Evaluation of Norges Bank's projections for 2001 and 2002

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Norges Bank's projections for developments in the Norwegian and international economy form an important basis for monetary policy decisions. Norges Bank places emphasis on the importance of evaluating the projections in the *Inflation Report* and on transparency in our forecasting work.[1] It is important to analyse forecast errors to improve the quality and accuracy of our projections. In addition to the series of articles containing evaluations of Norges Bank's projections, the assessments on which monetary policy decisions have been based are also included in the Bank's Annual Report.

Low and stable inflation has been Norges Bank's operational objective for monetary policy since March 2001. The inflation target is set at 2½ per cent. An optimal monetary policy is forward-looking and takes account of long and variable lags associated with monetary policy decisions. This is why inflation-targeting central banks use projections for future price inflation as a basis for monetary policy decisions.

This article analyses Norges Bank's projections for 2001 and 2002 as presented in *Inflation Report* 4/2000. Our projections for consumer price inflation receive particular emphasis, but we also look at the projections for other macroeconomic variables given the impact they have on consumer price inflation.

Consumer price inflation, as measured by the CPI-ATE[2], was approximately in line with our projection in 2001 and 2002. Wage growth was higher than expected. The projection nevertheless proved to be accurate partly because imported price inflation was low as a result of a higher-than-projected krone exchange rate. The analysis stresses that our understanding of wage formation requires greater emphasis on sheltered industries.

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 monetary policy decisions. Calculations presented in Norges Bank's *Inflation Report* indicate that a substantial share of the effects of an interest rate change on inflation will occur within two years. The key rate (the sight deposit rate) is set on the basis of an overall assessment of the inflation outlook, normally with a view to achieving an inflation rate of 2½% two years ahead. The direct effects on consumer prices resulting from changes in taxes, excise duties and extraordinary temporary disturbances shall in general not be taken into account. We therefore focus on actual developments in underlying price inflation, as measured by the CPI-ATE, compared with our projections.

The projections in the *Inflation Report* are conditional on various assumptions, such as technical assumptions concerning changes in the interest rate and the exchange rate. In *Inflation Report* 4/2000, the projections were based on the assumption that the exchange rate would remain constant and the interest rate would change in line with market expectations. These assumptions will not necessarily reflect the most probable outcome. Consequently, our projections will not always be the best forecast of economic developments. The purpose of Norges Bank's projections is to provide a basis for monetary policy decisions. If, for example, the conditional projection for consumer price inflation two years ahead is above the inflation target, the interest rate will normally be increased with a view to achieving the inflation target. In such a situation, the interest rate is changed in order to achieve a different outcome than projected. When the projections are subsequently evaluated, it is important to take into account that the projections do not necessarily represent Norges Bank's view of the most probable outcome.

It is decisive to have a good understanding of inflation developments if monetary policy is to fulfil the operational objective of stable inflation. Actual economic developments will often differ from the projections. The most important reasons for these forecast errors are:

- Assumptions included in the analysis may be incorrect. Norges Bank makes technical assumptions concerning the interest rate and the exchange rate.

- The projections are also based on other key assumptions concerning, for example, international economic developments, oil prices, public expenditure, and direct and indirect taxes. If developments differ from the assumptions, the projections will not be accurate.

- The economy is constantly being exposed to unexpected events that are impossible to predict at the time the projections are published. Examples of these events may be wage-driven cost shocks, unexpected changes in oil prices or low levels of rainfall resulting in sharp, unexpected increases in electricity prices.

- The economic models used in preparing the projections may be incorrect. Forecast errors may arise if historical relationships change, or if our understanding of the economic relationships on which our assessments were based proves to have been incorrect.

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

[1] See previous articles (Madsen 1996, Jore 1997, Jore 1999, Jore 2000, Sturød 2002)

[2] CPI-ATE is consumer prices adjusted for tax changes and excluding energy products.

- Any projection involves a certain degree of judgement. The projections generated by the models are different from the final projections. For example, we correct model projections that have proved to be systematically incorrect over time. In addition, professional judgement is used to assess how reasonable the model-generated projections are, based on our overall knowledge of the way the economy functions. This judgement may subsequently prove to have been unsatisfactory.

- There is also 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 subject to considerable revision. Forecast errors may result if the basis for analysing future developments is incorrect. If, for example, preliminary statistics indicate that there are strong pressures in the economy and labour shortages, while the opposite proves to be the case, this will result in policy errors.

It can be difficult to provide an exact analysis of why our projections of economic developments differ from actual developments. If actual developments differ from the assumptions underlying one variable, all the variables will be affected because economic variables are dependent on each other through various mechanisms. The variables included as assumptions in our analyses will, in reality, also be determined by economic developments. In addition to explaining the differences, the aim of evaluation is to provide greater insight into and understanding of the functioning of the economy. A reasonable description of demand and output developments will provide a good basis for projecting price inflation two years ahead. Wages are included both as a direct factor in prices for some services and as an important cost component in the production of other goods and services. We will be looking more closely at how accurate the projections published in December 2000 were in relation to economic developments both internationally and in Norway in 2001 and, to the extent data is available, in 2002. The projections in *Inflation Report* 1, 2 and 3 in 2000 did not differ significantly from the projections in the December *Inflation Report*. The projection for consumer price inflation in 2001 was revised upwards by ¾ percentage point through 2000, primarily reflecting a higher projection for wage growth. The projection for consumer price inflation in 2002 was kept unchanged through 2000.

In addition, we will focus on actual wage growth in comparison with projected wage growth because wage growth is one of the main determinants of domestic consumer price inflation.

2. How accurate were the projections for 2001 and 2002 published in December 2000?

The background for our projections in December 2000 was an economy marked by high capacity utilisation, a tight labour market and strong growth in labour costs. In

Table 1 Projected and actual developments in key macroeconomic variables for the Norwegian economy in 2001 and 2002. Percentage change from previous year unless otherwise specified.

	2001			2002		
	Projection	Actual	Forecast error[1)]	Projection	Actual[2)]	Forecast error[1)]
Mainland demand	1 ½	1.8	-¼	2 ¼	2 ¼	0
Private consumption	1 ½	2.5	-1	2 ½	3 ¾	-1 ¼
Public consumption	3	2.0	+12	2	½	-½
Fixed investment	-1 ¾	-4.6	+2 ½	1 ¼	-2 ¼	+3
Petroleum investment	-4	-7.4	+3 ½	-2	2	-4
Traditional merchandise exports	3 ¼	4.0	-¾	3 ¾	1	+2 ¾
Traditional merchandise imports	2 ½	4	-1 ½	4	2 ½	+1 ½
Mainland GDP	1 ¼	1.2	0	1 ¾	1 ¼	+½
Employment	¾	0.5	+¼	½	½	0
Rate of registered unemployment (level)	2 ¾	2.7	0	2 ¾	3 ¼	-½
Annual wages3)	5	5 ½	-½	4 ½	5 ¾	-1 ¼
Hourly pay	5	6	-1	4 ½	5 ¾	-1 ¼
Consumer price 4)	3	3	0	2 ½	1.3	+1 ¼
CPI-ATE	2 ¾	2.6	0	2 ½	2.3	+ ¼

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

2) Final figures for 2002 not available, with the exception of registered unemployment and consumer price inflation. Our projections from Inflation Report 1/03 have been used for the other variables.

3) Includes costs in connection with the two additional vacation days.

4) For 2002 we assumed that overall consumer price inflation for the year as a whole would shadow underlying price inflation. In our projections for 2002, we therefore disregarded the isolated and temporary effect of the reduction by half of VAT on food from 1 July 2001.

2000, the interest rate was increased by a total of 1½ percentage points.

Because of interest rate increases, price and wage inflation was expected to edge down in 2001 and 2002. We also placed emphasis on the high level of capacity utilisation and the limited supply of labour, which in isolation could lead to somewhat lower growth in the Norwegian economy. Growth in the global economy was also expected to decline in 2001.

Table 1 shows projected and actual developments for 2001 and 2002. For 2002, however, preliminary national accounts figures are only available for the first three quarters. We have therefore used our latest projections for developments in the real economy in 2002 as a basis for evaluating the projections published at the end of 2000. Consumer price inflation, as measured by the CPI-ATE, was approximately in line with our projections in 2001 and 2002. However, it must be taken into account that the developments in a number of variables underlying our projections for consumer price inflation did not materialize:

- Growth in the global economy was markedly lower than projected, while consumer price inflation was higher than projected.
- Unemployment remained low through 2001 in line with the projections, but increased more than expected in 2002.
- Wage growth was considerably higher than projected in both 2001 and 2002.
- The interest rate was higher than assumed. Our calculations were based on the technical assumption that interest rates would move in line with market expectations.
- However, the import-weighted krone exchange rate appreciated by about 15 per cent from December 2000 to December 2002, while the projections were based on a technical assumption of an unchanged krone exchange rate.

Growth in the global economy substantially underestimated

Developments in the global economy are an important assumption underlying our projections. The projections were based on a slowdown in growth in the global economy. Both Norges Bank and other forecasters underestimated the international downturn in 2001 (see Chart 1).

This is primarily due to a sharper-than-expected downturn in the US. GDP growth fell from 4.1 per cent in 2000 to 0.3 per cent in 2001. The decline was primarily triggered by developments in investment, particularly in the information and communications technology (ICT) sector. Considerable overcapacity had built up in this sector following sharp growth throughout the 1990s. However, expectations concerning corporate earnings were higher than later proved to be warranted. Weaker profits recorded by a number of US companies in the first half of 2000 resulted in a shift in the equity market. There was a considerable decline in companies' willingness to invest, and equity prices fell sharply.

Developments in the US gradually spread to other economic regions and resulted in the first synchronised downturn in the global economy since 1974. The sluggish developments continued in 2002.

In spite of substantially weaker developments in the global economy, international consumer price inflation was somewhat higher than expected in 2001 (see Chart 2). The oil price had risen from USD 10 at the beginning of 1999 to over USD 30 at the end of 2000. In spite of a decline in oil prices in 2001 approximately in line with the assumption underlying our projections, the second-round effects of the rise in oil prices seem to have con-

Chart 1 Projections for trading partners' GDP growth in 2001 published in 2000 by various institutions. Annual growth. Per cent

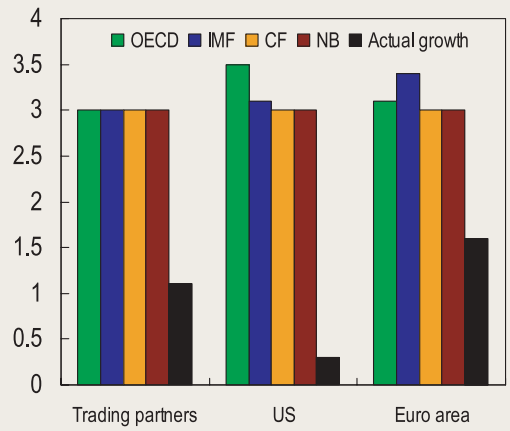
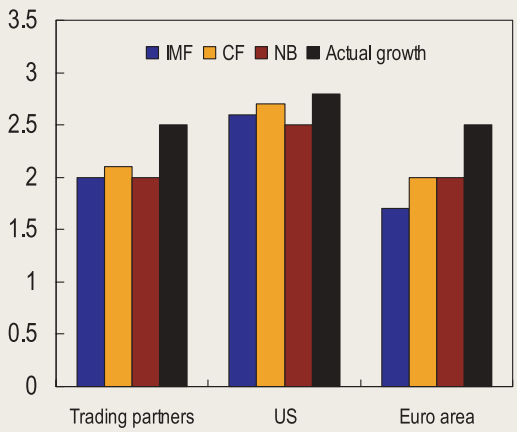


Chart 2 Projections for trading partners' consumer price inflation in 2001 published in 2000 by various institutions. Annual rise. Per cent



tributed to pushing up price inflation more than expected. In the first half of 2001, the impact of a number of livestock diseases on the agricultural sector in Europe resulted in higher food prices. The projections for international consumer price inflation for 2002 were accurate. Developments in international producer prices were also essentially in line with the projections published in December 2000.

The downturn in the global economy had limited effects on growth in the Norwegian economy

The downturn in the global economy in 2001 was much sharper than expected. However, this had little impact on the Norwegian economy in 2001. In spite of weak international developments, traditional merchandise exports were higher than projected in 2001.

Growth in both mainland GDP and unemployment were in line with projections in 2001 (see Table 1). However, growth in mainland demand was somewhat higher and employment somewhat lower than projected. Due to slightly stronger-than-projected growth in productivity, especially in the private services sector, the projections for growth in the Norwegian economy were nevertheless accurate.

Growth in private consumption was underestimated, and growth in public consumption was overestimated. This may be related to higher-than-expected wage growth. A larger share of public expenditure went to cover labour costs, and thus higher private income, and there was less room for increased activity in the public sector. Developments in the saving ratio are, nevertheless, the most important reason. The saving ratio fell somewhat from 2000 to 2001, whereas we had projected an increase.

Growth in mainland demand rose somewhat toward end-2001 and early 2002 as expected. Preliminary quarterly national accounts figures for the first three quarters of 2002 indicate, however, that growth in mainland GDP was somewhat lower than expected in 2002. Growth in employment was in line with projections, but unemployment rose more than expected.

The direct effects of weak developments in the global economy still had a limited effect on developments in the Norwegian economy at the beginning of 2002. Nonetheless, international developments had an impact on some sectors of Norwegian business and industry, not least through the exchange rate. Sharp reductions in interest rates in other countries widened an already considerable interest rate differential. The krone appreciated steadily through 2001. The trend intensified in 2002. These developments contributed to a sharp deterioration in the cost competitiveness of export-related manufacturing and other business and industry exposed to international competition. Traditional merchandise exports were considerably lower than projected for 2002.

Unemployment edged up through 2002 and at year-end was close to ¾ percentage point higher than projected two years earlier. Although manufacturing employment fell, manufacturing unemployment remained low. The increase in unemployment in 2002 occurred mainly in the service sector. Many enterprises in the ICT sector, travel industry, media industry and some retail sectors reduced their workforce and cut costs. Activity and the workforce were reduced in the ICT sector and the airline industry in particular.

Higher-than-expected wage growth

Annual wage growth was expected to decline from around 5 per cent in 2001 (including costs in connection with extra vacation days) to 4½ per cent in 2002. Some developments pointed to lower wage growth. Profitability in the business sector, especially in manufacturing, had deteriorated over a period of several years. It was assumed that this would contribute to wage moderation. The projections were based on the assumption that wage formation functioned in the same way as in the 1990s, when manufacturing was the wage leader.

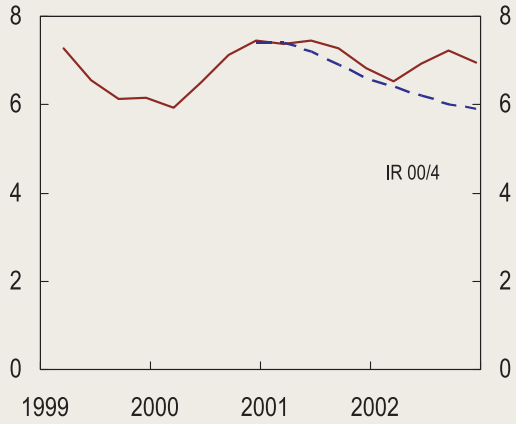
Annual wage growth in 2001, which was a year with interim wage settlements, was underestimated by ½ percentage point, in spite of accurate projections for unemployment growth. Moreover, the centralised wage increases were essentially known. Wage drift through 2001 was thus higher than projected. The growth in hourly labour costs was further underestimated because of an unexpectedly sharp rise in sickness absence. Higher-than-projected wage growth is probably one of the explanations for the underestimation of growth in private consumption. In spite of the rise in unemployment, the wage settlement in 2002 indicated that the social partners still perceived the labour market as tight. Preliminary figures indicate overall annual wage growth of 5¾ per cent in 2002, which is substantially higher than projected.

The interest rate was higher than assumed

In December 2000, the pricing of forward interest rate agreements indicated that the sight deposit rate was expected to fall from 7 per cent to 6-6¼ per cent a year later and to 5¾ per cent two years later. This was the assumption underlying our projections. Money market rates were on average 0.2 percentage point higher in 2001 and 0.9 percentage point higher in 2002 than the technical assumption (see Chart 3).

This must be viewed in conjunction with a persistent shortage of resources in the economy, which was reflected in the unexpectedly high wage growth. Through 2001 and the first half of 2002, it became clear that inflation two years ahead would be higher than the projections from 2000. Monetary policy became tighter than assumed at that time.

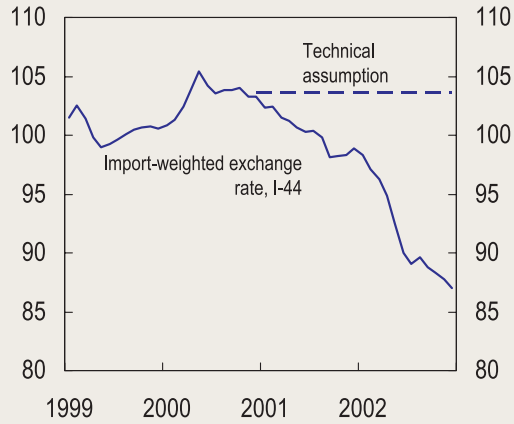
Chart 3 Short-term money market rates and technical assumption[1]. Per cent



[1] Three-month forward rates are estimated using four money market rates and five government bond yields with different maturities as observed on 14 December 2000.

Source: Norges Bank

Chart 4 Actual movements in the krone exchange rate (I-44) and the technical assumption underlying the projections in IR 4/00.



Source: Norges Bank

The krone appreciated

The krone exchange rate reflected these developments. The import-weighted krone exchange rate appreciated by around 15 per cent from December 2000 to December 2002 (see Chart 4). The appreciation of the krone was especially pronounced in 2002. These developments must be viewed in the light of high and widening interest rate differentials between Norway and other countries, caused primarily by substantial reductions in interest rates in other countries. The sharp fall in global equity prices, and thus increased interest in interest-bearing securities, combined with high oil prices may also have contributed to the appreciation of the krone.[3]

3. Consumer price inflation – an explanation of the model

The projections for consumer price inflation were relatively accurate for 2001 and 2002. A thorough evaluation must, however, look more closely at the factors that have affected consumer price inflation. Wage growth was higher than projected in both 2001 and 2002 and contributed in isolation to higher-than-projected price inflation. The appreciation of the krone exchange rate from December 2000 to end-2002 contributed in isolation to lower-than-projected price inflation. These two factors cannot be viewed separately however. Stronger-than-projected wage growth has probably led to expectations of high interest rates in Norway. Expectations of a wide interest rate differential against other countries appear to have been an important explanatory factor behind the appreciation of the krone.

Therefore, two questions should be raised:

1) Why did we underestimate wage growth?

2) Would our projections have been in line with actual price inflation if wage growth and exchange rate developments had been known?

Concerning point 1)

When the projections were made, the macroeconomic model RIMINI, which is an important tool in Norges Bank's forecasting work for the *Inflation Report*[4], underpredicted wage growth for the previous years, especially the results of the wage settlements in 1998 and 2000. This raised the question of whether the model would again underpredict wage growth for 2001 and 2002. On the other hand, several years of high wage growth indicated that profitability in the business sector was squeezed, which should have a dampening impact on wage growth. The wage projections in *Inflation Report* 4/2000 were somewhat higher than indicated by a neutral use of the RIMINI model, but the upward revision in the wage equation was considerably smaller than was necessary to explain the previous wage settlements. Therefore, the wage projections could largely be regarded as an expectation of a return to more normal wage growth after several years of underpredicted wage growth. Actual wage growth, especially in 2002, showed that the model on the contrary continued to increasingly underpredict this variable[5]. This raises the question of whether there has been a change in wage formation or whether the wage settlement in 2002 was unique and should be regarded as a shock.

[3] See box: "Factors behind the developments in the krone exchange rate", *Inflation Report* 1/2003.

[4] For more information about the RIMINI model and our use of it see Olsen and Wulfsberg (2001).

[5] The revision of the national accounts in summer 2002 somewhat improved the model's explanatory power for the last half of the 1990s. Nonetheless, the model has continued to underpredict wage growth the last few years, especially for 2002.

Table 2 Forecast error in 2001 and 2002 and the effects of changes in assumptions. Positive figures indicate that projections are too high. Percentage point

	Rise in CPI-ATE		Annual wage growth	
	2001	2002	2001	2002
Aggregate error	0	¼	-½	-1¼
Residual error				
– after incorporation of correct estimates for exogenous variables[1)]	-0.1	-½	-¾	-2
– and after incorporation of correct projection for wage growth (annual wage growth and hourly wage growth)	+0.1	0	0	0
Memo: Isolated effect of incorporation of correct exchange rate	-0.1	-0.6	-0.1	-0.6

1) Interest rates, the exchange rate, fiscal policy, oil prices, international producer prices and working hours.

In a scenario with a shift in wage determination in *Inflation Report* 4/2000, we illustrated a possible path for wage and price inflation, where weak profitability in manufacturing did not moderate wage growth to the same extent.[6)] We pointed out that the two divergent trends in the Norwegian economy, with falling manufacturing employment and continued growth in employment in the public and private service sectors could contribute to tension between the sectors and lead to changes in wage determination, with the sheltered sector playing a more prominent role in determining overall wage growth. Such a development could mean that labour market tightness would have a greater impact on wage determination. In this alternative scenario, wage growth was around 1 percentage point higher from 2002. This is largely in line with actual wage growth.[7)]

Based on the last few years' experience, we have looked at different empirical models for wage growth. In *Inflation Report* 1/2002, we described an alternative wage equation. The most important difference from the wage determination described in the RIMINI model is that the alternative wage equation models wage growth for the Norwegian economy as a whole without assuming that manufacturing is the wage leader. Overall labour market conditions play a relatively larger role than profitability. Used in isolation in autumn 2000, this alternative wage equation would have projected the outcome from the wage settlements at 5½ per cent both in 2001[8)] and 2002. This is broadly in line with actual developments. In the last reports, this equation has received more emphasis in our projections.

Concerning point 2)

To answer the question of whether our projections would have been accurate if wage growth and exchange rate developments had been known, we can start by looking at the RIMINI model as it was used in December 2000.[9)] The first line in Table 4 shows the forecast error for consumer price inflation and wage growth for both 2001 and 2002. The projections for CPI-ATE were close to the outcome for 2001 and 2002. The projections for wage growth were too low both years.

The second line shows the residual forecast error after the incorporation of the actual values for a number of key exogenous variables such as interest rates, the exchange rate, fiscal policy, oil prices, producer prices and working hours. Exchange rate movements are the main reason that the projection for price inflation for 2002 is now _ percentage point lower than the outcome. In the model, a stronger exchange rate will contribute to reducing prices for imported goods, which in turn curbs wage growth and in the next round price inflation. Therefore, the forecast error increases for both wage growth and price inflation when the actual values for the exogenous variables are incorporated in the model. Experience from the last two years indicates that such an exchange rate effect has not been especially pronounced.

The third line shows the residual forecast error after the incorporation of the actual outcome for wage growth. We see that if both the exchange rate and wage growth had been known, the forecast error would essentially have been eliminated in the model.

In a box in *Inflation Report* 2/2002, we provided a further account of the relationship between the exchange rate and inflation. Any effects on wages, and thereby on prices, of changes in the krone exchange rate will probably depend on how wage determination functions and the inflation expectations applied by the social partners in the wage settlements. With a credible inflation target for monetary policy, the social partners are likely to apply an expected inflation rate close to 2½ per cent as a basis for wage negotiations. In this case, it may be less likely that a stronger krone exchange rate will trigger a downward price-wage spiral.

4. Overview of projections from 1994-2001

Besides studying the projections in a single report, it is important to consider whether we make systematic errors over time. Charts 5 to 10 provide a comparison of actual

6) Technically, the results are obtained by removing the negative contribution from the add factors in the wage equation. This is accomplished by raising the equilibrium wage share to the projected level in the baseline scenario in 2002.

7) Subsequent revisions in the national accounts have shown that productivity growth was higher and the wage share lower than what was known in autumn 2000.

8 Including costs, about ¾ percentage point, connected with extra vacation days in 2001

9) Including use of the same add factors

Charts 5 – 10 Projections for growth from Statistics Norway (SN), Ministry of Finance (FIN) and Norges Bank (NB), and actual growth. Per cent 1994 to 2000

Statistics Norway | Ministry of Finance | Norges Bank | Actual growth

Chart 5 Mainland GDP

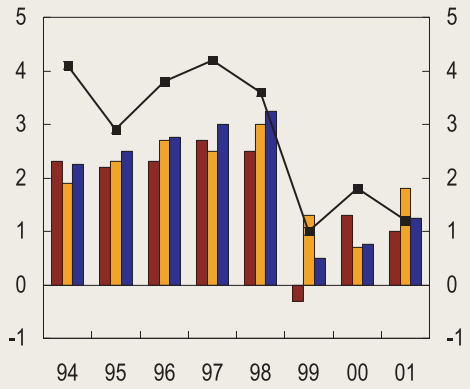


Chart 6 Mainland demand

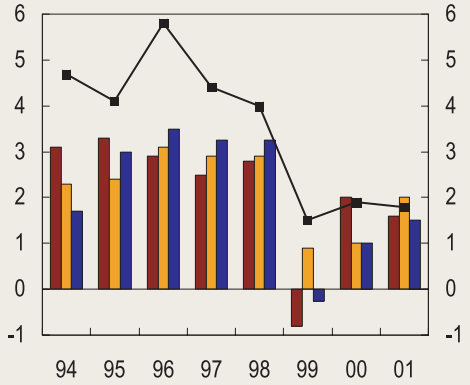


Chart 7 Employment growth

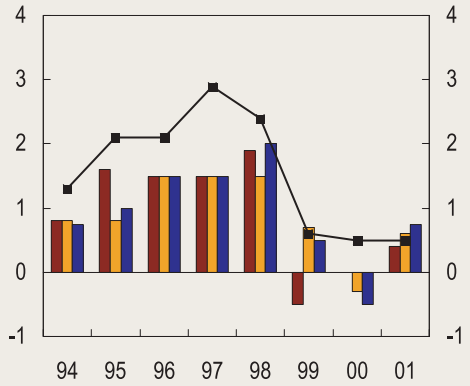


Chart 8 Unemployment rate

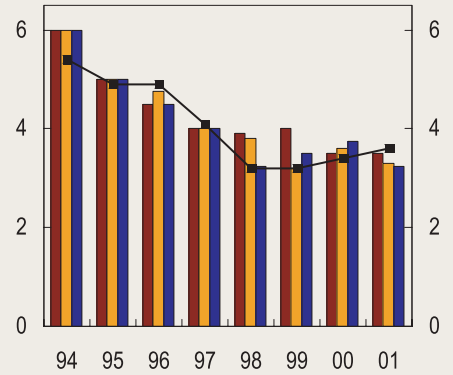
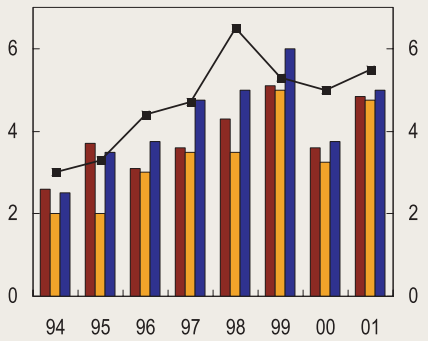
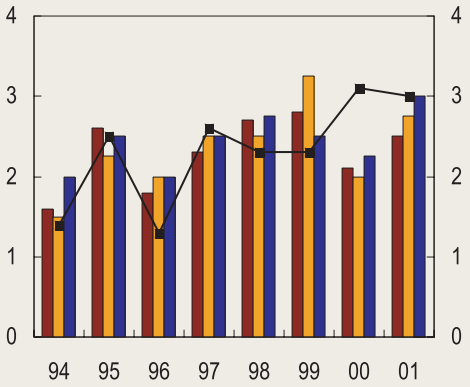


Chart 9 Annual wage growth[1)]



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

Chart 10 Consumer price inflation



figures for the period 1994-2001 with projections from Statistics Norway, the Ministry of Finance and Norges Bank made at the end of the year before the forecast year. There has been a tendency for all three institutions to underestimate the period of expansion in the 1990s. Growth in demand, employment and GDP was higher than expected every year from 1994 to 1998. In spite of this, the projections for unemployment were fairly accurate. Wage growth, however, has been systematically underestimated. The projections for CPI-ATE inflation have been relatively accurate.

Table 3 shows the average forecast error, the average absolute error (AAE[10]) and the relative root mean square error (RRMSE[11]). These are measures of the accuracy of our projections for the entire period. AAE provides an indication of the average forecast error in percentage points over these years, without the forecast errors with opposite signs offsetting each other. RRMSE penalises large forecast errors more heavily than small errors, and indicates the size 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 information in the charts. We see that the forecast error is smallest for wage growth and price inflation. The forecast error for consumer price inflation is virtually the same for all three institutions. Norges Bank's projections for wage growth have consistently been the most accurate.

Table 3 Average error, average absolute error (AAE) and relative root mean square error. (RRMSE) Statistics Norway (SN), the Ministry of Finance (FD) and Norges Bank (NB). 1995 to 2001

	SN	FD	NB
Growth in mainland GDP			
Average error	-1.08	-0.80	-0.79
AAE	1.08	1.03	0.81
RRMSE	0.55	0.41	0.35
Employment growth			
Average error	-0.65	-0.66	-0.61
AAE	0.65	0.71	0.68
RRMSE	0.79	0.67	0.80
Unemployment			
Average error	0.12	0.21	0.07
AAE	0.36	0.26	0.28
RRMSE	0.13	0.09	0.08
Growth in mainland demand			
Average error	-1.35	-1.34	-1.41
AAE	1.38	1.39	1.41
RRMSE	0.62	0.39	0.54
Annual wage growth			
Average error	-0.96	-1.44	-0.44
AAE	1.06	1.44	0.68
RRMSE	0.24	0.33	0.16
Consumer price inflation			
Average error	-0.01	0.03	0.13
AAE	0.44	0.46	0.36
RRMSE	0.22	0.28	0.27

Sources: Statistics Norway, Ministry of Finance and Norges Bank

5. Conclusions

The projections for consumer price inflation made in December 2000 were relatively accurate. Nonetheless, some conclusions may be drawn, and these have led to some change in our view of some economic relationships and our presentations in the *Inflation Report* the last few years.

Norges Bank underestimated wage growth for both 2001 and 2002. Several years of higher-than-projected wage growth raised the question of whether Norges Bank's understanding of the mechanisms which form the basis of wage determination was correct. As a result, work was begun to look at other models to explain wage growth. This work was discussed in a box in *Inflation Report* 1/2002. Recent years' experience may indicate that general labour market conditions play a more important part and profitability in manufacturing a less important part than experience over a longer period might indicate.

The krone exchange rate appreciated considerably more than the technical assumption in *Inflation Report* 4/2000. Nonetheless, our projections for consumer price inflation were very accurate. In the most recent reports, we have systematically tried to illustrate the effect of alternative scenarios on the krone exchange rate. In *Inflation Report* 2/2002, we also provided a new assessment of how we believe the krone exchange rate affects inflation two to three years ahead. Our analyses indicate that changes in the exchange rate have less impact on prices for domestically produced goods and services than we previously assumed.

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[10] AAE (average absolute error) is defined as, $(1/N)\sum_{n=1}^{N}\left|y_n - \hat{y}_n\right|$ 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 $\sqrt{1/N\sum_{n=1}^{N}\left(\left(y_n - \hat{y}_n\right)/y_n\right)^2}$ where y_n represents the actual growth rate and $\hat{y}_n$ is the projected growth rate.