower rate of 1.4 per cent per year in this scenario. In the fragmentation scenario all growth rates are reduced by 0.5-0.7 percentage points, except the rate of annual average growth in SO_2 emissions which is reduced by 0.8 percentage points. The results vary considerably, however, over countries, sectors and fuel types.

Discussion Papers

Sverre Grepperud:
Poverty, Land Degradation and Climatic Uncertainty
DP no. 162, 1996. pp. 30.

This paper studies farmers who operate in a risky environment at a minimum level of subsistence. In particular is investigated how poverty influences their soil conservation decision in the absence of formal insurance markets. It is shown that the consequences for the soil conservation decision from poverty differ across the agricultural activities considered in the model. Output-induced soil depletion increases with poverty, while soil conservation improves for the same reason when soil conservation inputs and overlapping technologies are considered.

John K. Dagsvik:
Consumer Demand with Unobservable Product Attributes. Part I: Theory
DP no. 166, 1996. pp. 40.

This paper develops a new framework for empirical modelling of consumer demand with particular reference to products that are differentiated with respect to quality and location attributes. The point of departure is a flexible representation of the distribution of product attributes and consumer tastes. From this representation and additional behavioral assumptions we derive a structural model for the distribution of the chosen product attributes and the associated quantities. Furthermore, an explicit relationship between the distribution of prices and unit values is obtained.

John K. Dagsvik:
Consumer Demand with Unobservable Product Attributes. Part II: Inference
DP no. 167, 1996. pp. 24.

In this paper we discuss statistical inference associated with the theoretical model developed in Part I. Specifically, we demonstrate how the relationship between the distribution of prices and unit values can be exploited to estimate some of the structural parameters. These estimates are essential for constructing price indices that account for unobservable taste-shifters and quality/location attributes. Finally, the remaining structural parameters can be estimated from data on demand by inserting the price indices into the corresponding demand system. Finally, we discuss the estimation procedure in the discrete case when consumers choose one unit of a variant at a time.

Rolf Aaberge, Anders Björklund, Markus Jäntti, Mårten Palme, Peder J. Pedersen, Nina Smith and Tom Wennemo:
Income Inequality and Income Mobility in the Scandinavian Countries Compared to the United States
DP no. 168, 1996. pp. 41.

This paper compares income inequality and income mobility in the Scandinavian countries and the United States during the 1980's. The results demonstrate that inequality is greater in the United States than in the Scandinavian countries and that the ranking of countries with respect to inequality remains unchanged when the accounting period of income is extended from one to 11 years. The pattern of mobility turns out to be remarkably similar despite major differences in labor market and social policies between the Scandinavian countries and the United States.

Karine Nyborg:
Some Norwegian Politicians' Use of Cost-Benefit Analysis
DP no. 169, 1996. pp. 35.

Members of the Norwegian Parliament were interviewed about the decision process concerning national road investments. Most of them found cost-benefit analysis useful, but apparently not as a device for ranking projects. Rather, the cost-benefit ratio was used to pick project proposals requiring political attention among the large number of projects included in the plan. However, information about project-related local conflicts seemed to be used much more extensively for this latter purpose. Attitudes towards cost-benefit analysis varied along the left-right political axis. These findings are shown to be consistent with a hypothesis that politicians rationally maximize subjective perceptions of social welfare.

Elin Berg, Snorre Kverndokk and Knut Einar Rosendahl:
Market Power, International CO_2 Taxation and Petroleum Wealth
DP no. 170, 1996. pp. 47.

This paper studies the effects on fossil fuel prices, extraction paths and petroleum wealth of an international carbon tax on fossil fuel consumption. We present an intertem-

poral equilibrium model for fossil fuels, where the main focus in the oil market. The impacts of a global carbon tax of $ 10 per barrel of oil depend heavily on the market structure in the oil market. If OPEC acts as a cartel, they reduce their production to maintain the oil price. Thus, the effects on the oil wealth of the competitive fringe is minor, while OPEC's oil wealth is considerably reduced. This may explain the difference in attitudes of OPEC and other oil producing countries to international global warming negotiations. If, on the other side, the oil market is competitive, the highest relative reduction in the oil wealth are to be found among non-OPEC producers.

Rolf Aaberge, Ugo Colombino and Steinar Strøm:
Welfare Effects of Proportional Taxation: Empirical Evidence from Italy, Norway and Sweden
DP no. 171, 1996. pp. 25.

This paper employs a particular labour supply model to examine the welfare effects from replacing current tax systems in Italy, Norway and Sweden by proportional taxation on labour income. The results show that there are high efficiency costs for Norway and low costs for Italy and Sweden associated with the current progressive labour income taxes. However, there appears to be large variation in the distribution of welfare gains/losses. "Rich" households - defined by their pre-tax-reform income - tend to benefit more than "poor" households from replacing the current progressive tax systems by proportional taxation.

John K. Dagsvik:
Dynamic Choice, Multistate Duration Models and Stochastic Structure
DP no. 172, 1996. pp. 47.

An important problem in the analysis of intertemporal choice processes is how to justify the choice of mathematical structure of the transition probabilities. A related and delicate identification problem is to separate the effect of unobserved variables from the influence on preferences from past choice behaviour (state dependence). The present paper proposes a particular behavioural assumption to characterize the stochastic structure of intertemporal discrete choice models under the absence of state dependence. This assumption extends Luce axiom; "Independence from Irrelevant Alternatives", to the intertemporal context. Under specific regularity conditions the implication of these assumptions is that the individual choice process is a Markov chain with a particularly simple structure of the transition probabilities. By drawing on results obtained by Dagsvik (1983, 1988) it is demonstrated that this structure is consistent with an intertemporal and life cycle consistent random utility model where the utilities are independent extremal processes in time. Finally, the framework is extended to allow for state dependence and time varying choice sets.

John K. Dagsvik:
Aggregation in Matching Markets
DP no. 173, 1996. pp. 38.

This paper develops aggregate relations for a matching market of heterogeneous suppliers and demanders. The point of departure is the analysis of two-sided matching found in Roth and Sotomayor (1990). Under particular assumptions about the distribution of preferences, the present paper derives asymptotic aggregate relations for the number of realized matches of different types in the presence of flexible contracts (such as a price). Simulation experiments demonstrate that the model also provides excellent predictions in small populations.

Annegrete Bruvoll and Karin Ibenholt:
Future Waste Generation. Forecasts Based on a Macroeconomic Model
DP no. 175, 1996. pp. 16.

Generation of solid waste is closely associated with the use of tangible factor inputs and production levels in the economy. In this paper, we present projections of waste generated in the Norwegian manufacturing industry based on the development in these factors as simulated by a computable general equilibrium model. Over the simulation period, material input becomes relatively cheaper than labour and energy, thereby making it profitable to substitute materials for other factor inputs. This substitution effect is a general equilibrium effect mainly due to technological sectors. Thus, generated solid waste rises over the simulation period, both in terms of unit produced and per capita. The analysis predicts an increase in generated waste over the period from 1993 to 2010 in the range of 45-110 per cent, depending on the type of waste.

Reprints

Knut H. Alfsen, Mario A. De Franco, Solveig Glomsrød and Torgeir Johnsen:
The Cost of Soil Erosion in Nicaragua
Reprints no. 86, 1996. pp. 17.

Reprint from Ecological Economics, Vol. 16, No. 1, 1996, 129-145, with permission from Elsevier Ecience, Amsterdam, The Netherlands

Documents

Elin Berg:
Some Results from the Literature on the Impact of Carbon Taxes on the Petroleum Wealth
Documents 96/4, 1996. pp. 21.

Olav Bjerkholt, Kjell Arne Brekke and Robin Choudhury:
The Century Model - on the Long Term Sustainability of the Saudi Arabian Economy
Documents 96/7, 1996. pp. 20.

This report gives a documentation of the Century Model, developed by the Research Department of Statistics Norway (the Oslo Group) as part of the construction of a system of macroeconomic models for the use of the Ministry of Planning in connection with the preparation and monitoring of the five-year Development Plans. The assignment is an integral part of the UNDP Project SAU/94/001/A/01/01 Support for Economic Planning, Modelling and Management Information Systems Development under the contract TCD CON 4/95 with Statistics Norway. The Project is intended to assist the Government of Saudi Arabia in designing and implementing an interlinked system of macroeconomic models and will also support the development of an integrated information system in the Ministry of Planning directed at assisting the model development exercise and attaining closer coordination of plan formulation and execution processes.

Robin Choudhury:
The Century Model. Technical Documentation of Computer Programs and Procedures
Documents 96/8, 1996. pp. 37.

This document gives a detailed description of the computer programs and procedures developed to operate the Century Model, a long term macroeconomic model for Saudi Arabia, see Documents 96/7. The model has been developed by the Research Department of Statistics Norway for the Ministry of Planning in Saudi Arabia, as part of a United Nations Department for Development Support and Management Service (UN/DDSMS) project. The assignment has been an integral part of the UN/DDSMS Project SAU/94/001/A/01/01 Support for Economic Planning, Model-

ling and Management Information Systems Development under the contract TCD CON 4/95 with Statistics Norway. The motivation for the Century Model is to study the long run sustainability of the Saudi Arabian economy, which in stock terms, and due to the strong dependence upon exhaustible petroleum resources, can be thought of as managing national wealth. For the important issue of the overall sustainability of the Saudi economy, a longer time horizon is needed than the five-year development plans. Portable TROLL, a PC-based modelling and simulation system developed by Intex Solutions, Inc., has been used for the development and operating of the model. This document describes the organization of directories and the file structure of the computer programs used to operate the model, including a complete presentation of the programs controlling input and output. A description of the routines to generate the data base as well as a presentation of the model itself in full detail is also included. Finally, the document presents the programs and procedures made to organize simulations.

Robin Choudhury and Knut A. Magnussen:
The Implementation Model. Technical Documentation of Computer Programs and Procedures
Documents 96/9, 1996. pp. 134

This document gives a detailed description of the computer programs and procedures developed to operate the Implementation Model, a short-to-medium term, demand oriented, macroeconomic model for Saudi Arabia. The model has been developed by the Research Department of Statistics Norway for the Minstry of Planning in Saudi Arabia, as part of a United Nations Department for Development Support and Management Service (UN/DDSMS) project, and is intended to be used in connection with the preparation and monitoring of the five-year Development Plans. The assignment has been an integral part of the UN/DDSMS Project SAU/94/001/A/01/01 Support for Economic Planning, Modelling and Management Information Systems Development under the contract TCD CON 4/95 with Statistics Norway. The project is intended to assist the Government of Saudi Arabia in designing and implementing an interlinked system of macroeconomic models and will also support the development of an integrated information system in the Ministry of Planning directed at assisting the model development exercise and attaining closer coordination of plan formulation and execution processes. Portable TROLL, a PC-based modelling and simulation system developed by Intex Solutions, Inc., has been used for the development and operating of the model. This document describes the organization of directories and the file structure of the computer programs used to operate the model, including a complete presentation of the programs controlling input and output. A description of the routines to generate the data base as well as a presentation of the model itself in full detail is also included. Finally, the document presents the programs and procedures made to organize simulations.

Robin Choudhury:
The Selection Model. Technical Documentation of Computer Programs and Procedures
Documents 96/10, 1996. pp. 163

This document describes the computer programs and procedures developed to operate the Selection Model, a Computable General Equilibrium (CGE) model for Saudi Arabia. The model has been developed by the Research Department of Statistics Norway for the Ministry of Planning in Saudi Arabia, as part of a United Nations Department for Development Support and Management Service (UN/DDSMS) project. The assignment has been an integral part of the UN/DDSMS Project SAU/94/001/A/01/01 Support for Economic Planning, Modelling and Management Information Systems Development under the contract TCD CON 4/95 with Statisics Norway. The Project intended to assist the Government of Saudi Arabia in designing and implementing an interlinked system of macroeconomic models and will also support the development of an integrated information system in the Ministry of Planning directed at assisting the model development exercise and attaining closer coordination of plan formulation and execution processes. The model is intended for use in the elaboration of the Development Plans for the Saudi economy. Although the planning process is currently centred around five-year plans, each plan needs to be considered in a somewhat more long term perspective. Thus a model that focuses on more long term effects, specially with respect to utilization of resources, is warranted. The model is closely linked to the Implementation Model, in that the data and aggregation level is the same. Portable TROLL, a PC-based modelling and simulation system developed by Intex Solutions, Inc., has been used for the development and operating of the model. This document describes the organization of directories and the file structure of the computer programs used to operate the model, including a complete presentation of the programs controlling input and output. A description of the routines to generate the data base as well as a presentation of the model itself in full detail is also included. Finally, the document presents the programs and procedures made to organize the simulations.

Robin Choudhury:
The OM95 - An Oil Model for the Kingdom of Saudi Arabia. Technical Documentation of Computer Programs and Procedures
Documents 96/11, 1996. pp. 79.

This document contains a detailed description of the computer programs and procedures developed to operate the OM95, a short to medium term oil model for the Kingdom of Saudi Arabia. The model was developed by the United Nations Department for Development Support and Management Service (UN/DDSMS) residents experts Dr. Khalil M. Zahr and Dr. Hashim A-Shami and programmed and implemented into the computer system by Statistics Norway, for the Ministry of Planning in Saudi Arabia. The assignment is part of the UN/DDSMS Project SAU/94/001/A/01/01 Support for Economic Planning, Modelling and Management Information Systems Development and an extension of the contract TCD CON 4/95 with Statistics Norway. The importance of acquiring appropriate tools for the study of world and domestic energy markets was early recognised in the Ministry of Planning, when it, in 1982, developed a long term energy model for domestic, regional and world markets, in the context of preparing long term energy plans for Saudi Arabia. While this model fulfilled the need for studying long term developments in the oil market, it did not provide the appropriate tools for studying short to medium term oil markets developments. This fact, together with the increasing volatility in the market since the mid eighties, has motivated the development of a short to medium term oil model. Furthermore, an oil model was needed to support the economic planning process in Saudi Arabia which is based on five-year development plans. Portable TROLL, a PC-based modelling and simulation system developed by Intex Solutions, Inc., has been used for the development and operating of the model. This document describes the organization of directories and the file structure of the computer programs used to operate the model, including a complete presentation of the programs controlling input and output. A description of the routines to generate the data base as well as a detailed presentation of the models themselves is also included. Finally, the document presents the programs and procedures made to organize the simulations.

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Appendix

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National accounts for Norway

NATIONAL ACCOUNTS FOR NORWAY

Table 1. Macroeconomic figures. At current prices. Million kroner

	1994	1995	94:2	94:3	94:4	95:1	95:2	95:3	95:4	96:1
Final consumption exp. of households and NPISH	434798	457138	102714	109999	118550	107668	108190	116606	124675	114328
Goods	234526	247613	55104	57984	67360	56742	59036	61574	70260	61021
Services	198299	206763	47477	51528	49677	51484	48759	53559	52960	53496
Direct purchases abroad by residents	17713	17890	3910	6782	4031	2742	3864	7136	4149	2976
- Direct purchases in Norway by non-residents	-15740	-15127	-3778	-6296	-2518	-3300	-3469	-5664	-2694	-3165
Final consumption exp. of general government	185206	191973	45882	46766	47191	47015	47537	48470	48951	49610
Final consumption exp. of central government	74902	76847	18557	18914	19063	18837	19017	19400	19594	19961
Central government, civilian	53841	55915	13343	13596	13694	13708	13836	14114	14257	14502
Central government, defence	21061	20932	5213	5318	5369	5129	5181	5286	5337	5459
Final consumption exp. of local government	110304	115126	27325	27852	28128	28178	28520	29070	29358	29649
										..
Gross fixed capital formation	183560	197664	47107	46516	49078	44848	48579	48061	56176	45517
Crude petr., gas extr. and transp. via pipelines	54180	48145	16871	13318	11605	10407	12002	12321	13414	10189
Ocean transport and oil drilling	4647	3703	1519	1104	-350	1681	1551	-812	1284	723
Mainland industries	124732	145816	28717	32094	37823	32759	35026	36552	41478	34605
Manufacturing and mining	10776	15632	2336	2929	3601	2792	3814	4185	4841	3484
Production of other goods	11404	12179	3285	3047	3046	2319	3380	3203	3278	2220
General government	28276	29164	5954	6750	9809	6129	6342	7384	9309	6587
Dwellings	24271	28735	5491	6430	7286	6993	6966	7140	7635	6854
Other services	50005	60106	11652	12937	14080	14527	14524	14640	16416	15459
Changes in inventories	13445	23401	3697	1949	685	8963	6372	4702	3364	7944
Gross capital formation	197005	221065	50805	48465	49763	53810	54952	52764	59540	53460
										..
Final domestic use of goods and services	817009	870177	199400	205230	215504	208493	210678	217839	233166	217398
Demand from Mainland-Norway	744737	794927	177313	188858	203564	187442	190753	201627	215104	198542
										..
Exports	334837	355041	82029	84000	89895	89294	86302	88500	90945	97932
Traditional goods	128522	143413	30909	32097	35688	38118	33838	34730	36727	40377
Crude oil and natural gas	106440	113231	27131	24756	28929	28000	28003	26353	30875	34002
Ships and platforms	10597	10581	1809	2430	4310	1966	3024	3525	2066	1883
Services	89278	87816	22181	24717	20969	21210	21437	23892	21277	21670
										..
Total use of goods and services	1151846	1225218	281430	289229	305399	297787	296980	306339	324111	315330
										..
Imports	282104	299352	70180	71491	73341	71130	73395	75114	79713	73636
Traditional goods	184692	202854	44983	45899	50317	49236	49878	49300	54440	53156
Crude oil	867	1121	207	232	207	326	356	270	169	218
Ships and platforms	12355	12866	3712	1899	2374	3059	2415	2413	4979	2003
Services	84190	82511	21279	23461	20444	18509	20746	23131	20125	18259
										..
Gross domestic product	869742	925866	211250	217738	232058	226657	223585	231225	244398	241694
Mainland-Norway	741287	793220	178435	186899	197504	194285	190291	199786	208858	202653
										..
Oil activities and ocean transport	128455	132646	32814	30839	34554	32372	33294	31439	35540	39040
Mainland industries	656157	696538	158727	165018	173129	172444	166804	175164	182126	176210
Manufacturing and mining	104041	118140	26598	24744	27455	30059	29646	28137	30298	31550
Production of other goods	71254	79865	14033	20143	20056	20212	16400	21477	21776	21227
General government	138436	144418	34306	34956	35266	35358	35771	36467	36822	37470
Private services	342427	354115	83790	85175	90352	86814	84988	89082	93230	85963
Correction items	85129	96682	19708	21880	24375	21841	23487	24622	26732	26443

NATIONAL ACCOUNTS FOR NORWAY

Table 2. Macroeconomic figures. At constant 1993-prices. Million kroner

	1994	1995	94:2	94:3	94:4	95:1	95:2	95:3	95:4	96:1
Final consumption exp. of households and NPISH	428584	439735	101758	108398	116049	103503	104723	112474	119034	109279
Goods	230865	237868	54349	56769	65972	54706	56539	59076	67547	59029
Services	196045	199269	47298	51312	48633	49337	47704	52080	50148	50493
Direct purchases abroad by residents	17286	17298	3837	6630	3902	2676	3827	6880	3915	2794
- Direct purchases in Norway by non-residents	-15613	-14700	-3726	-6313	-2458	-3215	-3348	-5562	-2575	-3038
Final consumption exp. of general government	180868	181182	45003	45474	45593	44626	45045	45653	45858	45589
Final consumption exp. of central government	73232	72744	18236	18429	18429	18061	18131	18283	18268	18520
Central government, civilian	52850	53001	13185	13299	13296	13135	13221	13331	13314	13491
Central government, defence	20382	19743	5051	5129	5133	4926	4910	4952	4954	5029
Final consumption exp. of local government	107636	108438	26767	27046	27163	26565	26914	27369	27590	27069
										..
Gross fixed capital formation	179759	187837	46063	45616	47742	43184	46221	45487	52945	42403
Crude petr., gas extr. and transp. via pipelines	52972	46014	16597	12959	11199	10054	11495	11700	12766	9597
Ocean transport and oil drilling	4826	3373	1556	1099	-296	1681	1595	-1067	1164	643
Mainland industries	121961	138449	27911	31558	36839	31449	33131	34854	39015	32163
Manufacturing and mining	10698	15158	2315	2931	3559	2758	3700	4067	4633	3315
Production of other goods	11250	11731	3237	3014	2998	2262	3251	3086	3132	2101
General government	27706	27562	5816	6636	9561	5873	5991	6970	8729	6111
Dwellings	23526	26510	5367	6190	6979	6565	6407	6565	6972	6177
Other services	48781	57488	11176	12787	13742	13992	13782	14166	15549	14459
Changes in inventories	13506	23997	3602	2025	915	9041	6292	5283	3381	8861
Gross capital formation	193266	211834	49666	47641	48656	52225	52513	50770	56326	51264
										..
Final domestic use of goods and services	802717	832751	196427	201513	210298	200355	202281	208897	221218	206132
Demand from Mainland-Norway	731413	759366	174672	185431	198481	179579	182899	192981	203907	187031
										..
Exports	341828	354689	83555	84824	90900	88149	85221	89704	91615	96232
Traditional goods	127108	132372	30973	31409	34624	34644	31328	32057	34343	37913
Crude oil and natural gas	116112	125818	28595	26552	31627	30700	29844	30493	34781	35308
Ships and platforms	10416	10954	1806	2397	4178	2043	3037	3731	2143	1927
Services	88191	85544	22181	24466	20471	20762	21011	23422	20348	21084
										..
Total use of goods and services	1144545	1187439	279982	286337	301198	288504	287502	298601	312833	302364
										..
Imports	279766	294127	70335	70979	72125	69593	72896	73877	77761	71645
Traditional goods	184085	200845	45243	45835	49701	48661	49561	49049	53574	52320
Crude oil	943	1244	229	251	228	349	382	328	185	214
Ships and platforms	12446	13250	3745	1894	2351	3198	2566	2425	5061	2019
Services	82292	78787	21119	22999	19845	17385	20387	22075	18940	17092
										..
Gross domestic product	864780	893312	209647	215358	229073	218911	214606	224723	235072	230719
Mainland-Norway	725221	745023	175168	182568	191425	182728	179215	188319	194760	189364
										..
Oil activities and ocean transport	139559	148290	34479	32791	37648	36183	35391	36404	40312	41355
Mainland industries	651036	666373	157555	163921	170510	164405	160415	168421	173133	169290
Manufacturing and mining	101380	104322	25949	23876	26758	27099	26272	24197	26754	27814
Production of other goods	69487	75588	13625	19592	19227	18759	15047	20906	20876	19565
General government	134578	135321	33408	33749	33901	33358	33552	34066	34345	34167
Private services	345591	351141	84573	86705	90624	85189	85544	89251	91157	87744
Correction items	74185	78649	17613	18646	20916	18323	18801	19899	21627	20074

NATIONAL ACCOUNTS FOR NORWAY

Table 3. Macroeconomic figures. Growth rates. Percentage change in volume from preceding year

	1994	1995	94:2	94:3	94:4	95:1	95:2	95:3	95:4	96:1
Final consumption exp. of households and NPISH	4,1	2,6	4,4	3,6	3,0	1,1	2,9	3,8	2,6	5,6
Goods	5,1	3,0	5,1	4,1	3,6	1,7	4,0	4,1	2,4	7,9
Services	3,3	1,6	3,9	3,2	1,4	1,1	0,9	1,5	3,1	2,3
Direct purchases abroad by residents	8,6	0,1	8,8	11,1	9,0	-8,3	-0,3	3,8	0,3	4,4
- Direct purchases in Norway by non-residents	13,5	-5,8	13,9	13,3	-4,4	3,2	-10,2	-11,9	4,8	-5,5
Final consumption exp. of general government	0,7	0,2	0,6	0,8	1,2	-0,4	0,1	0,4	0,6	2,2
Final consumption exp. of central government.	-1,2	-0,7	-1,3	-1,2	-0,5	-0,4	-0,6	-0,8	-0,9	2,5
Central government, civilian	-0,1	0,3	-0,0	-0,2	0,6	0,5	0,3	0,2	0,1	2,7
Central government, defence	-3,9	-3,1	-4,6	-3,9	-3,1	-2,8	-2,8	-3,5	-3,5	2,1
Final consumption exp. of local government	2,0	0,7	2,0	2,2	2,4	-0,4	0,6	1,2	1,6	1,9
										..
Gross fixed capital formation	6,9	4,5	16,0	8,6	-2,3	7,1	0,3	-0,3	10,9	-1,8
Crude petr., gas extr. and transp. via pipelines	-7,3	-13,1	15,1	-10,4	-29,1	-17,7	-30,7	-9,7	14,0	-4,5
Ocean transport and oil drilling	-30,5	-30,1	234,4	-19,2	-111,2	-31,9	2,5	-197,1	-493,1	-61,7
Mainland industries	17,2	13,5	12,4	20,6	21,1	22,6	18,7	10,4	5,9	2,3
Manufacturing and mining	8,3	41,7	-2,0	10,1	23,7	45,6	59,8	38,8	30,2	20,2
Production of other goods	2,5	4,3	8,0	-6,2	11,8	13,1	0,4	2,4	4,5	-7,1
General government	1,6	-0,5	-3,5	1,5	4,5	3,1	3,0	5,0	-8,7	4,1
Dwellings	34,9	12,7	35,6	40,1	37,3	31,6	19,4	6,1	-0,1	-5,9
Other services	26,6	17,8	17,8	36,8	29,3	26,3	23,3	10,8	13,2	3,3
Changes in inventories	40,2	77,7	-251,4	-47,3	-203,1	29,8	74,7	161,0	269,6	-2,0
Gross capital formation	8,7	9,6	33,0	3,9	1,5	10,4	5,7	6,6	15,8	-1,8
										..
Final domestic use of goods and services	4,4	3,7	9,4	3,0	2,3	3,0	3,0	3,7	5,2	2,9
Demand from Mainland-Norway	5,2	3,8	4,6	5,4	5,5	3,9	4,7	4,1	2,7	4,1
										..
Exports	8,2	3,8	3,9	7,2	9,9	6,8	2,0	5,8	0,8	9,2
Traditional goods	13,1	4,1	8,6	17,7	12,5	15,1	1,1	2,1	-0,8	9,4
Crude oil and natural gas	11,6	8,4	10,2	8,4	9,3	4,6	4,4	14,8	10,0	15,0
Ships and platforms	-12,0	5,2	-57,0	-20,9	86,5	0,4	68,2	55,6	-48,7	-5,7
Services	0,6	-3,0	2,1	-1,7	-1,3	-1,5	-5,3	-4,3	-0,6	1,6
										..
Total use of goods and services	5,5	3,7	7,7	4,2	4,4	4,1	2,7	4,3	3,9	4,8
										..
Imports	6,9	5,1	12,6	4,7	3,7	4,9	3,6	4,1	7,8	2,9
Traditional goods	15,3	9,1	18,7	16,3	12,0	12,4	9,5	7,0	7,8	7,5
Crude oil	-17,5	32,0	-5,9	-20,8	-24,8	48,5	66,9	30,8	-18,9	-38,7
Ships and platforms	-33,9	6,5	2,1	-57,6	-57,7	-28,2	-31,5	28,0	115,3	-36,9
Services	0,4	-4,3	3,4	-2,5	2,7	-5,1	-3,5	-4,0	-4,6	-1,7
										..
Gross domestic product	5,0	3,3	6,2	4,1	4,7	3,9	2,4	4,3	2,6	5,4
Mainland-Norway	4,3	2,7	5,1	4,3	4,3	3,8	2,3	3,2	1,7	3,6
										..
Oil activities and ocean transport	8,8	6,3	12,0	2,7	6,9	4,4	2,6	11,0	7,1	14,3
Mainland industries	4,0	2,4	4,9	4,0	3,8	3,4	1,8	2,7	1,5	3,0
Manufacturing and mining	5,4	2,9	7,9	5,7	5,6	9,3	1,2	1,3	-0,0	2,6
Production of other goods	0,8	8,8	3,1	-0,7	1,8	10,1	10,4	6,7	8,6	4,3
General government	1,1	0,6	0,9	1,3	1,2	-0,5	0,4	0,9	1,3	2,4
Private services	5,4	1,6	5,9	5,8	4,8	1,8	1,1	2,9	0,6	3,0
Correction items	7,5	6,0	7,0	7,3	7,8	7,7	6,7	6,7	3,4	9,6

NATIONAL ACCOUNTS FOR NORWAY

Table 4. Macroeconomic figures. Price indices. 1993=100. Percentage change in prices from preceding year

	1994	1995	94:2	94:3	94:4	95:1	95:2	95:3	95:4	96:1
Final consumption exp. of households and NPISH	1,5	2,5	1,2	2,0	0,8	2,9	2,3	2,2	2,5	0,6
Goods	1,6	2,5	1,3	1,9	1,6	3,1	3,0	2,0	1,9	-0,3
Services	1,1	2,6	1,0	1,7	-0,5	2,6	1,8	2,4	3,4	1,5
Direct purchases abroad by residents	2,5	0,9	2,1	3,5	1,8	-0,0	-0,9	1,4	2,6	3,9
- Direct purchases in Norway by non-residents	0,8	2,1	0,5	1,0	0,8	1,6	2,2	2,1	2,1	1,5
Final consumption exp. of general government	2,4	3,5	2,2	2,4	2,3	4,0	3,5	3,2	3,1	3,3
Final consumption exp. of central government	2,3	3,3	2,1	2,5	2,1	3,0	3,1	3,4	3,7	3,3
Central government, civilian	1,9	3,6	1,6	2,2	1,6	3,3	3,4	3,6	4,0	3,0
Central government, defence	3,3	2,6	3,4	3,2	3,3	2,3	2,2	2,9	3,0	4,3
Final consumption exp. of local government	2,5	3,6	2,4	2,4	2,5	4,7	3,8	3,1	2,8	3,3
										..
Gross fixed capital formation	2,1	3,1	2,5	1,4	2,3	2,5	2,8	3,6	3,2	3,4
Crude petr., gas extr. and transp. via pipelines	2,3	2,3	2,5	1,9	2,4	2,1	2,7	2,5	1,4	2,6
Ocean transport and oil drilling	-3,7	14,0	-1,6	1,7	19,1	3,9	-0,4	-24,2	-6,8	12,5
Mainland industries	2,3	3,0	2,7	1,1	2,4	2,4	2,8	3,1	3,5	3,3
Manufacturing and mining	0,7	2,4	0,9	-0,1	0,6	0,4	2,1	3,0	3,3	3,8
Production of other goods	1,4	2,4	1,4	0,8	1,2	1,2	2,5	2,7	3,0	3,1
General government	2,1	3,7	2,4	1,4	2,2	3,1	3,4	4,2	4,0	3,3
Dwellings	3,2	5,1	2,3	3,5	4,1	5,0	6,3	4,7	4,9	4,2
Other services	2,5	2,0	3,7	0,1	2,4	1,4	1,1	2,1	3,0	3,0
Changes in inventories	-0,5	-2,0	4,3	-4,7	-32,0	-2,9	-1,3	-7,5	32,9	-9,6
Gross capital formation	1,9	2,4	2,4	1,1	1,9	1,6	2,3	2,2	3,4	1,2
										..
Final domestic use of goods and services	1,8	2,7	1,8	1,9	1,4	2,8	2,6	2,4	2,9	1,3
Demand from Mainland-Norway	1,8	2,8	1,7	2,0	1,4	3,1	2,7	2,6	2,9	1,7
										..
Exports	-2,0	2,2	-2,9	-1,3	1,7	6,0	3,2	-0,4	0,4	0,5
Traditional goods	1,1	7,1	-0,6	1,7	4,6	11,0	8,2	6,0	3,8	-3,2
Crude oil and natural gas	-8,3	-1,8	-8,5	-6,7	-1,8	4,4	-1,1	-7,3	-3,0	5,6
Ships and platforms	1,7	-5,1	0,2	1,0	1,9	-4,4	-0,6	-6,8	-6,5	1,6
Services	1,2	1,4	0,8	0,5	1,9	0,5	2,0	1,0	2,1	0,6
										..
Total use of goods and services	0,6	2,5	0,3	0,9	1,4	3,7	2,8	1,6	2,2	1,0
										..
Imports	0,8	0,9	0,9	0,8	0,1	1,0	0,9	0,9	0,8	0,6
Traditional goods	0,3	0,7	0,1	0,1	0,2	0,7	1,2	0,4	0,4	0,4
Crude oil	-8,1	-2,0	-7,2	-11,5	-7,0	-0,7	3,0	-11,0	0,7	9,2
Ships and platforms	-0,7	-2,2	0,4	-0,4	0,8	-2,5	-5,1	-0,7	-2,6	3,7
Services	2,3	2,4	2,6	2,7	-0,2	2,7	1,0	2,7	3,1	0,3
										..
Gross domestic product	0,6	3,1	0,2	1,0	1,8	4,5	3,4	1,8	2,6	1,2
Mainland-Norway	2,2	4,2	1,9	2,5	2,1	4,9	4,2	3,6	3,9	0,7
										..
Oil activities and ocean transport	-8,0	-2,8	-8,4	-7,5	0,4	2,5	-1,2	-8,2	-3,9	5,5
Mainland industries	0,8	3,7	0,8	1,5	0,1	4,7	3,2	3,3	3,6	-0,8
Manufacturing and mining	2,6	10,3	2,2	2,8	4,4	9,0	10,1	12,2	10,4	2,3
Production of other goods	2,5	3,0	1,4	1,9	5,7	7,9	5,8	-0,1	-0,0	0,7
General government	2,9	3,7	2,7	2,8	3,3	4,8	3,8	3,4	3,1	3,5
Private services	-0,9	1,8	-0,4	0,5	-3,5	2,6	0,3	1,6	2,6	-3,9
Correction items	14,8	7,1	11,5	11,0	19,5	5,8	11,6	5,4	6,1	10,5

NATIONAL ACCOUNTS FOR NORWAY

Table 5. Balance of payments. Summary. At current prices. Million kroner

	1994	1995	94:2	94:3	94:4	95:1	95:2	95:3	95:4	96:1
Exports	334837	355041	82029	84000	89895	89294	86302	88500	90945	97932
Goods	245559	267225	59848	59282	68927	68084	64865	64608	69668	76262
Services	89278	87816	22181	24717	20969	21210	21437	23892	21277	21670
Imports	282104	299352	70180	71491	73341	71130	73395	75114	79713	73636
Goods	197914	216841	48902	48030	52898	52621	52649	51983	59588	55377
Services	84190	82511	21279	23461	20444	18509	20746	23131	20125	18259
External balance	52733	55689	11849	12508	16554	18164	12907	13386	11232	24296
Primary income and transfers from abroad	29154	31143	6526	5886	7232	7885	7186	7832	8240	8603
Interest	19068	21823	4386	4004	4576	5689	5134	5277	5723	5574
Dividends etc.	1899	2853	361	285	228	530	995	758	570	1360
Reinvested earnings	-1095	-2179	-356	-259	-264	-413	-811	-556	-399	-1144
Current transfers to Norway	9282	8646	2135	1856	2692	2079	1868	2353	2346	2813
Primary income and transfers to abroad	60870	58436	14399	12900	18135	15028	15033	12711	15664	14237
Interest	24975	24378	6244	4745	6993	6876	6619	4720	6163	6133
Dividends etc.	10944	11489	4925	1094	1204	3934	4812	1305	1438	2917
Reinvested earnings	4170	1953	-1134	2489	2457	-710	-1112	1934	1841	488
Current transfers from Norway	20781	20616	4364	4572	7481	4928	4714	4752	6222	4699
Primary income and transfers from abroad, net	-31716	-27293	-7873	-7014	-10903	-7143	-7847	-4879	-7424	-5634
Current external balance, net	21017	28396	3976	5494	5651	11021	5060	8507	3808	18662
Revaluation	2672	10092	2780	3528	-1310	6613	54	-8687	12112	-4254
Total net inflow on capital transactions	-1084	-1224	-271	-271	-271	-56	-79	-66	-1023	30
Decrease in the net debt of Norway	22605	37264	6485	8751	4070	17578	5035	-246	14897	14438

Reconciliation due to changes in exchange rates

B-blad

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