

Evaluation of Norges Bank's projections for 2003

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Consumer price inflation¹ in 2003 was substantially lower than previously projected by Norges Bank and other forecasters. The difference between actual and projected consumer price inflation can be mainly explained by a sharp fall in prices for imported consumer goods. This in turn is attributable to the krone appreciation in 2002 and the fall in prices for these goods measured in foreign currency. The rise in prices for goods and services produced in Norway was also somewhat lower than expected. Prices fell more than expected in the last part of 2003 in particular. Weaker economic growth, coupled with increased competition and greater efficiency in a number of industries, probably contributed to pressure on prices for both goods and services produced in Norway and imported consumer goods.

Since March 2001, Norges Bank's operational objective for monetary policy has been low and stable inflation. The inflation target is set at 2½ per cent. Monetary policy is forward-looking. Projections for price inflation and economic developments therefore form an important basis for monetary policy decisions.

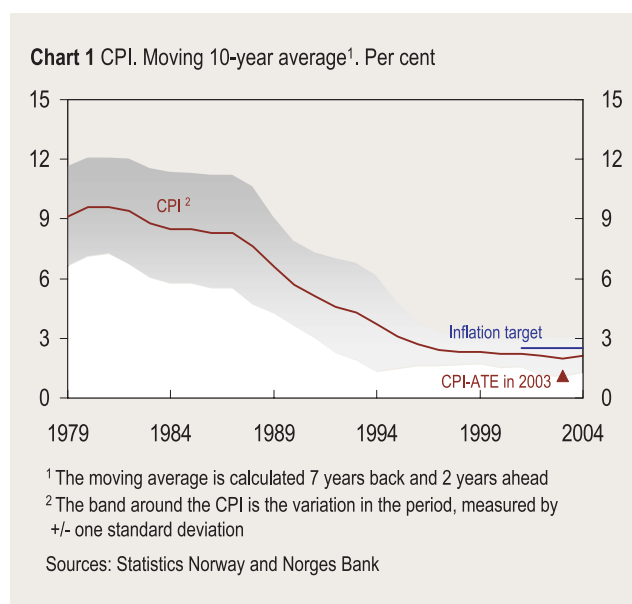
Analysing forecast error can help us to improve the accuracy of our forecasts in the future and our understanding of the disturbance to which the economy has been subjected. In the light of new, lower projections for externally generated impulses to the Norwegian economy, Norges Bank has revised previous estimates of the exchange rate pass-through to prices for imported consumer goods. Preliminary estimates indicate that the pass-through to these prices may be somewhat weaker, and come later, than previously assumed.

1 Introduction

Like other central banks with an inflation target for monetary policy, Norges Bank uses projections for consumer price inflation as a basis for the setting of interest rates. If monetary policy is to fulfil the operational objective of stable inflation, a thorough understanding of the factors behind price movements is crucial. By analysing forecast error, we gain a better insight into and understanding of economic relationships and price formation. This is important for enabling us to improve the accuracy of our projections.

There may be many reasons why projections do not tally with actual developments.²

- The projections in the *Inflation Report* are based on technical assumptions concerning interest rates and exchange rates. These assumptions do not necessarily reflect the most probable outcome. The purpose of Norges Bank's projections is to provide a basis for monetary policy decisions. Consequently, our projections will not always be the most accurate forecast of economic developments. If, for example, the conditional projection for consumer price inflation two years ahead is lower than the inflation target, the interest rate will normally be reduced with a view to achieving the inflation target. In such a situation, the interest rate is changed precisely in order to achieve a different outcome from the projected one. When the projections are evaluated, it is important to bear in mind that they do not necessarily represent Norges Bank's view of the most probable outcome.
- The projections are also based on assumptions concerning international economic developments, oil



prices, public expenditure, and direct and indirect taxes. These are factors that monetary policy cannot influence. If developments differ from the assumptions made for these variables, the projections will not be accurate.

- The economy is constantly subjected to unexpected events or shocks that it is not possible to take account of in advance.
- There is uncertainty surrounding the actual state of the economy at the time the projections are published. This is because it takes time for the statistics to be published, and because the statistics are often extensively revised. If the basis for analysing future developments is incorrect, forecast error may result.

* With thanks to my colleagues at Norges Bank for their useful comments.

¹ Measured by the consumer price index adjusted for tax changes and excluding energy products

² For an in-depth discussion of the reasons for forecast error, see Heidi Lohmann (2003): "Evaluation of Norges Bank's projections for 2001 and 2002" in *Economic Bulletin* 1/03.

- The analytical apparatus that is used may provide an inaccurate or inadequate description of actual economic relationships.
- All projections involve a certain degree of judgement. Forecast error may also arise if this judgement proves to be unsatisfactory.

This article is an evaluation of the inflation projections for 2003.³ Norges Bank has also provided an account of consumer price inflation in 2003 and the background to the deviation from the inflation target in the *Annual Report* for 2003 (March 2004).

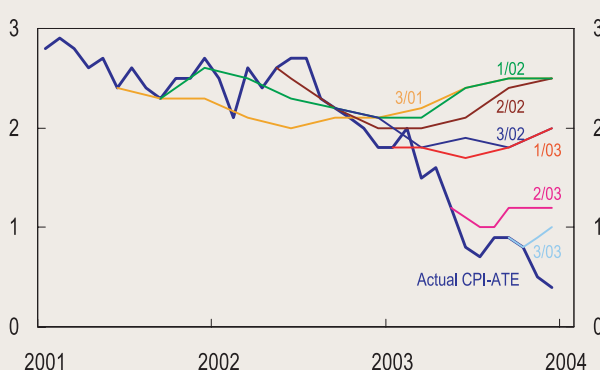
2 Projected inflation in 2003

Chart 2 shows changes in Norges Bank's inflation projections for 2003 and actual inflation. The projections were gradually revised downwards from the summer of 2001. Other institutions lowered their projections for inflation in 2003 to approximately the same extent as Norges Bank (see Chart 3). On the whole, Norges Bank revised its projections downwards somewhat earlier than most of the other institutions shown in the chart.

The difference between actual and projected price inflation in 2003 must be assessed in the light of developments in the economic variables that influence price inflation. Inflation is primarily determined by developments in the exchange rate, externally generated price impulses, wage growth in Norway and the competitive situation in the Norwegian economy. Developments in these variables are closely related to economic growth internationally and in Norway. Price inflation is influenced with varying time lags. Differences between actual and projected developments in variables that influence price inflation therefore have to be assessed over time.

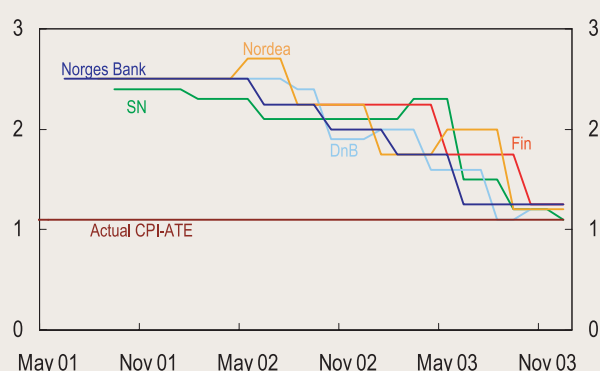
Table 1 shows the difference between actual and projected developments in 2002 and 2003 for a number of variables that influence price inflation. Since monetary

Chart 2 CPI-ATE projections made at different times. Year-on-year rise (historic monthly figures), January 01–December 03



Sources: Statistics Norway and Norges Bank

Chart 3 CPI-ATE. Projections for 2003 published at different times. Per cent



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

policy is as a general rule oriented towards reaching the inflation target two years ahead, it is appropriate to use projections made in 2001 for 2003 as the point of departure. We have used the projections published in *Inflation*

Table 1. Assumptions and projections for some key macroeconomic variables for the Norwegian economy in 2002 and 2003 published in *Inflation Report* 3/2001, and actual developments. Percentage change from previous year unless otherwise specified.

	2002			2003		
	Projection IR 3/01	Actual	Difference ¹⁾	Projection IR 3/01	Actual	Difference ¹⁾
Interest rate (%)	7	6.7	-¼	7	4.2	-2 ¾
Exchange rate (level, I-44)	98.9	91.6	-8 ²⁾	98.9	92.8	-6 ½ ²⁾
GDP trading partners	1 ¼	1.3	0	2 ½	1 ¼ ³⁾	-1 ¼
Producer prices, trading partners	0	-0.5	-½	¾	0.3	-½
Mainland GDP	1 ½	1.3	-¼	1 ¾	0.7	-1
Annual wages	5	5.7	¾	5	4 ½	-½
CPI-ATE	2	2.3	¼	2 ½	1.1	-1 ½

¹⁾ Percentage points. Negative figures indicate that projections are too high.

²⁾ Per cent. Negative figures denote a stronger exchange rate.

³⁾ Projections from *Inflation Report* 1/04.

Sources: Statistics Norway and Norges Bank

³ In this article, we consider how underlying price inflation, measured by the consumer price index adjusted for tax changes and excluding energy products (CPI-ATE), has developed compared with our forecasts.

Report 3/01 as a reference. The analysis would not have been substantially different if we had used another inflation report from 2001.

Towards the end of 2001, it was projected that price inflation would be at the inflation target rate of 2½ per cent in 2003. The projection was based on the assumption that the pressures in the Norwegian economy would remain high in the years ahead. Since 1998, the Norwegian economy had been characterised by substantial labour shortages and a considerably higher rise in labour costs than among trading partners. The global economy had been experiencing a downturn since mid-2000. Global economic growth was expected to pick up the following year already. According to our evaluation, the Norwegian economy would be affected to only a limited extent by the global downturn.

In 2002, economic developments and inflation were approximately as expected. Wage growth in Norway was surprisingly high, however, and the exchange rate was substantially stronger than expected.

In 2003, developments were generally weaker than expected. Price inflation measured by the CPI-ATE was 1.1 per cent in 2003, almost 1½ percentage points lower than projected in 2001. Economic developments in Norway and internationally took an unexpected turn. External price impulses, measured by a weighted average of producer prices among 25 trading partners, were weaker than expected. The krone exchange rate was still at a stronger level than foreseen in 2001. Wage growth in Norway was somewhat slower than projected.

3 Reasons why price inflation was lower than expected

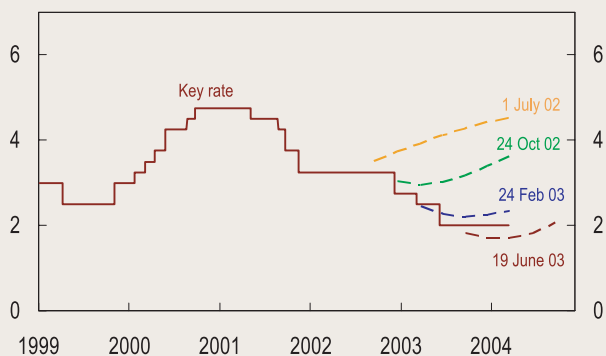
Sharper global downturn

In spring 2002, global growth appeared to be picking up, in line with forecasts. Long-term interest rates were increasing, and the equity market was rebounding. However, the upturn proved to be temporary, and during the summer and autumn growth prospects gradually deteriorated. Share prices on stock exchanges worldwide fell appreciably. Terror, the war in Iraq and SARS contributed to increased international uncertainty in the first part of 2003.

In 2002, overall economic growth was approximately as expected. In 2003, growth was markedly weaker than the IMF, the OECD, other analysts and observers or Norges Bank expected in 2001 and 2002. The Bank for International Settlements' Annual Report for 2002 states the following:

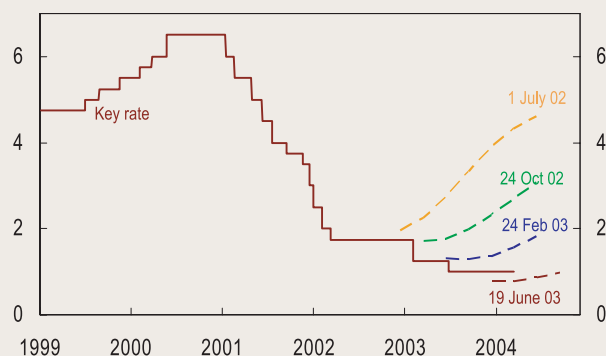
“The last year or so has been marked by economic disappointments. Interrelated developments in the geopolitical, economic and financial spheres held back growth and led to great uncertainty about the future. The recovery in the world economy seemed to stall. Indeed, the

Chart 4 Interest rate expectations in the euro area. Actual developments and expected key rate



Sources: Norges Bank and Bloomberg

Chart 5 Interest rate expectations in the US. Actual developments and expected key rate



Sources: Norges Bank and Bloomberg

news got worse rather than better during most of the period under review. This was surprising to many given the high degree of policy stimulus being applied in large parts of the world.” (p. 3.)

The change in interest rate expectations internationally is a good indication of how far actual developments differed from expectations. Interest rate expectations may reflect the market's expectations regarding economic growth. These expectations were gradually revised downwards in the short and long term, in line with cuts in key rates in many countries and lowered growth and inflation expectations (see Charts 4 and 5).

The krone appreciated

The krone exchange rate (I-44) appreciated by 14 per cent between October 2001, when *Inflation Report 3/01* was published, and January 2003. Weak global economic developments were one important factor behind the appreciation of the krone.

In 2001 and the first part of 2002, the global downturn appeared to have had a limited impact on the Norwegian

economy. Economic resources were under strong pressure. The wage settlements in spring 2002 were surprisingly high, and it seemed likely that wage growth would remain high and push inflation up to above the target two years later. This contributed to the ½ percentage point rise in the interest rate in summer 2002. A higher interest rate in Norway along with both lower interest rates and lower interest rate expectations internationally led to a substantial increase in the expected interest rate differential between Norway and trading partners in the course of 2002. In autumn 2002, the interest rate differential was the widest it had been since 1998.

The wider interest rate differential may partly explain the krone appreciation through 2001 and 2002. Moreover, special factors in the international economy led to a stronger krone than the interest rate differential alone would imply.⁴ The fall in equity prices in 2002 led to greater caution and expectations of a further decline. Many investors therefore wanted to shift more capital into fixed-income securities. According to market participants, the Norwegian krone, with a relatively high interest rate, was a good alternative. Higher oil prices in 2002 and the decrease in the expected fluctuations between the major currencies also increased interest in NOK. Smaller fluctuations in exchange rates among the main currencies reduced the scope for speculative gains in the market. Investors therefore placed greater emphasis on interest rate differentials than earlier and invested a larger portion of their portfolios in high interest rate currencies, such as the Norwegian krone. Moreover, global political uncertainty, in part related to a possible war in Iraq, led to NOK being regarded as a safe haven from time to time.

During 2003, NOK depreciated again. However, changes in the krone exchange rate affect consumer price inflation with a lag. Norges Bank's analyses indicate that most of the impact on price inflation of a change in the exchange rate comes after about 1-1½ years. The krone appreciation in 2002 therefore had a substantial negative impact on inflation in 2003. Chart 6 shows developments in the krone exchange rate and technical assumptions underlying the projections from one inflation report to the next from 2001 to 2003.

Growth in the Norwegian economy came to a halt

In 2003, growth in mainland GDP was 0.7 per cent, 1 percentage point lower than projected in Inflation Report 3/2001.⁵ The downturn in the Norwegian economy was probably closely related to the fact that the international downturn was more extensive than Norges Bank and most other observers had believed. The strong growth in investment in the late 1990s led to idle capacity in many enterprises when demand slowed, and investment dropped sharply. The equity price fall in

2002 also reduced the incentive to invest. In the light of the international downturn and clear signs of a slowdown in the Norwegian economy, Norges Bank and other forecasters made appreciable downward revisions during 2002 and 2003 of their growth estimates for 2003 (see Chart 7).

Unemployment increased through 2002 and 2003. In 2002 unemployment mainly increased in service industries such as ICT, consulting and the travel industry. These industries were strongly affected by the global economic situation. Despite this rise in unemployment, wage growth was the highest for many years, particularly in the public sector. In 2003, unemployment rose in a number of service industries, manufacturing and the public sector. The rise in unemployment in manufacturing was driven by weak international demand, the appreciation of the krone and several years of high wage

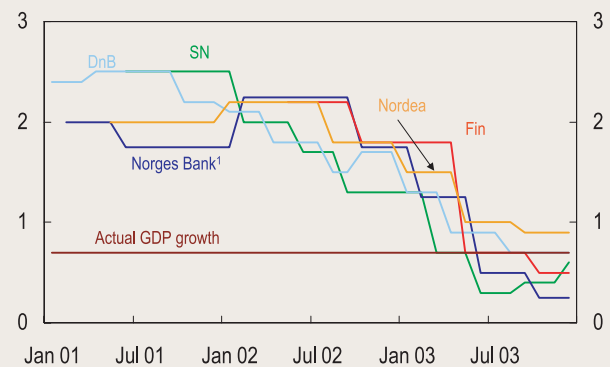
Chart 6 Effective krone exchange rate (I-44) and assumptions in inflation reports. Index¹. Daily figures. 1 January 01–31 December 03



¹ A rising curve denotes a weaker krone exchange rate

Source: Norges Bank

Chart 7 Mainland GDP. Projections for 2003 published at different times. Per cent



¹ Including changes in electricity production. Inflation Report 2/2003 and 3/2003 presented projections for mainland GDP adjusted for changes in electricity production.

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

⁴ For further details, see the box in *Inflation Report 1/03* and Bjørn Naug (2003): "Factors behind changes in the krone exchange rate – an empirical analysis" in Norges Bank's *Occasional Papers* no. 32.

⁵ Lower energy production contributed to curbing GDP growth in 2003. This may explain approximately ¼ percentage point of the difference between actual and projected GDP growth. Fluctuations in energy production were not taken into account in the projections.

growth. In the public sector there was no budgetary scope for maintaining employment after several years of sharply rising labour costs. Wage growth slowed in 2003 and was somewhat lower than projected.

Lower demand growth in the Norwegian economy may have influenced price inflation. In spring 2003, Norges Bank's regional network signalled a fall in demand and intense competition in several sectors, especially clothing and audiovisual equipment. The decline in demand must be viewed against the backdrop of the electricity price shock of winter 2002/2003. A sharp increase in electricity expenses led to a temporary decline in household purchasing power in spring 2003. At the same time, competition has intensified in recent years in industries such as telecommunications and air travel as a result of deregulation and new entrants. Low private sector demand may have contributed to intensified competition and squeezed margins in these industries.

4 Technical review of the difference between actual and projected inflation

Developments in prices for imported consumer goods in particular were different from the projections. Chart 8 shows actual and projected growth in the total CPI-ATE, and broken down into price inflation for imported consumer goods and goods and services produced in Norway, respectively.

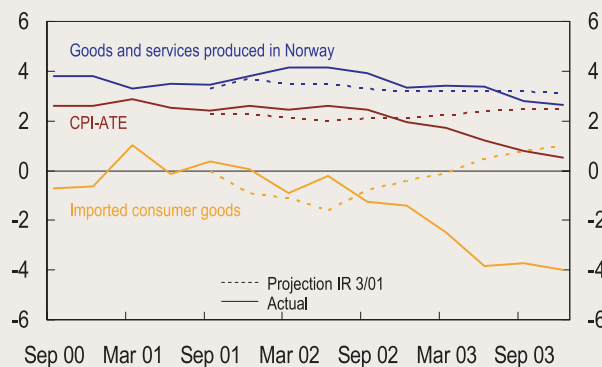
In *Inflation Report 3/01*, Norges Bank projected a temporary dip in import prices as a result of the krone appreciation from 2000, and a temporary dampening of external price impulses. In 2002, the rise in prices for imported consumer goods was approximately as expected. In 2003, price inflation was 4 percentage points lower than expected.

The rise in prices for goods and services produced in Norway remained surprisingly high through 2002. From the latter half of 2003, the rise in prices for this group was also somewhat lower than projected in 2001. On average, the rise in prices for goods and services produced in Norway was $\frac{1}{4}$ percentage point lower than estimated in 2003.

Imported consumer goods

The fall in prices for imported consumer goods must be viewed in the light of the krone appreciation through 2002. The exchange rate explains most of the difference between actual and projected price inflation for these goods. In addition, external price impulses, measured by producer prices, were lower than assumed. This must be viewed in the light of the global downturn. Towards the end of 2003, prices for imported consumer goods exhibited a surprisingly steep fall. The price fall was sharper than the krone appreciation and lower producer prices

Chart 8 CPI-ATE. Projections and actual developments. Total and by supplier sector. Year-on-year growth (historic monthly figures). Per cent. September 00–December 03



Sources: Statistics Norway and Norges Bank

alone would imply. As a result, we have looked more closely at possible other causes of the fall in prices.

Prices for clothing and audiovisual equipment have fallen substantially more than the exchange rate and producer prices should suggest and account for a large share of the fall in prices for consumer goods as a whole. Prices for imported clothing have been falling for many years partly as a result of the trade shift from high- to low-cost countries.⁶ New analyses indicate that this trend intensified in 2003. Prices for audiovisual equipment have fallen in most countries as a result of strong productivity growth in the manufacture of these goods.

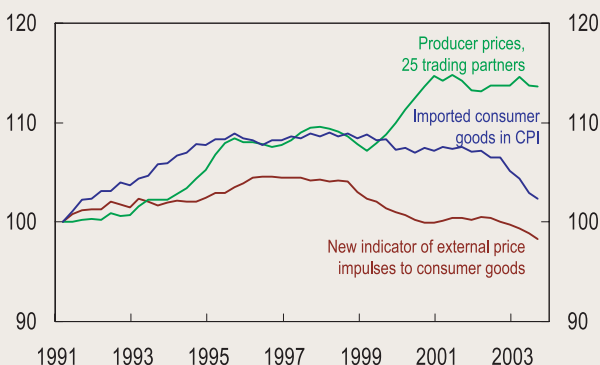
Box 1: Indicator of external price impulses to Norwegian consumer goods

Producer prices – weighted average of producer prices among 25 trading partners. Weighted by total imports to Norway (consumer goods, intermediate goods and capital goods). Includes prices for intermediate goods and capital goods, and prices for goods that only go to trading partners' domestic consumption. Influenced strongly by variations in oil prices. Does not capture the effect on prices of the shift in trade towards countries with a different cost level.

Norges Bank's indicator – Weighted average of inflation in prices for consumer goods in the countries that export those goods to Norway. Consumer prices, export prices or producer prices in the countries the goods are imported from are used, depending on availability and relevance to prices in Norway. Captures the effects on prices of the shift in trade towards countries with a different cost level.

⁶ *Inflation Report 3/01*: "Why has the rise in prices for imported consumer goods been low?" and *Inflation Report 2/02*: "Why have clothing prices fallen?" See also the article: "The effects of trade liberalisation on clothing prices and on overall consumer price inflation" in *Economic Bulletin 4/02*.

Chart 9 Developments in prices for imported consumer goods in the CPI and indicators of price developments in foreign currency. Index. 1991 Q1 = 100, 1991 Q1–2003 Q3



¹ 3-quarter moving average

Sources: Statistics Norway and Norges Bank

The decline in prices for clothing and audiovisual equipment is probably not reflected in producer prices (see box).

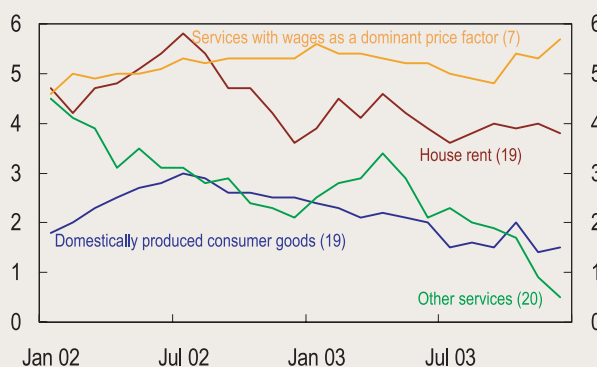
As a result, Norges Bank has calculated a new indicator of external price impulses as an alternative to producer prices. This indicator measures more directly developments in prices for consumer goods that Norway imports.⁷ The indicator captures the effects of the shift in trade to countries with lower price levels and the particularly high productivity growth in connection with the manufacture of certain types of goods, particularly audiovisual equipment.

Chart 9 shows the new indicator of external price impulses compared with prices for imported consumer goods in the consumer price index and producer prices. The new indicator of external price impulses has been declining since the mid-1990s. In 2003, external price impulses, measured in this way, fell by 1½ per cent. This is 2¼ percentage points lower than projected by Norges Bank in 2001.

In empirical studies of the factors that determine prices for imported consumer goods in the consumer price index, Norges Bank has previously used international aggregate indices for producer prices, export prices or consumer prices as an indicator of external price impulses. The new indicator of external price impulses showed slower price inflation in the 1990s than producer prices indicated. Preliminary empirical studies that take account of this show that the krone exchange rate has a somewhat weaker effect on prices than is indicated by earlier analyses.⁸ In addition, the studies show that the effects of the krone exchange rate occur somewhat later than previously assumed. However, the studies confirm that the krone exchange rate remains the most important cause of the fall in prices for imported consumer goods.

In addition to a stronger exchange rate and lower external price impulses than assumed, lower domestic

Chart 10 CPI-ATE by domestic supplier sector. 12-month rise. Per cent. January 02–December 03



Weightings in CPI-ATE in brackets

Sources: Statistics Norway and Norges Bank

demand probably contributed to pushing down prices for imported consumer goods in 2003. Information from Norges Bank's regional network indicates that the decline in demand in spring 2003 contributed to pushing down prices for these goods through more sales promotion than normal.

Goods and services produced in Norway

The rise in prices for goods and services produced in Norway was higher than expected in 2002 and lower than expected in 2003. The difference in 2002 must be viewed in the light of higher-than-projected wage growth that year.

Changes in wage growth affect prices over a period of time. Higher-than-projected wage growth in 2002 also exerted upward pressure on inflation in 2003. Lower-than-projected wage growth in 2003 had the opposite effect. The overall effect on inflation in 2003 of the differences between actual and projected wage growth in 2002 and 2003 was roughly neutral.

Towards the end of 2003, the rise in prices for goods and services produced in Norway declined to an unexpected degree (see Chart 8). Lower wage growth may have played a part. The rise in prices for services with wages as a dominant cost factor has remained high, however (see Chart 10).

Prices for some services have fallen. Prices for telecom services and air travel fell by 0.8 per cent and 3.8 per cent respectively from 2002 to 2003.⁹ The price fall gathered pace towards the end of 2003. The decline in prices must be seen in the light of structural changes and increased competition in these industries. Prices for some groceries have also fallen. They may have been cut in response to the establishment of the international low-price chain, Lidl, in Norway.

Operators in the air travel business and telecommuni-

⁷ The index is described in a box in *Inflation Report* 1/04, and further documentation will be provided in *Economic Bulletin* 2/04.

⁸ New empirical studies of the exchange rate pass-through are discussed in a box in *Inflation Report* 1/04.

⁹ Adjusted for tax changes.

Table 2. Decomposition of the difference between actual and projected CPI-ATE in 2003. Contribution to annual price inflation in percentage points

Difference between actual and projected rise in CPI-ATE	-1½
Decomposition of difference	
Stronger exchange rate in 2002	-(½-¾)
Weaker external price pressures	-(¼-½)
Higher wages in 2002, lower wages in 2003	0
Stronger competition	-¼
Not explained/other factors ¹	-¼

¹ Other factors that may explain the difference are falling prices for telecom equipment and the introduction of a maximum rate for day-care centres. The calculated index for external price impulses does not include prices for telecom equipment because some foreign statistics are not available. Prices for these goods are not published in Norway either, but the fall in prices is probably in line with, or even larger than the fall in prices for audiovisual equipment. The introduction of a maximum price for day care may explain up to 0.1 percentage point of the difference between actual and projected price inflation. This is a temporary disturbance that Norges Bank does not take into account in its setting of interest rates.

cations have cut costs through downsizing and restructuring. This probably led to increased productivity, which has provided room for lower prices. However, further falls in profitability in the airline industry indicate that increased productivity has not fully compensated for the fall in prices. Information from Norges Bank's regional network indicates that productivity is also improving at several stages of the value chain in the food retail sector. Several chains have begun cooperating with international food retail groups, making it possible to improve distribution efficiency.

Norges Bank did not include special effects on prices due to possible changes in the competitive situation in the assumptions underlying the projections for its inflation reports. Increased competition in some industries may therefore explain some of the difference between actual and projected price inflation in 2003.

Other factors may also have influenced prices for goods and services produced in Norway. The change in the krone exchange rate has an indirect effect on prices for goods and services produced in Norway, through lower prices for imported intermediate goods and services. The price of charter travel, for instance, fell sharply in spring 2003 as a result of the krone appreciation in 2002. The introduction of a maximum rate for day-care places has also contributed to curbing domestic price inflation.

Decomposition of the difference between actual and projected price inflation

In Table 2, the difference between actual and projected price inflation is decomposed into the various explanatory variables. New projections for external price impulses and new estimates of the pass-through from the exchange rate to prices are used in the decomposition. Norges Bank's analytical apparatus does not provide a basis for an exact calculation of the effects of increased

competition and structural changes in individual sectors. The effect is estimated by comparing actual price developments for some goods and services that may be influenced by these factors, with an estimated price rise of 2½ per cent on these goods and services. The difference can be assumed to be the effect on prices of changes in the competitive situation. In our calculations we have used prices for air travel, telecom services, hotel services and some groceries.

5 Conclusion

One important reason for evaluating the projections is to achieve a better understanding of economic relationships and price formation, so that Norges Bank can make more accurate projections in the future.

The difference between actual and projected price inflation in 2003 is due to several factors. A stronger-than-expected exchange rate can explain a substantial portion of the difference. In *Inflation Report 3/01*, the exchange rate was held constant in the period ahead as a technical assumption. If Norges Bank had assumed the "correct" krone exchange rate, the forecast error would have been smaller. However, it is difficult to project exchange rate movements in the short- and medium-long term. A number of studies have shown that today's exchange rate is a more accurate short-term forecast for the exchange rate than forecasts based on empirical exchange rate models or uncovered interest rate parity. One important cause of the krone appreciation in 2002 was that the global economy was subjected to a number of negative disturbances, and special conditions in the international equity and foreign exchange markets. Neither Norges Bank nor other forecasters succeeded in predicting actual global economic developments.

Another important source of difference between actual and projected price inflation is that external price impulses have been lower than previously projected. New calculations show that external impulses to Norwegian prices have been close to zero or negative since the mid-1990s. The new indicator of external price impulses will probably improve the basis for making inflation projections in the future. First, Norges Bank will know more than previously about actual external price impulses at the time of making projections. Second, Norges Bank will now be able to capture special factors that influence prices for consumer goods imported by Norway, but which are not reflected in aggregate international indices for producer and export prices.

New empirical studies, based among other things on the new indicator of external price impulses, may imply that the effect of the krone appreciation on consumer prices has been somewhat smaller and occurred somewhat later than our previous calculations suggest. However, estimates of the exchange rate pass-through

Growth forecasts from Statistics Norway, Ministry of Finance and Norges Bank, and actual growth. Last projections published previous year. Per cent. 1994 to 2003

Statistics Norway ■ Ministry of Finance ■ Norges Bank ■ Actual growth —◆—

Chart 11 Mainland GDP

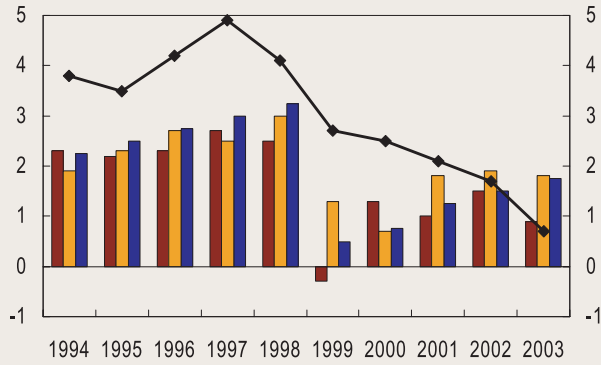


Chart 12 Mainland demand

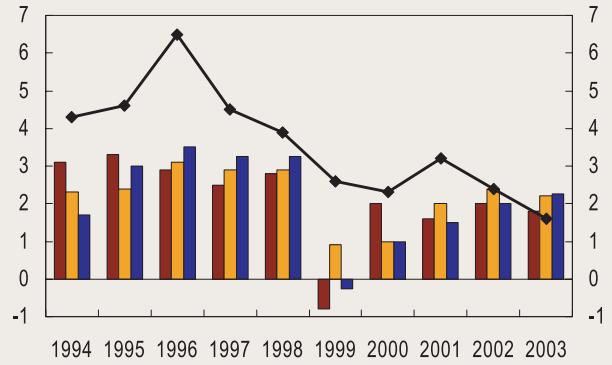


Chart 13 Employment growth

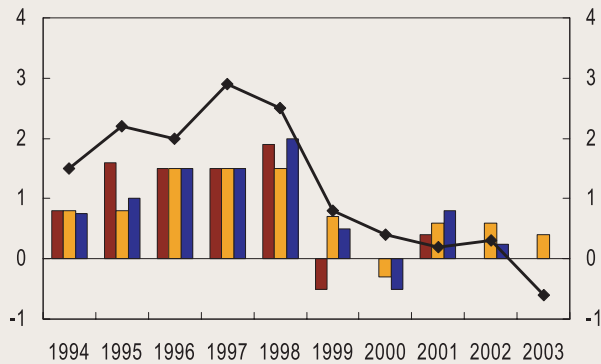


Chart 14 Unemployment rate

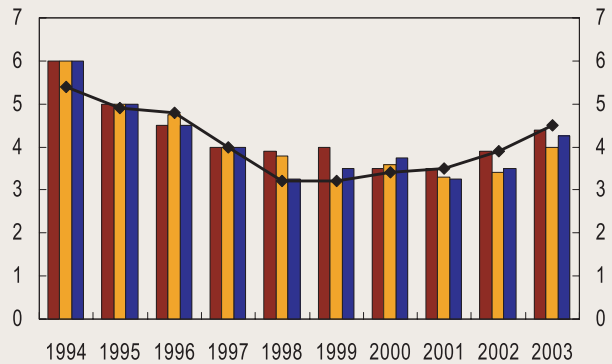
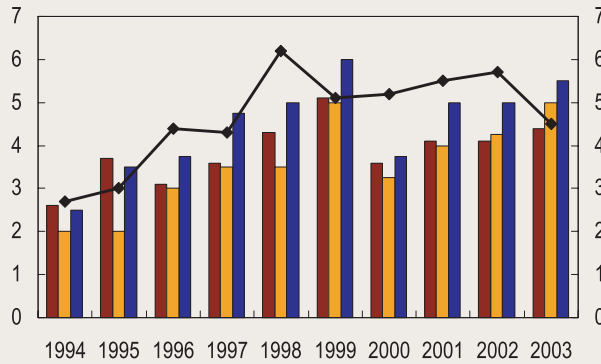
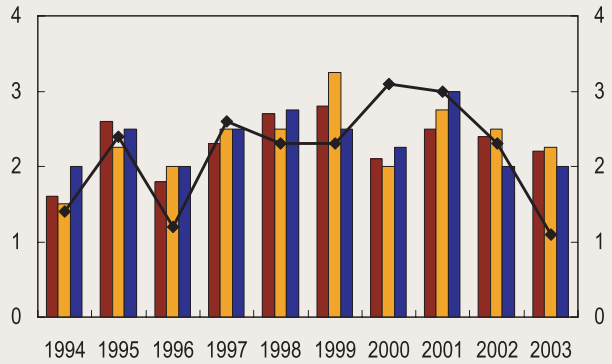


Chart 15 Annual wage growth¹



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

Chart 16 Consumer price inflation¹



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

are uncertain. Norges Bank has relatively limited experience of how inflation and price-setting mechanisms function when monetary policy is oriented towards inflation targeting.

Weaker economic growth, a decline in demand and structural changes in some markets contributed to more intense competition in many sectors. The effect on prices of changes in competitive conditions may be substantial, but is difficult to quantify. As a result of experience from 2003, however, Norges Bank is now more aware of this type of factor. We use our regional network actively in an attempt to capture changes in competitive pressures and the effects they may have on prices in the different industries.

Annex: Overview of projections from 1994 to 2003

In addition to studying the projections presented in a single report, it is important to consider whether we make systematic errors over time. Charts 11 to 16 provide a comparison of actual figures for the period 1994-2003 with projections from Statistics Norway, the Ministry of Finance and Norges Bank made at the end of the year before the forecast year. All three institutions tended to underestimate the period of expansion in the 1990s. Growth in demand and GDP was higher than expected every year from 1994 to 2001. Employment was higher than expected from 1994 to 2000. There has also been a systematic tendency to underestimate wage growth. Projections for consumer price inflation have been relatively good, with some exceptions.

Table 3 shows the average forecast error, the average absolute error (AAE¹⁰) and the relative root mean square error (RRMSE¹¹). These are measures of the accuracy of our projections for the entire period. AAE provides an indication of the average actual forecast error in percentage points over the years, without the

Table 3. Average error, average absolute error (AAE) and relative root mean square error (RRMSE) Statistics Norway (SN), the Ministry of Finance (Fin) and Norges Bank (NB). 1994 to 2003

	SN	FD	NB
Growth in mainland GDP			
Average error	-1.38	-1.03	-1.07
AAE	1.42	1.29	1.28
RRMSE	0.52	0.64	0.64
Growth in employment			
Average error	-0.50	-0.41	-0.44
AAE	0.66	0.75	0.68
RRMSE	0.85	1.08	1.25
Growth in mainland demand			
Average error	-1.47	-1.38	-1.47
AAE	1.51	1.50	1.60
RRMSE	0.53	0.44	0.53
Annual wage growth			
Average error	-0.80	-1.11	-0.19
AAE	0.94	1.21	0.76
RRMSE	0.22	0.28	0.17
Consumer price inflation			
Average error	0.13	0.18	0.18
AAE	0.49	0.50	0.43
RRMSE	0.39	0.43	0.38

Sources: Ministry of Finance, Statistics Norway and Norges Bank

forecast errors with opposite signs offsetting each other. RRMSE penalises large forecast errors more heavily than small errors, and indicates the magnitude of the errors in relation to actual growth. This makes it possible to compare the magnitude of the forecast errors across different variables.

The table provides a summary of the information in the charts. Forecast error is least for price inflation, and greatest for demand growth and GDP growth. There is little difference in forecast error between the three institutions. The table shows that the Ministry of Finance has forecast demand growth most accurately, and Norges Bank has been most accurate on wage growth.

¹⁰ AAE (average absolute error) is defined as, $(1/N) \sum_{n=1}^N |y_n - \hat{y}_n|$ where y_n represents the actual growth rate and \hat{y}_n is the projected growth rate.

¹¹ RRMSE (relative root mean square error) is defined as $\sqrt{1/N \sum_{n=1}^N \left(\frac{y_n - \hat{y}_n}{y_n} \right)^2}$ where y_n represents the actual growth rate and \hat{y}_n is the projected growth rate.