

Evaluation of Norges Bank's projections for 2005

Erik Remy Åserud, economist in the Economics Department of Norges Bank¹

In 2005, the rise in consumer prices adjusted for taxes and excluding energy products (CPI-ATE) was noticeably lower than projected in 2004. The deviation between the projections and actual developments is primarily ascribable to a stronger-than-expected exchange rate and lower-than-projected wage growth. After surprisingly low inflation at the beginning of the year, the projections published throughout 2005 were closely in line with actual price developments. Capacity utilisation in the Norwegian economy, as measured by the output gap, was somewhat lower than previously projected, but the deviation is small compared to the considerable degree of uncertainty surrounding this projection.

1 Introduction

This article evaluates the projections for economic developments in 2005 as presented in *Inflation Report 1/04* and subsequent reports. First, we look at developments in output and inflation through 2005. We then analyse in greater detail the deviations between the projections and actual developments. Finally, we compare our projections with those of other institutions, both for 2005 and over a somewhat longer time horizon.

The operational objective of monetary policy is low and stable inflation with an annual rise in consumer prices of close to 2.5 per cent over time. Norges Bank operates a flexible inflation-targeting regime so that weight is given to both variability in inflation and variability in output and employment. Monetary policy affects the economy with a lag and policy must therefore be forward-looking. Thus, projections for inflation and future economic development are an important basis for monetary policy decisions. Norges Bank continuously works to improve the basis for the projections. Analysing deviations between actual developments and projections is part of this work.

It is important to evaluate previous projections with a view to further developing analysis and projection work. This holds true whether the projections prove to be close to or far from the mark in retrospect. If the projections are not in line with actual developments, this does not necessarily mean the analysis underlying the forecasts was wrong. Conversely, a projection may be on the mark even though it is based on an analysis that proved to be of inferior quality.

When evaluating the projections, it may be useful to distinguish between the various causes of projection errors.

Uncertainty about the current situation

There is considerable uncertainty surrounding the actual state of the economy when projections are made. Such uncertainty is due in part to the fact that it takes some

time before statistics are published, and in part to the fact that statistics are often subject to considerable revision at a later date. Norges Bank's view of the current situation is summarised in the estimate of the output gap. The output gap is the difference between the economy's actual output level and the output level that is consistent with stable inflation over time. The output gap is thus an expression of inflationary pressures in the Norwegian economy. The output gap is not an observable variable, which implies that historic values must also be estimated. Our estimate of the output gap is based on technical calculations and our assessment of various indicators. The estimate of the output gap may change if national accounts figures are revised or if more information emerges and new methods are developed that provide a basis for reassessing potential output and capacity utilisation in the economy.

Random disturbances and errors in assumptions

The projections are based on several exogenous assumptions. If these assumptions develop differently than we had expected, this may lead to projection errors. Among the most important assumptions are developments in GDP growth, inflation and interest rate developments among our trading partners. The price of oil and developments in petroleum investment are other important assumptions in addition to the activity level in the central and local government sectors.

Up to *Inflation Report 3/05*, Norges Bank's projections were also based on technical assumptions regarding developments in interest rates and the krone exchange rate, based on developments in forward rates. In the first two *Inflation Reports* in 2005, forward rates were adjusted upwards somewhat towards the end of the projection period. Analyses indicated that long-term interest rates might be pushed down by temporary conditions and did not therefore reflect actual expectations concerning the future interest rate level.²

Since *Inflation Report 3/05*, Norges Bank has based

¹ Thanks to Anne Berit Christiansen and Kåre Hagelund for useful comments and suggestions. I would also like to thank other colleagues at Norges Bank.

its projections on the Bank's own forecast for developments in interest rates ahead. Consequently, the interest rate path can no longer be viewed as an independent projection but is instead the result of a simultaneous process with the projections for capacity utilisation and inflation. The interest rate path should provide a reasonable balance between the considerations Norges Bank is to emphasise in interest rate setting, and thus becomes both a reaction to and a basis for the other projections.

Random events can also affect the economic variables that we forecast. Such random disturbances will naturally be unexpected and therefore lead to projection errors. One example is the introduction of new VAT rates, which had some bearing on price developments in 2005. Another example is regulatory changes that probably led to a considerable drop in sickness absence through 2004, which increased the supply of labour.

The functioning of the economy

The projections are based on our understanding of the functioning of the economy, which is based on theory and empirical analyses of history. Structural changes in the economy's functioning can be difficult to capture and take into account before they occur. Moreover, even though we are aware of emerging structural changes, it can be difficult to assess their implications. Further, it is often difficult to determine the duration of various changes that arise. An example of this is the shift in trade towards low-cost countries which has led to a steady fall in prices for imported consumer goods in recent years. Initially, Norges Bank considered the shift in trade to be a transitory phenomenon affecting only certain groups of goods, but evidence suggests that this trend may persist for some time and affect a wider range of goods.

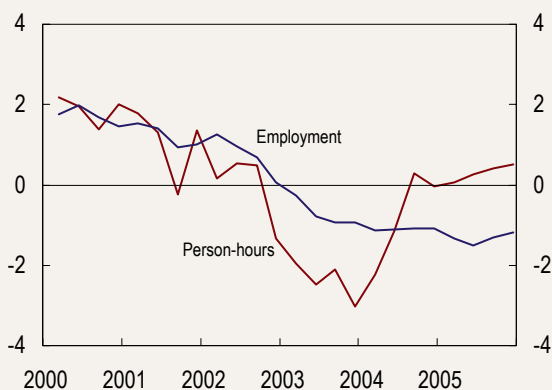
2 Inflation and output through 2005

The economic recovery that has marked the Norwegian economy since the beginning of 2003 continued in 2005. As estimated by Norges Bank, the output gap was probably positive at the beginning of 2006. Low interest rates, increased petroleum investment, strong international growth and an improvement in the terms of trade have been the main driving forces behind the upturn. Low interest rates contributed to high growth in private consumption and residential investment. Growth gradually became more broad-based, and in 2005 exports and mainland business investment expanded at a brisk pace.

Compared with previous upturns, however, it took longer for employment to pick up. A sharp drop in sickness absence throughout 2004 led to a relatively rapid increase in the number of person-hours worked (see Chart 1). Enterprises may thus have increased their supply of labour without having to hire new staff. The supply of additional resources as a result of lower sickness absence, combined with low wage and price inflation, is one of the main reasons why Norges Bank assumes that potential growth in the Norwegian economy was somewhat higher than normal in both 2004 and 2005. As a result, the economy has been able to grow at a faster pace without giving rise to bottlenecks and cost inflation. Towards the end of 2005, employment also picked up as a result of continued strong growth in output and demand.

While capacity utilisation in the economy recovered from the relatively moderate cyclical trough in 2003, inflation also picked up from its very low level in 2004 (see Chart 2). Consumer price inflation adjusted for taxes and excluding energy products (CPI-ATE) was 1.0 per cent in 2005. Through 2005, the decline in prices for imported consumer goods varied between -0.5 and -1.5 per cent. A higher rise in prices for domestically produced goods and services contributed to a sharper

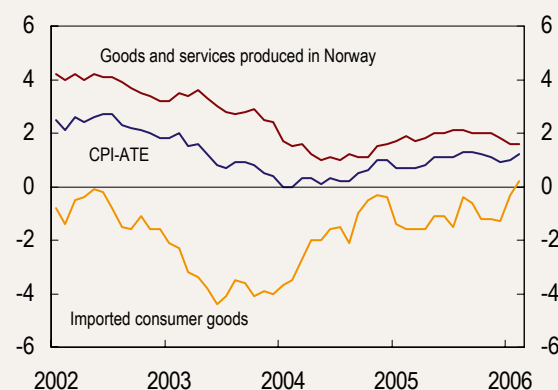
Chart 1 Employment and person-hours worked. Percentage deviation from trend¹⁾. 2000 Q1 – 2005 Q4



¹⁾ Trend calculated using HP filter. See Staff Memo 2005/2 (www.norges-bank.no) for further details.

Sources: Statistics Norway and Norges Bank

Chart 2 CPI-ATE¹⁾. Total and by supplier sector²⁾. 12-month change. Per cent. Jan 2002 - Feb 2006

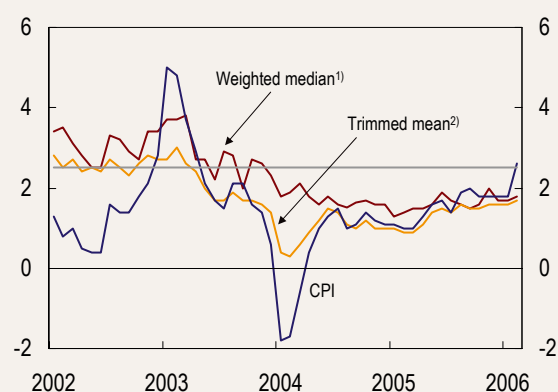


¹⁾ CPI-ATE: CPI adjusted for tax changes and excluding energy products. A further adjustment is made for the estimated effect of reduced maximum day-care rates from January 2006.

²⁾ Norges Bank's calculations.

² See box in *Inflation Report* 1/05.

Chart 3 CPI and indicators of underlying inflation. 12-month change. Per cent. Jan 2002 – Feb 2006



¹⁾ Estimated on the basis of 146 sub-groups of the CPI.
²⁾ Price changes accounting for 20 per cent of the weighting base are eliminated.

Source: Statistics Norway

rise in consumer prices during the first six months. Towards the end of the year, however, both lower domestic inflation and an accelerating fall in prices for imported consumer goods pushed down CPI-ATE inflation. Other measures of underlying inflation showed somewhat stronger inflation than the CPI-ATE for 2005 as a whole (see Chart 3). The difference was, however, less pronounced than in the two previous years. Partly owing to increased VAT rates and high energy prices, CPI inflation has picked up.

3 Deviations between projections and actual developments

Table 1 shows central assumptions and projections for 2005 in the *Inflation Reports* published since autumn 2003. In the box entitled “Changes in the Projections” (pp. 101-102), a more detailed account is given of the

changes made to the projections in the various *Inflation Reports*.

The output gap

Estimates of the output gap in Norway in 2005 have not been substantially changed, in view of the considerable uncertainty surrounding this variable. Norges Bank’s current assessment is that the output gap was close to a normal level in 2005 as a whole, but positive towards the end of the year. Even though this is somewhat lower than projected in the *Inflation Reports*, the projections have been based throughout on the assumption that the output gap would gradually close and become positive in 2005.

The estimate for the output gap further ahead reflects a combination of three uncertain variables:

- Estimated current output gap or the current economic situation.
- Projected potential growth in the economy; i.e. how much output can rise without increasing pressures in the real economy
- Projected economic growth ahead

In the following section, we examine how these variables have influenced the assessment of capacity utilisation in 2005.

More idle resources in 2003 and 2004

Norges Bank uses a wide range of indicators to form a picture of the current economic situation. A correct assessment of the state of the economy at the time projections are prepared is essential to their quality.

The projections for 2005, made in 2003 and 2004, were based on a picture of the current situation in which idle capacity in the economy was relatively limited. In retrospect, the level of idle capacity seems to have been

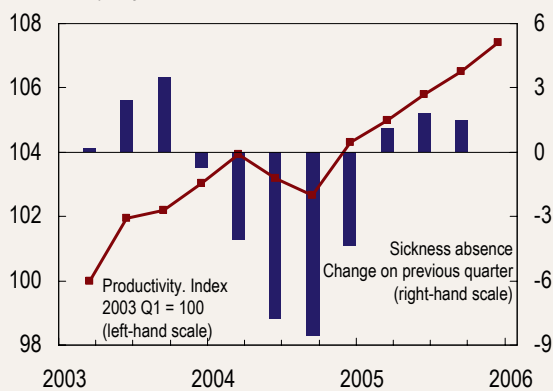
Table 1 Central assumptions and projections of some key macroeconomic variables for Norway’s economy in 2005, and actual developments. Percentage change from previous year unless otherwise specified.

	IR 3/03IR	IR 1/04	IR 2/04	IR 3/04	IR 1/05	IR 2/05	IR 3/05	
Interest rate ¹ (level, per cent)	4.2	2.6	3.2	2.3	2.3	2.2	2.2	2.2
Exchange rate I-44	96.1	99.0	95.2	93.3	93.3	92.0	91.8	91.9
GDP trading partners	2 ³ / ₄	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₄	2	2 ¹ / ₄	2.4
International prices	3 ³ / ₄	-1 ¹ / ₂	-1 ¹ / ₄	1 ¹ / ₄	-3 ³ / ₄	-1 ¹ / ₂	-1	-0.9
Brent Blend oil price	23.4	28.9	33.1	46.0	50.6	54.3	55.0	54.5
Petroleum investment	-5	3	5	15	25	25	20	15.7
Mainland GDP	2 ³ / ₄	3 ¹ / ₄	3	3 ¹ / ₂	4	3 ³ / ₄	3 ³ / ₄	3.7
Potential growth	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ³ / ₄	2 ³ / ₄
Unemployment (LFS)	4 ¹ / ₂	4 ¹ / ₄	4	4	4	4 ¹ / ₄	4 ¹ / ₂	4.6
Annual wages	4 ³ / ₄	4 ³ / ₄	4 ¹ / ₂	4 ¹ / ₂	4	3 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₄
CPI	2	2 ¹ / ₄	1 ³ / ₄	2 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₂	1.5
CPI-ATE	2 ¹ / ₄	2 ¹ / ₄	1 ¹ / ₂	1 ¹ / ₂	1	1	1	1.0
Output gap	1 ¹ / ₂	1 ¹ / ₄	1 ¹ / ₄	3 ³ / ₄	3 ³ / ₄	1 ¹ / ₂	1 ¹ / ₄	0

¹ Three-month money market rate.

Sources: Statistics Norway, Technical Reporting Committee on Wage Settlements and Norges Bank

Chart 4 Productivity and change in sickness absence. Seasonally adjusted. 2003 Q1 – 2005 Q4



Sources: Statistics Norway and Norges Bank

higher than we assumed at that time. The output gaps in 2003 and 2004 are now estimated at $-1\frac{1}{2}$ and -1 per cent, respectively, whereas at the beginning of 2004 we estimated them to be $-1\frac{1}{2}$ and $-1\frac{1}{4}$ per cent respectively. One of the reasons for the downward adjustment is that revised national accounts figures show that labour utilisation edged down somewhat more in the last downturn than provisional figures indicated. Other indicators also point to a higher level of idle capacity. This applies in particular to domestic inflation. Whereas output growth in 2004 was somewhat higher than projected in the last *Report* of 2003, domestic inflation was $1\frac{1}{4}$ percentage points lower.

Further into the upturn, employment growth also remained relatively low. An important reason may be the considerable decrease in sickness absence (see Chart 4). A persistent decline in sickness absence will lead to a sustained increase in available person-hours. Combined with efficiency measures, this probably contributed to fairly high economic growth without resulting in constraints on the supply of labour or productive capital. Potential growth in the Norwegian economy is now estimated to have been half a percentage point higher than normal in 2004.

Norges Bank continuously seeks to improve its analysis of the current situation. To this end, we make greater use of information from our regional network directly in our assessment of the output gap. One important advantage of the network is that the analysis is completed shortly after the responses have been received. The information from the network also gives us a different approach to measuring the output gap, in addition to the analysis of statistics, which involve a lag and are subsequently revised. On the other hand, it can be difficult to interpret information from the network, but we gain more experience as the time series become longer.

High potential growth in 2005

Norges Bank usually assumes that annual growth in potential output is $2\frac{1}{2}$ per cent. This means that if GDP growth is close to $2\frac{1}{2}$ per cent, the output gap will not change in relation to the previous year. Potential growth for 2005 was adjusted upwards to $2\frac{3}{4}$ percentage points in the last *Inflation Report* in 2005.

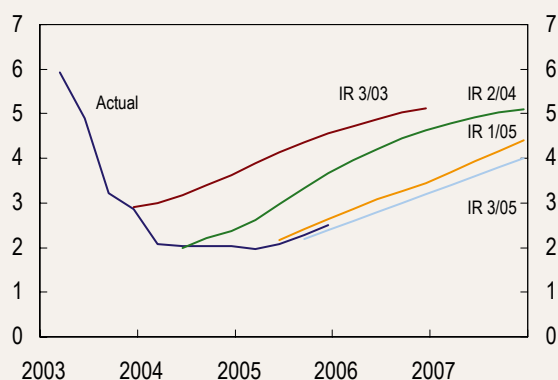
The reason for this adjustment is that increased labour migration from the new EU countries may have reduced pressures on the real economy in Norway. A substantial share of foreign workers accept short-term contracts in Norway without being employed in a Norwegian enterprise. In the statistics, this will appear as an increase in service imports. Increased service mobility may have contributed to curbing costs, even though demand growth has been high.

Both the reduction in sickness absence and the rise in inward labour migration are examples of how changes in legislation lead to structural changes in the economy. The impact of such structural changes is often difficult to estimate in advance.

Growth in 2005 slightly higher than initially projected

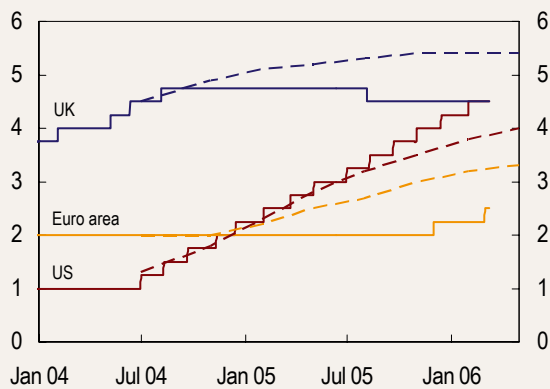
The downward revisions of past output gap estimates have, to some extent, been offset by higher growth in 2004 and 2005 than projected at the end of 2003 and the beginning of 2004. When growth in the Norwegian economy rapidly slowed towards the end of 2002, and the inflation outlook was adjusted downwards, the interest rate was lowered considerably. In spring 2004, the interest rate was reduced to 1.75 per cent, and at the same time, Norges Bank estimated GDP mainland growth at 3 per cent in 2005. This projection was based on the assumption that interest rates would rise in tandem with market expectations as implied by forward interest rates (see Chart 5). However, actual interest rates were lower than assumed, and this may have con-

Chart 5 3-month money market rate and interest rate assumptions in selected *Inflation Reports*. 2003 Q1 – 2007 Q4



Source: Norges Bank

Chart 6 Interest rate expectations. Actual and expected key rate¹⁾ at 24 June 04. 2 Jan 04 – 10 Mar 06



¹⁾ Broken lines show expectations in IR 2/04. Based on FRAs and futures contracts adjusted for the estimated difference between 3-month money market rates and the key rate.

Sources: Reuters and Norges Bank

tributed to somewhat higher-than-projected economic growth.

Another reason for higher-than-projected growth at the beginning of 2004 is that we at that time assumed that developments in petroleum investment would be relatively moderate. As from the last *Inflation Report* in 2004, however, it became clear that petroleum investment would also show strong growth in 2005. The upswing in petroleum investment has translated into increased imports, but it has also generated a considerable impetus to growth in the Norwegian economy.

Growth in petroleum investment may, in part, be attributed to substantially higher oil prices than assumed in the first *Inflation Reports* in 2004. High economic growth in many regions of the world and a sharp increase in China's oil imports led to high growth in demand and rising oil prices through 2004.

Overall, output and inflation among our trading partners have developed in line with projections in 2005.

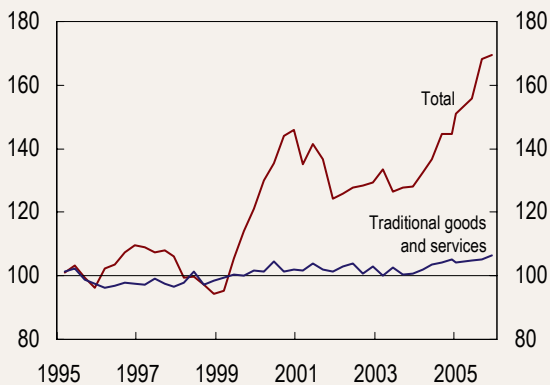
The rise in oil prices has so far had limited effects on inflation and global economic activity.³ This may be related to the fact that the increase in oil prices is largely the result of demand growth. Most previous oil price increases have been the result of reductions in supply. Moreover, industrial nations are less dependent on oil than previously. This is due to technological progress and the relatively larger share of services in GDP in these countries.

Low international interest rates have also contributed to maintaining high growth in most countries. As in Norway, interest rates internationally have risen at a slower pace than market participants had previously expected (see Chart 6). Idle resources in the global economy may also have limited the effect of higher oil prices on other prices or on wage growth. Globalisation in the form of intensified international competition and relocation of production to low cost countries may partly have offset the impulses from increased oil prices. Without the surprising surge in oil prices, GDP growth internationally might have been somewhat stronger than we had assumed.

Global economic growth has also resulted in higher prices for non-oil commodities, in particular metals and energy-intensive products. Increased trade has given rise to higher demand in the transport sector and higher shipping freight rates. This has improved our terms of trade with our trading partners (see Chart 7). Improved terms of trade imply an increase in the price of exports relative to imports. Relatively high export prices have boosted earnings in the exposed sector, in spite of the appreciation of the krone.

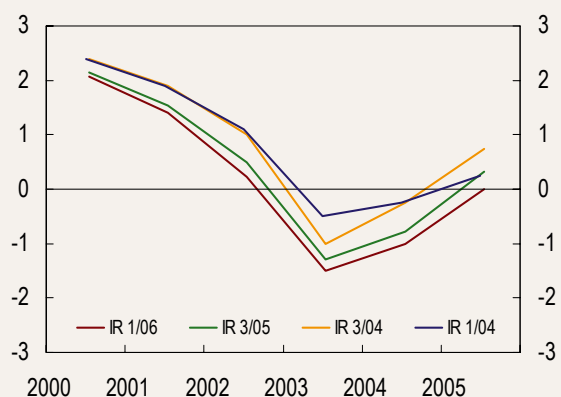
Overall, Norges Bank's previous projections for capacity utilisation in 2005 were slightly higher than our current estimate. This is primarily because the basis for the projections, the level of the output gap in 2003 and 2004, later proved to be somewhat more negative than we previously assumed (see Chart 8). The devia-

Chart 7 Terms of trade. Index 1995=100. 1995 Q1 – 2005 Q4



Sources: Statistics Norway and Norges Bank

Chart 8 Estimates for output gap in various *Inflation Reports*. Per cent. 2000–2005



Source: Norges Bank

³ See box in *Inflation Report* 3/05.

tions are relatively small, in view of the considerable uncertainty surrounding the projections for the output gap. We still assume that capacity utilisation increased through 2005 and that the economy entered a moderate expansionary phase in the latter half of 2005. However, Norges Bank's output gap estimates in 2005 may still be changed as a result of revisions of national accounts figures or new assessments.

Inflation in 2005 lower than projected in 2004

Actual inflation measured by the CPI-ATE was 1 per cent in 2005. At the beginning of 2004, Norges Bank projected that CPI-ATE inflation would be 2¹/₄ per cent. At the same time the output gap was estimated at 1/4 per cent and was thus very close to the current estimate. The relatively large deviation between actual and projected inflation (see Chart 9) can only to a limited extent be attributed to changes in capacity utilisation, since pressures in the real economy in 2005 were approximately as projected at the beginning of 2004. The delayed effects of a narrower-than-expected output gap in 2003 and 2004 may, on the other hand, have contributed to some extent.

The deviation between projected and actual inflation in 2005 may primarily be attributed to the following:

- the krone exchange rate was stronger than initially assumed
- prices for imported consumer goods fell more than expected, and
- wage growth was lower than projected

Higher-than-assumed krone exchange rate

The krone appreciated throughout 2004 and 2005 and was, on average, almost 8 per cent stronger in 2005 than assumed in the March 2004 *Inflation Report* (see Chart 10). Early in 2004, we expected that the substantial

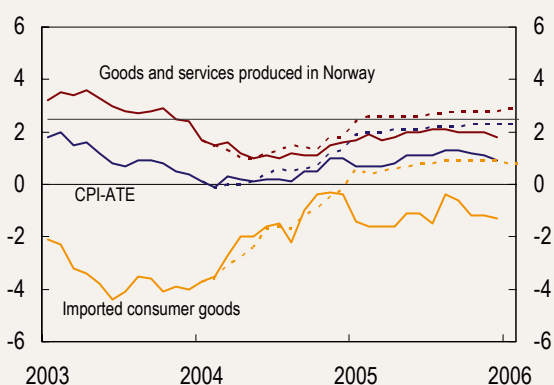
depreciation of the krone through 2003 would gradually push up prices for imported consumer goods. Instead, the krone appreciated and had the opposite effect. The krone may have appreciated partly because interest rates among a number of our trading partners were not raised as quickly as indicated by market expectations at the beginning of 2004. The rise in oil prices may also have contributed to the appreciation of the krone, even though empirical analyses show that the relationship between the krone exchange rate and oil prices varies over time.

External price impulses broadly in line with projections....

Independently of the movements in the krone exchange rate, international prices for consumer goods that we import have fallen in recent years. This is primarily due to the growing share of imported consumer goods from low-cost countries in Asia and central and eastern Europe. Clothing and shoes are goods that are influenced by this shift in imports. Moreover, strong international competition and efficiency measures in production have led to a fall in prices for a number of other goods, such as audiovisual equipment.

Since the beginning of 2004, Norges Bank has estimated a variable in order to capture these external price impulses to imported consumer goods (IPC). As a result of improved access to data from a number of emerging economies, this indicator was revised and broadened towards the end of 2005.⁴ The new calculations show that imported price impulses since 2001 have fallen more than we previously expected. This is particularly because the shift has affected a wider range of goods than we were able to capture using the previous data. In 2005, the decline in prices abated slightly, probably due to higher prices for oil and non-oil commodities. Partly for this reason, projections in the March 2004 *Inflation Report* for external price impulses in 2005 were only about 1/2 percentage point too high.

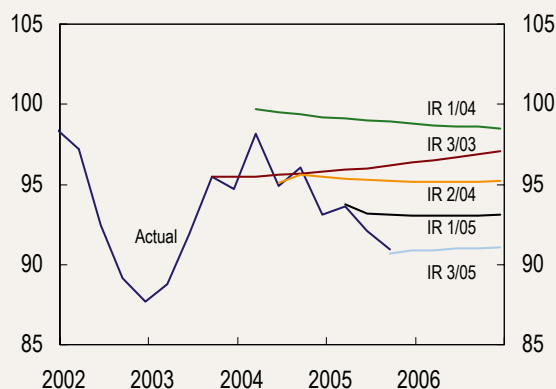
Chart 9 CPI-ATE¹⁾. Total and by supplier sector. Historical developments and projections (broken line) from IR 1/04. 12-month change. Per cent. Jan 2003 - Dec 2005



¹⁾ CPI-ATE: CPI adjusted for tax changes and excluding energy products.
²⁾ Norges Bank's calculations.

Sources: Statistics Norway and Norges Bank

Chart 10 Exchange rate (I-44) and assumptions in *Inflation Reports*. 2003 Q1 - 2006 Q4



Source: Norges Bank

⁴ See box in *Inflation Report* 3/05.

...but nevertheless a sharper fall in prices for imported consumer goods

Since 2001, a model using the variable IPC and the exchange rate as explanatory factors has been able to explain most of the developments in prices for imported consumer goods in Norway⁵ (see Chart 11). The chart also shows this relationship weakened at the beginning of 2005, when prices for imported consumer goods dropped far more than the model could account for.

Changes in indirect taxes and unusually high sales activity around the turn of the year 2004/2005 could be possible explanations. When calculating the CPI-ATE, full adjustment is made for tax changes from the time they are introduced. Low inflation at the beginning of 2005 may in part be attributed to the fact that actual retail prices were not fully adjusted following the increase in VAT. Furthermore, a poor season for winter clothing and other seasonal products may have led to larger price discounts than usual at the beginning of the year. Developments at the beginning of 2006 nonetheless indicate that movements in prices for imported consumer goods are again more in accordance with the model.

In January 2005, the 12-month rise in the CPI-ATE was only 0.7 per cent as a result of a sharper fall in prices for imported consumer goods. Surprisingly low inflation at the beginning of the year also influenced our projections for the year as a whole. Developments in the first quarter largely determine the path for the remainder of the year, both because several components are measured in this quarter, and because many prices are adjusted in January and February (see Chart 12). Simulations using Norges Bank's aggregated macroeconomic model⁶ indicate that weak developments in the first quarter of 2005 cannot be explained by the output gap or the exchange rate.⁷

Lower-than-projected wage growth

In the March 2004 *Inflation Report*, wage growth in

2005 was projected to be 4³/₄ per cent. Provisional figures from the Technical Reporting Committee on Wage Settlements indicate that wage growth in 2005 reached 3¹/₄ per cent. The substantial fall in prices for imported consumer goods at the beginning of 2005 contributed to clearly lower-than-projected consumer price inflation prior to the wage settlement. Because of low inflation, relatively moderate nominal wage increases still resulted in growth in purchasing power.

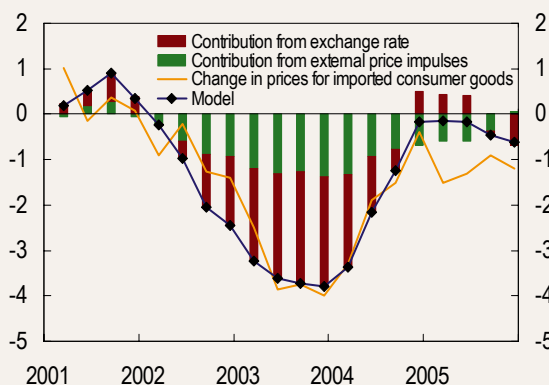
Real wage growth was also lower than previously projected. The wage projection was based on the assumption that employment growth would rapidly pick up later in 2005, and contribute to bringing average unemployment down to 4 per cent (see Chart 13). Measured in number of persons, however, employment growth was more sluggish than in previous cyclical upturns (see Chart 14). Two factors in particular might explain the sluggish rise in employment:

- First, the decline in sickness absence through 2004 provided companies with an added supply of labour. As a result, output could be increased without the need to hire new staff.
- Second, the supply of foreign labour increased markedly after EEA enlargement in May 2004. In many cases, foreign workers will not be captured in employment statistics, even though they contribute to increasing the supply of available labour. The relatively low wage level among foreign workers may also have contributed to curbing wage growth, especially in the construction industry, where activity has been very high.

Competition in the product market approximately as expected

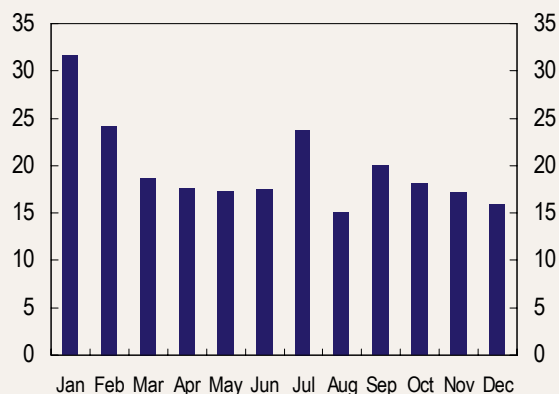
Following the contractionary phase in 2003, it gradually became clear that competition in several markets was intensifying, leading to rationalisation and cost

Chart 11 Change in prices for imported consumer goods and estimated effects of external prices and exchange rate movements. Contribution in percentage points to 4-quarter change. 2001 Q1 – 2005 Q4



Sources: Statistics Norway and Norges Bank

Chart 12 Share of price observations that change in different months (weighted). Excluding sales



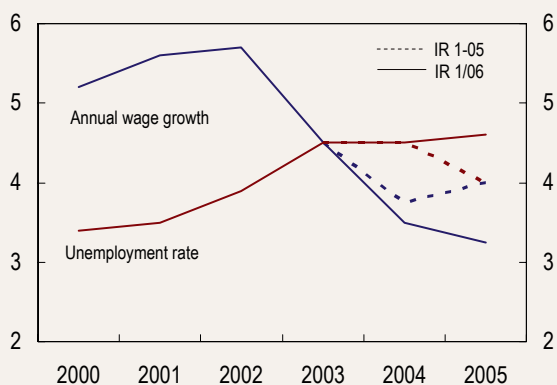
Sources: Statistics Norway and Norges Bank

⁵ See box in the *Inflation Report* 1/04.

⁶ See *Norges Bank's Staff Memo* 2004/3.

⁷ The price equation in the model must receive a considerable negative shock in order to drop to actual inflation at the beginning of 2005. Impulses to individual equations in a model as aggregated as this one are difficult to interpret, but may point to an unexpected shock on the supply side of the economy related to productivity or margins.

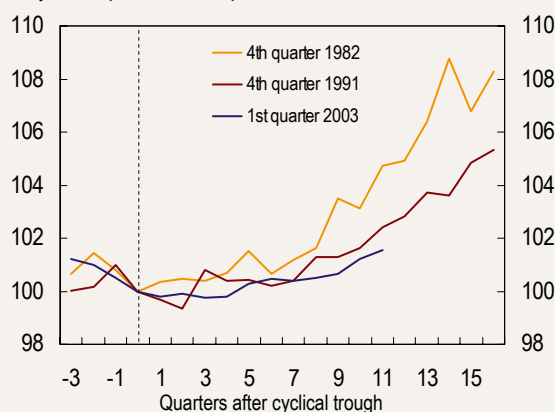
Chart 13 Estimated annual wage growth¹⁾ and LFS unemployment. Per cent. 2000 – 2005



¹⁾ Average for all groups. Including costs associated with increase in number of vacation days.

Sources: Technical Reporting Committee on Income Settlements, Statistics Norway and Norges Bank

Chart 14 Number employed. Developments after the start of a cyclical upturn. Index, quarter 0 = 100



Sources: Statistics Norway and Norges Bank

cuts. In addition, new operators, for example in the air travel industry and the grocery trade, contributed to increased competition and substantially lower prices for some goods and services. In the March 2004 *Inflation Report*, we assumed this would have an impact on price developments throughout 2004, but that the situation would normalise in 2005, in step with the economic recovery. This analysis still seems to be broadly in line with actual developments. A pronounced deceleration in the rise in food prices towards the end of 2005 and the beginning of 2006 may, however, be an indication of stronger competition in the grocery sector although other factors, such as new data collection methods, may have influenced these developments.

Norges Bank's analytical tools do not provide a basis for accurately calculating the effects on inflation of changes in competitive conditions. A model of domestic inflation (see Appendix 1) can to a great extent explain price developments in 2005 using developments in wage and price inflation the previous year. The model is not as accurate with respect to actual inflation in 2003 and 2004. Prices that dropped considerably in 2004, such as air travel and some groceries, have also moved on a more normal path through 2005.

CPI-ATE broadly in line with the projections published in 2005

Following surprisingly low inflation at the beginning of 2005, the CPI-ATE projection was adjusted downwards to 1 per cent in the March 2005 *Inflation Report* and subsequent reports. This proved to be a fairly accurate forecast of actual developments. The CPI-ATE rose by 1.0 per cent from 2004 to 2005. Projections published through 2005 were based on assumptions concerning interest rate and exchange rate developments, which also proved to be accurate in relation to actual developments.

Even though the projection for annual average infla-

tion was accurate, there was a deviation between the observed and projected year-on-year rise in prices towards the end of the year. In the second half of 2005, the year-on-year rise in the CPI-ATE fluctuated between 1 and 1½ per cent, before it unexpectedly fell to 0.9 per cent in December. If inflation is adjusted for the estimated direct effect of the interest rate reductions on house rents, inflation may be estimated at 1.1 per cent in December. Both a slower rise in prices for domestic goods and prices, and prices for imported consumer goods pushed down CPI-ATE inflation.

Decomposition of the projection error

In Table 2, the deviation between the forecast for the CPI-ATE presented in *Inflation Report 1/04* and *Inflation Report 1/05* and actual developments has been quantified in the light of various underlying causes. The decomposition shows that approximately 0.4 percentage point of the projection error from the first *Inflation Report* in 2004 is the result of a stronger-than-expected krone exchange rate.

Approximately 0.4 percentage point of the projection error is related to an excessively high estimate for wage growth in 2005. Due to an unexpected supply of labour, as a result of lower sickness absence and inflows of foreign labour, the labour market was less tight than expected. The model for domestic inflation (see Appendix 1) is part of the basis for the decomposition in Table 2. In this model, wage growth is exogenous, with no feed-through from inflation to wage growth. Surprisingly low inflation at the beginning of 2005 probably contributed to moderation in the wage settlement by influencing the social partners' inflation expectations. Nonetheless, in the table, this indirect effect of low inflation is placed under wages. If we had given more weight to indirect effects in the decomposition, the unexplained share of the projection error might have been greater. At the same time, an excessively high

estimate of wage growth would explain a smaller share of the forecast error in the CPI-ATE.

The decomposition cannot fully explain the deviation between the projection presented in *Inflation Report 1/04* and actual developments. 0.2 percentage point of the deviation cannot be related to errors in other projections or assumptions. As shown in Chart 11, we cannot explain

Table 2 Decomposition of the deviation between actual and projected inflation in 2005 presented in *Inflation Report 1/04* and *1/05*.

	IR 1/04	IR 1/05
Deviation between actual and projected CPI-ATE inflation. In percentage points	-1 ¹ / ₄	-0.1
<i>Decomposition of deviation</i>		
Stronger exchange rate	-0.4	0
Lower external price impulses	-0.1	0
Lower wage growth	-0.4	-0.1
Interest rate's direct effect on house rents	-0.2	0
Other factors / unexplained ¹	-0.2	0

¹ Primarily relating to the fall in prices for imported consumer goods in 2005.

the low rise in prices for imported consumer goods using our existing analytical tools. A possible explanation is that the shift in imports towards low-cost countries has been stronger than we are able to capture using the variable for imported price impulses. It is also possible that high productivity growth in retail trade has provided a basis for reduced margins and lower retail prices.

4 Alternative projections and other institutions' projections

As a part of the evaluation, Norges Bank's projections are compared with projections using alternative models and those made by other institutions.

Other institutions' projections

Projections made by other institutions can be used as a basis for evaluating Norges Bank's projections. Charts 15 and 16 show developments in Norges Bank's and some other institutions' projections for CPI-ATE inflation and mainland GDP in 2005, from 2003 to date. Such projections are difficult to compare. The projections are not revised continuously, and will therefore be based on various statistical sources. There may also be differences in the assumptions for the projections.

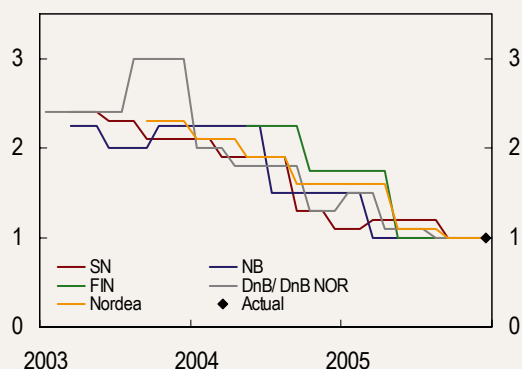
Through most of 2004, none of the institutions predicted that CPI-ATE inflation would reach 1.0 per cent in 2005. In the early phases of the economic upturn, all institutions underestimated mainland GDP growth in 2005. Norges Bank was one of the first to revise up its growth projections.

Alternative models

When making inflation projections, the results of "naïve" projection methods are also assessed. A simple time series model (ARIMA) that captures trend growth and seasonal variations in the CPI-ATE has often proved to predict price developments fairly accurately in the short term. Such a model does not contain information on the driving forces behind inflation developments, and it will not be accurate in the long term. It is possible to calculate confidence intervals that illustrate the uncertainty surrounding the projections. These are based on the historical variation in the time series.

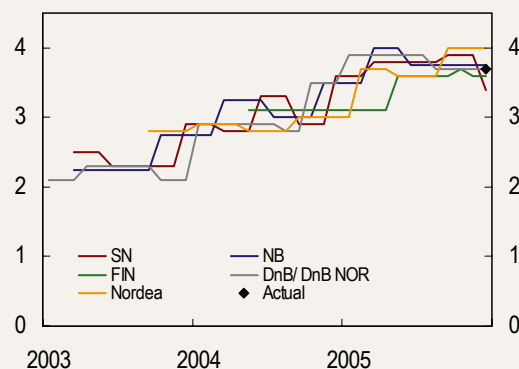
Chart 17 compares CPI-ATE predictions from a simple ARIMA model with projections from *Inflation Report 1/05*, and actual developments through 2005. Both the projections in *Inflation Report 1/05* and the ARIMA forecasts were based on information available up to the CPI-ATE for February. In the first months, Norges Bank's projections were fairly similar to the ARIMA forecasts, but Norges Bank expected inflation to increase somewhat more through summer and

Chart 15 CPI-ATE. Projections for 2005 published at different times. Annual rise. Per cent



Sources: Statistics Norway (SN), Ministry of Finance (Fin), DnB NOR, Nordea and Norges Bank

Chart 16 Mainland GDP. Projections for 2005 published at different times. Per cent



Sources: Statistics Norway (SN), Ministry of Finance (Fin), DnB NOR, Nordea and Norges Bank

autumn. The projections in *Inflation Report 1/05* predicted actual developments more accurately than the ARIMA forecasts through most of the year. The average absolute deviation is approximately twice as large for the ARIMA forecasts as for the projections in *Inflation Report 1/05*.

“Naïve” models can be valuable as a crosscheck of the projections in the short term. In the longer term, it will be more appropriate to compare the projections with models that also include other explanatory factors. In Chart 18, the projections from *Inflation Report 1/04* are compared with forecasts based on the macroeconomic model we now utilise in our projection work. All exogenous and endogenous variables, with the exception of the CPI-ATE, are set at their actual values. This model had not yet been developed when *Inflation Report 1/04* was published. In the simulation, the model predicts actual CPI-ATE developments fairly accurately, both in 2004 and 2005. This result partly depends on when the simulation is started; in the chart, the starting-point is the second quarter of 2004.

How accurate are the forecasts of other inflation-targeting central banks?

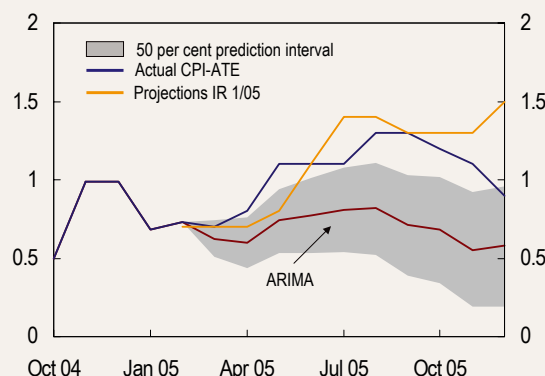
Table 3 shows the deviations between actual inflation and projections from six central banks that operate an inflation-targeting regime. The projections are taken from the last inflation reports in each year. The figures for the average deviation between projected and actual inflation for the years prior to 2005 indicate that Norges Bank’s projections are somewhat less accurate than the others in the table. Nevertheless, it appears that other small, open economies such as Sweden and Australia have also had difficulty in forecasting inflation.

With respect to the forecasts for 2005 presented a year earlier, Norges Bank’s projection errors are approximately on a par with the average for other central banks. The deviation between inflation in 2005 and the projection presented two years earlier is, however, greater than the deviations of other central banks. This must be viewed in conjunction with the surprisingly low inflation rate in 2004.

Conclusion

In 2005, the output gap was slightly lower than previously projected by Norges Bank. Downward adjustments of the output gap level in the years prior to 2005 were, to a certain extent, offset by stronger growth through the year, partly reflecting higher-than-expected oil investment. CPI-ATE inflation was, however, clearly

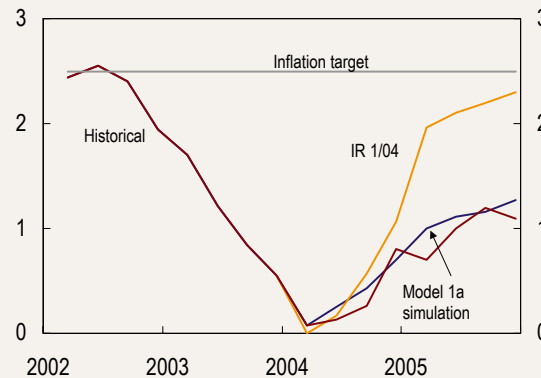
Chart 17 CPI-ATE¹⁾. Projections in IR 1/05, ARIMA projections and actual price movements. 12-month change. Per cent. Oct 2004 – Dec 2005



¹⁾ CPI-ATE: CPI adjusted for tax changes and excluding energy products.

Sources: Statistics Norway and Norges Bank

Chart 18 CPI-ATE¹⁾. Projections in IR 1/04, macromodel 1a-based simulation and actual developments. Per cent. 2002 Q1 – 2005 Q4



¹⁾ CPI-ATE: CPI adjusted for tax changes and excluding energy products.

Sources: Statistics Norway and Norges Bank

Table 3. Deviation between actual and projected inflation for a selection of inflation-targeting central banks.

	Average deviation from projection until 2004 ¹		Deviation from projections for 2005	
	Projection one year ahead	Projection two years ahead	One year ahead	Two years ahead
Australia	1.1	0.9	0.2	0.2
Euro area	0.3	0.5	0.2	0.6
New Zealand	0.4	0.7	0.2	0.5
United Kingdom	0.3	0.3	0.6	0.2
Sweden	0.7	1.0	0.7	1.2
Norway	0.8	1.1	0.5	1.3

¹ The average has been calculated for the period 1998-2004. For the euro area and Norway, the period is 2001-2004.

Sources: Inflation reports from the Reserve Bank of Australia, the European Central Bank, the Reserve Bank of New Zealand, the Bank of England, Sveriges Riksbank and Norges Bank.

lower than Norges Bank had projected. Other institutions' inflation forecasts were also too high for a long period. An unexpected fall in prices for imported consumer goods, despite higher oil prices, relatively low wage growth and a appreciation of the krone have all pushed down inflation.

Norway's small, open economy is particularly vulnerable to external impulses. In recent years, developments in the economy have reflected the impact of increasing globalisation. In Norway, we have felt the effects in the form of falling import prices, an increase in the supply of foreign labour and higher oil prices. In 2005, the analysis of external price impulses from imported consumer goods was improved and expanded.⁸ We now assume that the decline in external price impulses will persist for longer than we had previously expected. We have also attempted to analyse the increase in the use of foreign labour in Norway.

Projection work carried out in recent years has shown that the description of the current situation and short-term developments is very important to the quality of the projections. We are now focusing more attention on methods to improve our projections of developments in key variables in the short term. The framework for incorporating information from our regional network into our assessment of capacity utilisation and the current situation is also gradually improving.

Appendix 1. A model for the rise in prices for domestically produced goods and services

The model used as a basis for the decomposition in Table 2 in this article can theoretically be interpreted in the light of inflation models of imperfect competition à la de Brouwer and Ericsson (1998) and Kolsrud and Nymoén (1998). In the long term, prices for domestically produced goods and services, p^d_t , reflect the level of total unit labour costs. In our model, these costs are expressed through $(w-z)_t$, where w_t represents total labour costs and z_t the productivity level in period t . In the short term, inflation is determined by the rise in unit labour costs and inflation in the previous period. Furthermore, any deviation from the long-term equilibrium between the price and unit cost will gradually be corrected by means of the equilibrium adjustment expression $(p^d - (w-z))_{t-1}$. All variables are expressed as logarithms, and Δ is a difference operator. The model is expressed by:

$$\Delta p^d_t = 0.20 + 0.53 \Delta p^d_{t-1} + 0.34 \Delta (w-z)_t - 0.04 (p^d - (w-z))_{t-1} + 1.18 d86$$

(0.07) (0.043) (0.059) (0.014) (0.504)

The final term in the equation, $d86$, is a dummy variable that captures the effects of the krone devaluation in 1986. The figures in brackets are the standard deviations of the coefficients. All coefficients are statistically significant. The model has been tested for other possible explanatory variables, such as the output gap, the exchange rate and external prices. However, these variables have not been found to be statistically significant. It is nonetheless likely that they have some (direct) effect on domestic prices. The model explains inflation well, but as usual the results should be interpreted with caution, especially in view of the few observations covered by the analysis.

References

- “Modelling Inflation in Australia”, *Journal of Business & Economic Statistics*, American Statistical Association, 16(4), pages 433–449
- Kolsrud, D. & R. Nymoén (1998): “Unemployment and the Open Economy Wage-Price Spiral”, *Journal of Economic Studies*, 25, 450–467

Appendix 2. Overview of projections from 1995–2005

In addition to studying the projections for a single year, it is important to look at the projections over time to determine whether systematic errors occur. Charts 19-21 provide a comparison of realised variables for the period 1995-2005 and projections from Statistics Norway (SN), the Ministry of Finance (Fin) and Norges Bank published at the end of the year preceding the projection year. All of the institutions have had a tendency to underestimate mainland GDP growth in the 1990s. Wage growth has also been consistently underestimated until the past few years, when projections have been somewhat more accurate. In recent years, CPI-ATE inflation has been lower than projected.

Table 4 shows the average error, the average absolute error (AAE) and the relative root mean square error (RRMSE). These are measures of the accuracy of our projections for the period as a whole. AAE provides an indication of the average actual forecast error in percentage points over the years, without the forecast errors with opposite signs offsetting each other. RRMSE penalises large forecast errors more heavily than smaller ones, and indicates the magnitude of the errors in relation to actual growth. This makes it possible to compare the size of the forecast errors across different variables. The table provides a summary of the measures of the forecast errors. There is little difference in forecast error between the three institutions.

Table 4. Average error, average absolute error (AAE) and the relative root mean square error (RRMSE). Projections by Statistics Norway (SN), the Ministry of Finance (FIN) and Norges Bank (NB). 1995–2005

	SN	FIN	NB
Growth in mainland GDP			
Average error	-1.18	-0.96	-0.96
AAE	1.20	1.13	1.04
RRMSE	0.48	0.39	0.41
Annual wage growth			
Average error	-0.61	-0.83	0.03
AAE	0.95	1.15	0.85
RRMSE	0.23	0.27	0.21
Rise in consumer prices			
Average error	0.22	0.36	0.31
AAE	0.55	0.65	0.54
RRMSE	1.26	1.58	1.75

Sources: Statistics Norway, Technical Reporting Committee on Wage Settlements and Norges Bank

¹ AAE (average absolute error) is defined as $\frac{1}{N} \sum_{n=1}^N |y_n - \hat{y}_n|$ where y_n represents the actual growth rate and \hat{y}_n is the projected growth rate.

² RRMSE (relative root mean square error) is defined as

$$\sqrt{\frac{1}{N} \sum_{n=1}^N \left(\frac{y_n - \hat{y}_n}{y_n} \right)^2}$$

where y_n represents the actual growth rate and \hat{y}_n is the projected growth rate.

⁸ See box in *Inflation Report 3/05*.

Chart 19-21 Growth projections from Statistics Norway, Ministry of Finance and Norges Bank, and actual growth. Last projections published previous year. Per cent. 1995 to 2005

Statistics Norway Ministry of Finance Norges Bank Actual growth

■ ■ ■ —■—

Chart 19 Mainland GDP

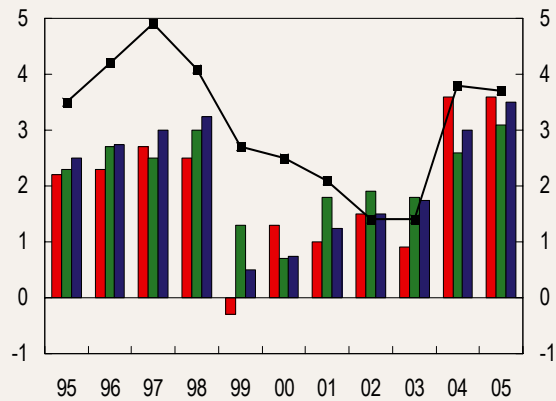
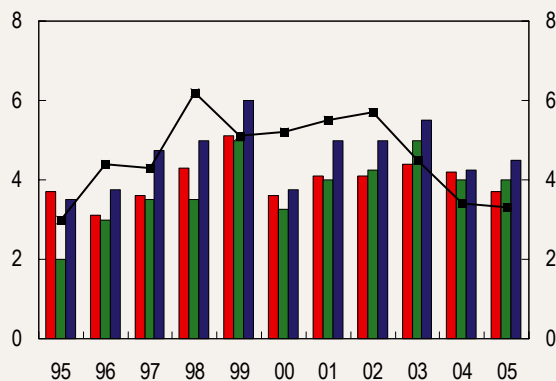
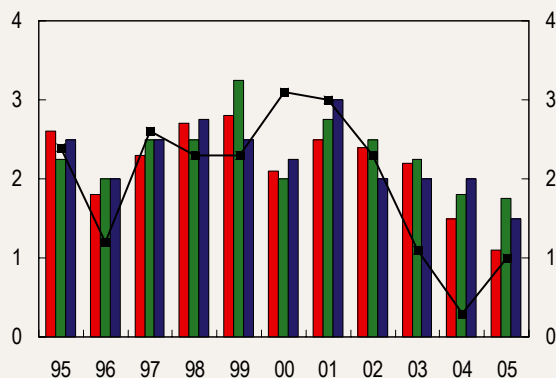


Chart 20 Annual wage growth¹⁾



¹⁾ The figures for 2000 and 2001 include the costs of extra vacation days.

Chart 21 Consumer price inflation¹⁾



¹⁾ Projected and actual CPI developments to 2001. Projected and actual developments in CPI-ATE since 2002.

Changes in the projections

Inflation Report 1/04

The international economy had entered a clearly expansionary phase concentrated in the US, Asia and Eastern Europe. The projections for growth in 2005 among Norway's trading partners were adjusted downwards from 2³/₄ per cent in *Inflation Report 3/03* to 2¹/₂ per cent in *Inflation Report 1/04*. We had envisaged a steadier cyclical profile in other countries.

In Norway, further interest rate reductions had been implemented since autumn 2003, and the krone had depreciated. At the same time, it was quite clear that the downturn had come to a halt and economic growth had been solid for several consecutive quarters. With low interest rates as an important driving force, the household sector in particular had contributed to the change, with solid growth in private consumption and residential property investment.

On the basis of an overall assessment of developments in output, employment and inflation, the estimate of the output gap in 2002 and 2003 was adjusted downwards in this Report. At the same time, potential growth in the Norwegian economy was projected to be somewhat higher than usual in 2004. Many companies had undertaken extensive rationalisation, and in the short term it appeared that output could be increased without a corresponding increase in employment. This upward adjustment allowed relatively strong economic growth without giving rise to higher capacity utilisation. In 2005, projected mainland GDP growth was 3¹/₄ per cent, half a percentage point higher than in the previous Report. Due to lower initial levels for the output gap and higher potential growth in 2004, the output gap for 2005 was nonetheless adjusted downwards somewhat.

The projections for inflation and wage growth for 2005 remained unchanged in relation to the previous Report. On the other hand, the 2004 projection for CPI-ATE inflation was revised downwards considerably after an unexpected decline at the beginning of 2004. We assumed that competition within industries such as air travel, telecommunications services and the grocery trade would normalise and that inflation would reach a higher level again in 2005. However, the risk that continued strong competition in several industries could also curb inflation further ahead was emphasised.

In relation to previous projections, it was now assumed that the rise in prices for imported consumer goods measured in foreign currency would fall again in 2005, but that the decline in the krone exchange rate through 2003 would push up prices for imported consumer goods measured in NOK.

Wage growth in 2005 was projected at 4³/₄ per cent,

the same growth rate as in the last Report in 2003. We expected employment growth to pick up later in 2004 and into 2005, and that this in turn would contribute to accelerating wage growth and rising inflation.

Inflation Report 2/04

The international recovery continued and broadened. Stronger growth abroad than predicted in Inflation Report 1/04 contributed to increased prices for oil and non-oil commodities. The Norwegian economy had emerged from the economic downturn, and inflation had developed as forecast in the previous *Inflation Report*. Projected CPI-ATE inflation for 2005 was nonetheless revised downwards by ³/₄ percentage point to 1¹/₂ per cent. Several factors contributed to this considerable downward adjustment. The krone had appreciated, and the forward rates underlying the projections in this Report, were slightly higher than in the previous Report. The strong krone led us to expect a weaker rise in prices for imported consumer goods, even though increased prices for oil and non-oil commodities in isolation continued to have the opposite effect. Somewhat higher interest rates also resulted in slightly lower projections for mainland growth for 2005, but the projection for the output gap remained at ¹/₄ per cent, due to an upward revision of the growth projection the previous year. Low inflation in 2004 was expected to result in a more moderate wage settlement in 2005, which, in turn, would curb inflation that year.

The editorial of the Report referred to the forward rates underlying the projections in the Report, and stated that: "...the interest rate should be kept unchanged for a longer period than indicated by market expectations. The prospect of continued low inflation in Norway also implies that we should not be the frontrunner when interest rates are increased in other countries."

Inflation Report 3/04

Global growth seemed likely to be the strongest for several decades. Despite the fact that solid demand growth had led to a sharp increase in prices for a number of commodities, consumer price inflation remained low in most regions of the world. Intensified international competition, strong productivity growth and idle capacity could explain low inflation. Improved credibility regarding inflation-targeting in many regions of the world was also highlighted as a possible cause.

Production developments in Norway's economy were broadly in line with projections in *Inflation Report 2/04*, as was inflation. Employment growth, however, had not picked up as markedly as expected in the previous Reports. Projected mainland GDP growth in 2005 was increased to 3¹/₂ per cent in this Report due to slightly lower forward rates and pros-

pects of higher growth in investment in residential property and petroleum extraction. This revised projection for output growth was fully reflected in the estimate for the output gap, which was now expected to reach $\frac{3}{4}$ per cent in 2005.

Despite a revised growth projection and pressures in the economy, projected inflation remained unchanged. This was particularly because it did not seem likely that pressures in the economy would result in higher wage growth. Prices for domestically produced goods and services had risen more slowly than expected in the previous Report, and we assumed increased competition would continue to curb inflation in the period ahead. The krone had appreciated somewhat.

Inflation Report 1/05

Towards the end of 2004, economic growth was slightly weaker in some regions of the world than assumed in the previous *Inflation Report*. Oil prices were again considerably higher than expected, but the effect on economic activity and prices still seemed to be very limited compared with what might have been expected from calculations based on previous upswings in oil prices. Idle capacity in many economies and lower oil intensity may have been important reasons for this.

In Norway, output was also slightly weaker than expected in 2004. Combined with a downward revision of the output gap in 2003, this resulted in an output gap estimate for 2004 that was half a percentage point lower than in the previous Report, i.e. $-\frac{3}{4}$ per cent. Projected growth for 2005, however, was revised upwards to 4 per cent. Our assessment of capacity utilisation this year thus remained unchanged at $\frac{3}{4}$ per cent, as in the previous Report.

At the beginning of 2005, the fall in prices for imported consumer goods was clearly sharper than assumed, whereas domestic goods and services developed in line with expectations. It was uncertain how much of the unexpected fall in prices could be attributed to abnormal seasonal variations, and how much, if any, could be attributed to weaker developments in underlying prices. Nevertheless, projected CPI-ATE inflation for 2005 was reduced by half a percentage point to 1 per cent.

Sickness absence had declined markedly through 2004. This probably provided scope for a relatively sharp increase in output without a corresponding rise in employment. In the context of low inflation, even a moderate wage settlement – in view of labour market tightness – would result in relatively high wage growth.

Inflation Report 2/05

For our trading partners, it seemed likely that GDP growth in 2005 would be slightly weaker than previously projected, especially because of a downward

revision of the growth projection for Sweden. Even though oil prices had risen to new heights, external price impulses, measured in foreign currency, were assumed to be lower than in the previous Report. This change was the result of weak developments through spring, and a tendency towards a stronger shift in imports than previously assumed.

Output developments in Norway's economy were broadly in line with the projections in the previous Report, but employment had not increased as expected. Delayed effects of the decline in sickness absence through 2004 and the increased use of foreign labour that is not captured in the Labour Force Survey (LFS) may be the underlying cause of the deviation between actual developments and previous projections. In this report, we expected that increased use of foreign labour through service imports would replace some domestic output, resulting in mainland GDP growth of $\frac{3}{4}$ per cent this year, $\frac{1}{4}$ percentage point lower than projected in the previous Report.

The wage settlement had resulted in lower wage growth than previously assumed, and it appeared that wage growth for 2005 would reach $\frac{3}{2}$ per cent, half a percentage point lower than projected in *Inflation Report 1/05*. Inflation had, in turn, been slightly stronger in the first part of the year than we had previously expected. First and foremost, prices for domestic goods and services rose slightly more than expected. Since the projection for wage growth was revised downwards at the same time, no changes were made to the projection for CPI-ATE inflation, which remained at 1 per cent.

Inflation Report 3/05

Internationally, inflation had increased slightly in recent months as a result of high oil prices. For the time being, we saw no indication that high energy prices would influence other prices, or that employees would receive compensation in the form of higher wage growth.

In Norway, consumer prices had developed in line with the projections in the previous Report, but the CPI-ATE was influenced by relatively large fluctuations in prices for imported consumer goods through summer and autumn.

Output also developed in line with previous projections, but once again it became clear that employment was not rising as much as we had projected. The deviation between LFS unemployment and registered unemployment was increasing. In view of moderate employment growth, we changed the projection for potential growth in 2005 from $\frac{2}{2}$ to $\frac{2}{4}$ per cent. Since the projection for GDP mainland growth remained unchanged at $\frac{3}{4}$ per cent, this implied a downward revision of the gap in 2005 to $\frac{1}{4}$ per cent.