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Economic perspectives

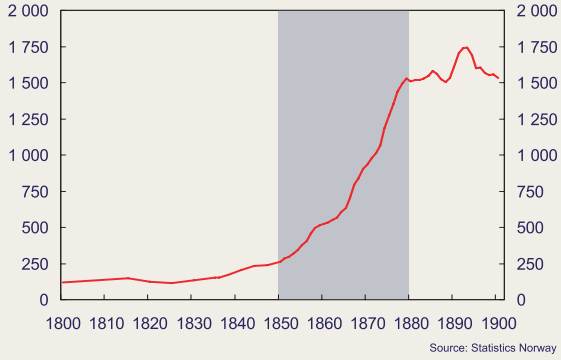
Address by Governor Svein Gjedrem at the meeting of the Supervisory Council of Norges Bank on Thursday, 16 February 2006

1. Introduction

On the way into this building, we pass a statue of the nineteenth century Norwegian actor Johannes Brun. He performed at Christiania Theatre, which once stood in the square in front of the main entrance. Brun was an acquaintance of Henrik Ibsen, who also worked at the same theatre for a period – part-time as dramatic consultant – when the theatre he had been directing closed. This was a difficult time for our great dramatist, both personally and financially. He was struggling to overcome writer's block and the public's preference for the mediocre and the trivial.[1] Nineteenth-century Christiania (now Oslo) was described as "O great and little city! What a cold and surly sky broods over you!"[2]

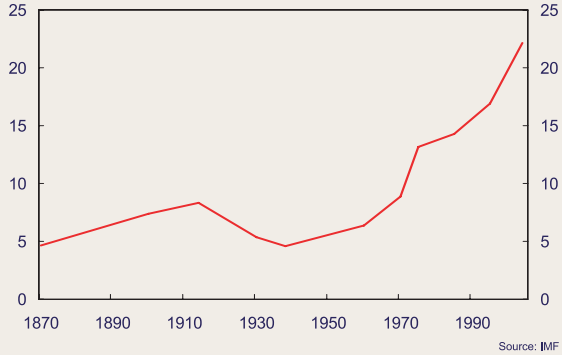
A bleak time for Ibsen, perhaps. But the Norwegian economy was not faring all that badly. The economic expansion that had begun in the 1820s gathered momentum from the middle of the century. The British navigation acts were repealed in 1849 and the Norwegian fleet was permitted to transport other countries' goods to and from England. Norway had suddenly become a major exporter of services. The tonnage of the Norwegian commercial fleet increased almost six-fold from 1850 to 1880.

Chart 1. Norwegian merchant fleet 1800 - 1900. In thousands of gross tons



The chart shows developments in the Norwegian merchant fleet from 1800 to 1900 in thousands of gross tons. Annual figures.

Chart 2. Exports of goods. Per cent of global GDP. 1870 - 2004



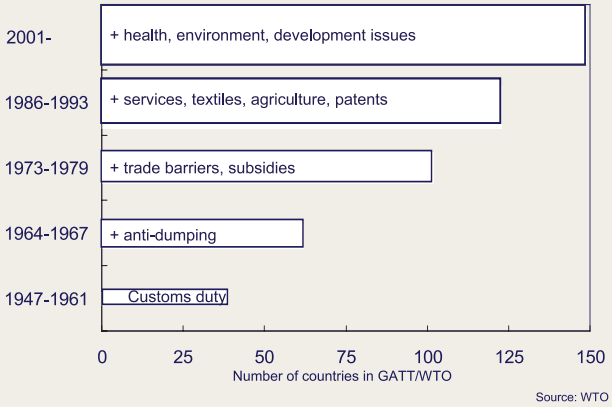
The chart shows the total of individual countries' exports as a share of global GDP, measured in USD. 1870 to 2004. Annual figures.

2. Changes in the international division of labour

We are now again in a period of considerable changes in the international division of labour. Global trade is again growing at a markedly faster pace than production, thanks to technological advances and a sharp reduction in the costs associated with trade in goods, services and information.

Trade barriers have been removed. In the early post-war years, tariff barriers between a few industrialised countries were dismantled. The later rounds in GATT, now the WTO, embraced both a far broader agenda and a greater number of countries. Today, almost all coun-

Chart 3. Extended trade cooperation



The chart shows developments in GATT/WTO trade cooperation from 1947 to February 2006. The x-axis indicates the number of countries that have taken part in negotiations in different periods. The bars indicate the new topics included in trade cooperation in the different periods.

The number of countries that took part in the Torquay round (38) is shown for 1947-1961. [The numbers of participants in the various negotiations in the period 1947-1961 were: Geneva 1947: 23, Annecy 1949: 13, Torquay 1951: 38, Geneva 1956: 26, Geneva 1960-1961 (Dillon round): 26]

[1] Michael Meyer: Henrik Ibsen: the Making of a Dramatist 1828-1864, London 1967, p. 168

[2] Meyer, op.cit. p. 217: Excerpt from The Judge's Daughters, by the 19th century author Camilla Collett.

tries participate as members or observers and the issues are far-ranging. In addition to dismantling tariff barriers, anti-dumping measures have been introduced, subsidies have been removed and agreements have been entered into for textiles and agricultural products. In the current round, issues related to health, the environment and development are also being discussed.

Political changes have amplified this tendency. At the beginning of the 1990s, China changed course and is now a member of the WTO. Its share of total exports is growing rapidly. India is at the starting-line.

These countries have large labour forces that offer their services at very low wages, and these labour resources are available to companies that compete on world markets. The working-age population in rural China is nearly the same as that of the entire OECD area. Many are underemployed and are seeking work in urban areas.

Low labour costs and more efficient transport and communication attract labour-intensive production. Production is being transferred to China or other emerging economies. There are many examples showing that competition in selling highly skilled services is also intensifying. Myopia surgery is offered in Turkey. Dental care and other medical services are also offered, at prices that are substantially lower than in Norway. Norsk Hydro reports that almost 300 000 hours of engineering services for the Ormen Lange project were supplied by Indian engineers, located in India.

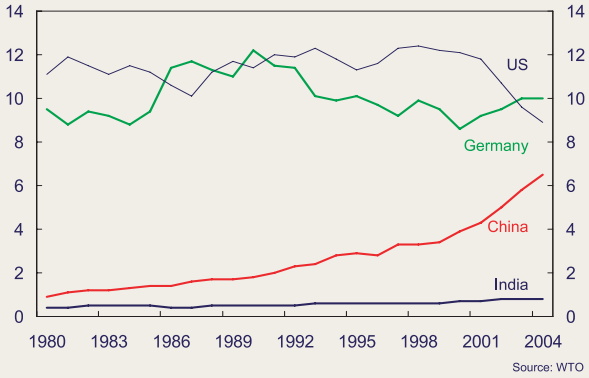
Trade in services flows both ways. Norwegian architects are designing landmark buildings all around the world. Det Norske Veritas sells its services worldwide. A company – Vik-Sandvik – that designs ships that are built in Europe, Asia and the US has its head office in the rural community of Fitjar. An ICT firm located in Ølen municipality – Omega – is developing and installing software for customers in Baku and Dubai.

New markets in Asia are creating opportunities for industrialised countries. Resources are transferred to enterprises producing goods and services that require specialised skills. Businesses that have been sheltered and protected by national regulations are in a weak position when new technology or new agreements expose them to external competition.

The shift in the division of labour is now influencing – and will continue to do so for a period – real wage growth in industrialised countries. The risk that a business will have to wind up operations or move abroad is dampening costs. In a number of European countries, wage growth is also being influenced by labour inflows from the new EU member states.

Increased trade has engendered higher demand for shipping services and favourable freight rates. This has in turn led to a boom in the shipbuilding industry. At the same time, high energy prices are boosting investment in the petroleum and electricity sectors, with considerable impetus to the engineering industry. Growth in Asia

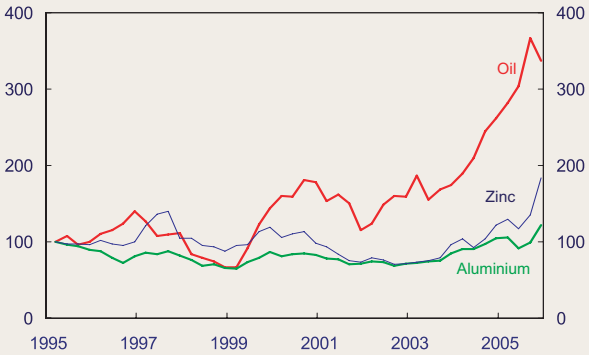
Chart 4. Share of global merchandise exports. Per cent



Source: WTO

The chart shows the shares of global merchandise exports of the US, Germany, China and India in the period 1980 to 2004. Annual figures.

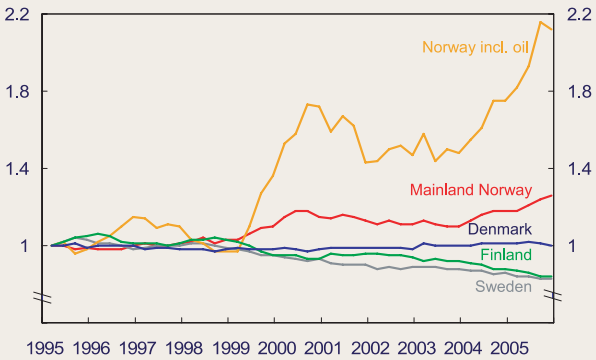
Chart 5. Commodity prices. Index



Sources: EcoWin and Reuters

The chart shows the spot price for oil, zinc and aluminium in USD. The series are indexed to 100 in 1995 Q1. Quarterly average of daily quotations.

Chart 6. Terms of trade. Index



Sources: Statistics Denmark, EcoWin, Statistics Finland and Statistics Norway

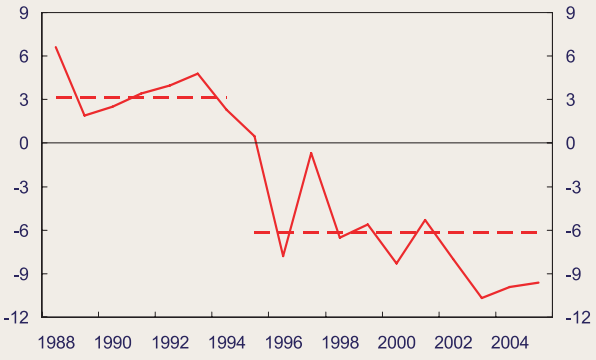
The chart shows the terms of trade of Denmark, Finland, Sweden, Norway and mainland Norway, from 1995 Q1 to 2005 Q4. The terms of trade are calculated as the export price index relative to the import price index. The indices cover all exports and imports apart from the indices for mainland Norway where oil and shipping are excluded from the export price index.

is having a favourable impact on aluminium prices.

Prices for our imported goods are falling in relation to prices for goods we export. Norway's terms of trade are improving. The impact of the rise in oil and gas prices is particularly strong, but the terms-of-trade gains for the mainland economy have also been high.

The situation in Norway differs from that of its Nordic neighbouring countries. Sales of Swedish and Finnish high-tech products are growing strongly in volume terms, but prices are falling. Denmark has a diversified business sector, which is overall moving on a steady path.

Chart 7. Change in prices for jackets, sweaters, blouses and dresses. Annual change. Per cent

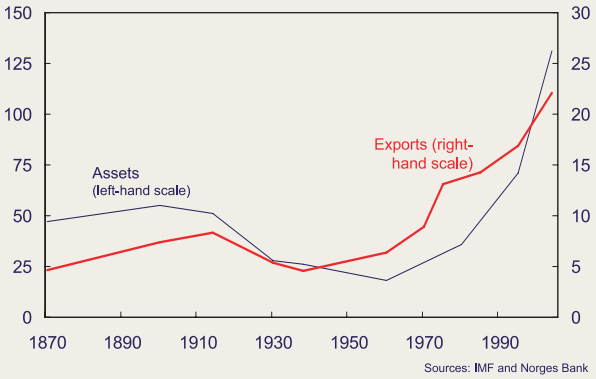


Sources: Statistics Norway and Norges Bank

The chart shows the change in prices from 1988 to 2005 in the product group "Women: blouses, dresses, skirts, jackets, sweaters" (Statistics Norway's COICOP group K03122). Annual figures.

The broken lines indicate the average change in prices in the periods 1988-1994 and 1995-2005, respectively. The time of the break is estimated in an analysis carried out by Norges Bank for the period 1980-2005.

Chart 8. Exports and foreign assets. Per cent of global GDP. 1870 - 2004



Sources: IMF and Norges Bank

The chart shows developments in exports and foreign assets from 1879 to 2004. Annual figures. The "Exports" curve shows the total of individual countries' exports as a share of global GDP. The "Assets" curve shows all countries' foreign assets (publicly or privately owned) as a share of global GDP. Values up to 1995 have been estimated by the IMF. The value for 2004 has been estimated by Norges Bank. The growth in foreign assets for the average of the G7 countries (the US, Canada, Germany, France, Italy, the UK and Japan) has been used for the period 1995-2004.

As consumers, we are benefiting from falling prices for many imported goods. Clothing prices are an illustration of this. Prices rose by around 3 per cent annually for a long period, but since 1995 they have been falling by about 6 per cent annually. This kink point coincides with the dismantling of the restrictions on textile trade and it coincides with a period of rationalisation in retail trade in Norway. China's membership of the WTO has subsequently pushed down prices further.

The Internet facilitates price comparison, and price margins in all sectors are under pressure.

World financial markets are also in flux. Technological advances, increased trade and liberalisation have increased cross-border capital flows. Foreign ownership of businesses has increased considerably. At the same time, savings are increasingly being invested in foreign countries. The home bias for investment has diminished.

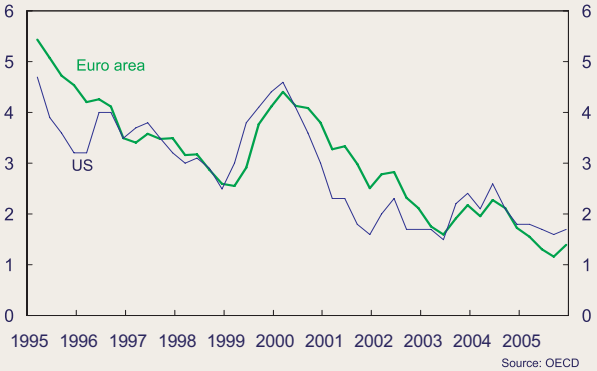
In recent years, long-term interest rates have declined. Low and stable inflation in many countries has made a contribution. Investors have less of a need to hedge against high inflation. There is a strong tendency to save among Asian and oil-exporting countries, while the willingness to invest is limited in many industrialised countries. This is pushing down interest rates. Low long-term rates probably also reflect low short-term interest rates and ample liquidity.

Interest rate developments and buoyant growth have led to a sharp rise in equity prices in the past few years. At the same time, property prices are rising sharply in many countries.

Low interest rates, sharply rising equity and property prices, high commodity prices and high energy prices are probably linked to cyclical developments and may therefore be transitory. Changes in the international division of labour, integrated financial markets and increased competition in broad goods and services markets are more permanent.

Globalisation and cyclical developments have been

Chart 9. Long-term real interest rates. Per cent



Source: OECD

The chart shows long-term real interest rates for the US and the euro area from 1995 Q1 to 2005 Q4. Long-term real interest rates are estimated by deflating yields on government bonds with a maturity of about 10 years by average consumer price inflation for the past two years. Quarterly figures.

kind to the Norwegian economy. Few countries are benefiting as much as Norway – and losing as little – in the current environment of freer trade in goods and services and cross-border labour mobility.

3. Challenges to monetary policy

After almost two decades of high inflation, the rise in prices stabilised in many countries in the 1990s. The year-on-year rise in prices in the industrial countries was about 13 per cent at the beginning of the 1980s. In the course of the following decade, it fell to below 2 per cent. Today, most central banks orient monetary policy towards low and stable inflation.

The practical implementation of monetary policy can vary, but the common objective is price stability. Low and stable inflation has contributed to solid growth in the global economy in recent years. Despite rising oil prices, international conflicts that have led to uncertainty, and other disturbances, the impact on inflation and output has been moderate.

The perception in Norway in the 1960s and 1970s, as in other countries, was that strong growth and low unemployment could be achieved if we were only willing to accept somewhat higher inflation. But it was gradually recognised that this was not the case. In 1980, Odd Aukrust, research director at Statistics Norway said the following about economic developments in Norway: "Unfortunately, there is even less reason for optimism this time. It appears that the competitive position of Norwegian manufacturing will weaken in the coming year. The main problem is that no one controls price developments. With an inflation rate of around 10 per cent a year, no one dares to make investments that could stop this price carousel."[3]

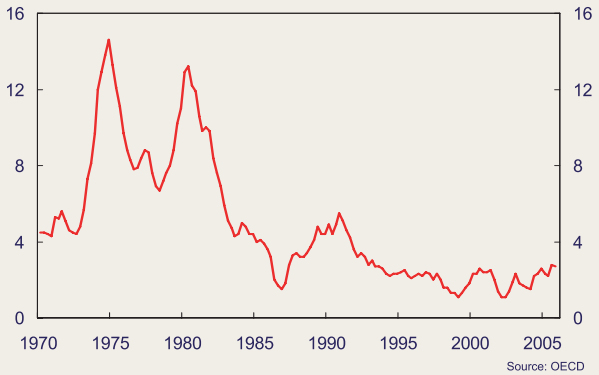
From the second half of the 1980s, the authorities started using monetary policy to control inflation.

At the beginning of the 1990s, inflation had fallen, and since 1988, inflation has averaged 2½ per cent. Studies of price developments for all goods and services show that price formation underwent a permanent shift around 1988.[4] A transition occurred from a period of high and unstable inflation to the current period of low and stable inflation.

Bringing the rate of inflation down had its costs. In the years from 1988 to 1992, the Norwegian economy experienced the deepest recession of the post-war period. But growth picked up quickly, and the 1990s as a whole wes a golden decade. It also appears that the present decade will be favourable. A foundation was laid when the Norwegian authorities took control of inflation.

Developments over the past 40 years illustrate that the most important contribution monetary policy can make to sound economic developments in the long term is low and stable inflation. This provides the economy with a nominal anchor.

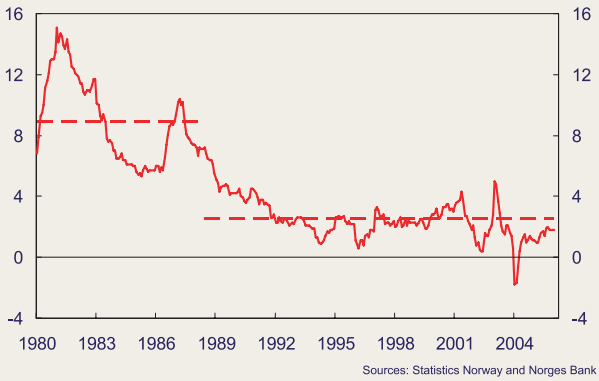
Chart 10. Inflation in industrialised countries. Annual change. Per cent



Source: OECD

The chart shows G7 inflation from 1970 Q1 to 2005 Q4, measured as the change in the consumer price index on the same quarter the previous year.

Chart 11. Inflation in Norway. Annual change. Per cent



Sources: Statistics Norway and Norges Bank

The chart shows inflation in Norway from January 1980 to January 2006. Inflation is measured as the change in the consumer price index on the same month the previous year. The broken lines indicate the average for January 1980 to May 1988, and for June 1988 to January 2006, respectively. The time of the break is estimated in an analysis carried out by Norges Bank in the period 1980-2005.

Low and stable inflation makes it easier for economic agents to distinguish changes in relative prices from changes in the general price level. Prices become a more accurate information vehicle. Alan Greenspan has defined price stability as "a situation in which households and businesses in making their saving and investment decisions can safely ignore the possibility of sustained, generalized price increases or decreases".[5] This is the aim of monetary policy in all countries.

When there is confidence in the inflation target, monetary policy can also contribute to stabilising output and employment.

Norges Bank operates a flexible inflation targeting regime, so that weight is given to both variability in inflation and variability in output and employment in interest-rate setting.

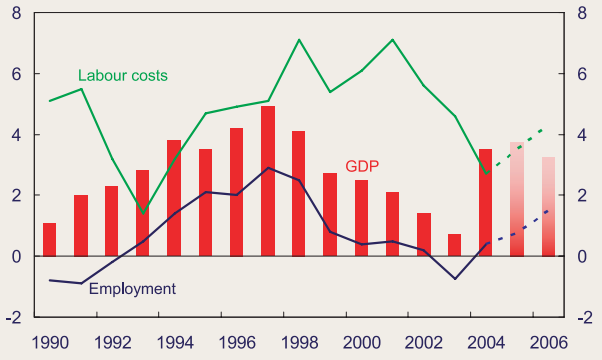
Past experience indicates that expectations as to future inflation remain stable even if inflation varies somewhat

[3] Interview in Adresseavisen, 27 December 1980.

[4] Based on an analysis conducted by Norges Bank of price indices for more than 130 different groups of goods and services for the period 1980-2005.

[5] Alan Greenspan: Testimony before the Committee on Banking, Finance and Urban Affairs, U.S. Senate, July 13, 1988.

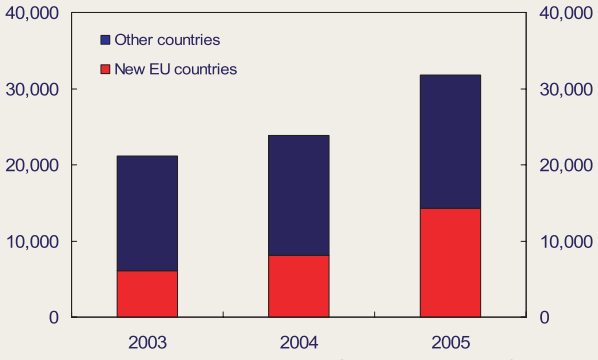
Chart 12. Employment, labour costs and mainland GDP. Annual growth. Per cent



Sources: Statistics Norway and Norges Bank

The chart shows growth in GDP, the number employed and labour costs per person-hour worked for mainland employees. Annual figures. Figures for 2005 and 2006 are projections from Inflation Report 3/05. The estimated rise in labour costs is set as equal to estimated wage growth in Inflation Report 3/05. The estimate includes the costs of an increased number of vacation days and the introduction of mandatory occupational pensions.

Chart 13. Work permits



Source: Norwegian Directorate of Immigration

The chart shows the average number of foreign workers per year with a valid work permit (issued for the purpose of work) in Norway. The average is calculated from monthly figures from 1 January 2003 to 1 December 2005. Nordic citizens do not need work permits and are therefore not included in "other countries".

New EU countries include Poland, Lithuania, Latvia, Estonia, Slovakia, the Czech Republic, Hungary, Slovenia, Malta and Cypros.

as long as the interest rate is used actively to curb the effects. Monetary policy cannot fine-tune economic developments, but it can prevent the largest effects from occurring when the economy is exposed to disturbances. In some situations, it may be appropriate to hedge against particularly unfavourable developments.

If inflation deviates substantially from the target for a period, the interest rate will be set with a view to gradually returning it to the target, so that we avoid substantial variations in output and employment. Through the 1990s, inflation remained on the whole in the interval $1^1/_2$– $3^1/_2$ per cent. Inflation has varied slightly more in the past few years. In a period of increased cross-border labour flows, substantial technological advances, changes in competitive conditions and new trading patterns, we may, with our very open economy, have to accept a somewhat greater variation in inflation and deviations from the target, as we have witnessed over the past two to three years.

Even though economic growth has been strong over the past 15 years, economic cycles have varied. A clear upturn in the years from 1993 to 1998 was followed by a period of more moderate growth and a mild downturn in 2002 and into 2003. Since summer 2003, the Norwegian economy has again experienced a marked upturn.

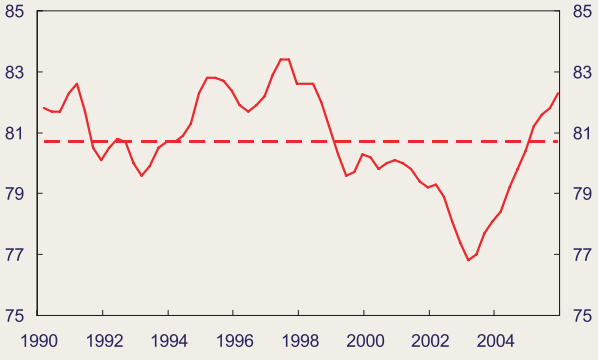
Wage developments reflect and influence business cycles. Strong employment growth in the 1990s resulted in a rise in labour costs, which in turn had a dampening impact on growth. Moderate wage growth in recent years is being accompanied by a strong cyclical upturn.

The Norwegian economy has continued to exhibit high growth this year. Low interest rates, higher petroleum investment and strong global growth have been the most important driving forces. Low interest rates contributed at the beginning of the upturn to high growth in private consumption and housing investment. Last year, exports and corporate investment also showed solid growth. There is now a broad upswing in demand for goods and services. It has taken time for employment to pick up, but this is occurring now.

Inflation has increased somewhat, but is still very low, even $2^1/_2$ years after the cyclical change. Inflation is still being restrained by the fall in prices for imported consumer goods, increased competition in a number of markets and the current period of lower nominal pay increases.

The trend in prices for consumer goods over the past two or three years is a result of favourable developments in the Norwegian and global economies. Low inflation is being accompanied by real income growth and a rise in production. In other words, low inflation is not the

Chart 14. Capacity utilisation in manufacturing. Per cent



Source: Statistics Norway

The chart shows the capacity utilisation trend in manufacturing, measured as a percentage, from 1990 Q1 to 2005 Q4, as it is measured in SN's business tendency survey. The broken line indicates average capacity utilisation for the period.

result of declining demand, activity or employment.

The labour supply and production equipment set a limit in the short term on the level of production in Norwegian enterprises. When production approaches this limit, wage and price inflation will pick up. For an open economy like Norway's, this limit can vary. We buy an increasingly wide range of goods and services abroad. The production of goods for the domestic market can be moved abroad. Services can also be provided by producers in other countries.

Norwegian companies are no longer looking to the domestic labour market only. Other Nordic countries are an important source of labour. Last year, the number of work permits issued increased by 30 per cent. A large share came from the new EU member states. The waiter from Sweden, the Polish carpenter, the cherry-picker from Lithuania, the dentist from Iran and the physician from Sri Lanka are altering the capacity limits of the Norwegian economy.

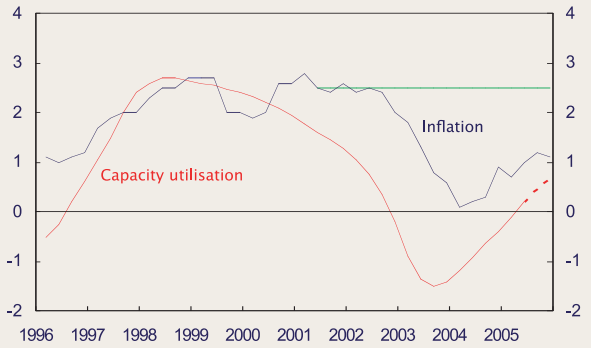
Nonetheless, many services are provided and must be delivered in Norway. Nor do we want to drive internationally exposed businesses out of the mainland economy. Language and cultural differences place limits on how quickly foreign labour can be absorbed, and the supply may diminish inasmuch as the economies of Sweden and Poland are now growing strongly. Norway's skills requirements and authorisation procedures are also curbing competition. Laws and resolutions on minimum pay requirements may also restrict the flow of labour.

Current evidence suggests that capacity utilisation is increasing in some sectors of the Norwegian economy.

Norwegian industrial leaders report that they are nearing capacity limits with regard to labour, plant and equipment. Three of four enterprises in the construction industry report that they are operating at capacity limits.[6]

The number of advertised vacancies is rising steadily.

Chart 15. Inflation and capacity utilisation in the Norwegian economy. Per cent



Sources: Statistics Norway and Norges Bank

The chart shows developments in inflation and capacity utilisation in the period 1996 Q1 to 2005 Q4. Inflation is shown as the CPI-ATE, which is the CPI adjusted for tax changes and excluding energy products (change from same quarter previous year). Capacity utilisation is measured as Norges Bank's estimate of the output gap. The output gap measures the difference between actual output and the output that is consistent with stable inflation (potential output). Quarterly figures for the output gap are derived from annual figures. The estimates for 2005 Q3 and Q4 are from Inflation Report 3/05. The green line indicates the inflation target of 2.5 per cent.

There are reports of shortages of craftsmen, project managers and supervisors, engineers and skilled workers.

Even though capacity utilisation is rising, there are no visible signs of inflation. Intensified competition is exerting downward pressure on margins. Wage growth is still at such a low level that it is strengthening businesses and employment. However, we have experienced earlier that cost inflation can rapidly accelerate. The settlements in 2004 and 2005 resulted in moderate wage growth. There are now signs of higher local pay increases in some industries. Pay increments are probably rising in occupations where pay is directly linked to performance. Municipalities and public entities have

Chart 16a. Household income and debt. Annual growth. Per cent

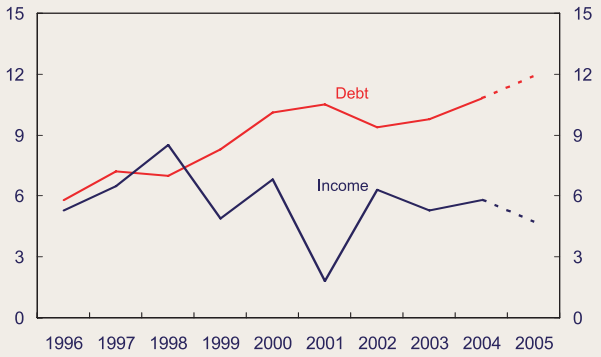
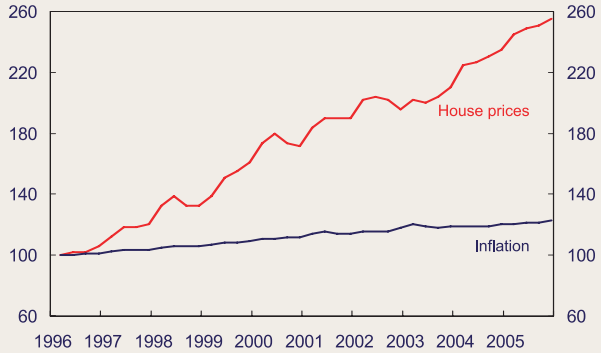


Chart 16b. House and consumer prices. Index



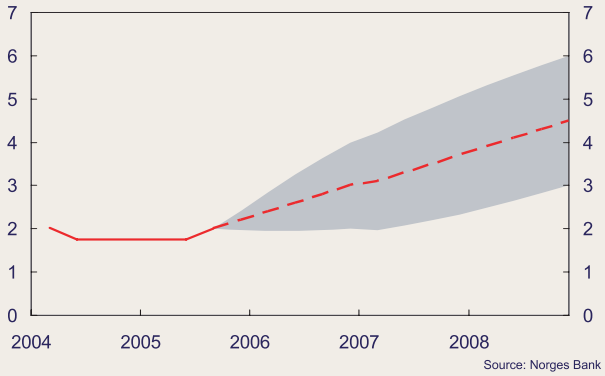
Sources: Sources: Norwegian Association of Real Estate Agents, Association of Real Estate Agency Firms, Finn.no, ECON, Statistics Norway and Norges Bank

Chart 16a shows the growth on the previous year of household disposable income and new debt from 1996 to 2005. Annual figures. The disposable income series has been adjusted for estimated reinvested share dividends since 2001. Debt is total growth of credit to households in Q4 compared with Q4 of the previous year. Estimates for 2005 (see Inflation Report 3/05).

Chart b shows developments in house and consumer prices in the period 1996 Q1 to 2005 Q4. The series is indexed to 100 in 1996.

6 Information from Norges Bank's regional network, January-February 2006.

Chart 17. Key interest rate forecast. Per cent



Source: Norges Bank

The chart shows actual developments in and Norges Bank's forecast for the key rate (the sight deposit rate) in Inflation Report 3/05 from 2004 Q1 to 2008 Q4. The shaded area represents one standard deviation.

recorded a sharp increase in revenues, and this may easily translate into higher labour costs. Nevertheless, the labour market is not so tight that there is a pronounced risk of a marked increase in wage growth in connection with the spring income settlement. Moreover, employee organisations have gained acceptance for important changes in labour legislation and regulations. This probably reduces the near-term risk of pay increases that weaken production.

A characteristic of the wage formation process in Norway has been that fairly long periods of moderate nominal pay increases and rising employment have culminated in a sharp rise in cost inflation – often as a result of working hour reforms – and a decline in employment. Developments in labour costs and the wage settlements in 1974 and 1975, 1986 and 1987 and in the period between 1998 and 2002 laid the basis for a subsequent decline in output and employment. In our interest-rate setting, we must continuously assess how we should take account of the risk of another sharp rise in cost inflation when the labour market tightens.

In the conduct of monetary policy, we assess the objective of stabilising inflation at close to 2½ per cent over time against the objective of stabilising output and employment. Given the low inflation rate, we have decided to keep interest rates at a low level and at times considered an even lower interest rate. However, against the background of solid growth in the Norwegian economy since summer 2003, we have instead decided to use some time to bring inflation back to target.

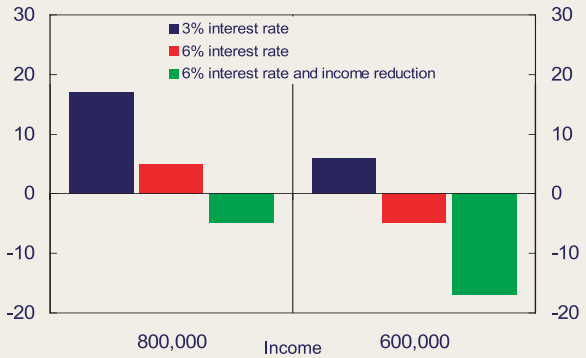
Household debt has risen sharply since the mid-1990s. At the same time, house prices have shown a marked increase. Debt developments through the 1990s can probably be viewed to some extent as a delayed adaptation to the deregulation of the housing and credit markets in the 1980s, after many households burned their fingers immediately after the deregulation. At the same time, the credit market has deepened. New loan products have emerged, and it is easier to raise loans. Borrowers can choose their repayment schedule. Credit and housing market liberalisation provides homebuyers with the opportunity to establish a high housing standard early in their adult lives and draw on this capital later in life. In recent years, household income growth has been solid, household confidence regarding the future has been strong and households probably perceive higher income levels as permanent. This may have resulted in a further rise in house prices and debt. In addition, low real interest rates are currently contributing to this.

We have limited scope for restraining structural changes that take place when households increase their debt over several years in order to invest in housing and other property and assets. An interest rate level that effectively restrains this restructuring process would also have had adverse effects on economic activity. However, households are more vulnerable when debt is high. Long periods of sharply rising asset prices and debt may be a source of subsequent instability in production and employment.

We believe that expectations regarding interest rate developments have a greater impact on household and business borrowing and investment behaviour than actual interest rates.

Norges Bank communicates its analysis of the outlook for the Norwegian economy and the interest rate. At this juncture, the outlook for output and inflation suggests that the interest rate should be gradually – in small, not

Chart 18. Disposable income after payment of basic expenses, interest and principal. Per cent of income



Sources: National Institute for Consumer Research (SIFO) and Statistics Norway

The chart shows an example of what two families have left as disposable income as a percentage of after-tax income after basic expenses, interest and principal have been paid.

The one family has a gross income of NOK 800 000 and debt of NOK 2 million. The other family has a gross income of NOK 600 000 and debt of NOK 1.5 million. Both loans have a repayment period of 20 years.

Basic expenses are based on a standard SIFO budget for a household of two adults and two children (aged 2 and 14), of NOK 222 480 per year. NOK 16 000 per year has been added for other expenses, including electricity.

The blue bars show disposable income as a percentage of after-tax income for each family given an interest rate level of 3%. The red bars show the same information for an interest rate level of 6%, and the green bars for an interest rate of 6% and a 10% income reduction.

[7] Based on the analyses in *Inflation Report* 3/05 and the assessments provided in the press release following Norges Bank's monetary policy meeting on 25 January 2006.

too frequent steps – brought up to a more normal level.[7] The economic outlook is uncertain. We illustrate interest rate uncertainty ahead with a fan chart, which is meant to capture the outcome with a 70 per cent probability.

The consequences of higher interest rates for two households are illustrated in this chart. Both households comprise two adults and two children. One household has a gross income of NOK 800 000 and NOK 2 million in debt. The other has an income of NOK 600 000 and NOK 1.5 million in debt. The chart shows the two households' income after basic expenses and interest and principal payments have been paid. The household with an income of NOK 800 000 can cope reasonably well with a debt of NOK 2 million even after the interest rate has increased by 3 percentage points. The household with the lowest income will have a tight margin. Principal payments will have to be deferred and, even with a deferral of a few years, this household will have little leeway after basic expenses have been paid. In order to increase its financial leeway, it will either have to increase its income, or reduce housing consumption and dispose of its debt.

Both households will be vulnerable should one member lose income from employment and have to rely on benefits. With an income loss of 10 per cent, even the household with the highest income level would have to make considerable spending adjustments.

Although these households have higher-than-average debt, this debt level is not uncommon. However, for most households, it will be relatively easy to cope with gradually higher interest expenses.

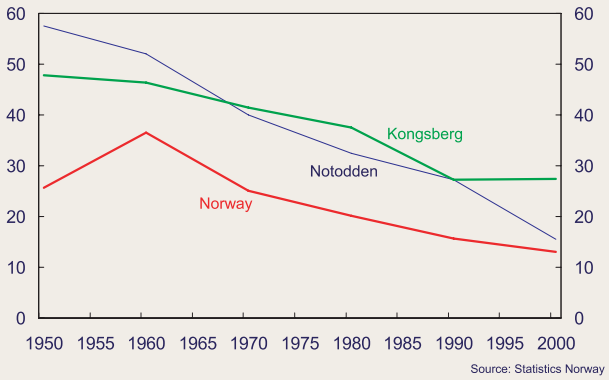
The outlook for the Norwegian economy is favourable. Output has picked up, although so far not to such a degree that there are visible signs of inflation. As long as the rise in prices is slow, it will be appropriate to maintain a low interest rate. But when capacity utilisation increases, the interest rate will have to be raised gradually towards a more normal level.

Even though price inflation has deviated from the target for a period, there are no indications that economic agents have changed their view of future inflation. Expectations are stable. When households and businesses make their saving and investment decisions and set prices, they can safely ignore the possibility of sustained, marked increases or decreases in the general price level. The business sector can base their decisions on the assumption that wage and cost inflation will not revert to the level seen in the 1970s and 1980s. Employees also know that their pay increases will not be eroded by inflation. Low and stable inflation is a credible objective.

4. Are we equipped for the future?

Norwegian enterprises have access to new markets and are encountering increasing competition. New businesses are emerging while others are scaling back and closing down.

Chart 19. Manufacturing workers as a percentage of the working population



Source: Statistics Norway

The chart shows the number of workers in manufacturing as a percentage of the total working population for Notodden, Kongsberg and Norway. The figures are taken from population and housing censuses in 1950, 1960, 1970, 1980, 1990 and 2001.

In 2001, the figures for working population in the population and housing census were obtained from registers. The statistics therefore use the number employed as an approximation of the working population.

We have behind us 15-20 years of fairly sound macroeconomic management, which provides a good basis for growth in the Norwegian economy. The banking system and securities markets are highly developed. Generally, only unprofitable projects lack financing and capital. In a take-over, new owners completely re-haul poorly run operations. In Norway, as in other industrialised countries, private ownership is firmly protected. This is a competitive advantage and a fundamental precondition for a market economy to function over time.

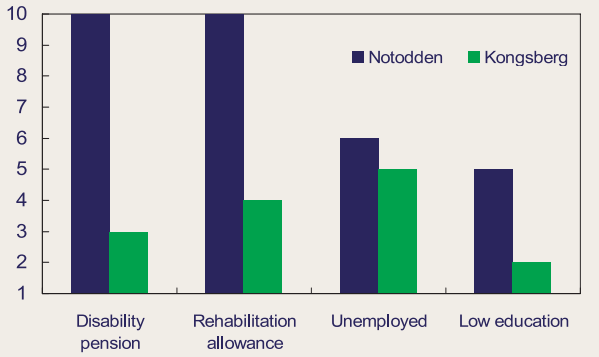
We like to believe that we have a highly educated labour force, and find some support for this in OECD surveys. As a result of the tax reforms of 1992 and 2006, we are able to finance the welfare state fairly effectively. Our infrastructure is being developed. The security provided by our welfare system means that restructuring is easier than in many other countries. Like other Nordic countries, we apply labour market rules that for the most part do not impede restructuring.

We learned a great deal about successful – and less successful – restructuring in the 1970s and 1980s. Two local communities that had to restructure are Kongsberg and Notodden.

The cornerstone enterprises in these two communities had to cut their workforces substantially. Kongsberg fared well. When Kongsberg Våpenfabrikk declared bankruptcy in 1987, its defence business was continued while all its civilian production was split up and sold. The new companies and spin-off companies in Horten, Stjørdal and Egersund have posted solid growth and profitability. Several of the companies have become leaders in their field. An adequate supply of state-of-the-art technical expertise has been important for the companies' restructuring success.

Notodden did not fare as well. In the 1950s, Tinfoss

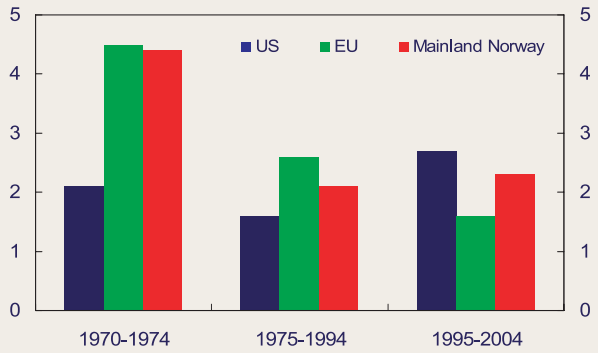
Chart 20. Living conditions - problems. Index. 2005



Source: Statistics Norway

The chart shows developments in selected sub-indices on problems linked to living conditions produced by Statistics Norway. The indices take values from 1 to 10. Municipalities and districts are ranked in 10 groups of equal size. A value of 1 means that the municipality is one of the 10 per cent with the lowest value in the indicator, etc., while a value of 10 means that the municipality is one of the 10 per cent with the highest value in the indicator. A high indicator value means, for example, a relatively high share of disability pensioners, unemployed etc.

Chart 21. Productivity growth in the business sector. Per cent



Sources: Bureau of Labor Statistics, OECD and Statistics Norway

The chart shows average business sector productivity growth in mainland Norway, the US and EU countries in the periods 1970-1974, 1975-1994 and 1995-2004. Productivity is calculated as value added per person-hour worked.

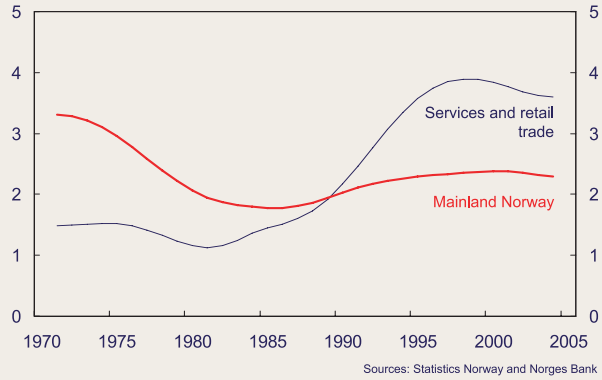
Figures from 1970 are not available for the EU and for Norway. Figures for the non-farm business sector have been used for the US. The EU her e consists of Germany, France, Italy, Belgium, the Netherlands, Denmark, Ireland, the UK, Spain, Finland and Sweden.

Jernverk and Norsk Hydro employed more than 1500 manufacturing workers. Towards the end of the 1960s, they started shedding labour. The processing industry has now been closed down. Many workers are now commuting to other municipalities, including Kongsberg. The share of the population that is on disability benefits or participating in various labour market programmes is above the national average. The basis for establishing new businesses has not been as favourable as in Kongsberg, but there are now at last signs that the situation is improving.

Kongsberg Våpenfabrikk was wholly state-owned. This was widely perceived as a guarantee for continued operations. The company repeatedly required state capital injections following unfavourable results. When the government allowed the company to fail, this also represented an important choice with regard to state ownership policy. Profit requirements bolstered discipline in the fledgling companies. At the same time, when the original company was split up, competencies and values became visible.

The state still has extensive ownership interests in Norwegian business and industry, but it has adopted a completely different approach to the management of its interests following the experience in Kongsberg, Mo i Rana, Sulitjelma and Syd-Varanger. Corporate governance is now exercised through resolutions in general meetings and according to recommendations from nominating committees, and the board and management can run companies with the objective of increasing value. The state-owned companies are subject to exactly the same market discipline as other operators, with a required return and continuous adaptation and development. This is also the only way companies can avoid stagnation.

Chart 22. Productivity in Norway. Annual growth. Per cent



Sources: Statistics Norway and Norges Bank

The chart shows trend productivity growth for mainland Norway, and for services and retail trade, from 1971 to 2004. Annual figures. The figures are a Hodrick Prescott trend estimated by Norges Bank.

Through the Government Pension Fund, the state owns equities worth more than NOK 500 billion, spread across nearly 3 500 companies in over 30 countries. The holdings are minority interests. While long-term interests in state-owned companies require ownership discipline and distance from decision-making, the challenge to the Pension Fund is to assert its minority interests and contribute to transparent corporate governance. Here we can apply internationally recognised principles drawn up by the OECD and the UN.

Restructuring in state-owned enterprises and the wider business sector has enhanced the efficient use of labour, capital and other resources.

International comparisons indicate that production in Norway is fairly efficient – also in sectors other than oil and gas.[8] A comparison shows that both Norway and

[8] See for example OECD (2006): Economic Policy Reforms: Going for Growth; Bart van Ark (2005): "Europe's Productivity Gap: Catching Up or Getting Stuck"; and Christine Cumming: Panel Remarks in a Symposium on Productivity, Competitiveness and Globalization, Banque de France, Paris, November 4, 2005.

Europe were catching up with the US for a while. In Norway, productivity showed a particularly strong increase at the beginning of the 1970s. Growth was weaker from the mid-1970s and up to the beginning of the 1990s, but has since picked up somewhat again.

Productivity growth has been weaker in many European countries over the past decade. Restructuring in retail trade and the financial industry in particular has progressed at a slower pace in Europe than in the US. In this respect, developments in Norway are more similar to developments in the US. When productivity growth picked up in Norway, it was primarily in retail trade and the postal, telecom and banking industries.

Two factors seem to be important for growth:

First: In areas and enterprises in decline, adversity can trigger creativity when companies are split up and new owners make their entry.

Second: In order to reap the benefits of new technology, enterprises must be able to make rapid changes in their workforces.[9]

However, at a more fundamental level, growth and restructuring capacity is closely linked to the level of skills in a population. European surveys indicate that there is a high level of science and technology skills among the adult population.[10] Surveys among pupils and students do not provide an equally positive picture. A report from the Norwegian Mathematics Council shows that the level of mathematical skills among new university students has declined markedly in recent years.[11] Even the top performing students score considerably lower than earlier. This is illustrated here as the percentage of correct answers in arithmetic and percent calculation, but we find similar scores for other mathematical skills. Norway is taking an economic risk in allowing the skills level to decline.

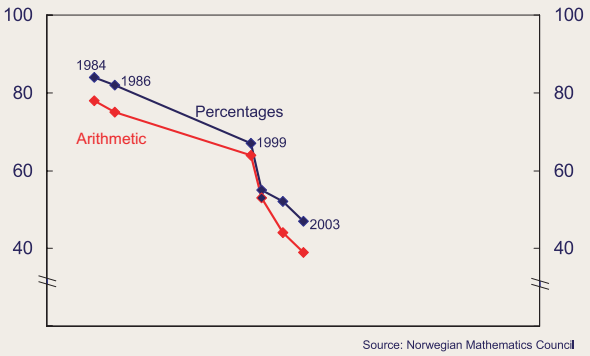
But – to take a brighter view of this: We have after all experienced that negative trends can be reversed in very important areas of society.

Our most important resource is our labour force. The employment rate is high in Norway. This is because many wish to participate in working life, and the vast majority find a job.

However, the Norwegian labour market also has its weak points. The annual number of person-years worked is lower in Norway than in the US and the rest of Europe. Both in Norway and the rest of Europe, the fall in the number of working hours is ascribable to longer holidays and shorter working days. The standard working year is short in Norway, but on the other hand Norway also has a higher percentage of part-time employees than other countries. Access to these working hour arrangements has made it easier for women and young workers to enter the labour market.

The income level in Norway has increased. Many may prefer to take advantage of this by increasing their leisure time in the form of shorter working days or longer holidays. And this has in fact taken place.

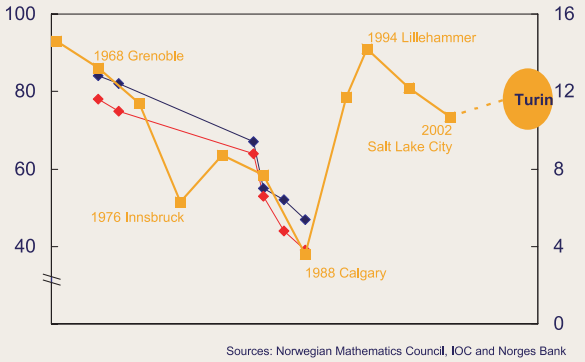
Chart 23. Mathematical skills among new students. Percentage correct answers



Source: Norwegian Mathematics Council

The chart shows the percentage share of students with correct answers for two problems with which the Norwegian Mathematics Council tested students in 1984, 1986, 1999, 2000, 2001 and 2003. The tests are national, and are taken by new students at universities and regional colleges.

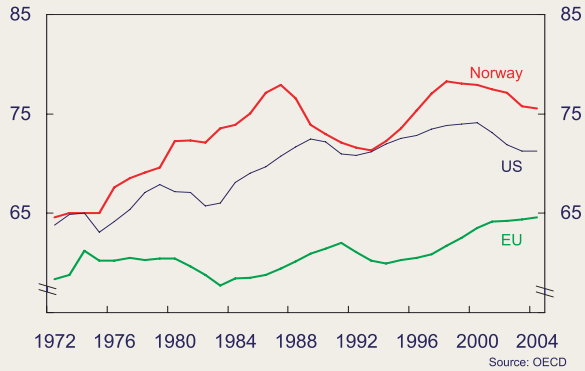
Chart 24. Norwegian medals in the Winter Olympics. Percentage of total attainable medals



Sources: Norwegian Mathematics Council, IOC and Norges Bank

The chart shows the percentage of students with correct answers for two problems with which the Norwgian Mathematics Council tested students in 1984, 1986, 1999, 2000, 2001 and 2003. The tests are national, and are taken by new students at universities and regional colleges. The chart also shows the percentage of Norwegian metals of the total number of medals in the Winter Olympics from 1964 to 2002 (right-hand scale).

Chart 25. Share employed. Per cent



Source: OECD

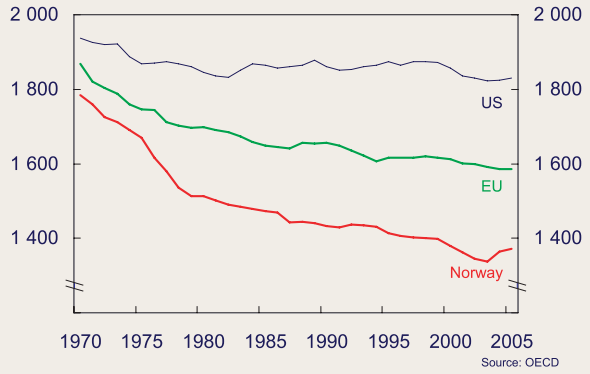
The chart shows the employment rate in Norway, the US and the EU (EU-15) from 1972 to 2004. The employment rate is measured as the number of employed persons aged 15-64 as a percentage of the total population in the same age group. Annual figures.

[9] See for example Cumming (2005) and van Ark (2005), op.cit.

[10] European Commission (2005): Special Eurobarometer 224, Europeans, Science and Technology, June 2005.

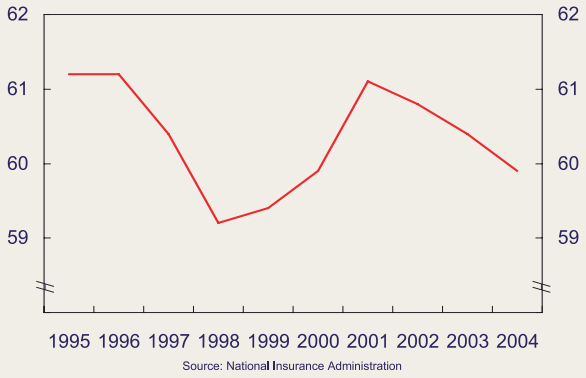
[11] Source: Telemark University College: Norwegian Mathematics Council's autumn 2003 survey among new students, February 2004.

Chart 26. Hours worked per employee



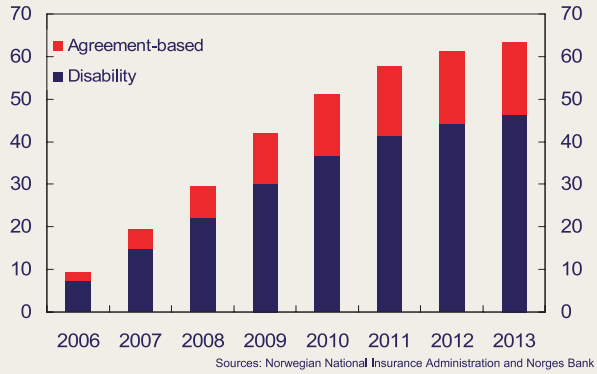
The chart shows actual hours worked per employee in the US, the EU and Norway from 1970 to 2004. Annual figures. Here 'EU' means only the euro area.

Chart 27. Expected retirement age



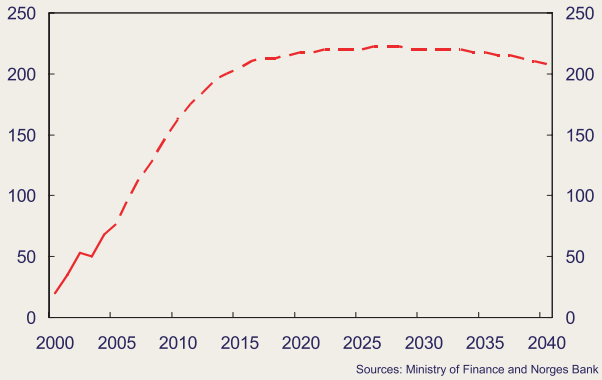
The chart shows the expected retirement age from 1995 to 2004. The figures indicate average retirement age, adjusted for skews in the population's age composition and mortality rate.

Chart 28. New pensioners on agreement-based and disability pensions. Projections. In thousands



The chart shows Norges Bank's projections for new pensioners onf agreement-based and disability pensions for the period 2006 - 2013, based on demographic developments and age-based rates for qualifying for disability and agreement-based pensions in 2005. Annual figures.

Chart 29. Government Pension Fund - Global. Per cent of mainland GDP



The chart shows developments in the value of the Government Pension Fund - Global as a percentage of mainland GDP, from 2000 to 2040. Annual figures.

Moreover, the retirement age is steadily declining. The expected retirement age is now below 60, when disability pensioners are taken into account. At the same time, life expectancy has increased, and leisure time accounts for an increasing share of our lives.

The large post-war cohorts will only reach ordinary retirement age after 2012, but are now nearing the age when they are eligible for early retirement. If they opt to retire under the scheme as it functions today, the number of pensioners under the contractual early retirement scheme will increase by 16 000 in six years. Similarly, the ageing of the population will result in an additional 41 000 disability pensioners.

The incentives embedded in pension rules, benefits and taxes encourage early retirement. The pension rules make it costly for companies to recruit older workers. The wage trend perceived by a wage-earner as appropriate over a lifetime may also deviate from the trend in work capacity expected by the employer.

The basic problem seems to be that individuals are not sufficiently exposed to the social costs associated with leisure and early retirement. Nor are the right incentives offered to individual businesses.

5. Saving and returns in the Government Pension Fund

Our labour force is clearly our most important national resource, but Norway also has substantial petroleum wealth. The state's share consists partly of the value of oil and gas under the seabed and partly of the financial wealth accumulated in the Government Pension Fund – Global.

It is misleading to look upon the cash flow from petroleum activities as income. The appropriate economic perspective is to see the transfer of the cash flow to the Government Pension Fund as a way of transferring capital from one account to another – from petroleum to foreign securities.[12] By doing so, we diversify risk.

We are in a period marked by high oil and gas production and high prices. Substantial resources are therefore transferred from the one account to the other. Combined with high returns, the result is that the value of the Government Pension Fund is rising rapidly and may continue to do so in the years ahead.

The Fund is now approaching the nominal value of one year's GDP and may reach two in the course of the next decade. This is based on the assumption that oil prices remain high over the next few years and then fall to about USD 30 per barrel. Experience has shown that forecasts for both oil production and oil prices are highly uncertain.

The government bases its withdrawals from the Fund on an average real return of 4 per cent for financing current expenditure. Given this spending rule, the return may come to finance more than 15 per cent of government expenditure in 10 years. We thus reap considerable benefits from managing our petroleum wealth well. The return represents future income that we forego if we draw on this wealth today. But even with this source of income, more than 80 per cent of expenditure must be covered by other sources. Financing the large pension payments that will have to be disbursed after 2012 will be very demanding in any event.

The Government Pension Fund has a prudent investment strategy, with broad risk diversification, and a real return of 4 per cent is expected in the long term. There are examples of companies and investors that achieve a considerably higher return on capital over time. However, it is important to remember that for each successful investor earning high returns, there are many others with the same ambition and risk willingness, but with a record of poorer performance and bankruptcies. The Government Pension Fund cannot run the risk of ending up among the worst performers.

The globalisation of financial markets provides the Fund with good opportunities for investing and diversifying risk. However, we cannot insulate the Fund from wide annual swings in the value of the investments. We invest in international equity markets where prices fluctuate widely. These fluctuations are the reason why equity investments generate a higher return over time. The best year in the Fund's history so far was 2003, when it posted a real return of 11 per cent. This stood in sharp contrast to the previous year's result, which was -6 per cent.

The use of the Fund's return must therefore be smoothed over time in order to prevent events in international capital markets from spreading to the Norwegian economy.

6. Conclusion

In the character of Peer Gynt, Ibsen drew a rather unflattering portrait of the Norwegian man who travelled out into the world and became rich – but who had no concern for others. At the end of the play, Peer is penniless.

Ibsen himself left Norway, and although the Norwegian landscape and his Norwegian identity were at the core of his writing, it was his encounter with other ideas and thinking that enabled him to reshape his experience into world-class literature.

In the asylum in Peer Gynt, where "man is himself to the uttermost limit" and "no-one considers another's ideas" but "encloses himself in a barrel of self", Peer Gynt is crowned "Emperor of Self". When the roles are reversed and the asylum's keepers protest at being caged instead of the inmates, the director of the asylum, Begriffenfeldt, answers: "When the world's in a whirl, then we must whirl with it".[13]

We do not share this attitude. We must not whirl helplessly along with the world. We should take advantage of the opportunities globalisation offers, but also contribute to those changes ourselves.

Thank you for your attention.

[12] Most of the central government's cash flow from the sale of oil and gas is derived from the extraction of wealth under the seabed (economic rent), while the remainder is a normal return on invested capital.

[13] Henrik Ibsen: Peer Gynt. Translated by Peter Watts. Penguin Books, London, 1966.

Projections, uncertainty and choice of interest rate assumption in monetary policy[1]

by Deputy Governor Jarle Bergo

Introduction

Norges Banks' views on future interest rate developments have often attracted considerable attention. For a long period, our analyses were based on the assumption that the interest rate would move in line with market expectations, and the discussion was usually about whether the bank agreed with this interest rate outlook or had a different interest rate path in mind. In *Inflation Report* 3/05, projections were based on the Bank's own projected path for future interest rates for the first time. In other words, from using technical assumptions and others' assessments of our future interest rate setting, we have now in a sense "assumed ownership" of the interest rate path in our projections. This article provides an account of the background for this decision and the assessments underlying our forecasting.

When we make forecasts for variables such as output and inflation, we must at the same time have formed an opinion of the future interest rate path. Interest rate developments, in turn, must be considered in the context of other forecasts.

The choice of interest rate path in forecasting is important because monetary policy influences developments in the economy primarily through expectations. This is discussed in more detail in the following section. First I will focus on the role of the interest rate in Norges Bank's projections. I will then move on to describe the analytical tools used by the Bank to arrive at a projection for future interest rates. Finally, I will discuss the uncertainty inherent in the projections.

Choice of interest rate assumption in forecasting

Norges Bank seeks to achieve an interest rate path that provides a reasonable balance between the objective of stabilising inflation at target and the objective of stabilising developments in output and employment. This means we have to judge how these variables will develop in the period ahead and how they are affected by the interest rate. Hence, in order to make forecasts for inflation and output, we must also judge how interest rates will develop in the future.

The interest rate can be approached in various ways in forecasting. There might be arguments in favour of basing the interest rate assumption on external factors, as an exogenous assumption, either by assuming that the interest rate will remain constant through the projection period or that it will develop in line with market expectations. The projections that result from such technical interest rate assumptions do not necessarily provide a reasonable balance between the different objectives of monetary policy. In some cases, both the interest rate assumption and the projections may seem unreasonable. This may raise the question of the purpose of forecasting. However, it provides a starting-point for discussions about how the interest rate path might be adjusted to produce more acceptable results.

Alternatively, the interest rate can be treated in the same way as other variables forecast by the Bank. We would then have to try to make projections for inflation, output and the interest rate simultaneously, with the aim of arriving at an interest rate path that provides a reasonable balance between the different objectives of monetary policy. If the central bank has the intention of adhering to this interest rate path, this might be regarded as an interest rate forecast rather than a technical assumption.

Establishing such an interest rate path is not a straightforward matter. Flexible inflation targeting, which is the system we use, means that the deviation from the inflation target and the output gap are both taken into account. There is considerable uncertainty surrounding the calculation of the output gap, and there is no simple relationship between developments in the output gap and developments in inflation. It cannot therefore be claimed with any great certainty that it is possible to identify one particular interest rate forecast that provides the indisputably "best" trade-off in monetary policy. More often than not, there will be a number of possible interest rate paths that might be said to provide a reasonable balance, in view of the uncertainty involved.

Norges Bank's treatment of the interest rate in forecasting has changed over time. In 1999 and 2000, forecasting was based on the assumption that the interest rate would develop in line with market expectations as indicated by forward interest rates. In 2001 and 2002, the Bank based its forecasting on the assumption that the interest rate would remain constant to the end of the projection period. The constant level of the interest rate was

[1] The article is based on the speech of the same title, given at the Foreign Exchange Seminar of the Association of Norwegian Economists at Sanderstølen on 27 January 2006.

[2] For a more detailed description of how Norges Bank calculates market participants' interest rate expectations, measured by forward rates, see Kloster, A. (2000): "Estimating and interpreting interest rate expectations", *Economic Bulletin* 3/2000, Norges Bank, and Myklebust, G. (2005): "Documentation of the method used by Norges Bank for estimating implied forward rates", *Staff Memo* 2005/11, Norges Bank. Both articles are available on www.norges-bank.no.

calculated on the basis of historical averages, although the historical period on which the calculations were based could vary from one period to the next. On some occasions, the interest rate assumption reflected the average for the interest rate over the previous three months, on other occasions, the average for the previous month. From mid-2003, the interest rate assumption was again linked to market expectations, and in autumn 2005 we published our own interest rate forecast.[2]

In addition to these changes in choice of interest rate assumption, Norges Bank has on some occasions commented on market expectations. In December 2000, the Bank stated in its editorial in the *Inflation Report* that market participants had a different view of the future interest rate: "It would appear that these agents have a different perception of the probability of a reduction in interest rates than the one expressed by Norges Bank."

Communication following monetary policy meetings sometimes contained information concerning probable interest rate developments in the near future. After the inflation target was introduced in March 2001, monetary policy assessments had a more prominent position in the *Inflation Report.* In some cases, the Bank indicated that it would prefer an interest rate path that differed from the path on which the projections were based. For example, *Inflation Report* 2/04 stated that "the most appropriate alternative now seems to be that the interest rate should be kept unchanged for a longer period than indicated by market expectations". In other words, the interest rate considered by the Bank to provide a better balance was lower than the rate factored in by market participants.

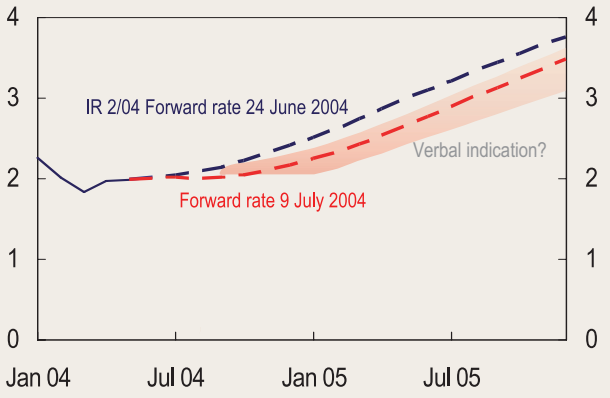
Chart 1 illustrates what happened in summer 2004. The broken blue line shows the interest rate path underlying the projections. The line was consistent with interest rate expectations in the market as measured by forward rates. Norges Bank indicated in the *Inflation Report* that a lower interest rate than expected by the market would provide a better balance. What the appropriate interest rate level should be, however, was not stated explicitly, but the shaded area can perhaps provide an illustration. In the period following the publication of the *Inflation Report,* market expectations fell in the desired direction, as shown by the broken red line. Market participants did not, however, find any answers in the *Report* that would enable them to assess whether the new level, in the opinion of Norges Bank, would provide a reasonable balance. The answer did not appear until the following *Inflation Report* in autumn 2004, which included the following statement: "On the basis of available information – including possible effects of alternative interest rate setting – such developments seem to provide a reasonable balance…." Against this background, the question might be raised of whether Norges Bank's guidance to the market in summer 2004 could have been even better.

In the first and second issues of the *Inflation Report* in 2005, the interest rate assumption was based on forward interest rates. However, the curve was adjusted upwards in the last part of the projection period (see Chart 2). The *Report* pointed to extraordinary factors that might imply that forward rates underestimated actual expectations. The adjusted interest rate path – the baseline scenario – was considered to provide a reasonable balance between the different monetary policy objectives.

Over time, Norges Bank has chosen different interest rate assumptions. This is partly because the Bank has assessed whether the interest rate assumption is reasonable and has not based its decision on a purely mechanical application of certain technical assumptions.

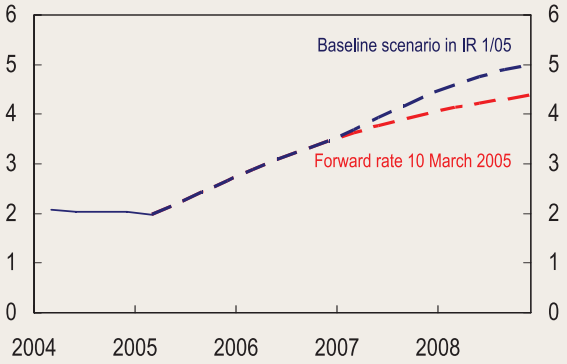
As from *Inflation Report* 3/02, the Bank has published a recommended interval for the sight deposit rate over the following four months. To begin with, the interval was published at the end of the period to which it applied. Since *Inflation Report* 2/04, it has been published ahead of the period. The interval reflects the

Chart 1 Market rates and our communication June 2004



Source: Norges Bank

Chart 2 Forward rate and baseline scenario in IR 1/05



Source: Norges Bank

Bank's sight deposit rate projection for the following four months, conditional on economic developments that are approximately as projected. The interval is an important part of the Bank's communication strategy. Since we now also publish an interest rate projection for the entire projection period and not only for the next four months, economic agents gain broader insight into the analytical base, the assessments made and the Bank's response pattern.

Possible advantages of an explicit interest rate projection

In forecasting inflation and output, there may be a number of advantages to basing forecasts on an interest rate projection that in the Bank's opinion provides a reasonable balance between the different monetary policy objectives.[3]

A communication such as this makes it clear which interest rate path, in the Bank's opinion, provides a balance between monetary policy objectives. Given the information at the Bank's disposal and the assessments made by the Bank at the time the projections are made, the interest rate forecast in the *Inflation Report* will reflect a monetary policy that provides a reasonable balance between the objectives of stabilising inflation at target and stabilising output and employment. This forecast might in many cases be close to market expectations, but this will not necessarily be the case.

When the interest rate forecast reflects a monetary policy that provides a reasonable balance, it contributes to monetary policy predictability. With a predictable monetary policy, market participants can react to new information in a way that contributes to stabilising developments in output and inflation. This makes monetary policy more effective, especially if market participants share the central bank's analyses and assessments. To be successful, monetary policy must be capable of influencing expectations. This is essential to effective monetary policy.

The essence of this argument is that it is primarily through the expectations channel that the central bank can influence economic developments. The expectations channel is the most important channel for monetary policy transmission. The central bank determines the shortest money market rates via the key rate. The shortest rates, however, are of limited importance to economic agents' consumption and investment decisions. These decisions depend more on agents' expectations with regard to future developments in the key rate, as illustrated in Chart 3.

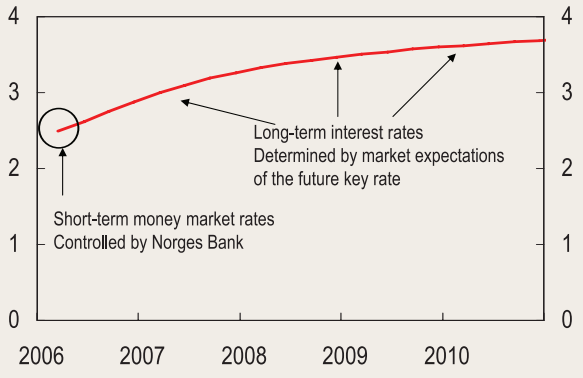
Michael Woodford, a professor at Columbia University and one of the leading experts in this field, has expressed this by saying that monetary policy is the "management of expectations"…"For not only do expectations about policy matter, but (…) very little else matters"…[T]he current level of the overnight interest rates as such is of negligible importance for economic decision making".[4]

The key rate is primarily effective because it influences market expectations concerning future interest rates. Economic agents therefore need to understand the central bank's intentions in its interest-rate setting. Otherwise, agents might perceive future interest rate developments as unnecessarily uncertain. Decisions on consumption and investment will then be more difficult to make. This might lead to greater instability both in terms of variables in the real economy and in inflation. As I mentioned earlier, Norges Bank only influences the shortest money market rates. Open communication concerning our future response pattern will probably also allow us to have more influence over somewhat longer-term interest rates and thereby conduct a more effective monetary policy.

Many agents outside the Bank place considerable emphasis on Norges Bank's projections when they make their decisions. The projections are also evaluated by agents outside the Bank and by Norges Bank itself. The interpretation and evaluation of these projections will be more difficult if they are based on an interest rate assumption that is not consistent with the rate Norges Bank considers most realistic. If the forecasts for inflation and output are to reflect the Bank's best estimates, the underlying interest rate assumption must be a rate the Bank believes to be realistic.

If the Bank's interest rate forecast is different from market expectations, then this is useful information, not only for market participants, but also for the central bank. This may indicate that the central bank and market participants have a differing perception of future economic developments. It may also reflect differing views concerning the trade-offs in monetary policy. Market expectations, as reflected in forward rates, will

Chart 3 Yield curve, mid-January 2006



Source: Norges Bank

[3] Arguments in favour of the publication of an interest rate forecast by the central bank are discussed in more detail in some of the papers presented at the conference hosted by Sveriges Riksbank entitled: "Inflation Targeting: implementation, communication and effectiveness": http://www.riksbank.com/templates/Page.aspx?id=15814. Reference is made in particular to Archer, D. (2005): "Central-bank communication and the publication of interest rate projections", Faust, J. and E. Leeper (2005): "Forecasts and inflation reports: An evaluation", Svensson, L.E.O. (2005): "Further Developments of Inflation Targeting" and Woodford, M. (2005): "Central-Bank Communication and Policy Effectiveness".

[4] This is further discussed by Woodford, M. (2005): "Central-Bank Communication and Policy Effectiveness", see footnote 3.

be a way of cross-checking the Bank's interest rate forecast. If Norges Bank's interest rate forecast deviates from market expectations, the Bank should be able to explain this satisfactorily in order to influence interest rates in the money market.

In *Inflation Report* 3/05, there were only minor differences between Norges Bank's interest rate path and calculated forward rates up to 2007 (see Chart 4). Forward rates indicated that interest rates would then level off, while our forecast indicated a continued gradual rise up towards a more normal level. After the publication of the *Report* and up to end-January, market expectations fell. This shows that the interest rate path envisaged by the Bank and the path expected by the market can differ. There may be several reasons for this. Calculated forward rates will usually reflect market expectations concerning the future interest rate path. Market interest rates may, however, be influenced by extraordinary supply and demand factors that do not have a bearing on the outlook for underlying economic developments or monetary policy. But market participants may also have a different perception of the interest rate path that is required to stabilise inflation at target. The difference can also be ascribed to the downward pressure exerted on long-term interest rates in many countries by extraordinary conditions in international capital flows.

Possible challenges of an explicit forecast of future interest rates

To what extent a central bank should publish an interest rate forecast has been the subject of discussion in international economic literature.[5] The discussion has arisen as a result of the different solutions chosen by different central banks for different reasons.

It has been argued that the central bank might feel too bound by a previously announced interest rate path. Publication of the Bank's interest rate forecast might impose constraints on monetary policy, making it more difficult to adjust the interest rate to changes in economic developments. The interest rate path may be perceived as a straightjacket, preventing the central bank from pursuing the policy it considers to be appropriate at any given time. In addition, if the central bank should deviate from the previously published interest rate forecast, the Bank might be accused of misleading the market. Confidence in the central bank may thereby be undermined.

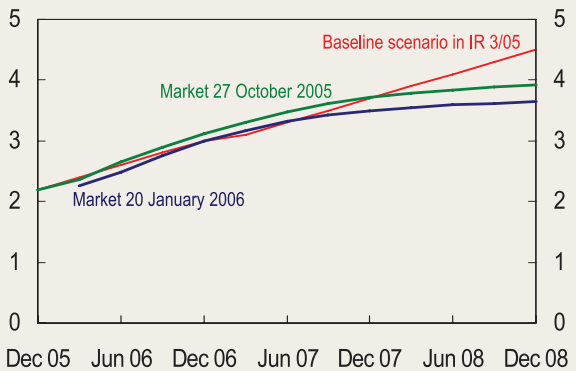
Some economists stress that a published interest rate forecast may create problems in the practical implementation of monetary policy. Results published in the literature, however, seem to point in a different direction.

First, any constraints a published interest rate forecast might entail are not necessarily a disadvantage; on the contrary, they may be an advantage. Indeed, if interest rate expectations can be influenced, a response pattern that is binding for a shorter or longer period will in many cases be useful for a central bank. By being committed to a response pattern, the need for interest rate changes today may be reduced. From mid-2003 to mid-2004, for example, the Federal Reserve was concerned that inflation might fall too low: "In these circumstances, the Committee believes that policy accommodation can be maintained for a considerable period".[6]

Norges Bank has expressed a similar view of future interest rates. For example, from mid-2004 to the beginning of 2005, the Bank stated that "the prospect of continued low inflation in Norway also implies that we should lag behind other countries in setting interest rates at a more normal level". Statements such as this are intended to influence market expectations. Similarly, there may be advantages of publishing an explicit interest rate forecast. This may lead to commitments that increase the credibility of consistent interest-rate setting by the central bank. Nevertheless, statements related to the interest rate path can still be useful as they can provide information about why a particular path has been chosen. In addition, such statements can provide some information about our response to conditions outside the Bank's control.

Second, when the central bank deviates from the original projection for future interest rates, an explanation has to be provided. The interest rate forecast is based on incomplete information about the current situation and the functioning of the economy. If the economy is exposed to disturbances, the central bank's assessment of these disturbances must be communicated. The same applies if the central bank should change its view of the functioning of the economy. Professional financial market participants and other economic agents will have little difficulty in understanding that the interest rate will occasionally have to deviate from the forecast.

Chart 4 Norges Bank's and the market's interest rate paths



Source: Norges Bank

[5] Arguments against the publication of an explicit interest rate forecast by the central bank are discussed in more detail in Goodhart, C. (2001): "Monetary Transmission Lags and the Formulation of the Policy Decision on Interest Rates", Federal Reserve Bank of St. Louis Review, July/August 2001 (http://research.stlouisfed.org/publications/review/01/05/165-182Goodhart.qxd.pdf) and Mishkin, F. S. (2004): "Can Central Bank Transparency Go Too Far?", NBER working paper no. 10829 (http://www0.gsb.columbia.edu/faculty/fmishkin/PDFpapers/56959-w10829.pdf).

[6] See press release from the Federal Reserve, Board of Governors, 12 August 2003, www.federalreserve.gov.

Basis for the interest rate forecast

In forecasting economic variables, Norges Bank uses an approach that captures and juxtaposes many different elements. Chart 5 provides an illustration of the structure of forecasting. One important source of information on the current situation is current statistics. In addition to official statistics, information from our regional network plays an important role. In the course of a year, around 1400 interviews are held with leaders from various parts of the corporate and public sectors about economic developments in their enterprises and institutions. In our forecasting, we seek to build a bridge between our assessments of the current situation and the knowledge we have about long-term relationships in the economy. As a tool in this work, the Bank uses several macroeconomic models: one core model and a number of smaller models.

Central to this process is the use of judgment. The macroeconomic models provide a very simplified description of the economy and only serve as a forecasting tool. The forecasts for inflation, output, the interest rate and other variables in the economy must be perceived as a result of the Bank's best judgment. There is no mechanical relationship between the models the Bank uses and its forecasts.

Nevertheless, the models are a very useful tool in the conduct of monetary policy. In the process of arriving at an interest rate forecast that in the Bank's opinion provides a reasonable balance, a model system is needed where the interest rate and other variables in the economy are interdependent. The core model has this property.[7]

The core model includes relationships that describe the demand and supply side of the economy and a relationship that describes interest-rate setting. The interest rate is set on the basis of a long-term normal interest rate level in addition to information on inflation and output. Disturbances to the economy that influence developments in inflation, output or the exchange rate also trigger interest rate changes. Interest rate changes in turn affect inflation, output and the exchange rate in such a way that these variables stabilise over time around their equilibrium values. The model thus also embodies assumptions concerning long-term developments. In the literature, an interest rate path determined in this way is often referred to as an endogenous interest rate path. This means that the interest rate is simultaneously determined within the model with other variables such as inflation, output and the exchange rate – the interest rate is not taken as a given outside the model.

Economists with experience of other Norwegian macromodels may argue that the model I have just described seems too small to describe a complicated reality. The strength of such a small model is primarily that it isolates the mechanisms we are particularly interested in. At the same time, we also want to focus on a larger set of variables. In addition to the core model itself, the Bank therefore also uses a number of smaller additional models in its forecasting. This is illustrated in Chart 6, where the core model is represented by the yellow boxes at the top. The additional models are represented by the blue boxes, while the red boxes represent exogenous factors. The additional models are smaller models used to forecast variables such as wage growth, private consumption, investment and imports. We also look at conditions related to financial stability. The results produced by the core model and the additional models are tested against each other, and by means of an iteration process based on judgment we arrive at forecasts we believe are reasonable.

The forecasts that result from the models can be referred to as model-consistent. These forecasts will not necessarily be consistent with the Bank's perception of realistic economic developments. This is because the models are too simple to describe the real world, and as a rule, judgment will need to be applied to adjust the forecasts. Judgment is used to ensure that the forecasts for the different variables are economically consistent.

The work on models at Norges Bank has partly been focused on describing the role of the interest rate in the economy and partly on developing models that may be

Chart 5 The basis for the projections

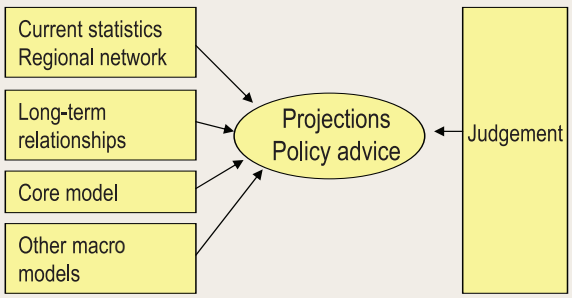
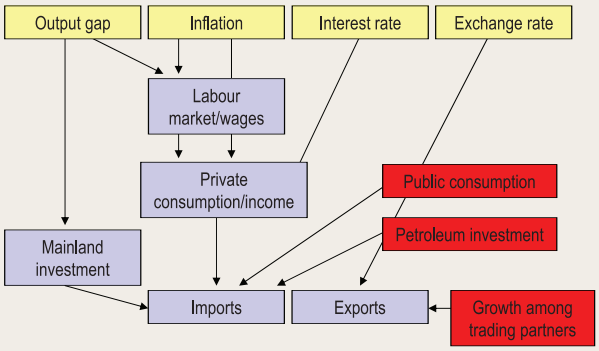


Chart 6 The system of models in the projection process



[7] See Husebø, T. A., S. McCaw, K. Olsen and Ø. Røisland (2004): "A small calibrated macro model to support inflation targeting at Norges Bank", Staff Memo 2004/3, Norges Bank, see www.norges-bank.no.

useful to decision-makers. A central element of the core model is that agents are forward-looking, reacting to expected economic developments. In recent years, a number of central banks have developed models of this type. However, it must be stressed that our core model and the models we develop only provide a very simplified description of reality. The Bank's forecasts are based on a broad range of different sources of information, with judgment as a substantial component.

Important elements in the assessment of what a good interest rate path is – and which underline the judgment component in this assessment – are reflected in six criteria that should be satisfied. The criteria are:

1. If monetary policy is to anchor inflation expectations around the target, the interest rate must be set so that inflation moves towards the target. Inflation should be stabilised near the target within a reasonable time horizon, normally 1-3 years. For the same reason, inflation should also be moving towards the target well before the end of the three-year period.

2. Assuming that inflation expectations are anchored in the target, the inflation gap and the output gap should be in reasonable proportion to each other until they close. The inflation gap and the output gap should normally not be positive or negative at the same time further ahead.

3. Interest rate developments, particularly in the next few months, should result in acceptable developments in inflation and output also under alternative, albeit not unrealistic assumptions concerning the economic situation and the functioning of the economy.

4. The interest rate should normally be changed gradually so that we can assess the effects of interest rate changes and other new information about economic developments.

5. Interest-rate setting must also be assessed in the light of developments in property prices and credit. Wide fluctuations in these variables may in turn constitute a source of instability in demand and output in the somewhat longer run.

6. It may also be useful to cross-check by assessing interest rate setting in the light of some simple mone tary policy rules. If the interest rate deviates systematically and substantially from simple rules, it should be possible to explain the reasons for this.

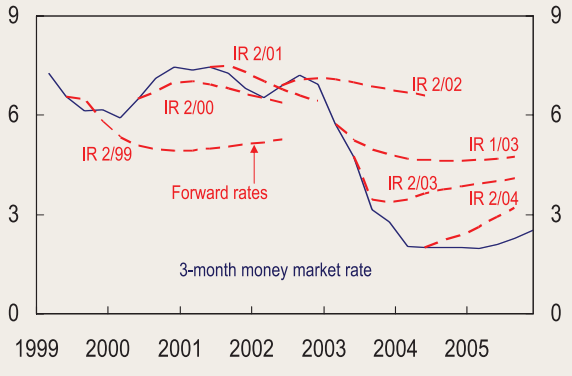
These criteria are important guidelines in forecasting an interest rate that provides a reasonable balance in monetary policy. Of course, the criteria cannot provide a precise instruction as to how the interest rate should be set, but points to factors we should have taken into account and assessed. In some contexts, the various criteria may be in conflict. In these situations, it is particularly important to exercise judgment in the trade-off between the different objectives of monetary policy.[8]

Uncertainty surrounding future interest rate developments

What I have said so far about interest rate forecasts has perhaps left the impression of an exaggerated belief in control. This was not my intention. Our recent history underscores that economic developments involve a great deal of uncertainty. Even if the Bank publishes a forecast for the interest rate, this does not mean that the interest rate will follow the forecast throughout the projection period. Forecasts for inflation, output, the interest rate and other variables are based on an assessment of the current situation and a perception of how the economy functions. Disturbances to the economy may result in changes in the forecasts. Our ambition must be to reduce uncertainty with regard to our own response pattern. That actual interest rate developments will deviate somewhat from Norges Bank's forecast must be expected to be the rule rather than the exception. There is, in other words, substantial uncertainty associated with future interest rates. I would draw your attention to the fact that the Executive Board, when providing a more precise indication of where the interest rate level should lie over the coming four month period, operates with an interval of around one percentage point. Uncertainty does not of course diminish as we look further ahead.

This is a familiar situation for financial market participants, who are constantly changing their expectations concerning future interest rates as the economy is exposed to disturbances. Market participants' interest rate expectations can be calculated on the basis of observed money market rates, see Chart 7. The devia-

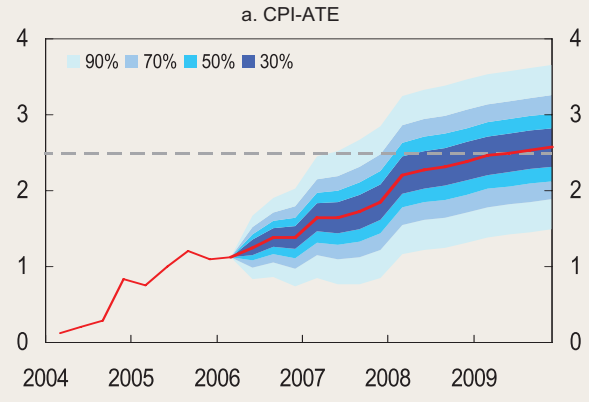
Chart 7 Market participants' interest rate expectations and actual interest rate developments

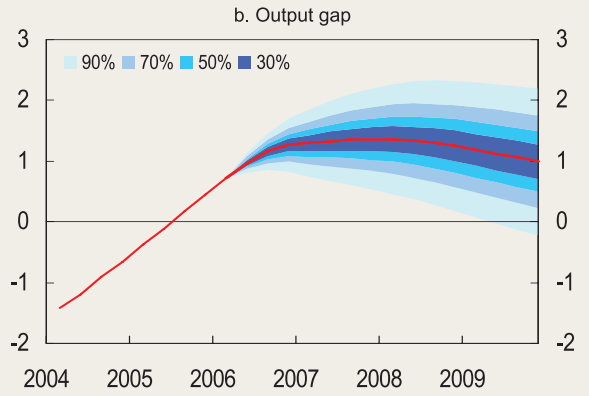


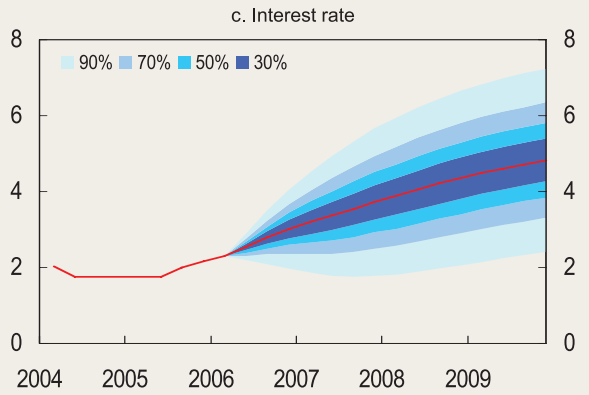
Source: Norges Bank

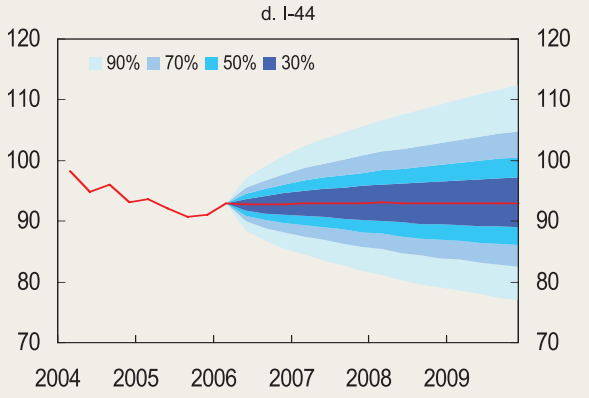
[8] For more about these criteria, see Qvigstad, J.F.Q. (2005): "When does an interest rate path "look good"? Criteria for an appropriate future interest rate path - A practician's approach", Staff Memo 2005/6, Norges Bank, see www.norges-bank.no.

Chart 8 Uncertainty surrounding the projections. IR 1/06









tion between market expectations and the actual interest rate has been substantial in periods. One important reason for this is that the Norwegian economy has been exposed to unexpected disturbances, often originating in the global economy. As a result, market participants have constantly had to change their assessments of future interest rate developments. There is no reason to believe that Norges Bank will not also have to reassess its interest rate forecasts as new information emerges about economic developments.

While Norges Bank now publishes forecasts for inflation, output and the interest rate, we also try to provide information about the uncertainty in these variables. Chart 8 shows the projections in *Inflation Report* 1/06. Uncertainty is illustrated by fan charts. The broader the fans are, the more uncertain are the forecasts. For example, our calculations indicate that there is a 90 per cent probability that the interest rate towards the end of 2009 will lie in the interval 2½ - 7 per cent. Uncertainty with regard to the interest rate reflects uncertainty in inflation, output and the exchange rate when the central bank's response pattern is taken into account. In other words, uncertainty with regard to the interest rate reflects the monetary policy response to unexpected disturbances in inflation, output and the exchange rate.

There is considerable uncertainty associated with constructing these fan charts. Not only are the forecasts themselves uncertain, but the forecasts' uncertainty is also uncertain. The core model, described above, serves as a useful tool in constructing fan charts. The fan charts are of course only indicative and depend on a number of model-based technical assumptions. The model incorporates relationships for the demand and supply side of the economy. In addition, a relationship for interest-rate setting is included. Within the framework of the model, we have sought to quantify uncertainty in key variables such as inflation, output, the interest rate and the exchange rate, based on the disturbances in the Norwegian economy in the period 1993-2005. Within the structure of the model, we have exposed the economy to similar disturbances ahead through Monte Carlo simulations of add factors. This gives an indication of uncertainty surrounding the different variables based on historical disturbances. Monetary policy responds to disturbances to the other variables. This increases uncertainty about the future interest rate, but at the same time reduces uncertainty in the other variables.

In other words, there are strict, model-based technical assumptions behind the fan charts we use to illustrate uncertainty in our forecasts. It goes without saying that it is difficult to be very precise as to exactly how great the uncertainty will be. Nevertheless – in spite of these strict model-based technical assumptions – the fan charts illustrate an important point: that the forecasts are very uncertain.

Norges Bank seeks to achieve an interest rate path that provides a reasonable balance between the objective of

stabilising inflation at target and the objective of stabilising developments in output and employment. Monetary policy influences the economy with a lag; when the interest rate has been set, a period of time elapses before the effects on inflation and the real economy can be observed. In periods, inflation will deviate from the target while output will also deviate from potential output. A successful monetary policy provides the economy with a nominal anchor and contributes to stabilising the economy. This reduces the uncertainty associated with future inflation.

Conclusion

Assessing uncertainty is an important part of the central bank's communication strategy. An explicit forecast for inflation, output and the interest rate, in addition to assessing uncertainty in the forecasts, is intended to enable economic agents to better understand the central bank's intentions in its interest-rate setting. When the economy is exposed to disturbances, agents will have a basis for predicting the central bank's interest rate response and helping to ensure that market interest rates move in the right direction, thereby increasing the effectiveness of monetary policy.

Norges Bank has in recent years taken a number of steps towards greater transparency in monetary policy. The strategy intervals are published at the beginning of the period to which they apply. Each monetary policy meeting is followed by a broad review of the most important factors underlying the interest rate decision. The use of the Bank's own forecasts for the interest rate path in the *Inflation Report* can be viewed as a further step towards increased transparency with regard to the basis for monetary policy.

Financial stability and monetary policy – theory and practice

Kjersti Haugland, economist, and Birger Vikøren, director, both in the Financial Markets Department [1]

Both price stability and financial stability are important for achieving macroeconomic stability. It is not clear-cut, however, what weight should be attached to financial stability and price stability considerations, respectively, when making monetary policy decisions. Nevertheless, both the communication and the monetary policy decisions of central banks indicate that financial stability is in the process of acquiring a more distinct role in monetary policy. This can be ascribed to the recognition that financial stability has consequences for future developments in inflation and output. In Norway, financial stability assessments are incorporated in the monetary policy advisory process, as Norges Bank Financial Stability contributes information, forecasts and recommendations in the process leading to monetary policy decisions.

1 Introduction

Central banks aim to promote economic stability, usually by targeting price stability and financial stability. In monetary policy regimes that target low and stable inflation, the key interest rate is the main policy instrument. However, the level of and the changes in this policy rate may also have an impact on financial stability. In some situations, the two objectives may be in conflict.

What weight should be attached to financial stability and price stability considerations, respectively, when making monetary policy decisions? Financial instability normally develops over a long period, and there are considerable problems associated with operationalising and measuring financial stability. The challenges linked to modelling the interplay with monetary policy are even greater. Flexible inflation targeting, where emphasis is placed on both variability in inflation and variability in output and employment, is a framework where the outlook for financial stability may have monetary policy consequences to the extent that it influences future inflation and output.

External communication and policy decisions in a number of central banks indicate that taking account of financial stability has consequences for practical monetary policy. At Norges Bank, financial stability assessments are part of the preparations leading up to monetary policy decisions. Norges Bank Financial Stability[2] contributes by compiling and evaluating information from the financial sector as well as information concerning the financial position of households and enterprises. In addition, it provides specific recommendations on the monetary policy strategy in the light of the financial stability outlook, where projections of macroeconomic variables of importance to financial stability figure prominently in the assessments.

Section 2 of the article discusses the relationship between price stability and financial stability, and its consequences for the conduct of monetary policy. Section 3 considers three aspects of Norges Bank's incorporation of financial stability in monetary policy: the underlying motivation; the specific contributions; and the basis for the assessments.

2 The link between price stability and financial stability

Both price stability and financial stability are important for achieving macroeconomic stability. When inflation is low and stable, economic agents are in a better position to distinguish relative price changes from changes in the general price level. A more reliable information set underlying decisions on resource allocation contributes to stability in credit and securities markets, and price stability thus contributes to financial stability. Similarly, financial stability is a prerequisite for macroeconomic stability. Instability in the financial system may lead to pronounced fluctuations in monetary variables and in the real economy. Hoggarth et al. (2001) showed that financial crises entail not only financial costs, but also costs in the form of lost output. A smoothly functioning financial system also contributes to promoting macroeconomic stability. Deeper financial markets have probably increased the capacity of the financial system to absorb adverse shocks to the economy. White (2002) points to the emergence of a steadily increasing diversity of credit channels. New instruments are better suited to transferring various types of risk to those best able to cope with it. In addition to banks, institutions that channel credit include securities markets, pension funds, insurance companies and mortgage companies that specialise in high risk projects. White (2002) also stresses that financial institutions now measure risk more accurately, and that it has become simpler and cheaper to access and to exchange information. This helps markets to function more efficiently during periods of turbulence.

Although the objectives of price and financial stability are compatible in many situations, this provides no guarantee of financial stability during periods of price stabil-

[1] We should like to thank Kristin Gulbrandsen, Kjersti-Gro Lindquist, Ingvild Svendsen,Thorvald Grung Moe, Tor Oddvar Berge, Dag Henning Jacobsen, Øistein Røisland and Morten Jonassen for useful comments and suggestions.

[2] Norges Bank's work on price stability and financial stability is divided between two separate organisational areas: Norges Bank Monetary Policy (NBMP) and Norges Bank Financial Stability (NBFS).

ity. Since the episodes of high and unstable inflation in the 1970s, inflation has been reduced and become more stable in most countries. Nevertheless, there have been a number of incidents where the financial system has been under pressure, with large fluctuations in asset prices and debt levels. In the most serious cases, these have developed into financial crises.

Much of the explanation for the episodes of financial instability must be ascribed to problems associated with the transition from a regulated to a liberalised financial system (see Allen and Gale, 1999)[3]. Financial liberalisation may to some extent have increased the volatility of the financial system, because inherent pro-cyclical forces in financial markets are subject to fewer restrictions than before (Borio et al. 2001). On the other hand, increased system volume and liquidity serves to create greater stability.

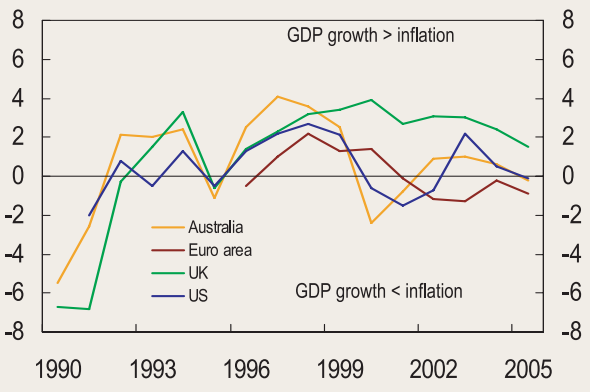
The recent relatively long period of low and stable inflation has shown that strong economic growth does not necessarily result in high inflation (see Chart 1).

If the cause of the strong growth is a positive supply side shock, for example in the form of stronger international competition or higher productivity, inflation will remain low. In such situations, it can therefore be argued that there is less of a case for tightening monetary policy. The combination of moderate interest rates and strong economic growth may then lead to an upswing in asset and property prices. This will tend to lead to an increase in bank lending, because economic agents need more capital to purchase assets. There is a risk of their becoming overly optimistic in their assessment of the future. A number of studies have shown that risk perceptions tend to depend on the current state of the economy.[4] If economic agents systematically overestimate the probability that the economy will continue to grow at the same high pace, this may lead to an excessive rise in asset prices relative to fundamentals. The new higher debt level may then be unsustainable over time for economic agents. At some point in time, for example when economic growth begins to stagnate, imbalances may unwind abruptly. If they have been extensive, the effect may feed through into the financial system and the real economy, through falls in collateral values and a decline in the debt-servicing capacity of households and enterprises[5]. This happened during the Nordic banking crises in Norway, Sweden and Finland in the late 1980s and early 1990s.

Thus price stability is no guarantee of financial stability. A somewhat more controversial view is that monetary policy oriented towards low and stable inflation may be a source of financial instability. Borio and Lowe (2002) take a case in which monetary policy, aimed at low and stable inflation, is accorded a high degree of credibility by economic agents. They take low inflation as a given in wage settlements and price-setting, even in a situation where the economy is approaching full capacity utilisation. This delays price signals in the products market, which in turn delays the monetary policy response to demand pressures. The pressures may instead be manifested in the form of an upswing in asset prices and the debt level, variables that are not affected by inflation expectations, and to which monetary policy does not respond. By the time inflationary pressures ultimately feed through to the products market, financial imbalances have had a chance to build up.

The relationship between price stability and financial stability is normally benign, but it may change over time. Monetary policy-makers may therefore have to consider whether to trade the two objectives off against one another. The emergence of ever more relevant literature on this subject in recent years bears witness to a growing recognition that dilemmas of this kind can arise. Should there be a trade-off between the objectives of financial stability and price stability in monetary policy decision-making? Conclusions based on theoretical models vary, but central bank practice appears to be fairly similar.

Chart 1 Difference between GDP growth and consumer price inflation in selected countries. Annual figures. 1990-2005



Source: EcoWin

Challenges in taking account of financial stability in monetary policy

Financial stability is important in the conduct of monetary policy. As discussed above, the state of the financial system has a direct impact on the economic objectives that the central bank attempts to attain. Moreover, financial stability plays a more concrete role in the conduct of monetary policy. A smoothly functioning financial system enhances the effect of changes in the central bank's policy rate on money market rates. These are the interest rates that ultimately influence the central bank's monetary policy objectives through their impact on consumption and investment.

In order to take explicit account of financial stability in the conduct of monetary policy, financial stability must be clearly defined. The concept is complicated and diffi-

[3] For example, one of the key factors triggering the Norwegian banking crisis was the failure to dismantle the artificially low, politically regulated interest rates following the deregulation of the credit system. For a further elaboration of the Norwegian banking crisis, see Moe et al., 2004.

[4] See for example Borio, Furfine and Lowe (2001).

[5] An asset price correction will result in a fall in collateral values, which in turn may lead to a credit squeeze. Bordo and Jeanne (2002) show that this may lead to undesirable boom-bust investment cycles (see also Kiyotaki and Moore, 1997).

cult to operationalise[6] and this field of research is still in its early phase. Developments in financial stability cannot be captured in a simple qualitative measure (see Houben et al., 2004). The state of financial institutions, markets and infrastructure is decisive, but it is not obvious how to include and weight the elements in appropriate intermediate objectives. Moreover, there must be an understanding of how financial stability is influenced by factors within and outside the financial system, and what conditions actually threaten financial stability.

A common definition of financial stability is the absence of imbalances in financial markets (Foot, 2003). There is an ongoing debate as to whether the central bank should react using the precautionary principle by tightening monetary policy to counter the emergence of imbalances in the financial system. There are many challenges involved in such an approach (see e.g. Bernanke and Gertler, 2001). Identifying imbalances requires the identification of the causes underlying developments in asset prices, which is a difficult task. The relationship between sharply rising asset prices and debt accumulation and a period of financial instability varies over time. A monetary policy response would not necessarily be able to reduce the imbalances, and the degree of precision might be low. An excessive tightening of monetary policy may lead to instability in other sectors of the economy. If central banks have a stated strategy of responding to imbalances, this may have a negative effect on economic agents' behaviour by impairing their assessment of future risk. In that case, the monetary policy strategy could create imbalances rather than preventing them.

Nickell (2005) illustrates these difficulties by looking at the surge in house prices in the UK in 2002. In his analysis, he finds that an interest rate increase of about 3 percentage points over three years would be necessary to curb the rise in house prices. Nickell's calculations show that such a monetary policy response would have led to a decline in GDP growth of ½ per cent in 2003. In addition, Nickell argues that it is difficult, both in real time and in retrospect, to determine whether the rise in house prices actually represented an imbalance.

The difficulties relating to identification and implementation may indicate that monetary policy should only be used as a reactive instrument to alleviate the effects of a financial crisis, and not as a proactive instrument to prevent financial imbalances (see Greenspan, 2002). Those who are still in favour of a precautionary approach to financial imbalances recognise the problems above, but argue that the costs of not responding are too high to disregard. Borio and Lowe (2004) argue that there are also serious estimation and identification problems associated with other variables, such as the output gap[7]; a key variable in monetary policy analyses. The challenges of identifying and measuring financial imbalances should therefore be addressed. Gruen et al. (2003) argue that three factors are decisive in determining whether the precautionary principle should be applied. The likelihood that imbalances will resolve themselves should be low, efficiency losses associated with the bubble should be high and the expected effect of monetary policy on bubbles should be substantial.

The activist view has often been referred to as "leaning against the wind"[8], and entails increasing the key rate in response to emerging financial bubbles with the aim of reducing the likelihood of future economic instability and the costs that would imply. This can be likened to an insurance policy, where the insurance premium is the cost of potentially lower economic growth for a period (Bordo and Jeanne, 2002).

Many countries have introduced an explicit inflation target for the conduct of monetary policy. In addition to stabilising inflation, weight is commonly given to short-term stabilisation of the real economy, known as flexible inflation targeting[9]. Bean (2003) argues that a flexible inflation target takes sufficient account of the objective of financial stability in the conduct of monetary policy. A financial crisis or a sharp unwinding of financial imbalances may have an adverse impact on future inflation and output. Central banks should therefore give weight to such events in their maroeconomic forecasts and respond accordingly. The outlook for financial stability will have monetary policy implications to the extent that as it has consequences for future inflation and output. Thus, a separate financial stability objective for monetary policy is not necessary. Moreover, flexible inflation targeting ensures that economic agents will not be charged high interest rates at the same time as unemployment is high and demand in the economy is low. Critics argue that it takes a long time for financial imbalances to build up and that flexible inflation targeting should thus apply a longer time horizon in the assessment of the outlook for inflation and output. The need for greater emphasis on the distribution of risk around future expectations has also been highlighted (see Borio, 2005).

The costs associated with financial instability are not necessarily linked to the effects on prices and output. For example, structural costs may arise as a result of poor decisions by agents using faulty information. It can be argued that flexible inflation targeting, where the focus is only on the costs of imbalances in the form of future inflation or production, does not give sufficient weight to financial stability[10]. This view implies that financial stability should be an independent objective of monetary policy. In addition to the operational challenges associated with such a monetary policy regime, one can argue that agents will have difficulty understanding the monetary policy strategy and hence struggle to form stable expectations about the central bank's

[6] For a discussion of different definitions of financial stability, see e.g. Schinasi (2004).

[7] The output gap can be defined as the difference between actual output and potential output in an economy, and is then used as a measure of pressures in the economy.

[8] Trichet (2005) defines "leaning against the wind" as increasing the interest rate to or over the level that is necessary to maintain price stability in the near and medium term when a potentially adverse increase in asset prices has been identified.

[9] For a further discussion of flexible inflation targeting, see Svensson (2003).

[10] See, for example, the discussion in Norges Bank Watch 2005.

response pattern when this involves a trade-off between several different objectives.

International practice among central banks reflects a growing awareness of financial stability issues in the conduct of monetary policy[11]. In situations where the financial system is under pressure, there appears to be agreement that monetary policy should be used to promote financial stability (Gjedrem 2005). As regards the question of whether the central bank should respond to long-term imbalances, the communication and practice of central banks reflect a similar view, albeit with different rationales. In a speech given in 2002, Federal Reserve Chairman Ben Bernanke, then member of the FOMC, took a positive view to giving weight to financial balances in the conduct of monetary policy to the extent that they have an impact on inflation. ECB President Jean Claude Trichet argued in a speech in June 2005 that allowing short-term deviations from price stability on the basis of financial imbalances could in some cases be an optimal monetary policy if this better ensures price stability in the longer run (Trichet, 2005).

The *BIS Annual Report* (2005) points out that both the Bank of England and the Reserve Bank of Australia indicated that concerns about rising house prices and debt played a role, along with strong demand growth, in explaining their interest rate increases in 2005. Sveriges Riksbank, for similar reasons, did not lower interest rates as much as might have been expected given that it was actually undershooting its inflation.

The objective of financial stability thus seems to have a bearing in the practical conduct of monetary policy, but how do central banks approach this issue in practice? The next section explores three aspects of incorporating financial stability into Norges Bank's monetary policy: the motivation, specific contributions and basis for the assessments.

3 Financial stability and monetary policy in Norges Bank

Norges Bank's monetary policy is oriented towards low and stable inflation. Inflation targeting shall be flexible so that weight is given to both variability in inflation and variability in output and employment. The Executive Board sets the key rate. The Executive Board is composed of five external members in addition to the central bank governor and deputy governor. Three times a year, the Executive Board decides on a strategy for the implementation of monetary policy over the subsequent four-month period. Interest rate decisions are normally taken by the Executive Board at its monetary policy meetings held every sixth week. Norges Bank Monetary Policy plays a key role in the preparatory work for the monetary policy meetings and the strategy discussion. Their work includes projections for economic variables and monetary policy analyses. Norges Bank Financial Stability (NBFS) also participates in the process by contributing information, assessments, forecasts and advice. This role is further discussed below.

Motivation

In its work on financial stability, Norges Bank monitors financial institutions and securities markets in order to identify developments that may weaken the stability of the financial system. The assessments are published biannually in the report *Financial Stability*. The assessments of financial stability are also included in the preparatory work for the monetary policy meetings. The Governor of Norges Bank, Svein Gjedrem, discussed the underlying motivation for this in a speech (Gjedrem, 2005). He highlighted three aspects:

- Monetary policy should pay sufficient attention to the potential risks to financial stability.
- In monetary policy work, all available information that may influence future inflation and output should be taken into account. One of the six criteria for evaluating monetary policy strategy reflects one aspect of this: *"Interest-rate policy must also be assessed in the light of developments in property prices and credit. Wide fluctuations in these variab les may in turn constitute a source of instability in demand and output in the somewhat longer run."*[12]
- Structural and empirical information about factors central to analyses of financial stability, such as financial markets, asset prices, financial institutions and the debt-servicing capacity of households and enterprises, provide extra information about developments in the Norwegian economy.[13]

The specific contributions

NBFS contributes in the preparations leading up to monetary policy decisions by compiling, sorting and evaluating information with a bearing on financial stability. The information is used in the overall assessments of the economic situation and the future outlook that is presented in the *Inflation Report*. NBFS also provides the Governor with specific advice on the monetary policy strategy three times annually in the light of the financial stability outlook. The advice contains an evaluation of the prospects for a build-up of financial imbalances in the long term. This is analysed mainly by means of projections of macroeconomic variables with a particular bearing on financial stability.

In connection with the monetary policy meetings every six weeks, NBFS advises the Governor as to which interest rate decision will best safeguard financial stability.

[11] For a further discussion, see Gjedrem (2005).

[12] *Inflation Report* 3/05

[13] The financial stability outlook is reported twice a year in the Financial Stability report, which has been published since 1997.

This advice does not weigh up the objective of financial stability against that of attaining the inflation target. The written contribution contains short-term assessments of the prospects for acute liquidity and solvency problems in the financial sector. The risk of a build-up of financial imbalances that may threaten financial stability over time is also discussed. This discussion is closely related to the analyses in the input to monetary policy strategy and the *Inflation Report.*

Assessments

A large range of data and analytical tools can be drawn upon in the work of providing input for monetary policy. Banks, households, enterprises, financial markets and asset prices are all important factors in evaluating financial stability. The situation of the household sector and the enterprise sector, in particular, are thoroughly analysed from both a macro- and a micro-perspective, because they affect banks' credit risk. This constitutes important information in the monetary policy process.

Macroanalyses

Macroanalyses, with the focus on households, enterprises and financial institutions as a group, feature prominently in NBFS's input into the process that culminates in monetary policy decisions. The analyses are based largely on macroeconomic equations which are estimated for variables that are indicators of the situation in these sectors.

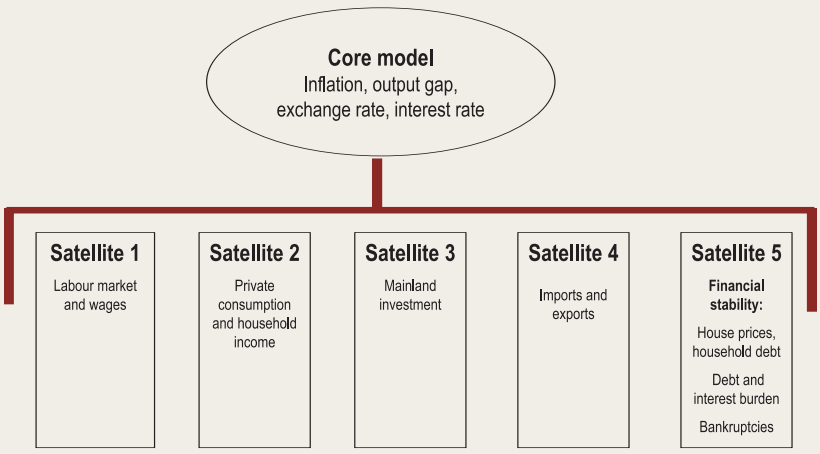
Bankruptcy trends are an important indicator of the debt-servicing capacity of enterprises. Jacobsen and Kloster (2005) have modelled an equation for bankruptcy developments in which the real interest rate, real exchange rate, level of activity in Norway and abroad, real production costs and commercial property prices are all included as explanatory factors. In a small, open economy like that of Norway, the international competitiveness of enterprises is particularly important. The empirical analysis indicates that developments in the krone exchange rate and domestic production costs relative to foreign costs can substantially influence the number of bankruptcies, and hence financial stability.

Historically, banks' losses on loans to households have been relatively low compared with losses on loans to the corporate sector, and the credit risk on loans to enterprises is therefore higher than that on loans to households. The situation in the household sector is nevertheless important for two reasons. First, households account for an increasing share of bank loans. The potential impact of the household sector on the financial system has therefore increased. Second, pronounced negative developments in the household sector will lead to enterprises experiencing a fall in demand. Such an indirect effect may have substantial consequences for the total credit risk of banks. The estimated macroeconomic equations for developments in house prices and household debt are central to analyses of the household sector (Jacobsen and Naug, 2004, 2005). Interest rates, housing starts, unemployment and household income are the most important explanatory factors behind house price developments, which in turn constitute the key explanatory factor for developments in household debt. A change in house prices has a strong and prolonged effect on household debt, because it takes time before all dwellings are sold at the new price level. Other explanatory variables for household debt are housing stocks, interest rates, unemployment, turnover in the housing market and wage income.

NBFS has linked its econometric macro-equations to Norges Bank's forecasting and policy analysis system (FPAS)[14]. They form part of the financial stability satellite, which is still being developed and which is linked to the core model and other satellites in the system (see Chart 2).

FPAS enables us to analyse developments in the real economy and the financial system within a common framework, with internally consistent paths for central economic variables. The system can also be used for analysing alternative risk scenarios for macroeconomic developments. A common database and infrastructure simplify cooperation between NBFS and NBMP. The system does not include explicit channels for the repercussive effects of the variables in the financial stability satellite on the core model or other satellites.[15] Results from the financial stability satellite are nevertheless used as input for the qualitative analyses of the household and corporate sectors, and may thus have repercussive effects on macroeconomic estimates.

Chart 2 Forcasting and policy analysis system



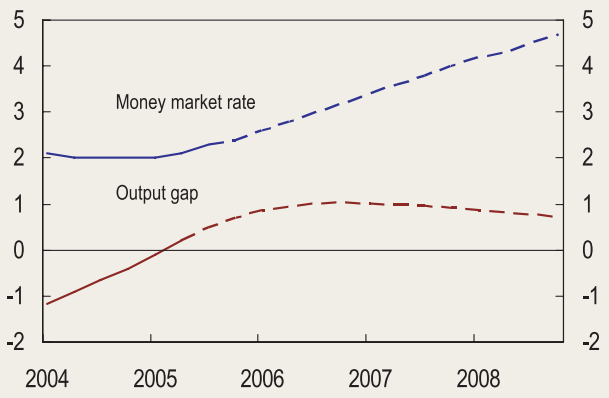
[14] For a more detailed account of the FPAS, see Qvigstad (2005).

[15] In addition, NBFS uses a small-scale estimated aggregated model to capture the effects of the financial sector on the rest of the economy. When different monetary policy strategies are to be evaluated in the light of the financial stability outlook, such effects may be important.

Chart 3 shows the projections for money market rates and the output gap through the forecast period in *Inflation Report* 3/05. Chart 4 shows projections for developments in house prices and household debt, which are based on the projections for interest rates and other macroeconomic variables upon which the report is based. A gradual rise in interest rates contributes to curbing the rise in house prices and debt growth after a while. It is important to bear in mind that models are uncertain, and that the estimates must be interpreted with caution.

In NBFS's input into the monetary policy strategy, macroanalyses are used as a basis for evaluating the outlook for the financial position of households and the enterprise sector. A development that strengthens their financial position will reduce banks' credit risk, and thereby improve the financial stability outlook. The consequences of various interest rate paths are analysed in order to identify the monetary policy that best safeguards financial stability. The interests of the household and enterprise sectors may be in conflict, as illustrated by developments in the Norwegian economy in recent years. Norway has experienced a period with a strong rise in house prices and household debt growth. An interest rate increase may curb this rise, and thereby reduce the risk of more unstable economic developments in the long term. This will contribute positively to financial stability. On the other hand, a rise in interest rates could lead to an appreciation of the krone, and thereby increase the number of bankruptcies in the enterprise sector. This will contribute negatively to financial stability. In NBFS's advice on monetary policy strategy, these two considerations must therefore be weighed against one another, and the FPAS system is a tool for assisting in this process.

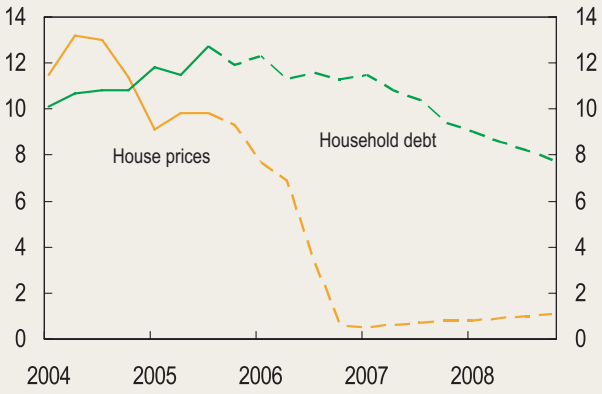
Chart 3 Money market rate and output gap in *Inflation Report* 3/05. 2004 – 2008[1]



[1] Projections from 2005

Source: Norges Bank

Chart 4 Rise in house prices and household debt in *Inflation Report* 3/05. 2003 – 2008[1]



[1] Projections from 2005

Sources: Norwegian Association of Real Estate Agents, Association of Real Estate Agency Firms,,FINN.no, ECON and Norges Bank

Microanalyses

Microanalyses focus on individual households, enterprises and financial institutions.

Norwegian microdata on these areas are of high quality and are relatively easily available, and form a valuable basis for Norges Bank's macroeconomic monitoring and modelling.

Household microdata are based on Statistics Norway's Income Distribution Survey. This survey provides information on the financial position of a representative sample of households. The last survey (2003) covered 17 000 households. This material can be used to reveal how many households have a high debt burden, and the share of total debt that is attributable to these households. We can also determine how financial wealth is distributed, and how many households with a large amount of debt also have small financial buffers. The analyses indicate how vulnerable households are to unexpected negative economic shocks.

In the enterprise sector, the microanalyses are based on accounts figures for all Norwegian limited companies, of which there were 125 000 in 2004. Detailed analyses can therefore be carried out of developments in the profitability and financial strength of various enterprises and industries. A bankruptcy prediction model has also been developed which is estimated on these data.[16] The model provides estimates of the probability of individual limited companies going bankrupt in the course of the next three accounting years. The probability is a function of age, size, industrial characteristics and accounting variables which represent the company's earnings, liquidity and financial strength.[17] By combining the individual bankruptcy probabilities, a measure is obtained of the bankruptcy risk facing the enterprise sector as a whole. Moreover, by multiplying the debt of the individual

[16] For a presentation of the SEBRA model, see Eklund et al. (2001).

[17] Syversten (2004) compares the prediction capability of the SEBRA model with that of Moody's KMV Private Firm model for Norway. He concludes that the precision of SEBRA is just as high as, or somewhat higher than, the precision of the KMV model.

enterprise with the corresponding bankruptcy probability, an estimate can be obtained of banks' risk-weighted debt. This may be an indicator of banks' prospects of losses on loans to enterprises.[18]

Microdata for households and enterprises are used to supplement and add detail to the picture provided by the macroanalyses. If one group of households has the largest share of the debt, while another group has the largest share of the wealth, this may constitute a risk factor for financial stability, even if the overall situation appears satisfactory. Microdata are only published once a year, and are mainly commented upon when new data are available. Nevertheless, the conclusions drawn from the analyses always form a part of the assessments provided in NBFS's interest rate recommendations.

Financial markets

In the input to monetary policy strategy, assessments of financial markets are used to supplement the assessments of the economic balance of risks in the period ahead. It is desirable that prices in financial markets reflect the fundamental value of the underlying object. This will reduce the risk of abrupt, substantial price changes which would affect the value of the financial reserves of financial institutions. A sudden change in prices in the equity market will also affect the earnings of listed companies and households, and thus affect the credit risk of banks. Such shocks may thus threaten financial stability.

Financial markets are particularly volatile and difficult to model. Nevertheless, various indicators may help to reveal valuations and driving forces in markets.[19] The ratio of share prices to expected earnings (P/E) is one such indicator. A rise in share prices may reflect an upward adjustment of expectations regarding companies' future earnings, so that the P/E ratio remains unchanged. A rise in the P/E ratio may be due to a lower risk premium. Sharp upswings in financial markets due to investors' underestimating future risk may give rise to turbulence. The degree of uncertainty associated with future price developments can be measured by means of implied volatility indicators.

In the input to monetary policy strategy, a broad set of valuation indicators for the financial market are discussed, with a view to identifying the potential for substantial price changes in securities markets which may be a source of economic instability. Market expectations regarding future economic developments are also discussed. There is a particular focus on equity markets and the earnings growth and risk premia that are priced into share prices.

Overall assessment

The assessments of financial institutions, enterprises and households, and developments in financial markets are combined to provide a qualitative overall picture of the financial stability outlook. This picture is thoroughly documented in the Financial Stability report. Recommendations are also provided on the interest rate path that will best safeguard financial stability in the period ahead. The insight and recommendations become part of the basis for monetary policy decision-making through the established channels, which ensures a focus on financial stability considerations in monetary policy. In addition, micro- and macro-knowledge of the financial system and the financial position of households and enterprises provide extra information on developments in the Norwegian economy.

Norges Bank's Executive Board receives an overall recommendation concerning the monetary policy strategy and the interest-rate decision. The financial stability outlook is also assessed in the recommendation. The Executive Board's assessments and trade-offs are presented in the discussion of monetary the policy strategy and press releases associated with interest rate decisions. The discussion of the background to the monetary policy strategy adopted on 2 November 2005 includes the statement that "Safeguarding financial stability implies that the interest rate should be brought up towards a more normal level." Following an overall assessment of the economic outlook, the Executive Board concludes that "the interest rate may gradually – in small, not too frequent steps – be brought back towards a more normal level. (…) The interest rate path presented in this Report will provide a reasonable balance between the objective of bringing inflation up to target and the objective of stabilising developments in output and employment, conditional on the information Norges Bank has at this juncture."

4 Conclusion

Financial stability and the interplay between financial stability and monetary policy are relatively new fields of research which are continuously evolving. There is no simple answer to the question of how much emphasis the central bank should place on financial stability considerations in its monetary policy. Nevertheless, both the communication and the monetary policy decisions of central banks indicate that financial stability is in the process of acquiring a more distinct role in monetary policy. This can be ascribed to recognition that financial stability has consequences for future developments in inflation and output. In Norway, financial stability assessments are incorporated in the monetary policy advisory process, as Norges Bank Financial Stability contributes information, forecasts and advice in the process leading to monetary policy decisions.

[18] The results must be interpreted in the light of the strong probability that the banks will recover part of the loan in the event of bankruptcy, so that the losses will be less than indicated by the risk-weighted debt.

[19] For a discussion of the use of financial market indicators, see for example the special feature in the ECB's Financial Stability Review, December 2005. "Measurement challenges in assessing financial stability".

References

Allen, Franklin and Douglas Gale (1999): "Bubbles, crises and policy". *Oxford Review of Economic Policy* no. 15(3), pp. 9-18

Bean, Charles (2003): "Asset Prices, Financial Imbalances and Monetary Policy: Are Inflation Targets Enough?". BIS *Working Paper* no. 140

Bernanke, Ben (2002). "Asset price 'bubbles' and monetary policy". Remarks before the New York Chapter of the National Association of Business Economics, New York, 15 October

Bernanke, Ben and Mark Gertler (2001): "Should Central Banks Respond to Movements in Asset Prices?", *American Economic Review* no. 91, May, pp. 253-57

BIS (2005): *75th Annual Report.* Bank for International Settlements

Bordo, Michael and Olivier Jeanne (2002): "Monetary Policy and Asset Prices: Does 'Benign Neglect' make sense?" *IMF Working Paper* no. 2/225

Borio, Claudio (2005): "Monetary and Financial Stability: so close and yet so far?". *National Institute Economic Review* no. 192, April, pp. 84-101

Borio, Claudio and Philip Lowe (2002): "Asset prices, financial stability and monetary stability: exploring the nexus". BIS *Working Paper* no. 114

Borio, Claudio and Philip Lowe (2004): "Securing sustainable price stability: should credit come back from the wilderness?" *BIS Working Paper* no. 157

Borio, Claudio, Craig Furfine, and Philip Lowe (2001): "Procyclicality of the Financial System and Financial Stability: Issues and Policy Options". In "Marrying the Macro- and Micro-Prudential Dimensions of Financial Stability", *BIS Papers* no. 1, pp.1-57

Eklund, Trond, Kai Larsen and Eivind Bernhardsen (2001): "Model for analysing credit risk in the enterprise sector". *Economic Bulletin* 3/01, Norges Bank

Foot, Michael (2003): "Protecting Financial Stability – How good are we at it?". Speech at the University of Birmingham, 6 June. <http://www.fsa.gov.uk/
Pages/Library/Communication/Speeches/2003/sp133.shtml>

Gjedrem, Svein (2005): "The macroprudential approach to financial stability". *Economic Bulletin* 2/05, Norges Bank

Greenspan, Alan (2005): "Economic Volatility". Speech at a symposium in Jackson Hole, Wyoming, 30 August 2002.
<http://www.federalreserve.gov/boarddocs/speeches/2002/20020830/default.htm>

Gruen David, Michael Plumb and Andrew Stone (2003): "How Should Monetary Policy Respond to Asset-price Bubbles?". Research Discussion Paper 2003-11, Reserve Bank of Australia

Hoggarth, Glenn, Ricardo Reis and Victoria Saporta (2001): "Cost of banking system instability: some empirical evidence". Bank of England Financial Stability Review, Issue 10, Article 5, June

Houben, Aerdt, Jan Kakes and Garry Schinasi (2004): "Toward a Framework for Safeguarding Financial Stability". *IMF Working Paper* no. 101

Jacobsen, Dag Henning and Bjørn E. Naug (2004): "What influences the growth of household debt?" *Economic Bulletin* 3/04 Norges Bank

Jacobsen, Dag Henning and Bjørn E. Naug (2005): "What drives house prices?" *Economic Bulletin* 1/05 Norges Bank

Jacobsen, Dag Henning and Thea Birkeland Kloster (2005): "What influences the number of bankruptcies?". *Economic Bulletin* 4/05. Norges Bank

Kiyotaki, Nobuhiro and John Hardman Moore (1997): "Credit cycles". *Journal of Political Economy* no. 105, pp. 211-48

Moe, Thorvald; Jon Solheim and Bent Vale, ed. (2004): "The Norwegian Banking Crisis". *Norges Bank Occasional Papers* No. 33

Nickell, Stephen (2005): "Practical Issues in UK Monetary Policy, 2000-2005". British Academy Keynes Lecture, 20 September 2005.
<http://www.britac.ac.uk/pubs/src/_pdf/nickell.pdf>

Norges Bank (2005): *Inflation Report* 3/05 with monetary policy assessments

Norges Bank Watch (2005): *An Independent Review of Monetary Policymaking in Norway*. *Norges Bank Watch Report Series* No. 6. Centre for Monetary Economics. BI Norwegian School of Management

Qvigstad, Jan F. (2005a): "Policy-making and models at Norges Bank". *Norges Bank Staff Memo* 2005/5

Schinasi, Garry J. (2004): "Defining Financial Stability". *IMF Working Paper* no.187

Svensson, Lars E. O. (2002): "Monetary Policy and Real Stabilization". In *Rethinking Stabilization Policy, A Symposium Sponsored by the Federal Reserve Bank of Kansas City,* Jackson Hole, Wyoming, 29-31 August 2002, pp. 261-312

Syversten, Bjørne Dyre H. (2004): "How accurate are credit risk models in their predictions concerning Norwegian enterprises?" *Economic Bulletin* 4/04, Norges Bank

Trichet, Jean-Claude (2005). "Asset price bubbles and monetary policy". Mas Lecture, 8 June 2005, Singapore. <http://www.ecb.int/press/key/
date/2005/html/sp050608.en.html>

White, William (2002): "Financial markets: shock absorbers or shock creators?". Speech at the Fourth Geneva Conference on the World Economy, 10 May 2002 <http://www.bis.org/speeches/sp020510.htm>

Collateral for loans from Norges Bank – new rules

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Norges Bank extends loans to banks against collateral in the form of securities. These loans are provided in connection with payment settlement and the implementation of monetary policy. Since the bond market in Norway is relatively small, Norges Bank has up to now accepted a broad range of securities as collateral. Norges Bank has thereby accepted a higher level of risk in its lending to banks than a number of other central banks. In recent years, banks' available resources in Norges Bank – sight deposits and unutilised borrowing facilities – have increased more than borrowing requirements. This has made it possible for Norges Bank to adapt the rules for collateralisation so that they are more in line with rules in other countries. The article describes Norges Bank's previous rules for collateral for loans, the background for the changes that have been made, the new rules and the consequences the changes might have for banks.

1. Introduction

Norges Bank has required its loans to banks to be fully collateralised since 1999. Banks' borrowing facilities are determined by their collateralisation, which can vary from day to day.[2] In 2005, banks' borrowing facilities largely varied between NOK 100 and 160 billion. Borrowing facilities in Norges Bank are in general important for payment settlement and the implementation of monetary policy, but small and medium-sized banks primarily use the facilities to meet the liquidity reserve requirement.[3] Collateralisation is to reduce the risk that Norges Bank will incur losses if a bank is placed under public administration. Norges Bank's requirements should therefore ensure that securities used as collateral are readily negotiable and have high creditworthiness even in periods of financial turbulence.

Government bonds are not issued to any great extent in Norway, and the supply of bonds from other public authorities has also been limited. Other types of bonds were therefore accepted as collateral in Norges Bank when the requirement for full collateralisation was introduced in 1999. These included corporate bonds and bank bonds (bonds issued by Norwegian banks and mortgage companies owned by Norwegian banks).

These liberal rules meant that Norges Bank accepted a higher level of risk than most other comparable central banks. A number of factors have now made it possible to change the rules in order to reduce Norges Bank's risk. First, banks' borrowing facilities have increased more than borrowing requirements. Second, the new Act relating to financial collateral (2004) provided for immediate realisation of collateral, allowing for banks' borrowing facilities to be calculated on the basis of market value rather than nominal value. Third, provisions have been made for the issue of asset-backed bonds in Norway. These bonds may account for a large share of banks' collateral in a few years' time.

On the basis of the above, Norges Bank has drawn up new rules. The most important changes they introduce are that i) Norges Bank will calculate banks' borrowing facilities on the basis of market value, ii) haircut rates for securities have been reduced, iii) rating requirements for Norwegian corporate bonds have been introduced, iv) a minimum-volume requirement has been introduced for bonds issued by Norwegian banks and mortgage companies owned by Norwegian banks, and v) further provision has been made for collateralisation of asset-backed bonds.

The rules were adopted by Norges Bank in August 2005 once they had been circulated for comment to the Norwegian Savings Banks' Association, the Norwegian Financial Services Association and Kredittilsynet (Financial Supervisory Authority of Norway). The rules entered into force on 24 October 2005, although parts will not apply until 1 November 2007. The changes on 24 October resulted in an increase in banks' borrowing facilities.

2. Norges Bank's previous collateral requirements

Banks can raise two types of ordinary loans in Norges Bank. (See box on borrowing facilities.) The first type is the D-loan (overnight loan), which is used in connection with payment settlements. The other is the F-loan (fixed-rate loan with varying maturity that cannot be terminated), which is used in connection with the implementation of monetary policy.

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[2] A borrowing quota in relation to a basis of measurement for each bank also applied to D-loans (overnight loans) up to 2001.

[3] See section 3.4.

2.1 Norges Bank's lending requirements from 1965 to 1999

Today, Norges Bank requires banks' loans to be fully collateralised. A similar requirement has applied in earlier periods, but in 1965 collateralisation requirements were relaxed.[4] In 1986, all collateralisation requirements were removed as a result of the currency crisis. At that time, Norges Bank supplied considerable liquidity in order to prevent a sharp increase in money market rates. Norges Bank was thereby left with large unsecured claims on banks that encountered solvency problems during the following years' banking crisis.

After consultation with the political authorities, Norges Bank provided income support in 1988 and 1989 to a savings bank in the form of subsidised interest rates and by writing down loans. In Report No. 24 (1989-1990) to the Storting concerning the banking crisis, the Ministry of Finance stated that "Writing down central bank loans to banks may (…) represent an active use of government funds that should be deliberated by the Storting in advance". The Ministry also assumed that ordinary legislative procedures would be followed in any future crisis situations in Norwegian banks and referred to the schemes established through the guarantee funds. The Standing Committee on Finance endorsed this view in its follow-up in Recommendation no. 90 (1989-90) to the Storting. This served to further clarify the division of responsibilities between the central bank, the guarantee funds and government authorities in the financial safety net. It was specified in particular that Norges Bank itself shall not increase its risk and impose losses on the state.

It was difficult to reintroduce collateralisation requirements in subsequent years. Banks had large loans but limited holdings of securities that could be used as collateral. The size of banks' loans was reduced in the course of 1993, however, and Norges Bank introduced a requirement for partial collateralisation of D-loans towards the end of the year. Norges Bank introduced a requirement for full collateralisation of D-loans from 1995, and the same requirement was introduced for F-loans in 1999.

In 1999 there was some uncertainty as to whether banks had adequate holdings of bonds that could be used as collateral. As a result, new types of bonds were also approved as collateral in Norges Bank when the requirement for full collateralisation of F-loans was introduced. These included bonds issued by private undertakings within the OECD area, bonds issued by Norwegian undertakings and bonds issued by Norwegian banks. Some of these bonds are less liquid and have lower creditworthiness than bonds approved by Norges Bank before 1999.

2.2 Main features of the 1999 rules

Banks' borrowing facilities were determined by the value of bonds they had furnished as collateral. For a bond to be used as collateral, the issuer had to be

Borrowing facilities in Norges Bank - function

Banks can raise F-loans and D-loans provided they have pledged collateral in favour of Norges Bank. The collateral can apply to both types of loan, so that collateral that has not been used as collateral for an F-loan can be used as collateral for a D-loan. These borrowing facilities serve to ensure the implementation of monetary policy and the execution of payment settlements (see Kran and Øwre, 2001).

Norges Bank's key rate is the sight deposit rate, which is the interest rate on banks' deposits in Norges Bank. Norges Bank ensures that the central bank's interest rate decisions have an impact on short money market rates through its liquidity policy. When banks' overall liquidity shows a surplus at the end of the day, market rates on deposits will not be appreciably higher than the interest rates on deposits in the central bank. Short money market rates are thus slightly higher than the sight deposit rate. Norges Bank will hold auctions of F-loans if forecasts indicate that liquidity must be supplied in order to bring banks into a deposit position. Banks can redistribute liquidity through the interbank market. This market does not, however, function perfectly, and if money market rates are to remain just above the key rate, overall deposits by banks must be of a certain size. If banks' deposits in Norges Bank are too low, the market will normally not be able to meet the requirements of some banks, and these banks will have to resort to overnight loans at an interest rate two percentage points above the key rate. This might result in higher short money market rates. Recently, Norges Bank has set the scale of F-loans to ensure that banks have had total deposits of about NOK 15 billion at the end of the day.

Even if a bank has deposits in Norges Bank at the beginning of the day, the deposits will not necessarily be large enough to meet the bank's requirements in connection with payment transactions in the course of the day. The bank can obtain liquidity to cover payments through a D-loan, which is a drawing right. A D-loan is interest-free if it is repaid in the course of the day.

[4] For a more detailed description, see Gerdrup (2004)

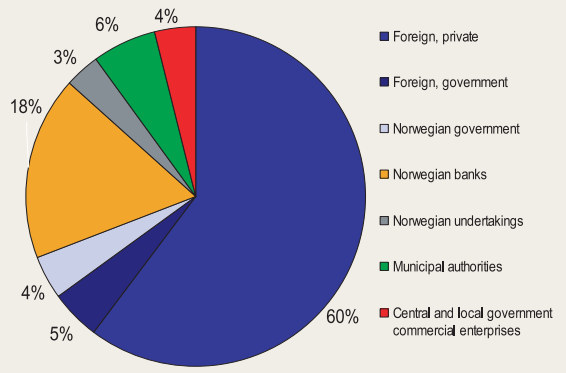
approved by Norges Bank. Different issuers were approved for Norwegian bonds and foreign bonds (within the OECD). Of Norwegian issuers, the government, state-owned enterprises, municipal authorities, county authorities, banks, mortgage companies and private undertakings were approved. Norges Bank also approved ownership interests in Norwegian securities funds as collateral. Of foreign issuers, Norges Bank approved governments and private undertakings with a satisfactory credit rating.[5]

Bonds issued by Norwegian private undertakings had to be registered in an approved securities depository, be listed on the stock exchange and have a remaining fixed-rate period of no more than 10 years. If the bonds were issued by private Norwegian undertakings without a credit rating, there was an additional requirement that the volume outstanding should be at least NOK 300 million. Bonds from other Norwegian issuers (public authorities, banks and mortgage companies owned by banks) were not subject to requirements related to volume, fixed-rate period or listing on the stock exchange. Bonds with foreign issuers had to have a credit rating, be registered in an approved securities depository, be listed on the stock exchange and have a remaining fixed-rate period of no more than 10 years.

Bonds and notes issued by Norwegian banks and mortgage companies owned by Norwegian banks were subject to a quota arrangement. Under this arrangement, only up to 50 per cent of a bank's total collateralisation could be in the form of these bonds. The quota also included bonds and notes issued by companies where Norwegian banks directly or indirectly owned more than 1/3, and Norwegian bond and money market funds registered in the Norwegian Securities Depository (VPS).

A bond was given a loan value equivalent to the nominal value of the bond less a haircut. The size of the haircut depended on the issuer and on whether the bond was denominated in Norwegian kroner or foreign currency. Haircuts were highest for private Norwegian undertakings without a satisfactory credit rating (25 per cent) and lowest for bonds issued by states within the OECD (5 per cent). Bonds denominated in foreign currency were subject to an additional haircut of 5 per cent.

Chart 1 Banks' collateral by issuer. Total amount pledged NOK 156 billion



3. Background for adjustments to Norges Bank's rules

Under the 1999 rules, banks could furnish collateral that exposed Norges Bank to risk, but because the number of Norwegian government bonds issued was limited, liberal rules were necessary. After 1999, however, banks' borrowing facilities have increased in relation to their requirements in connection with payment settlement and monetary policy. The supply of bonds denominated in NOK that are approved by Norges Bank has also increased. In addition, provisions allowing for the rapid realisation of collateral in the Act relating to financial collateral have allowed a transition to market values, and thereby lower haircut rates and higher loan values for banks' collateral. Amendments to the Financial Institutions Act also provide for the issue of collateralised bonds in Norway. This type of bond may be important for banks' collateral arrangements in Norges Bank in the long term. Finally, the IMF (International Monetary Fund) pointed out in its review of the Norwegian financial system in 2005 that collateral in the form of bank bonds should be reduced, and that the same requirements should be applied to a greater extent to issuers of both Norwegian and foreign bonds.

3.1 Transition to market values

The Act relating to financial collateral incorporates the EU Directive on financial collateral arrangements (2002/47/EC) into Norwegian law. The Act provides protection for some financial contracts in the event of a bankruptcy and enables the rapid realisation of collateral. For Norges Bank, this means a lower risk of a reduction in the value of pledged securities before they can be realised. As a result of the Act, it was an advantage for Norges Bank to use market value rather than nominal value when calculating banks' borrowing facilities. With more accurate information about the value of pledged bonds, Norges Bank can reduce the haircut on bonds without increasing its own risk. With the current interest rate, banks' borrowing facilities will also increase since the market value of bonds is typically higher than their nominal value.

3.2 Introduction of asset-backed bonds in Norway

Since 1 January 2004, the Financial Institutions Act has allowed for the issue of bonds secured on financial insti-

[5] Only bonds regarded by Norges Bank as ordinary are eligible as collateral. Convertible bonds or indexed bonds, for example, are not eligible.

tutions' total assets.[6, 7] It is relatively common in other countries to raise capital on the bond market for financial institutions' lending through two models developed for the purpose.

The first model involves mortgage companies (mortgage banks) that extend loans for a limited range of purposes, such as house purchases or loans guaranteed by the state, and that finance this activity by issuing bonds. In Norway, such asset-backed bonds will be issued by mortgage companies with a licence to conduct financing activities under section 3-3 of the Financial Institutions Act. The Act includes requirements as to the organisation and operation of the mortgage company, which loans may be included in the portfolio and requirements applicable to the underlying collateral. Special requirements are set out to guarantee bond owners' rights in a bankruptcy situation. The suitability of asset-backed bonds as collateral is thereby supported by legislation.

In the second model, a credit institution sells a group of claims to a special purpose vehicle (SPV), which issues bonds to finance its purchase (see box). Bonds issued by the SPV are often divided into tranches, with the bonds in the lowest tranche bearing any losses first. The SPV has no activity of its own, and can leave all the administration of these claims to the initial credit institution, a bank or another similar financial institution.

An SPV is not regarded as a credit institution and is not subject to capital adequacy requirements or supervision. Thus, legislation and public regulation will not in itself ensure that bonds issued by SPVs have high creditworthiness. A large share of the bonds issued by SPVs, however, have a high credit rating from Moody's or Standard & Poor's and will be eligible as collateral in Norges Bank.

An SPV need not take over the group of claims itself, but can for example take over the credit risk associated with the claims by using credit derivatives. This is known as a synthetic structure (synthetic Collateralised Debt Obligation, CDO). Bonds from SPVs may have

Credit rating of bonds issued by Special Purpose Vehicles

Bonds issued by SPVs are often termed Asset-Backed Securities (ABS) or Collateralised Debt Obligations (CDO). These bonds give investors rights to the cash flow from an underlying portfolio that is owned by the SPV. The different names depend on whether the underlying types of credit are relatively homogeneous (ABS) or heterogeneous (CDO) with respect to risk. Examples of underlying credit in an ABS can be car loans, consumer credit, credit card loans or mortgage loans.[1] In a CDO, the underlying credit can for example be corporate loans and/or corporate bonds, with exposure to a limited number of parties.

ABSs and CDOs have in common that they are usually split into tranches with different priorities in a loss situation. The tranches are normally called the senior tranche (highest priority), the mezzanine tranche and the equity tranche (lowest priority). In a credit event in the underlying portfolio, the tranches with the lowest priority will bear the first loss. The mezzanine tranche will only be affected by loss if the entire equity tranche is depleted, and the senior tranche only if the entire mezzanine tranche is depleted. With this structure, the likelihood of losses in the different tranches depends on the size of the subordinate tranches.

A bond's credit rating is an assessment of expected loss or the likelihood of default. In an ABS or CDO, the structure can thereby be tailored so that the different tranches achieve a chosen credit rating. The usual arrangement is to ensure that the equity tranche absorbs a large enough share of any losses to allow the mezzanine tranche to carry an investment grade credit rating, and that the equity and mezzanine tranches absorb enough to allow the senior tranche to carry an AAA credit rating. Credit rating agencies' assessment is largely model-based, and the arranger of the issue tailors the structure so that expected losses in each tranche are at the level required to achieve the desired rating. The most important parameters in the model are estimates of creditworthiness and recovery rates in the underlying portfolio. For CDOs, where exposure is limited to a few names, the correlation between instruments in the portfolio will also be important.

An investment's risk profile depends on expected losses and uncertainty associated with these losses. A combination of expected losses and an assessment of this uncertainty (variance) therefore provides a better description of the risk profile than expected losses alone. The uncertainty associated with loss is usually called unexpected loss. Analysing unexpected loss is particularly important for ABS and CDO tranches because the division into tranches may result in a loss distribution that deviates considerably from the distribution in a bond portfolio with the same average rating. An important implication is that a credit rating provides an incomplete picture of the risk associated with debt instruments, and quality requirements based on credit rating may be less effective in limiting risk in portfolios containing ABS and CDO tranches than in portfolios containing traditional bonds only.

[1] Bonds issued against collateral in the form of residential and commercial property loans are often called Mortgage-Backed Securities (MBS).

[6] For a more detailed description, see Andresen and Gerdrup (2004). Norwegian only.

[7] The legal framework for asset-backed bonds is not yet complete. These bonds have therefore not yet been issued by Norwegian mortgage companies.

high creditworthiness and be liquid, but assessment of the risk associated with them often involves the use of new methods that have not been adequately tested.[8] They may therefore be less suitable as collateral than other types of bonds issued by SPVs.

3.3 Collateral that does not provide adequate risk reduction for Norges Bank

Norges Bank has applied more liberal requirements to bonds issued by Norwegian undertakings than to bonds issued by foreign undertakings. In some cases, bonds issued by private Norwegian undertakings have been approved even though Norges Bank has thereby been exposed to some risk. These have, for example, included some Norwegian corporate and bank bonds.

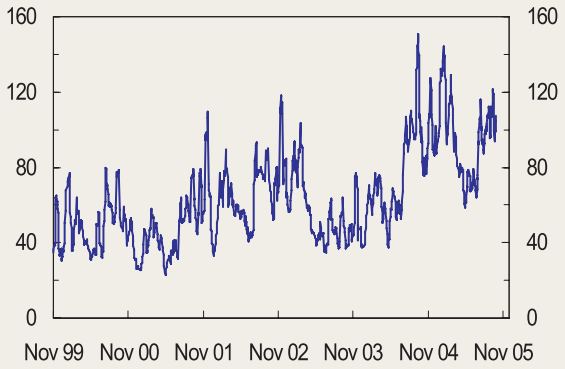
In the previous rules, Norges Bank did not require Norwegian corporate bonds to carry a credit rating. There were thereby no objective and accepted criteria available to Norges Bank to allow rejection of corporate bonds with a low credit rating. In practice, therefore, these bonds were approved as collateral even if they had been issued by undertakings in financial difficulty. Norges Bank thus risked being left with collateral that was difficult to realise if a bank was placed under public administration. It was therefore necessary to include a credit rating requirement for Norwegian corporate bonds in the new rules.

Bank bonds will often have high creditworthiness. The disadvantage of these bonds is that the borrower and issuer of the bonds may encounter difficulties at the same time. This may be the case during a banking crisis, for example. Norges Bank has therefore restricted the use of these bonds as collateral to 50 per cent of a bank's borrowing facility. A number of banks made full use of this quota. Norges Bank therefore regarded the risk associated with collateralisation of bank bonds as high, and wished to place further restrictions on the use of these bonds as collateral. This assessment also indicated that these bonds should to a greater extent be subject to the same requirements as other bonds with private issuers. In its review of the financial system in Norway, the IMF also recommended that the quota for bank bonds should be further reduced from 35 per cent, a reduction Norges Bank will be introducing from November 2006. For more details on requirements with regard to bank bonds, see section 4.5.

3.4 Higher disposable resources in Norges Bank

Norges Bank has accepted bonds with a certain level of risk because banks' borrowing facilities in Norges Bank might otherwise have been inadequate. However, the aim of Norges Bank has been to reduce the use of these bonds as collateral. In recent years, there has been not only a considerable rise in collateral levels but also an increase in banks' deposits in Norges Bank. However, turnover in the payment settlement system and the need for collateral for F-loans have not increased to the same extent. Furthermore, banks' borrowing facilities will increase as a result of the transition to market value and the reduction in haircut rates, see 3.1 and 4.2. There was therefore scope for adjustment in the rules without negative implications for the conduct of monetary policy or payment settlement.

Chart 2 Disposable funds in Norges Bank's settlement system (NBO) as a percentage of turnover[1]. Moving 10-day average



[1] The days before and after 31 December 1999 are not included because of unusually low turnover in NBO

Source: Norges Bank

3.5 Changes in liquidity reserve requirement

Most small and medium-sized banks utilise a very small portion of the borrowing facility at Norges Bank for payment settlement, and do not normally raise F-loans. It therefore seems likely that these banks pledge collateral in Norges Bank in order to meet official liquidity requirements.[9] The Norwegian Savings Banks' Association has also pointed out that for smaller savings banks it is important to view the consequences of the new collateralisation rules in the context of the liquidity requirement. The Ministry of Finance has announced that the quantitative liquidity requirement will be replaced by a general requirement stating that banks must have adequate liquidity to meet their commitments. Such a change in the liquidity requirement will reduce the need for these banks to maintain a borrowing facility.

[8] Cousseran and Imène (2005).

[9] The regulations concerning minimum liquid reserve requirements for commercial and savings banks (No. 1222 of 16 December 1988) require banks to hold at least six per cent of a basis of measurement as liquid funds.

4. Amendments to the rules

Norges Bank has drawn up new rules on the basis of the developments outlined above. Many adjustments have been made to the rules, but only the most important are dealt with in this section. The previous and the current rules are both available on Norges Bank's website.[10]

4.1 Transition to market value

Norges Bank replaced nominal value with market value as a basis for calculating banks' borrowing facilities on 24 October 2005 (see box). As a result, banks' borrowing facilities are closer to the value of the securities pledged as collateral in favour of Norges Bank. With calculations based on market value, a bank might find itself in an uncollateralised borrowing position as a result of changes in bond prices. Banks in this position will be requested to increase their collateral or reduce their loans by the end of the day. Banks that have not covered their position by the end of the day, will receive an uncollateralised D-loan (overnight loan), and penalty interest will accrue.

4.2 Reduced haircut rates

Haircut rates for all bond categories have been reduced and will now depend on the issuer and the remaining fixed-rate period. Bonds are divided into three categories depending on the credit risk for the different issuers, and four categories according to the period remaining to maturity or the next interest rate adjustment (lowest haircut rate for bonds with the shortest period remaining to the next interest rate adjustment). This means that the rules will operate with twelve haircut rates.

Haircut rates for virtually all bonds will be reduced compared with the rates in the previous rules. How much haircut rates will be reduced on average depends on which securities banks have pledged at the time this is measured. An estimate before the changes were implemented showed that average haircut rates would be reduced from 16 per cent to slightly below 8 per cent. The estimate includes the haircut for foreign exchange, which would be reduced from 5 to 3 per cent.

4.3 Asset-backed bonds

Asset-backed bonds are no longer included in the quota for bank bonds, and a bank may pledge asset-backed bonds as collateral even if it owns the mortgage company that issued the bonds. In addition, asset-backed bonds that are issued by Norwegian mortgage companies will not be subject to the volume or credit rating requirements in the transitional period, which lasts until 1 November 2007.

4.4 Special purpose vehicles (SPVs)

Norges Bank still accepts bonds issued by SPVs, provided they are in the upper tranche. It is also a requirement that bonds are not linked to credit derivatives (synthetic CDOs are not eligible).

4.5 Requirements applicable to bank bonds

Norges Bank is introducing the requirement that bank bonds must have an outstanding volume of NOK 300 million, and that bonds must be registered on a stock exchange or an alternative marketplace approved by Norges Bank. The quota for bank bonds is also being reduced. As of 24 October 2005, the quota was set at 45 per cent. It will be reduced to 40 per cent from 2 May 2006, and to 35 per cent from 1 November 2006. Bank bonds will continue to be exempt from the credit rating requirement.

4.6 Credit rating and corporate bonds

Norges Bank has introduced a credit rating requirement for Norwegian corporate bonds. The requirement is set at BBB- from Standard & Poor's (S&P) or Baa3 from Moody's (also known as investment grade). Corresponding requirements for bonds with foreign issuers will continue to be A from S&P, or A2 from Moody's. In contrast to foreign issuers, Norway also accepts credit ratings of an issuing institution and not only credit ratings of the bond itself. Norwegian corporate bonds with a credit rating lower than A and A2 will be subject to an extra haircut.

4.7 Issuers home country and currency

The requirement that a bond must be issued by an undertaking or country within the OECD no longer applies. All bonds from foreign issuers are required to have a satisfactory credit rating, although government-guaranteed bonds may be exempt from this requirement following an evaluation. For bonds with issuers resident outside the EEA, Norges Bank may need legal confirmation that there are no problems associated with for example realisation of collateral. Any costs of obtaining such confirmation will have to be covered by the pledging bank.

Norges Bank is introducing requirements that bonds and notes must be denominated in NOK, SEK, DEK, EUR, USD, GBP, JPY or CHF. This is a smaller number of currencies than in the previous rules, in which all OECD currencies were accepted by Norges Bank.

[10] See circular no. 8/2005 and no. 2/2003.

Transition to market value

Norges Bank has replaced nominal value with market value as a basis for calculating banks' borrowing facilities. The transition required substantial changes in Norges Bank's systems. Solutions had to be developed to enable available market rates to be recorded on a daily basis, and to determine a synthetic value for bonds for which updated market rates are not available. Norges Bank's treatment of pledged bonds now also varies somewhat, depending on where the collateral is registered.

Securities pledged as collateral in the Norwegian Securities Depository (VPS)

The VPS provides a daily report of the latest market rates on the Oslo Stock Exchange for securities pledged as collateral. If a long period has passed since a security was last traded, the last market price will not necessarily reflect the security's current value. In these cases, Norges Bank will assign a price equal to the estimated current value of the bond. The price will normally overestimate the bond's value as credit and liquidity risk are not taken into account. The haircut rates applied by Norges Bank to securities pledged as collateral are, however, set on the basis of assumptions concerning differences in creditworthiness and liquidity for different categories of issuer. Norges Bank will therefore also assign an appropriate loan value for bonds without an updated market price.

Securities pledged in another approved securities depository

For securities pledged in foreign securities depositories approved by Norges Bank, Norges Bank buys price information from Financial Times Interactive Data (FTID). FTID provides market prices from international stock exchanges and from direct trades between market participants that report to the International Capital Market Association. In addition, FTID delivers synthetic prices made by the company's analysts. For some kinds of securities, however, FTID does not deliver synthetic prices. This applies, for example, to some bonds secured on lending portfolios. Norges Bank is therefore exposed to a risk that neither an updated market price nor a synthetic price is available for a security. A floating-rate security does not pose a problem as its value will normally be close to its nominal value. Norges Bank will then utilise the nominal value with an additional haircut depending on the security's credit rating. For fixed rate securities, the value of the security might differ considerably from its nominal value. Such securities are therefore not eligible as collateral.

5. Consequences of the new rules

The aim of the new rules is to reduce Norges Bank's risk exposure. The transition to market value and reduced haircut rates has, however, resulted in an increase in banks' total borrowing facilities. The increase in banks' borrowing facilities will be sharpest in the transitional period (from 24 October 2005 to 1 November 2007) and will affect all or virtually all banks. The immediate effect of the implementation of the new rules, was that borrowing facilities increased by about 14 per cent. After the transitional period, some types of bonds will no longer be eligible as collateral, and it will therefore be necessary for some banks to pledge new bonds if they wish to maintain their borrowing facilities at the current level. For banks as a whole, borrowing facilities will probably be higher than under the previous rules, even if bonds that are no longer eligible are not replaced.

The fact that some bonds are no longer eligible as collateral at Norges Bank may make it more expensive for some bond issuers to raise loans in the bond market, as the demand for a bond may decline if it cannot be used as collateral. This effect will be limited since only a small portion of these bonds are pledged in Norges Bank.

Changes normally occur in banks' collateralisation on a daily basis. It is therefore difficult to make an accurate calculation of how banks' borrowing facilities will be affected when the transitional period ends on 1 November 2007. All calculations have been based on banks' collateralisation in the period before the new rules were introduced. This means that it has not been taken into account that banks will adapt to the new rules or change their collateralisation for other reasons up to end-2007. Furthermore, it has not been taken into account that banks' need to maintain their borrowing facility may be reduced if the quantitative liquidity requirement no longer applies.

5.1 Norges Bank's risk exposure

Norges Bank's exposure to risk will be reduced by tightening the requirements concerning certain types of bonds before they are approved as collateral. This primarily applies to Norwegian corporate and bank bonds. Under the previous rules, corporate bonds could be approved without a credit rating, but the new rules require either the bonds or the issuers to be rated by Standard & Poor's or Moody's. Corporate bonds with low creditworthiness have not been utilised as collateral to any great extent, but a bank could in principle have used such bonds as collateral for all its borrowing. The credit rating requirement has therefore resulted in a substantial reduction in Norges Bank's risk exposure.

Norges Bank has also reduced risk exposure associated with bank bonds. Financial problems may arise in several Norwegian banks at the same time, and it is therefore a disadvantage for one bank to use bonds issued by another bank to secure its borrowing. Up to 24 October, the use of bank bonds as collateral was limited as these bonds could not account for more than 50 per cent of banks' total collateral. Under the new rules, this quota will be gradually reduced to 35 per cent. A volume requirement of NOK 300 million for bonds issued by banks and mortgage companies is also being introduced. This will improve the liquidity of bank bonds pledged as collateral in favour of Norges Bank.

5.2 Banks as borrowers

The new rules allow banks to pledge some types of bonds that were not eligible under the previous rules. For example, Norges Bank may accept bonds without a credit rating if they are government-guaranteed, notes (in addition to bonds) from private issuers if they have a satisfactory credit rating, and bonds from issuers in non-OECD countries. More importantly, however, Norges Bank has made it easier for banks to pledge asset-backed bonds. These bonds are no longer included in the quota for bank bonds, and banks will be permitted to pledge asset-backed bonds issued by a mortgage company in the same corporate group. For most Norwegian banks, the effect of these rules will be limited in the short term because asset-backed bonds are not yet issued in Norway. In the longer term, however, the volume of such bonds is expected to increase.

The quota for bank bonds is being reduced to 35 per cent from 1 November 2006, and from 1 December 2007 a minimum volume of NOK 300 million will also be required for bank bonds used as collateral in Norges Bank. For banks as a whole, these changes will mean that more than 8 per cent of current collateral can no longer be used. This will in isolation reduce banks' borrowing facilities, although the reduction is less than the increase in borrowing facilities from 24 October 2005. Thus, it will not be necessary for most banks to adjust their collateral in order to maintain their borrowing facilities at the current level.

Small and medium-sized banks (the 105 smallest), however, have collateralised a larger share of their borrowing using bank bonds than other banks. Based on collateralisation under the new rules, it is estimated that over 40 per cent of the bonds pledged by these banks will no longer be eligible.[11] Some of the reduction in borrowing facilities will be offset by a reduction in haircut rates, but it is reasonable to assume that banks will have to increase the collateralisation of other bonds by approximately 35 per cent or more than NOK 2 billion to maintain their borrowing facilities at the current level.[12] Such an increase in collateralisation will have to be effected in the period to 1 November 2007. Few of these banks raise loans in Norges Bank today, however. It is therefore conceivable that they will choose not to maintain their borrowing facilities at the current level if the quantitative liquidity requirement is discontinued.

Small and medium-sized banks primarily invest only in the Norwegian market. Approximately NOK 500 billion in Norwegian bonds that satisfy the new requirements from Norges Bank have been issued to date. Banks that wish to maintain their borrowing facilities should therefore not find it difficult to replace bonds that are no longer eligible. However, these banks may have to invest in bonds that involve a lower return and lower risk than the bonds they currently own.

5.3 Consequences for bond issuers

The changes in the rules may affect two groups of issuers in particular. The first group is small and medium-sized banks that issue bonds with a minimum volume below NOK 300 million. The second comprises Norwegian undertakings that do not satisfy the investment grade credit rating requirement from Moody's or Standard & Poor's. When bonds issued by these undertakings are no longer eligible, it may be more costly for them to raise loans in the bond market.

The effect for these issuers, however, will be reduced since only a small share of the bonds they issue are used as collateral in favour of Norges Bank. When the new rules came into effect, Norwegian banks had issued approximately NOK 90 billion in bonds that did not satisfy the minimum volume requirement. Of these, NOK 14 billion were pledged as collateral in favour of Norges Bank. Norwegian undertakings had issued more than NOK 60 billion in bonds, and collateralisation of these bonds came to NOK 8.2 billion. The majority of these bonds – over NOK 7.2 billion[13] – were moreover issued by undertakings that have or would probably have been eligible for a satisfactory credit rating, so that these bonds can still be pledged as collateral.

[11] This estimate is uncertain. It will, for example, depend on which Norwegian undertakings receive a satisfactory credit rating from Standard & Poor's or Moody's.

[12] This depends to a certain extent on how many Norwegian undertakings obtain a credit rating from Standard & Poor's or Moody's.

[13] Source: Norges Bank and DnB NOR Markets Kredittanalyse.

6. Summary

Since the bond market in Norway is relatively small, Norges Bank has accepted a broad range of bonds as collateral since 1999. This has facilitated payment settlement and the implementation of monetary policy. With regard to Norges Bank's exposure to risk, however, it has been a drawback that the rules have permitted the use of bonds that could have limited liquidity or creditworthiness in periods of financial unrest. This implied that Norges Bank should make adjustments in the rules when banks had ample liquidity.

Banks' balances and borrowing facilities in Norges Bank have gradually increased in recent years. Moreover, the transition from nominal value to market value has resulted in a further increase in banks' borrowing facilities in Norges Bank. In the somewhat longer term, banks' supply of securities with high credit ratings may also increase as a result of the possibility of issuing asset-backed bonds in Norway. Against this background, Norges Bank has implemented some changes in the rules in order to limit its exposure to risk.

The changes will have an impact on banks as borrowers in Norges Bank. After the transitional period, the borrowing facilities for small and medium-sized banks may be reduced to a certain extent. Norges Bank's estimates, however, show that the 100 smallest banks only need to increase their collateralisation by NOK 2 billion in order to maintain their borrowing facilities. If the quantitative liquidity requirement is discontinued, it is also conceivable that some banks will not see a need to maintain their borrowing facilities at the current level. Overall, the new rules will probably result in a slight increase in banks' borrowing facilities which will continue after the transitional period.

The change in the rules may have an impact on two types of issuer. One is Norwegian undertakings without satisfactory credit ratings and Norwegian banks and mortgage companies owned by Norwegian banks that issue bonds of less than NOK 300 million. Such bonds will no longer be eligible as collateral, and it may therefore be more costly for the issuers to raise loans. The effect of the change will, however, be limited since only a small portion of these bonds are pledged in Norges Bank.

The changes in the rules have resulted in reduced risk for Norges Bank. In the long term, additional changes will be made in order to reduce Norges Bank's risk even further. The most important of these will probably be that the quota for bank bonds will be reduced to a level that is substantially lower than 35 per cent, although stricter requirements may also be applied to Norwegian corporate bonds.

Literature:

Gerdrup, Karsten R. (2004): Norges Bank's role in the event of liquidity crises in the financial sector *Economic Bulletin* 2/05.

Andresen, Ingrid and Gerdrup, Karsten R (2004): Kredittrisikooverføring (Transfer of credit risk). *Penger og Kreditt nr. 4/2004* (Norwegian only).

Kran, Lars-Christian and Grete Øwre (2001): Norges Bank's system for managing interest rates. *Economic Bulletin* 2/01.

Cousseran, Olivier and Rahmouni Imène (2005): The CDO market: Functioning and implications in terms of financial stability. *Banque de France, Financial Stability Review* No 6, 2005.

BIS (2005): "The role of ratings in structured finance: issues and implications".

Intraday liquidity and the settlement of large-value payments: a simulation-based analysis

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Interbank systems are of great importance to the economy and the financial system. Using simulations based on real data from Norges Bank's settlement system, this article illustrates trade-offs between delayed payments and liquidity usage in interbank settlement systems. The simulations demonstrate, for example, that the speed with which payments are settled may be affected by changes in the liquidity available to settlement participants. The effect of optimisation routines in the settlement system is also simulated.

1. Introduction

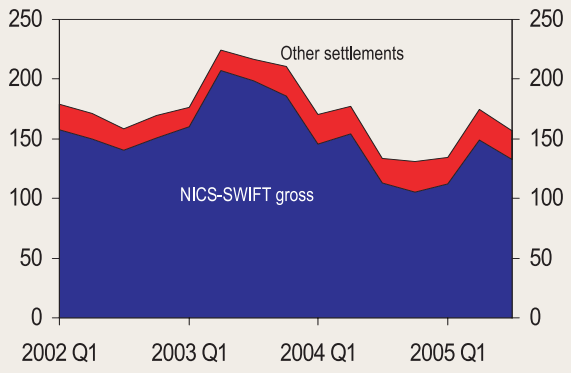
Banks are linked together by interbank systems, through technical systems and agreements for clearing and settling money transfers between banks. Norwegian interbank systems comprise of several systems with different clearing and settlement procedures for retail payments, securities trading and individual large-value transactions. Gross turnover in the Norwegian Interbank Clearing System (NICS), which is the largest system, is on average NOK 200 billion per day. The bulk of these transactions is settled over banks' accounts in Norges Bank's settlement system (NBO). The average daily value of settlements in NBO is over NOK 150 billion. Most large-value payments in NBO are settled in *NICS-SWIFT*[2] *gross settlements.* Chart 1 shows that these settlements also account for the bulk of turnover in NBO.

Settlement systems for large-value payments are central to the financial infrastructure, due to the size of the payment transactions and the fact that it is important that they are executed correctly and at the right time. Smoothly functioning systems for large-value payments are thus crucial to the efficiency of the financial markets, the stability of the financial system and the implementation of monetary policy in a country. As they are typically regarded as *systemically important,* central banks and supervisory authorities have a particular interest in how these systems are organised and operated (see separate box).

In an efficient payment and settlement system, payments are carried out *cost efficiently* and with *low risk*. For participants in the financial sector, the cost of carrying out payment transactions includes the cost of producing payment services, the cost of any payment delays and the cost of payment system participants having to keep a different asset portfolio than they might otherwise have done, in order to execute payments. This may, for example, take the form of deposits in the settlement bank and securities that provide borrowing rights for carrying out settlement.

Berger, Hancock and Marquardt (1996) present a theoretical framework for analysing the trade-off between risk (e.g. delayed completion of payment) and costs in the payment system (e.g. liquidity costs). A payment system is deemed to be technically efficient if costs are minimised at a given risk level and risk is minimised at a given cost level. The simplified illustration given in Chart 2 shows risk (settlement delays) and costs (liquid-

Chart 1 Average daily turnover in NICS-SWIFT gross transactions and other settlements in NBO. Quarterly figures. In billions of NOK



Source: Norges Bank

Organisation and operation of settlement systems

It is normal that the central bank operates the most important settlement system in a country. The manner in which the authorities deal with interbank systems that are not operated by the central bank varies from country to country, but they are often subject to some form of public regulation and supervision. In Norway, for example, there is specific legislation governing this area (the Act relating to Payment Systems) that vests Norges Bank with responsibility for authorising and supervising interbank systems. The purpose of the Act is to ensure that interbank systems are organised in such a way that the consideration of financial stability is upheld.

1 The authors would like to extend a special thanks to Steinar Guribye and Bent Vale for their useful comments.

2 SWIFT is an acronym for Society of Worldwide Interbank Financial Telecommunication. In this context, SWIFT means a standard messaging format for settlement transactions.

ity usage), where the curve, FF, represents a set of technically efficient points. The curve also shows that risk rises at an increasing rate as costs are reduced (convexity). Innovations in the payment system, for example, technical developments that make it possible to carry out payment faster at a given liquidity level, shift the curve inwards (towards F'F'). Where the outcome on this line occurs depends on the preferences of participants in the payment system, represented by curve II. All points on II are in principle equal for all participants. The curve's concave form reflects the assumption of a decreasing marginal utility of risk reduction, in other words, that participants are less willing to pay for risk reduction from a starting point of low risk, than for a similar reduction from a high risk level. A number of such curves can be drawn inside and outside II, where participants are more satisfied the closer the curve is to the origin in the chart, i.e. the lower risk and costs are. Point A is the outcome here, given the participants' trade-off between delays and liquidity usage and the technical possibilities represented by F'F'.

Using a simulation-based approach, this article will illustrate the trade-offs that exist between payment delays and liquidity usage in interbank settlement systems. A number of key concepts and features of settlement systems are introduced in the next section.

2. Features of settlement systems

a) Gross and net settlement

Large-value payments can either be settled individually in gross systems or included in a clearing that is then settled in a net system. Other solutions (hybrid systems) also exist. Gross and net systems entail different risks and costs for settlement participants. Three key risk/cost elements in a settlement system are liquidity, risk of delay and credit risk.

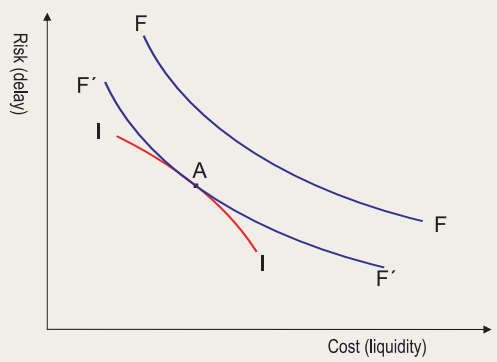
In a net system, participants settle the result from an earlier clearing of incoming and outgoing payments at designated times. Given the interval that elapses between the time that transactions are submitted for clearing and the final settlement of the clearing, banks receiving funds in the settlement implicitly provide credit to other participants for this period. If a bank that owes money in the clearing experiences solvency problems after the transactions have been submitted for clearing, but before final settlement, other banks will be exposed to credit risk in relation to that bank. In this way, the settlement system may cause the spread of solvency problems from one bank to others. This is often called *systemic risk* and is potentially a danger to the stability of the financial system.[3] In gross systems, or RTGS (Real Time Gross Settlement), positions between banks are settled on an individual basis continuously throughout the day, as soon as the payment transaction enters the system. A payment transaction can only be settled if the participant has cover (sufficient liquidity) in their account in the settlement bank. When this account is debited, the payment is completed with final effect. The continuous settlement of transactions entails no credit risk in these systems. Settlement systems for large-value payments have increasingly been based on RTGS (see box).[4]

From a risk/cost perspective, there are different advantages and disadvantages attached to gross and net settlement systems. Net settlement economises on liquidity, as participants only require the amount needed to cover the results of the clearing. However, as settlement is delayed, net settlement does expose participants to potential credit risk. RTGS settlement is carried out swiftly and does not involve credit risk, but requires more liquidity, as payment transactions are settled individually. Efficient liquidity management throughout the day is therefore important for participants in such settlement systems.

b) Intraday liquidity and transaction cycles

Banks are expected to settle their obligations to customers and other banks in time. They therefore need liquidity, i.e. funds that can be used as means of payment in

Chart 2 Risk and costs in a settlement system



"The RTGS revolution"

Net systems with end-of-day settlement were replaced by RTGS systems with continuous settlement throughout the day in a number of countries in the 1990s. Technological developments and central banks' focus on systemic risk were important reasons for this transition (BIS 2005). In Norway, RTGS was introduced in 1999 in connection with the modernisation of the settlement system in Norges Bank (NBO).

[3] Net systems can, however, be organised in such a way that credit risk is managed, for example, with deferred customer crediting, limits on counterparty exposure (caps), loss sharing agreements, etc.

[4] For a more detailed description of RTGS systems, see BIS (1997). For the introduction of RTGS in Norway, see Grønvik and Vedel (1999).

the settlement system. If a bank does not have sufficient liquidity to fulfil its obligations, payment transactions from that bank are delayed. For the other participants in the system, delayed settlement constitutes the risk of an unexpected need to refinance and possible further delays. In order to avoid delays in settlement, banks have to manage their liquidity so that payment obligations can be settled at the right time in the course of the day.

If banks carry out settlement in a central bank, intraday liquidity typically takes the form of deposits and borrowing facilities against pledged securities. In NBO, borrowing facilities generally account for the bulk of banks' disposable liquidity through the day; see Chart 3, which shows disposable liquidity in NBO in the form of borrowing rights and deposits at start-of-day.

As long as the settlement bank does not provide unlimited, unsecured and free credit to banks participating in the settlement, banks will incur costs in connection with acquiring and maintaining liquidity in order to fulfil their payment obligations. These costs are linked to the acquisition of liquid funds (direct funding costs) and also the maintenance of deposits in a settlement account in the central bank (alternative cost in the form of lost interest income). The fact that participating banks have to pledge securities as collateral for borrowing rights in the central bank does entail alternative costs to the extent that it influences banks' choice of securities portfolio. Banks also incur direct costs in connection with liquidity management.

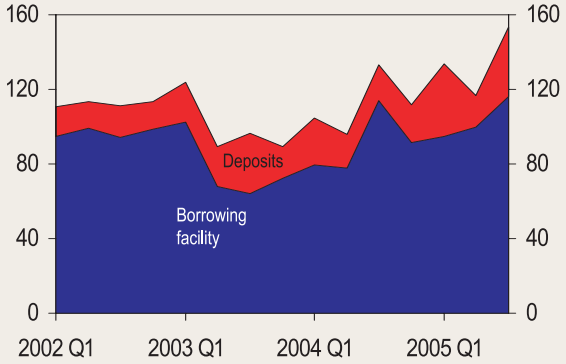
In addition, costs accrue if settlement is delayed or transactions are not settled at all. As the payments that are transferred in interbank systems are often large or time-critical, the costs incurred for banks and their customers may be substantial if transactions are not settled at the anticipated time. The fact that costs accrue in connection with maintaining liquidity and in the event of delayed settlement, banks have incentives to reduce their liquidity costs, but without it resulting in delays. The trade-off between liquidity costs and the cost of settlement delay is thus an important consideration for banks when adjusting their liquidity levels. Different banks may have different preferences as regards this trade-off, and these can change over time. If a bank's costs in connection with settlement delays are substantial in relation to liquidity costs (e.g. because many of the transactions are time-critical), it will probably choose to hold more liquidity in order to avoid delays in the settlement.

Several conditions affect participants' liquidity requirements in a RTGS system. Incoming payments from other settlement participants are one important source of liquidity. The structure of the banking and settlement system and how payments flow through the day will also be of importance to participants' liquidity requirements (i.e. how evenly incoming and outgoing payments are distributed). A bank can influence its liquidity needs if outgoing payments are managed to coincide with incoming payments. Coordination between settlement system participants may help to reduce the liquidity need and the risk of delays. This can be achieved through the use of shared information systems and the general agreement and regulatory framework for the settlement system in question, including any arrangements for coordinating the exchange of transactions over the course of the day. Such an arrangement may help to prevent situations where individual participants intentionally wait for liquidity from incoming payments before placing their own transactions in the system (free-riding).[5] In order to economise on liquidity usage, banks in Norway have coordinated the exchange of gross transactions in NBO.

A well-designed settlement system can help to make liquidity usage more efficient, which is particularly pertinent in situations where there is not much liquidity and payments are queued. If the settlement system includes elements of both gross and net settlement, improved recycling of liquidity can be achieved. In RTGS systems, for example, it is usual to have queue management mechanisms, where transactions that do not have sufficient liquidity to be settled are placed in a queue in the settlement system. These transactions then await new liquidity from later payments and are settled according to more detailed rules for settlement prioritisation and sequencing. Systems may also include netting procedures for transactions in the queue, where the netting effect is bilateral between two participants and/or multilateral between several participants. Features such as queue management and netting procedures minimise participants' liquidity need at the same time as reducing the delays in settlement. The result is a better trade-off between liquidity and settlement speed than might otherwise be achieved in a purely gross or net settlement.

The article will use a simulation-based approach to illustrate trade-offs between different levels of bank liquidity and payment delays in NBO settlement. But first of all, the data and methodology on which the analysis is based will be presented.

Chart 3 Average daily liquidity available in NBO at the start of the day. Quarterly figures. In billions of NOK



Source: Norges Bank

[5] For a discussion on payment flows and ways in which to influence transaction patterns, see Trundle & McAndrews (2001), pp. 131–133.

3. Data and method

A simulation tool developed by the Finnish central bank makes it possible to carry out simulations based on actual settlement data.[6] The simulator can be used to analyse the effect of changes in the liquidity available to settlement participants and/or the introduction of new settlement procedures. The effect on variables such as the liquidity requirements, payment delays and the settlement ratio can then be studied.

The simulations presented in this article were carried out using settlement data from the RTGS system in NBO *(NICS-SWIFT gross transactions)* and by generating systems data in the simulator. The relevant data from NBO includes participating banks, transactions between participants (time, sender/receiver and amount) and their available liquidity (balance in settlement accounts and borrowing facilities). The settlement procedures and rules are defined in the simulating tool, including the system's opening hours, how transactions are settled and any optimisation routines (queuing function, netting procedures, etc.).

The analysis is based on settlement data from 10 days in October 2005. The days can be characterised as relatively normal, with transactions for a value of NOK 160 billion on average being settled in NICS-SWIFT gross settlements per day. This accounts for around 87 per cent of total turnover in NBO in the period. On average, there were 558 transactions per day and the average size of transactions was NOK 287 million. A maximum of 20 banks participated in the settlement. The settlement volume is relatively concentrated. The five largest banks accounted for over 88 per cent of the transaction value. As the banks coordinate the exchange of transactions, the bulk of the settlement is carried out between 12.30pm and 1.30pm (69 per cent of the turnover value). When presenting the results, the average for the days in the period has been used.

Two types of simulation have been carried out. In section 4 a) the theoretical reference points for the amount of liquidity needed to finalise a given flow of gross transactions are calculated. In sections 4 b) and c) the effects of varying liquidity on payment delays and the volume of unsettled transactions are studied. NBO's features have been imitated as closely as possible here, based on the following settlement procedures: when a settlement participant places a payment transaction in the system, the transaction will be settled immediately if there is sufficient liquidity (a positive balance and/or borrowing rights). If the participant lacks liquidity, the transaction is placed in a queue until there is sufficient cover for settlement. The transaction will be settled if and when incoming transactions from other participants can supply sufficient new liquidity or if the participant's borrowing facilities are increased. Transactions that are waiting in a queue are managed according to the FIFO principle ("first in, first out"), which means that transactions are released from the queue for settlement in the order in which they joined the queue ("longest in the queue, processed first"). When a queue starts to form, a gridlock mechanism will also try to offset the transactions between participants both bilaterally and multilaterally.[7] If a participant still lacks liquidity at end-of-day, the transaction will not be settled that day.

In the simulations in sections 4 b) and c) information about participating banks' actual liquidity in NBO has been used. The simulations were made by changing the level of available liquidity, by adjusting participants' balances and borrowing facilities by the same percentage. What determines participants' liquidity needs is the actual transaction flows through the day and the settlement system properties. This entails an assumption that banks' behaviour remains unchanged even though their liquidity level varies. There is, however, reason to assume that participants' transaction patterns will also change when liquidity in the settlement is changed. Furthermore, liquidity is in practice not just used for NICS-SWIFT gross settlement, but also for other settlements in NBO. On any given day, other settlements will thus be able to supply or draw in liquidity for the participant in question. The simulations do not take account of the fact that some transactions are time-critical.[8] The results must be evaluated in light of this.

4. Simulation results

a) Theoretical reference points for liquidity requirements

Liquidity requirements in a RTGS system will, among other things, depend on whether payment transactions are settled immediately or whether they are placed in a queue for settlement later. This means that a trade-off between liquidity need and settlement delays has to be considered. This trade-off can be illustrated by calculating the reference points for liquidity needs. The concepts of upper bound (UB) and lower bound (LB) for liquidity requirements are relevant in this context (Koponen & Soramäki, 1998). UB shows how much liquidity a participant in a RTGS system needs to ensure that all outgoing payments are settled immediately when they enter the system (without waiting in the queue). LB shows the minimum amount of liquidity a bank needs to cover its net obligations at end-of-day, for all its transactions through the day.[9] When assessing the trade-off between liquidity needs and the speed with which pay-

[6] For a description of the simulator ("BoF-PSS2"), see Leinonen & Soramäki (2003) or Bank of Finland: http://www.bof.fi/eng/3_rahoitusmarkkinat/3.4_Maksujarjestelmat/3.4.3_Kehittaminen/ 3.4.3.3_Bof-pss2/

[7] This procedure has been simplified somewhat in the simulations in relation to the actual system.

[8] In the simulations, payments in connection with the foreign exchange settlement system, CLS, are treated such that payments from CLS are executed irrespective of banks' pay-ins. Payments in connection with Scandinavian Cash Pool (SCP) are not included in the simulations.

[9] In situations where liquidity is below LB, transactions will remain unsettled, whereas a liquidity level below UB means that payments cannot be settled immediately and have to be placed in a queue.

ments are settled, UB can be seen as a situation where the liquidity requirement and settlement speed are both maximised. LB minimises the liquidity requirement, but it also minimises the speed of settlement, as all transactions are settled at end-of-day.

The reference points for liquidity needs can be illustrated by looking at the liquidity cycle throughout the day for a hypothetical bank in a RTGS system, as shown in Chart 4. The bank starts the day with a positive balance in its account in the settlement bank. Transactions through the morning are largely outgoing, so the bank reaches a position where it has to draw on its borrowing rights in the settlement bank. In the afternoon, the bank has substantial incoming payments and ends up in a net deposit position. The bank's largest negative position in the course of the day is thus the banks' upper bound (UB) or maximum liquidity requirement (to ensure that its transactions are settled immediately). For the bank in question, this was at around 8am, when it used NOK 7 billion of its borrowing facility. The bank's net payment obligations through the day equal the differential between its liquidity position at the start and end of the day. This is the same as the bank's lower bound (LB) liquidity requirement.

The simulations are based on actual gross transactions in NBO. UB is calculated by simulating a RTGS system where participants have unlimited borrowing rights to settle outgoing payments immediately. The individual bank's greatest intraday negative balance is then, as mentioned, its maximum liquidity requirement. LB is simulated by carrying out a net settlement at end-of-day. The system's liquidity need is then the sum of participants' liquidity requirements.

Table 1 shows UB and LB as a share of total turnover in NICS-SWIFT gross settlements. The result of the simulations was that, on average, there was a liquidity requirement equivalent to 5 per cent of the turnover value in order to carry out one net settlement at end-of-day (LB). If participants had had unlimited borrowing rights, the average liquidity requirement would be 27 per cent of the turnover value (UB). As the table indicates, there is some variation in liquidity requirements over the period.

It is important to emphasise that these limits are theoretical measures. In order for a liquidity level equivalent to UB to actually result in maximised settlement speed, it is assumed, among other things, that the liquidity in the system is optimally divided between participants at all times. No consideration is taken of the fact that a number of transactions may be time-critical or that it is possible for participants to reprioritise transactions that are placed in a queue. In the event of time-critical transactions, LB will, for example, be too low as participating banks have to secure liquidity in order to carry out such transactions at a given time. [10]

Chart 4 Developments in a bank's intraday liquidity position[1]. In billions of NOK

[1] Positive value: Deposits in settlement account. Negative value: Borrowing position

b) Liquidity and settlement delays

The starting point for the following simulations was to study how changes in actual liquidity available to settlement participants influence the speed with which payments can be settled, or if they can be settled at all. The settlement procedures imitate NBO as closely as possible (cf. section 3). Transaction flows are the same as actual NICS-SWIFT gross settlement in NBO.

Settlement delays as a result of varying liquidity availability can be measured in several ways. One way to express the overall level of delays is with an indicator introduced by Leinonen & Soramäki (1999). The level of delays is measured by ρ:

ρ can assume values between 0 and 1. k is an index for each separate payment, s is the value of each payment, t' is point at which the payment enters the system, t the point at which the payment is settled and T is end-of-day. The indicator is based on the time each separate payment spends in the queue compared with its maximum possible time in the queue. This gives a value-weighted average of the relative delay for all payments. If all payments are settled immediately on entry into the system, $\rho = 0$. If $\rho = 1$, all payments have remained in the queue from the time they were placed in the system until end-of-day.

Chart 5 shows the effect of changing the level of available liquidity on the extent of delayed settlement, measured by the indictor ρ. A liquidity level of say 40 per

Table 1 Liquidity requirement limits as a percentage of total turnover

	Lower bound	Upper bound
Average	5%	27%
Highest value	14%	33%
Lowest value	2%	23%

Source: Norges Bank

[10] For a more detailed discussion of upper and lower bounds, see Koponen & Soramäki (1998).

cent means that participants are allocated liquidity equivalent to 40 per cent of their actual balance and borrowing rights. The chart shows that generally liquidity must be reduced substantially for the value of the indicator ρ to rise noticeably. At a liquidity level of 50 per cent, ρ has a value of 0.05. If the level is reduced to 20 per cent, ρ more than doubles to 0.11. With a 5 per cent liquidity level, ρ increases markedly to 0.34.

One key observation is the shape of the curve. The curve is generally convex, which means that the more the settlement participants' liquidity is reduced, the greater the delay in settlement. Or, in other words, at low liquidity levels, a small injection of liquidity can substantially reduce delays.

Table 2 shows the effects of varying liquidity on some other indicators for delays and for settlement in NICS-SWIFT gross settlement. When available liquidity was halved, the average settlement time was, for example, four minutes.[11] If liquidity was reduced to 20 per cent,

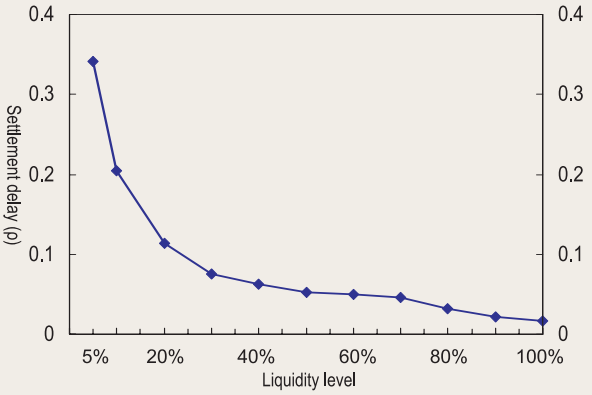
$$\rho = \frac{\sum_k (t_k - t'_k)s_k}{\sum_k (T - t'_k)s_k}$$

the average settlement time was 19 minutes. The simulation results also show that the value of transactions that remained unsettled at this liquidity level was NOK 7 billion. With a liquidity level of 10 per cent, this figure rose to NOK 16 billion.

c) Effect of optimisation features

NBO contains features for managing queues and gridlock situations. The gridlock mechanism attempts, as the name indicates, to resolve gridlocks, in other words, situations where there is little liquidity and the queue formation means that several payment transactions between banks are awaiting settlement. None of the transactions in the queue can be settled if they are viewed in isolation. If several transactions are taken for settlement at the same time, they could, however, be settled. Thus the gridlock mechanism makes the use of liquidity more efficient by netting the transactions that are waiting in the queue. The netting can be both bilateral (between two participants) and multilateral (between several participants). The purpose is to reduce delays in settlement and the number of transactions that cannot be settled at end-of-day. If there is still insufficient liquidity to settle the payments after this procedure, the situation is characterised as 'deadlock'. Only the supply of new liquidity will then be able to prevent transactions from remaining unsettled.

Chart 5 Settlement delay indicator (ρ)



Source: Norges Bank

Simulations can be used to illustrate the effect of such optimisation routines. As in the last section, the simulations are based on a RTGS system with a FIFO queuing function where a gridlock mechanism attempts to achieve netting effects between participants. Two reference scenarios are made. In the first, a pure RTGS system without queuing and gridlock functions is simulated. In the second, a RTGS system with a FIFO queuing function, but no gridlock mechanism, is simulated. The effect on the settlement ratio in the different scenarios is then compared.

Chart 6 shows the value of total unsettled payment

Table 2 Selected indicators at different liquidity levels[1]

	Liquidity level in % of actual liquidity						
	5%	10%	20%	30%	40%	50%	100%
Settlement delay indicator (ρ)	0.34	0.20	0.11	0.08	0.06	0.05	0.02
Average settlement time (min)	107	56	19	12	7	4	1
Value of unsettled payments (NOK billions)	43	16	7	5	3	1	0
Memorandum:							
Average daily turnover value in period: NOK 160 billion							

[1] Results are presented as an average of daily observations in the sample that describes the settlement.

Source: Norges Bank

[11] Defined as the average time a monetary unit has to wait in queue before settlement (time and value-weighted average).

transactions as a share of total turnover. The results show that optimisation routines ensure a considerably higher settlement ratio than in a system without such features. The difference is relatively small between RTGS with a queuing function and RTGS with a queuing and gridlock function at liquidity levels down to 20 per cent. But below this level, the difference increases. One reason that the gridlock mechanism is efficient is that a substantial share of transactions are between a small number of larger participants and bilateral netting effects can thus be achieved. At very low liquidity levels, however, the settlement ratio is reduced noticeably even when there is a gridlock function. This is because the system increasingly experiences "deadlocks", in other words, only the supply of new liquidity will increase the level of settlement. At a 5 per cent liquidity level, more than 27 per cent of the transaction value was unsettled at end-of-day.

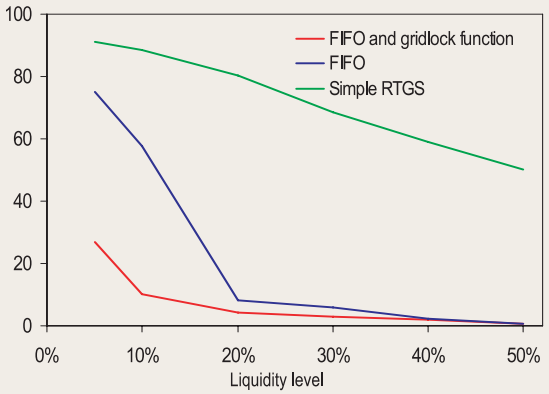
5. Conclusion

Using a simulation-based approach, this article has illustrated relationships between settlement delays and liquidity usage.

The banks that participate in NBO generally hold liquidity levels that entail little delay in payment settlements. The simulations indicate that liquidity must be reduced substantially before considerable settlement delays occur. It must be emphasised that the analysis is based on data from a period with relatively normal transaction volumes and liquidity levels. However, even though the level of liquidity is sufficient in normal situations, the extent of delays and unsettled transactions may become significant when a "critical" liquidity level has been reached. The simulations regarding the effect of optimisation routines show that these do contribute to a higher payment settlement ratio.

The liquidity levels that participants in NBO have chosen, may indicate that the costs of delays in the Norwegian settlement system are deemed to be relatively high compared with liquidity costs. If the relative costs of liquidity increase, banks might adapt to new levels of liquidity and/or adjust their transaction pattern. However, further analyses would be needed in order to establish whether this might result in a greater number of delays and unsettled transactions.

Chart 6 Value of unsettled transactions as a percentage of turnover



Source: Norges Bank

References

Berger, Allen, Diana Hancock and Jeffrey Marquardt (1996): "A Framework for Analyzing Efficiency, Risks, Costs, and Innovations in the Payments System". *Journal of Money, Credit and Banking* 28 (4), pp. 696–732.

Bank for International Settlements (2005): "New developments in Large-Value Payments Systems". May, BIS.

Bank for International Settlements (1997): "Real-Time Gross Settlement Systems". March, BIS.

Grønvik, Gunnvald and Eline Vedel (1999): "Oppgjørssystemer i et internasjonalt perspektiv", *Sentralbanken i Forandringens Tegn – Festskrift til Kjell Storvik,* Norges Bank Working Papers no. 28, pp. 72–89 (Norwegian only)

Leinonen, Harry and Kimmo Soramäki (2003): "Simulating interbank payment and securities settlement mechanisms with the BoF-PSS2 simulator". *Bank of Finland Discussion Papers,* no. 23/2003.

Leinonen, Harry and Kimmo Soramäki (1999): "Optimising Liquidity Usage and Settlement Speed in Payments Systems". *Bank of Finland Discussion Papers*, no. 16/1999.

Koponen, Risto and Kimmo Soramäki (1998): "Intraday Liquidity Needs in a Modern Interbank Payment System – A Simulation Approach". Bank of Finland Studies, no. E:14/1998.

McAndrews, James and John Trundle (2001): "New Payments Systems Designs: Causes and Consequences". *Bank of England Financial Stability Review,* December, pp. 127–136.

Norges Bank (2005): *Annual Report on the Payment System 2004.*

Coin issue to mark Ibsen Year

Henrik Ibsen is the most frequently performed dramatist in the world after Shakespeare. His plays are no less topical 100 years after his death and have contributed far more than anyone realises to creating the Norwegian identity.

Commemoration of Ibsen Year is being coordinated by the National Ibsen Year Committee, which was appointed by the Ministry of Culture and Church Affairs. The commemoration is intended to focus on Henrik Ibsen's literature and drama and the unique position he still enjoys both in Norway and abroad.

On 16 January, Norges Bank issued a 20-krone special edition circulation coin to commemorate Ibsen Year. The coin is legal tender. The ordinary 20-krone coin will not be minted with the date 2006.

The obverse (front) of the coin has been designed by Ingrid Austlid Rise, designer at Det Norske Myntverket AS (Mint of Norway). The reverse of the coin has been designed by sculptor Nina Sundbye.

Technical specifications

Diameter:	27.5 mm
Thickness:	2.2 mm
Weight:	9.9 g
Alloy:	81% Cu, 10% Zn, 9% Ni
Edge:	Plain

Distinguishing features:

Obverse:
H.M. King Harald V's portrait in profile viewed from the right. Around the portrait: HARALD V. NORWAY'S KING. To the left, the artist's initials: IAR: Under the portrait: the date, 2006, with to the left the Mint of Norway's mintmark, the crossed pick and hammer, and to the right the initials of the Director, Magne Flågan.

Reverse:
The reverse of the coin shows a full-length left profile of Henrik Ibsen on the move. The motif is designed to connect the past and the future. To the left of the figure: Henrik Ibsen's own signature. To the right: the denomination, 20, with KR immediately below. Below, to the right of Ibsen's overcoat, the artist's initials: NS.

Tables

Norges Bank publishes more detailed and updated statistics on the Internet (www.norges-bank.no). The advance release calendar on the website shows when new figures for the statistics in question will be released.

Standard symbols:

. Category not applicable
.. Data not available
... Data not yet available
– Nil
0 } Less than half the
0.0 } final digit shown

Table 1. Norges Bank. Balance sheet. In millions of NOK

	31.12.2003	31.12.2004	31.12.2005	31.01.2006
Financial assets	**1 134 756**	**1 287 865**	**1 744 575**	**1 762 553**
International reserves	250 941	268 360	318 163	308 081
Investments for the Government Pension Fund - Global	844 587	1 015 471	1 397 896	1 450 820
Other assets	39 228	4 034	28 516	3 652
Liabilities and capital	**1 134 756**	**1 287 865**	**1 744 575**	**1 762 553**
Foreign liabilities	51 963	51 167	63 333	64 565
Deposits Government Pension Fund - Global	844 587	1 015 471	1 397 896	1 450 820
Notes and coins in circulation	46 249	47 595	51 910	48 320
Other domestic liabilities	145 744	126 330	162 814	128 240
Capital	46 213	47 302	68 622	70 608

Source: Norges Bank

Table 2. Norges Bank. Investments for Government Pension Fund - Global. In millions of NOK

	31.12.2003	31.12.2004	30.09.2005	31.12.2005
Total investments	**844 587**	**1 015 471**	**1 280 530**	**1 397 896**
Fixed income securities	482 341	631 256	738 292	682 024
Equities	354 317	407 673	511 821	576 683
Lending (reverse repos etc.)	287 042	380 117	474 743	558 979
Borrowing (repos etc.)	-298 603	-406 194	-443 772	-438 717
Other investments	19 489	2 619	-554	18 927

Source: Norges Bank

Table 3. Banks. Balance sheet. In millions of NOK

	31.12.2003	31.12.2004	30.11.2005	31.12.2005
Financial assets	**1 725 093**	**1 805 276**	**2 118 017**	**2 154 698**
Cash and deposits	108 766	87 227	134 481	128 511
Bonds and notes	126 530	147 672	167 303	162 844
Loans to the general public	1 186 014	1 303 655	1 482 242	1 542 644
Other loans	172 325	155 110	213 944	191 156
Other assets	131 458	111 612	120 047	129 542
Liabilities and capital	**1 725 093**	**1 805 276**	**2 118 017**	**2 154 698**
Deposits from the general public	786 055	844 782	922 562	928 057
Other deposits from residents	86 848	83 418	103 168	108 583
Deposits from non-residents	204 958	209 277	315 790	309 879
Bonds and notes	388 660	422 410	481 091	499 796
Other liabilities	154 854	134 789	167 861	179 169
Capital and profit / loss	103 718	110 600	127 545	129 214

Source: Norges Bank

Table 4. Banks. Loans and deposits by public sectors. In millions of NOK

	31.12.2003	31.12.2004	30.11.2005	31.12.2005
Loans to:	**1 186 014**	**1 303 655**	**1 482 242**	**1 542 644**
Local government (incl. municipal enterprises)	3 556	2 832	2 521	2 562
Non-financial enterprises	360 921	362 765	422 799	436 944
Households	821 537	938 058	1 056 922	1 103 138
Deposits from:	**786 055**	**844 782**	**922 562**	**928 057**
Local government (incl. municipal enterprises)	33 859	34 731	36 567	37 663
Non-financial enterprises	238 910	268 049	296 995	314 742
Households	513 286	542 002	589 000	575 652

Source: Norges Bank

Table 5. Profit/loss and capital adequacy. Per cent of average total assets

	2003	2004	2005 Q 3	2005 Q 4
Interest income	5.8	4.2	4.2	4.4
Interest expenses	3.9	2.4	2.6	2.7
Net interest income	1.9	1.8	1.7	1.7
Operating profit before losses	1.2	1.1	1.2	1.2
Losses on loans and guarantees	0.4	0.1	-0.1	-0.1
Ordinary operating profit (before taxes)	0.7	1.1	1.3	1.3
Capital adequacy	12.4	12.2	11.3	11.9
- of which core capital	9.7	9.8	8.8	9.5

Source: Norges Bank

Table 6. Banks. Average interest rates on NOK loans and deposits. Per cent per annum

	31.03.2005	30.06.2005	30.09.2005	31.12.2005
1. Loans (1)	3.97	3.86	3.97	4.04
2. Deposits (2)	1.30	1.30	1.48	1.62
Interest margin (1 - 2)	2.67	2.56	2.49	2.42

Source: Norges Bank

Table 7. Securities registered with the Norwegian Central Securities Depository (VPS), by issuing sector. Nominal values. In millions of NOK

	Interest-bearing securities		Equities	
	31.12.2004	30.09.2005	31.12.2004	30.09.2005
Total	**668 847**	**708 247**	**124 989**	**131 431**
Central government	200 748	199 622	0	0
Banks	223 892	251 296	31 195	31 605
Other financial institutions	69 720	63 918	20 400	20 424
Public non-financial enterprises	33 920	35 969	17 797	17 472
Private non-financial enterprises	43 195	58 434	48 627	51 569
Other resident sectors	73 517	72 494	197	197
Non-residents	23 855	26 515	6 772	10 165

Sources: Norwegian Central Securities Depository and Norges Bank

Table 8. Securities registered with the Norwegian Central Securities Depository (VPS), by holding sector. Estimated market values. In millions of NOK

	Interest-bearing securities		Equities	
	31.12.2004	30.09.2005	31.12.2004	30.09.2005
Total	**699 548**	**739 959**	**1 065 067**	**1 489 791**
Central government	46 211	42 808	336 151	475 318
Banks	107 537	118 157	18 432	17 935
Insurance companies	279 148	290 295	33 355	38 897
Mutual funds	67 576	73 794	38 868	52 898
Other financial enterprises	13 696	7 380	27 785	27 980
Private non-financial enterprises	29 494	34 717	192 688	251 881
Households	31 189	33 534	60 919	78 615
Other resident sectors	52 000	47 685	12 878	16 840
Non-residents	72 697	91 590	343 992	529 427

Sources: Norwegian Central Securities Depository and Norges Bank

Table 9. Credit indicators and money supply. In billions of NOK and per cent

	Stock	Growth last 12 months. Per cent		
	31.01.2006	30.11.2005	31.12.2005	31.01.2006
C2, credit from domestic sources	2 291	12.3	13.2	13.4
C2, households	1 404	13.2	13.4	13.2
C2, non-financial enterprises	712	12.1	14.6	15.7
C2, local government	175	6.3	6.7	5.9
Total credit from domestic and foreign sources, C3 [1]	2 624	9.8	…	…
Narrow money M0	79	20.0	11.7	-6.6
Broad money M2	1 033	8.7	9.7	9.9
M2, households	591	6.7	4.6	4.7
M2, non-financial enterprises	316	17.1	17.3	20.6

[1] C3 as at 30.11.2005

Source: Norges Bank

Table 10. Household financial balance. In billions of NOK

	2003	2004	2004 Q 3	2005 Q 3
Currency and deposits	26.4	30.5	-15.4	-10.4
Equities and primary capital certificates	30.1	38.2	8.5	3.9
Mutual fund shares	4.1	1.1	-0.7	1.1
Insurance technical reserves	49.6	48.0	12.4	11.5
Other assets	34.1	26.8	12.2	15.6
Investments in financial assets	144.4	144.6	17.0	21.6
Loans from banks	92.3	113.8	26.1	35.3
Other loans	18.4	16.1	3.3	3.7
Other liabilities	-3.0	1.5	-7.0	-6.6
Change in liabilities	107.7	131.3	22.4	32.5
Net financial investments	36.7	13.3	-5.5	-10.9

Source: Norges Bank

Table 11. Consumer price indices. 12-month growth. Per cent

	2004:12	2005:11	2005:12	2006:01
Norway (CPI)	1.1	1.8	1.8	1.8
Norway, adjusted for tax and excluding energy products	1.0	1.1	0.9	0.8
US	3.3	3.5	3.4	…
Euro area	2.4	2.3	2.2	…
Germany	2.1	2.3	2.1	…
UK	3.5	2.4	2.2	…
Sweden	0.3	0.8	0.9	…

Sources: Statistics Norway and IMF

Tables previously published in *Economic Bulletin*

The Statistical Annex in *Economic Bulletin* has been reduced with effect from no. 1/06. The following is a list of tables published up to and including no. 4/05, with website references.

Financial institution balance sheets
http://www.norges-bank.no/english/balance/
1. Norges Bank. Balance sheet

http://www.norges-bank.no/front/statistikk/en/
2. Norges Bank. Specification of international reserves
3. State lending institutions. Balance sheet
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http://www.ssb.no/emner/10/13/10/forsikring_en/
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10b. Mutual funds' assets under management by holding sector. Market value

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12. Share capital and primary capital certificates registered with the Norwegien Central Securities Depository, by issuing sector. Nominal value
13. Net purchases and net sales (-) in the primary and secondary markets of shares registered with the Norwegian Central Securities Depository, by purchasing purchasing/selling and issuing sector. Market value
14. Bondholdings in NOK registered with the Norwegian Central Securities Depository, by holding sector. Market value
15. Bondholdings in NOK registered with the Norwegian Central Securities Depository, by issuing sector. Nominal value
16. Net purchases and net sales (-) in the primary and secondary markets for NOK-denominated bonds registered with the Norwegian Central Securities Depository, by purchasing, selling and issuing sector. Market value
17. NOK-denominated short-term paper registered with the Norwegian Central Securities Depository, by holding sector. Market value
18. Outstanding short-term paper, by issuing sector. Nominal value

Credit and liquidity trends
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22. Household financial balance. Financial investments and holdings, by financial instrument

http://www.norges-bank.no/cgi-bin/pml.cgi
23. Money market liquidity

Interest rate statistics
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24. Nominal NOK interest rates

Not published on Norges Bank's website
25. Short-term interest rates for key currencies in the Euro-market

http://www.norges-bank.no/english/statistics/interest_rates/interest_rates.html
26. Yields on Norwegian bonds

Not published on Norges Bank's website
27. Yields on government bonds in key currencies

http://www.norges-bank.no/front/statistikk/en/
28. Banks. Average interest rates and commissions on utilised loans in NOK to the general public at end of quarter
29. Banks. Average interest rates on deposits in NOK from the general public at end of quarter
30. Life insurance companies. Average interest rates by type of loan at end of quarter
31. Mortgage companies. Average interest rates, incl. commissions on loans to private sector at end of quarter

Profit/loss and capital adequacy data
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32. Profit/loss and capital adequacy: banks
33. Profit/loss and capital adequacy: finance companies
34. Profit/loss and capital adequacy: mortgage companies

Exchange rates
http://www.norges-bank.no/english/statistics/exchange/
35. The international value of the krone and exchange rates against selected currencies. Monthly average of representative market rates

Not published on Norges Bank's website
36. Exchange cross rates. Monthly average of representative exchange rates

Balance of payments
http://www.ssb.no/english/subjects/09/03/ur_en/
37. Balance of payments

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International capital markets
http://www.bis.org/publ/qtrpdf/r_qt0512.htm
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