Evaluation of Norges Bank's projections for 2000

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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 the transparency of our forecasting work. This is why the Bank reports regularly on the evaluation of its projections and examines the sources of forecast errors. Analyses of Norges Bank's projections for the years 1996-1999 have been published earlier1). In this article, we analyse the projections for 2000 as presented in the December 1998 and December 1999 *Inflation Reports*.

In December 1998 it was assumed that the Norwegian economy would show a relatively pronounced downturn through 1999 and 2000. It turned out that the downturn was far less pronounced than expected, and that the two-years-ahead projections were therefore not very accurate. The projections for 2000 published in the December 1999 *Inflation Report* were closer to the outcome.

Norges Bank's projections are also compared with those of other institutions. The projections for consumer price inflation published by the Ministry of Finance, Statistics Norway and market participants have shown approximately the same degree of accuracy.

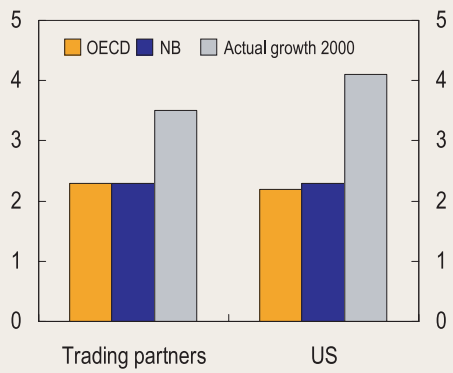
The projections for 2000 published in 1998

The projections published at the end of 1998 were influenced by the Asian crisis in 1997, the crisis in Russia in August 1998 and the crisis in Brazil in October/November the same year. Consequently, in the autumn of 1998 the projections for global economic developments were relatively pessimistic. At the same time, the Norwegian economy had experienced a turbulent year. Oil prices had fallen to almost USD 10 per barrel, and the wage settlement had resulted in considerably higher wage growth than expected. In conjunction with financial market unrest, this led to a weakening of the krone. Money market rates rose from 3.5 per cent to 8 per cent in the course of 1998. In the December 1998 Inflation Report, Norges Bank projected a period of relatively weak growth in the Norwegian economy, a fall in employment and higher unemployment. The downturn would come as a result of weaker competitiveness, lower growth in the world economy and a fall in fixed investment.

However, the outcome showed that Norges Bank and other forecasters underestimated global growth in both 1999 and 2000. Monetary policy stimulus in the US and Europe, a swift recovery in Asia and renewed stability in financial markets led to a faster-than-expected rebound in growth. Norges Bank's projections for GDP growth for trading partners published in December 1998 were consistent with OECD forecasts (see Chart 1). We underestimated growth in the US by a considerable margin.

The growth projections for the Norwegian economy were also off the mark. Table 1 shows projections and actual figures from the national accounts published in February this year. In 2000, economic growth was significantly higher than projected in December 1998. Mainland demand increased by 1.9 per cent in 2000, while our estimate was ¼ per cent. The demand estimate for 1999 was off the mark by the same margin. In particular, private consumption was underestimated for these two years, but fixed investment was also significantly higher than projected. For both 1999 and 2000, private consumption was projected to show slower growth, partly reflecting our projections of slower growth in disposable income and a fall in house prices. The outcome was a further rise of 12 and 14 per cent in house prices in these two years. A faster-than-anticipated upturn in the global economy and a sharp rise in oil prices probably boosted household expectations. The

Chart 1 Projections for trading partners' GDP growth in 2000 published in 1998 by Norges Bank and the OECD. Annual growth. Per cent



Sources: Norges Bank and OECD

* With thanks to colleagues for their useful comments

1) See previous articles (Madsen 1996, Jore 1997, Jore 1999 and Jore 2000)

Table 1 Projections for 2000 published in December 1998, and actual figures for 2000 (as at February 2002). Percentage rise on previous year unless otherwise indicated

2000	Projection	Actual	Forecast error[1)]
Mainland demand	1¼	1.9	-1¾
Private consumption	1¼	2.9	-1¼
Public consumption	2¼	1.4	¾
Fixed investment	-5¾	1.4	-7¼
Petroleum investment	-15	-17.1	2
Exports	5½	2.7	2¾
Crude oil and natural gas	9¼	6.4	2¾
Traditional goods	3¾	2.1	1¾
Imports	1¾	2.5	-¾
Traditional goods	3	1.7	1¼
GDP	1	2.3	-1¼
Mainland GDP	-¼	1.8	-2
Employment	-½	0.5	-1
LFS unemployment, level	4½	3.4	1
Annual wages (incl. costs of additional vacation days)	4¼	5.1	-¾
Import prices, traditional goods	¼	6.0	-5¾
Consumer prices	2¼	3.1	-¾

[1)] Positive figures indicate that projections are too high
Sources: Statistics Norway (Economic Survey 1/2002) and Norges Bank (Economic Bulletin 1998/4)

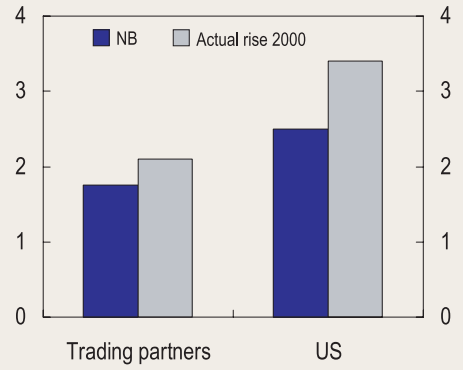
main reason behind the forecast error for private consumption was probably that the interest rate decline in 1999 had a faster and stronger impact on the Norwegian economy than we had expected (see section on sources of forecast errors).

Because demand picked up faster than expected, employment and production also rose more than projected. Mainland GDP was also pushed up by higher-than-expected electricity production in 2000. The number of employed increased by 0.5 per cent, while we expected a comparable fall. Instead of edging up towards 4½ per cent, LFS unemployment remained at 3.4 per cent in 2000.

With a tighter-than-expected labour market, growth in wage costs in 2000 was higher than projected. In 1999, the social partners adhered to the wage restraint recommended. The following year, however, growth in wage costs was pushed up as a result of the two additional vacations days in 2001 and 2002, which were negotiated at the same time. Taking into account the associated costs for enterprises in 2000, actual growth in wage costs turned out to be higher than projected in December 1998.

Consumer price inflation was also higher than projected. An unexpected surge in oil prices and global producer prices, in conjunction with a depreciation of the trade-weighted krone exchange rate, pushed up prices for traditional merchandise imports by 6 per cent in 2000. Consumer price inflation among trading partners also turned out to be higher than estimated (see Chart 2). The feed-through from international producer prices to Norwegian consumer prices did not materialise, however. Prices for imported consumer goods, which are

Chart 2 Projections for trading partners' consumer price inflation in 2000 published in 1998 by Norges Bank. Annual rise. Per cent

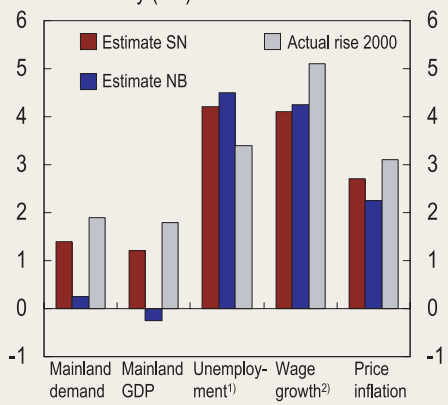


Source: Norges Bank

directly incorporated in the CPI, fell by 0.9 per cent in 2000. However, the sharp increase in oil prices had an impact on Norwegian consumer prices via higher petrol prices. At the same time, electricity taxes were increased. Price inflation adjusted for tax changes and excluding electricity products was 2.1 per cent in 2000, ie about the same rate of increase projected in December 1998.

Chart 3 provides a comparison of Norges Bank's projections for a number of key variables for 2000 and Statistics Norway's projections. Statistics Norway projected a less pronounced downturn in the Norwegian economy, but also underestimated GDP growth and overestimated unemployment. Both Statistics Norway and Norges Bank underestimated price inflation. In spite of having the highest unemployment estimate, Norges Bank also had the highest projection for wage growth, while Statistics Norway had the most accurate projection for price inflation. Statistics Norway had a somewhat higher estimate for import prices, but also empha-

Chart 3 Estimates for some key variables for 2000 published in 1998 by Norges Bank (NB) and Statistics Norway (SN). Annual rise. Per cent



[1)] Level
[2)] Including the costs of additional vacation days
Sources: Statistics Norway and Norges Bank

sised that the sharp rise in labour costs in 1998 would translate into higher price inflation in 1999 and 2000.

Sources of forecast errors

Forecast errors can in retrospect be attributed to erroneous assumptions, model deficiencies or assessment errors. There is also uncertainty attached to current statistics. Even the February accounts from Statistics Norway, which are the preliminary accounts for the previous year, are associated with a considerable margin of error. On average, the difference between the preliminary figures and the final national accounts figures for mainland GDP was close to 1 percentage point in the period 1979-1997.

Our projections are based on assumptions concerning the money market rate, the exchange rate, fiscal policy, petroleum investment and developments in the world economy. Some of the forecast errors for 2000 can be explained by considerable differences between developments in key parameters and our assumptions:

- The exchange rate turned out to be somewhat stronger than assumed in 1999, but depreciated thereafter by 2.5 per cent between 1999 and 2000, as measured by the trade-weighted krone exchange rate. The projections were based on the assumption that the krone would appreciate by ¾ per cent in both 1999 and 2000.
- Oil prices increased sharply through 1999 and most of 2000. On average, the oil price per barrel hovered around NOK 142 in 1999 and NOK 252 in 2000. As a technical assumption, we had put the real price at around NOK 90 per barrel for the period.
- International producer prices fell by 3.5 per cent in 1999 and rose by 6.8 per cent in 2000. We had assumed a fall of ½ per cent in 1999 and an increase of 1 per cent in 2000.
- Short-term interest rates were assumed to move in line with market expectations, as reflected in forward rates. This implied a gradual fall in interest rates to 5 per cent in 2000. Actual developments in 1999 were fairly closely in line with market expectations in December 1998, but short rates remained considerably higher in 2000 than implied by expectations. The average money market rate was 6.8 per cent in 2000, or 1½ per cent higher than assumed in the December 1998 Inflation Report.

The purpose of Norges Bank's projections is to achieve an optimal decision-making basis for setting interest rates. When the projections result in an interest rate level that is different from the underlying technical assumption, the task of evaluating the projections becomes even more demanding. In such cases, it is particularly important to break down the sources of error behind the deviations between forecasts and the outcome. The RIMINI model, which has been the main tool in Norges Bank's forecasting work, has been used for this purpose. The Bank's Research Department has been responsible for the econometric basis for the model, and the model is regularly developed thanks to the concerted efforts of several departments in the Bank. Around 70 of the model's 350 equations are estimated on the basis of historical data, while the remaining equations are definitional relationships.

The model's description of economic relationships is itself a source of error. For example, changes in the functioning of the economy may occur without these being captured by the model. Economic relationships for some areas may not be sufficiently incorporated in the model. The projections for 2000 were based on an interest rate path that was significantly lower than the outturn. In spite of this, we underestimated both private consumption and fixed investment in both years. Interest rate changes have probably had a faster and stronger impact on the Norwegian economy than we had assumed. The reasons for this may be that the key interest rate was previously changed in response to developments in the foreign exchange market. In addition, lending rates were regulated up to 1985. Today interest rates probably reflect household expectations to a greater extent. In the 1980s, when interest rates were regulated, house prices may have had this function. New estimates show that short-term interest rates have had a significant explanatory power since the end of the 1980s. A consumption equation with such an interest rate effect was first used in the model in the spring of 2000.[2)]

We exercise some degree of judgement in evaluating the model-based projections. In practice, this means that we adjust the model's residual variables, which often enhances the accuracy of the projections. On the other hand, erroneous assumptions may be a source of forecast error. Our analysis is limited here to the effects of an erroneous estimation of the exogenous variables on our projections. This is illustrated by replacing our exogenous assumptions with actual values, and showing the outcome for some key variables (see Table 2). This does not mean that we necessarily obtain the projections we would then have presented. If we had known the effects of the actual values on the exogenous variables, it is likely that our assessment of the economic picture would have been different.

In the first line of Table 2 we have selected forecast errors for some of the main key variables. The next line shows the residual forecast error after incorporating the actual values for fiscal policy, money market rates and the exchange rate. The result is less accurate projections for private consumption, fixed investment and GDP growth, primarily because a higher interest rate is now incorporated. The projection for employment remains unchanged, partly as a result of the estimates for public consumption in both 1999 and 2000. Public consumption was significantly underestimated in 1999, but somewhat overestimated in 2000. This resulted in high-

[2)] See box in the June 2000 Inflation Report.

Table 2 Forecast error in 2000 and the effect of changes in assumptions. Positive figures indicate that projections are too high. Percentage points. Forecasts from December 1998

	Mainland GDP	Employm-ployment	Wage growth[1)]	Consumer priceinflation	Private consumption	Mainland fixed investment
Aggregate error	-2	-1	-¾	-¾	-1¼	-7¼
Residual error – after change of policy assumptions[2)]	-2½	-1	0	-½	-1½	-9½
- and after incorporation of correct estimates for all exogenous variables	-2¼	-1¼	½	-¼	-¾	-8¾

[1)] Including the costs of additional vacation days

[2)] Exchange rate, money market rates, public expenditure (consumption, employment, investment and transfers)

Source: Norges Bank

er employment and lower unemployment, and hence higher wage growth. The associated increase in employment fully offset the decline attributable to a higher interest rate. The overall effect was somewhat higher wage growth. The estimate for wage growth is now consistent with the outturn, while the estimate for consumer price inflation approaches the actual rate. This is because we have incorporated the actual value of the trade-weighted krone exchange rate, which resulted in a weakening of 3.4 per cent in relation to our assumption. This contributed to pushing up the rise in import prices and thereby wage growth and price inflation as well.

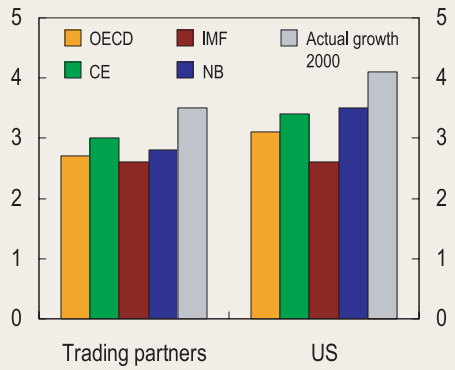
If we also incorporate the actual values for the other exogenous variables (such as oil prices, producer prices, some asset prices for households and working hours) the forecast errors are as shown in the third line. We then see that the forecast errors are reduced further for several variables. For households, we had underestimated some variables that influence asset values. The residual forecast error primarily reflects our underestimation of the rise in house prices and the impact of lower interest rates on the Norwegian economy. The projections for wage growth and price inflation would have been higher if we had incorporated the actual values of the exogenous variables. The main reason for this is that we have now incorporated the actual values of international producer prices. This influences our import prices and pushes up wage growth and price inflation. Wage growth is now estimated at a little more than the outcome, and the projection for consumer price inflation is close to the mark. The residual ¼ percentage point can be ascribed to an increase in electricity taxes that was not known when the projections were published.

Forecast errors for the projections for 2000 published in December 1998 cannot be explained in general by the lack of accuracy of the exogenous assumptions. The projections for wage growth and price inflation were fairly accurate, but the forecast errors for the real variables are considerable. For some variables, the forecast error increases when we incorporate actual values for the exogenous variables. This is partly because we based our projections on a pronounced downturn, with an unfavourable outlook for the global economy. When global growth recovered faster than expected, oil prices surged and interest rates fell, the RIMINI model did not capture the implications of these developments for economic sentiment and expectations. A stronger feed-through from interest rates to private consumption and investment would have reduced the forecast errors considerably.

The projections for 2000 published in December 1999

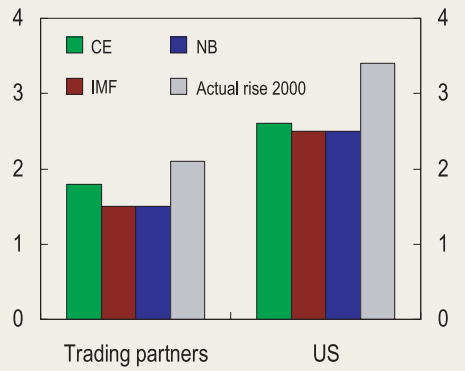
As a result of a faster-than-expected global recovery, the projections for growth among our trading partners in 2000 were revised upwards. In spite of this, GDP growth was higher in 2000 than most forecasters expected at the beginning of the year (see Chart 4). This was partly because few observers expected growth in the US to exceed 4 per cent after an upturn that had spanned almost ten years. In addition, consumer price inflation among trading partners had been underestimated (see Chart 5). We had assumed that intensified competition among producers in the euro area and continued high productivity growth in the US would have a dampening impact on the stronger inflationary impulses from com-

Chart 4 Projections for trading partners' GDP growth in 2000 published in 1999 by various institutions. Annual growth. Per cent



Sources: IMF, OECD, Consensus Economics Inc. (CE) and Norges Bank (NB)

Chart 5 Projections for trading partners' consumer price inflation in 2000 published in 1999 by various institutions. Annual rise. Per cent



Sources: IMF, Consensus Economics Inc. (CE) and Norges Bank

modity and producer prices ahead. Both oil prices and world producer prices increased more than expected through 2000, and contributed to higher consumer price inflation internationally.

In addition, the situation in Norway was also entirely different at the end of 1999 than one year earlier. Oil prices had risen steadily through the year and the trade-weighted krone exchange rate had appreciated by 3 per cent over one year. The key rate had been lowered by 2.5 percentage points during the same period. House prices had risen sharply and household consumption growth had increased.

Against this background, Norges Bank's assessment in the December 1999 *Inflation Report* was that the risk of a pronounced downturn was significantly smaller than in December the previous year. It was still assumed that the economy had entered a period of weaker growth, with lower employment and higher unemployment. Our estimates for both private consumption and fixed investment were revised upwards in relation to the December 1998 *Inflation Report*, while the estimate for petroleum investment was revised downwards. Wage growth and price inflation were projected to be moderate. Table 3 shows our projections and the actual national accounts figures published in February this year. Like our projections published one year earlier, our estimates for growth in domestic demand and labour demand were again lower than the outcome. Both private consumption and fixed investment turned out to be higher than projected, while growth in public consumption was lower than estimated. Employment and mainland GDP were 1 percentage point higher than projected. Unemployment increased somewhat compared with the previous year, but to a smaller extent than expected. Both wage growth and price inflation were higher than projected.

The projections in the December 1999 *Inflation Report* were based on the following key assumptions:

- As a technical assumption, the krone was assumed to remain constant through the entire projection period. This implied a weakening of the trade-weighted krone exchange rate of ¼ per cent between 1999 and 2000. Instead the krone exchange depreciated by 2.5 per cent during the period.
- Money market rates were assumed to move in line with market expectations, as reflected in forward rates in December 1999. This implied an average short-term money market rate of 5.7 per cent in 2000, or a 0.8 percentage point decline compared with 1999. The actual average rate was 6.8 per cent in 2000.
- In December 1999, oil prices hovered around NOK 205 per barrel. It was assumed that oil prices would gradually fall to NOK 125 per barrel. However, oil prices rose through most of 2000 and the average level turned out to be NOK 252 per barrel.
- The sharp rise in oil prices over two years led to higher prices internationally. World producer prices were assumed to rise by 1 per cent between 1999 and 2000, while the actual rise was 6.8 per cent.
- Growth in public consumption was estimated at 2¼ per cent, but did not exceed 1.4 per cent.

Table 3 Projections for 2000 published in December 1999, and actual figures for 2000 (as at February 2002). Percentage rise on previous year unless otherwise indicated

2000	Projection	Actual	Forecast error[1)]
Mainland demand	1	1.9	-1
Private consumption	2	2.4	-½
Public consumption	2¼	1.4	¾
Fixed investment	-3½	1.4	-5
Petroleum investment	-25	-17.1	-8
Exports	5¾	2.7	3
Crude oil and natural gas	10	6.4	3½
Traditional goods	3¾	2.1	1¾
Imports	-1	2.5	-3½
Traditional goods	-1	1.7	-2¾
GDP	2¼	2.3	0
Mainland GDP	¾	1.8	-1
Employment	-½	0.5	-1
LFS unemployment, level	3¾	3.4	¼
Annual wages (incl. costs of additional vacation days)	3¾	5.1	-1¼
Import prices, traditional goods	1	6.0	-5
Consumer prices	2¼	3.1	-¾

[1)] Positive figures indicate that projections are too high

Sources: Statistics Norway (Economic Survey 1/2002) and Norges Bank (Economic Bulletin 1999/4)

Table 4 shows the overall forecast errors for some key variables in the first line. In the second line, the residual forecast error is assessed after the incorporation of the actual values for interest rates, the exchange rate and fiscal policy. The results are similar to those in Table 2. A higher interest rate level than assumed contributes to increasing the forecast errors for private consumption, fixed investment, employment and GDP growth. Low

Table 4 Forecast error in 2000 and the effect of changes in assumptions. Positive figures indicate that projections are too high. Percentage points. Forecasts from December 1999

	Mainland GPD	Employment	Wage growth[1)]	Consumer price inflation	Private consumption	Mainland fixed investment
Aggregate error						
Residual error –after change in policy assumptions	-1	-1	-1¼	-¾	-½	-5
- and after incorporation of correct estimates for all exogenous variables	-1¾	-1¼	-½	0	-1¼	7

[1)] Including the costs of additional vacation days
Source: Norges Bank

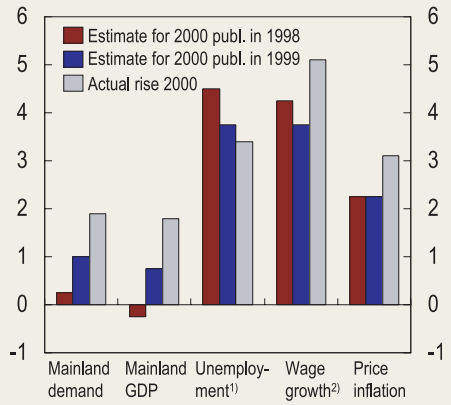
growth in public consumption further increases the forecast errors. However, the forecast error for wage growth and price inflation is reduced because we incorporated the actual outcome for the exchange rate. A sharper depreciation of the exchange rate contributes to pushing up import prices and thereby wage growth and price inflation. If we also incorporate the actual values for other exogenous variables, we see in the third line that the forecast error for price inflation is eliminated, while wage growth is now close to the actual level. This is because we have incorporated the marked rise in world producer prices, which had an effect on our import prices and thereby wage and price and inflation. As to the other variables, the forecast errors are still substantial, even after the incorporation of actual values for all the exogenous variables. The forecast error for private consumption shows a further increase, primarily because the value of household financial assets is reduced after incorporating actual values for some assets.

More accurate estimates of the exogenous variables do not reduce the general forecast error, with the exception of the estimates for wage growth and price inflation. The forecast errors here would also have been reduced in general had the impact of interest rates on private consumption and investment been greater.

Comparison of Norges Bank's projections at different points in time

Projections for economic developments may change considerably over a short period of time. In the course of 1999 it became clear that the downturn in the Norwegian economy was much less pronounced than we had anticipated at the end of 1998 (see Chart 6). The effects of the Asian crisis proved to be more short-term than feared and oil-prices exhibited a sharp rise through 1999 and 2000. Demand - in terms of both private consumption and investment - picked up to a further extent than expected. One of the reasons for this is that the effects of the reduction in interest rates through 1999 occurred faster and were stronger than expected. In addition, house prices rose at a considerably faster pace than projected in 1999. Projections for both demand and production were revised upwards in 1999. Despite this, growth in 2000 turned out to be markedly higher than projected.

Chart 6 Estimates for some key variables for 2000 published at various times. Annual rise. Per cent

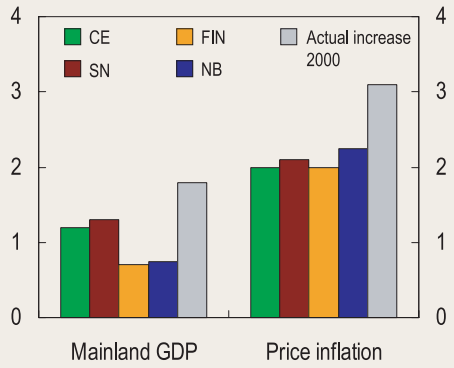


[1)] Level
[2)] Including the costs of additional vacation days
Sources: Statistics Norway and Norges Bank

While projections for most real variables were revised upwards in the course of 1999, estimates for annual wage growth were adjusted downwards. This was partly because annual wage growth was lower than projected in 1999, and we were expecting that the wage settlement in 2000 would also be marked by comparable moderation. The projection for consumer price inflation was nevertheless left unchanged as a result of the rise in oil prices and new assessments of the indirect tax programme for 2000.

Chart 7 shows that other institutions were also off the mark with regard to developments in 2000. The estimates from Consensus Economics Inc. represent an average of market participants' forecasts. According to Consensus Forecasts, some market participants and Statistics Norway were more optimistic than Norges Bank and the Ministry of Finance, but all the forecasts for GDP growth in 2000 were lower than the outturn. Consumer price inflation was also underestimated. Norges Bank's estimates were a little higher than those of other institutions here, but all the deviations were as wide as ¾ -1 percentage point.

Chart 7 Estimates for some key variables for 2000 published in December 1999 by various institutions. Annual rise. Per cent



Sources: Consensus Economics Inc. (CE), Statistics Norway (SN), Ministry of Finance (FIN) and Norges Bank (NB)

Overview of projections from 1994 to 2000

Charts 8 to 15 provide a comparison of projections from Statistics Norway, the Ministry of Finance and Norges Bank with actual figures.[3)]

There is no significant difference between the three institutions' projections for economic developments. We see that Statistics Norway rapidly shifted from having the most pessimistic outlook at the end of 1998 to the most optimistic picture one year later. All three institutions projected growth in demand and production, but both Norges Bank and the Ministry of Finance were very moderate. Since 1994 there has been a clear tendency for all three institutions to underestimate demand growth. The projections were somewhat more accurate in 2000. Statistics Norway's projection for demand growth was accurate and its projection for production growth was the most accurate. All three institutions underestimated production growth, primarily as a result of erroneous labour market assessments. In addition, electricity production was higher than expected. Statistics Norway projected that employment would remain stable, while Norges Bank and the Ministry of Finance projected a decline on the previous year. Instead, employment increased by 0.5 per cent. Throughout the cyclical upturn up to and including 1998, all three institutions underestimated labour market flexibility, and employment growth turned out to be higher than expected in those years. This is partly because we had underestimated labour force participation. Both Norges Bank and the Ministry of Finance were fairly accurate with respect to employment growth in 1999, but were off the mark by ¾-1 percentage point in 2000.

Despite the relatively large forecast errors for labour market developments, the projections for wage growth have been fairly accurate. There has still been a tendency for wage growth to be higher than projected, and wage growth had been underestimated by 1¼-1¾ percentage points for 2000. This is because all the projections indicated that the labour market would be markedly less tight than the outcome. The projections for consumer price inflation have also been relatively accurate. For all three institutions, the forecasts for 2000 were the least accurate. All three institutions underestimated the sharp rise in oil prices and its direct impact on consumer price inflation.

Table 5 shows the average absolute error (AAE [4)]) and the relative root mean square error (RRMSE [5)]). 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, but also shows the forecast error for several domestic components. The table shows that the forecast errors are smallest for wage growth and consumer price inflation. The forecast error for consumer price inflation is virtually the same for all three institutions, but Statistics Norway has consistently been slightly closer to the mark than the other institutions, as measured by RRMSE. Norges Bank's projections for wage growth have been the most accurate. The forecast errors for private consumption are relatively small for all three institutions. The forecast errors for employment and mainland GDP are also relatively moderate. The projections for mainland fixed investment and petroleum investment were the farthest off the mark.

The forecast errors vary somewhat between the three institutions, but on the whole the differences are insignificant. Our analysis does not provide a basis for asserting that the projections of one of the institutions are significantly more accurate than those of the two others. Moreover, the forecast errors that are discussed here only refer to some of the projections published by these institutions. Statistics Norway and Norges Bank published projections four times a year at that time. As from 2001, Norges Bank publishes projections only three times a year. The Ministry of Finance publishes projections in connection with the National Budget and the Revised National Budget.

3) The forecasts are published in Economic Survey (9/93, 9/94, 9/95, 9/96, 9/97, 9/98, 9/99), Final Budget Bill (1993, 1994, 1995, 1996, "Supplementary Budget Bill" (1997), National Budget (1999, 2000), and Economic Bulletin (1993/4, 1994/4, 1995/4, 1996/4, 1997/4, 1998/4, 1999/4).

4) 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.

5) 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 represents the actual growth rate and $\hat{y}_n$ is the projected growth rate.

Chart 8-15 Estimates from Statistics Norway (SN), the Ministry of Finance (FIN) and Norges Bank (NB), compared with the actual increase (Actual) from 1994 to 2000. Annual growth. Per cent.

Chart 8 Mainland demand

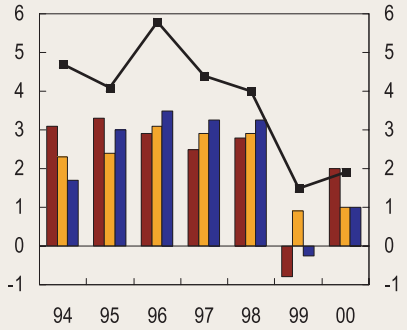


Chart 9 Exports of traditional goods

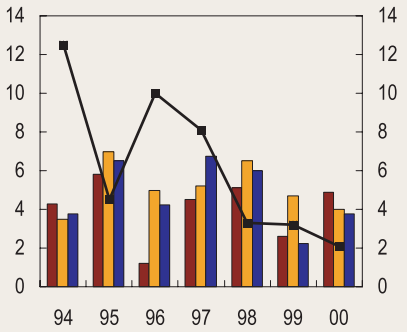


Chart 10 Petroleum investment

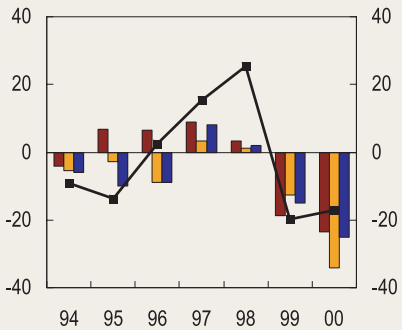


Chart 11 Mainland GDP

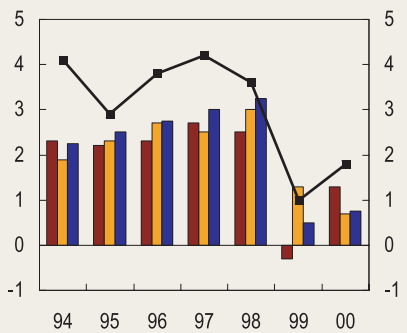


Chart 12 Imports of traditional goods

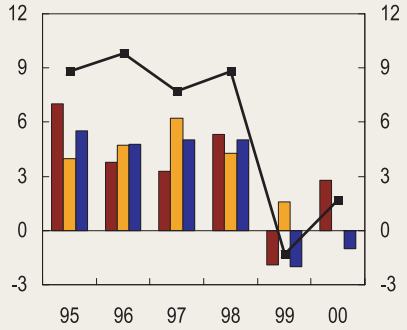


Chart 13 Employment growth

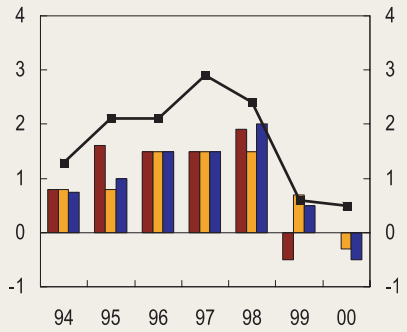
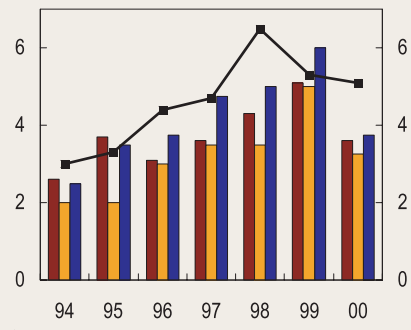


Chart 14 Annual wage growth[1)]



[1)] The figure for 2000 includes the costs of additional vacation days

Chart 15 Consumer price inflation

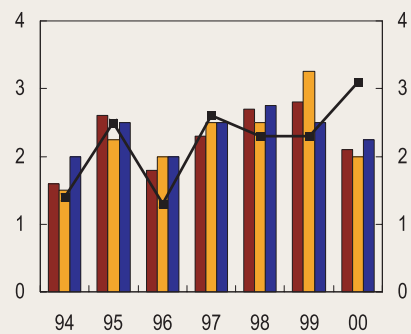


Table 5 Average absolute error (AAE) and relative root mean square error (RRMSE) Statistics Norway (SN), the Ministry of Finance (Fin) and Norges Bank (NB). 1994 to 2000

		SN	Fin	NB
Mainland GDP	AAE	1.20	1.09	0.91
	RRMSE	0.58	0.39	0.37
Employment	AAE	0.73	0.80	0.74
	RRMSE	0.84	0.71	0.83
Exports of traditional goods	AAE	3.87	3.71	3.31
	RRMSE	0.72	0.67	0.59
Imports of traditional goods[1)]	AAE	2.90	3.42	3.04
	RRMSE	0.51	1.07	0.77
Mainland demand	AAE	1.54	1.56	1.56
	RRMSE	0.66	0.42	0.58
Private consumption	AAE	0.90	1.16	0.89
	RRMSE	0.29	0.35	0.27
Mainland fixed investment[1)]	AAE	3.98	9.87	4.28
	RRMSE	1.17	1.38	1.70
Public consumption	AAE	1.10	1.19	1.26
	RRMSE	0.69	0.90	0.93
Petroleum investment	AAE	9.36	12.34	8.84
	RRMSE	0.91	1.83	1.75
Annual wages	AAE	1.01	1.44	0.71
	RRMSE	0.23	0.33	0.17
Consumer prices	AAE	0.43	0.49	0.41
	RRMSE	0.23	0.30	0.29

[1)] Because of major revisions in connection with a transition to new national accounts, the figures for 1994 are not included.
Sources: Ministry of Finance, Statistics Norway and Norges Bank

Summary

In the December 1998 *Inflation Report*, Norges Bank projected that the Norwegian economy would enter a period of relatively weak economic growth. The downturn would come as a result of weaker competitiveness, lower growth in the world economy and a fall in fixed investment. The outturn was indeed a period of weaker economic growth, but the path for real economic variables in 1999 and 2000 was considerable higher than projected. In 2000, wage growth and consumer price inflation were also higher than projected. However, price inflation adjusted for tax changes and excluding energy products turned out to be about the same as pro jected in December 1998.

In general, the closer ahead the period concerned, the easier it is to make projections for economic developments, and the forecast errors for the projections published in December 1999 were in fact somewhat smaller. The estimates for domestic demand were revised upwards, but most of the projections for the real economic variables were lower than the outcome also this time.

The deviations between our forecasts for 2000 and actual developments can primarily be explained by the following factors:

- The rise in oil prices was markedly higher than assumed. This was the main reason behind the forecast error for consumer price inflation.
- Global growth picked up faster than expected. Combined with the rise in oil prices, this boosted household and business optimism in Norway.
- The impact of the interest rate decline in 1999 on the Norwegian economy came faster and was stronger than anticipated. As a result, domestic demand showed stronger growth than we had projected. In turn, this meant that growth in employment and production had been underestimated. New estimates show that short-term interest rates have had a significant explanatory power in relation to private consumption since the end of the 1980s. A consumption function with such an interest rate effect was first used in the model in the spring of 2000.

In spite of the substantial forecast errors for the real economic variables, our projections for wage growth and consumer price inflation were fairly accurate after we had incorporated the actual values for all the exogenous variables. As to the projections published in 1999, wage growth was underestimated somewhat, while the projection for price inflation was accurate.

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