

N^o 2005/4

Oslo
May 10, 2005

Staff Memo

Monetary Policy

How to treat the exchange rate assumption for an inflation targeting regime

by

Jan F. Qvigstad

Publications from Norges Bank can be ordered by e-mail:

posten@norges-bank.no

or from: Norges Bank, Subscription service,

P.O.Box. 1179 Sentrum

N-0107 Oslo, Norway.

Tel. +47 22 31 63 83, Fax. +47 22 41 31 05

*Publications in the series Staff Memo are available as pdf-files on the bank's web site:
www.norges-bank.no, under "Publications".*

Staff Memos present reports on key issues written by staff members of Norges Bank, the central bank of Norway - and are intended to encourage comments from colleagues and other interested parties. Views and conclusions expressed in Staff Memos can not be taken to represent the views of Norges Bank.

© 2005 Norges Bank

The text may be quoted or referred to, provided that due acknowledgement is given to source.

Publikasjoner fra Norges Bank kan bestilles over e-post:

posten@norges-bank.no

eller ved henvendelse til:

Norges Bank, Abonnementservice

Postboks 1179 Sentrum

0107 Oslo

Telefon 22 31 63 83, Telefaks 22 41 31 05

Utgivelser i serien Staff Memo er tilgjengelige som pdf-filer på www.norges-bank.no, under «Publikasjoner».

Staff Memo inneholder utredninger som inngår i bankens arbeid med sentrale problemstillinger. Hensikten er å motta kommentarer fra kolleger og andre interesserte. Synspunkter og konklusjoner i arbeidene representerer ikke nødvendigvis Norges Banks synspunkter.

© 2005 Norges Bank

Det kan siteres fra eller henvises til dette arbeid, gitt at forfatter og Norges Bank oppgis som kilde.

ISSN 1504-2596 (online only)

ISBN 82-7553-292-2 (online only)

How to treat the exchange rate assumption for an inflation targeting regime

by

Jan F. Qvigstad¹

**Summary of talk held at Bank of England's Chief Economists' Workshop in London,
April 4th to 6th 2005**

¹ The author is Executive Director (Monetary Policy) and Chief Economist at Norges Bank. Thanks to Tom Bernhardsen and Einar W. Nordbø, both at Norges Bank, for valuable assistance in preparing this talk.

How to treat the exchange rate assumption for an inflation targeting regime

The topic I am going to discuss here is how to treat the exchange rate assumption when making projections under an inflation targeting regime. The central bank of Norway made the official change to inflation targeting in March 2001, and my talk is based on our experience since then.

But before I go into that, let me just give a brief overview of monetary policy in Norway. The operational target is consumer price inflation of close to 2.5 per cent over time, and we put particular emphasis on consumer price inflation adjusted for tax changes and excluding energy products (CPI-ATE) when assessing underlying inflation. Our inflation targeting regime is a so-called flexible inflation targeting regime, implying that we give weight both to variability in inflation and variability in output and employment. We set the interest rate with a view to stabilising inflation at the target within a reasonable time horizon, normally 1-3 years.

Chart 1

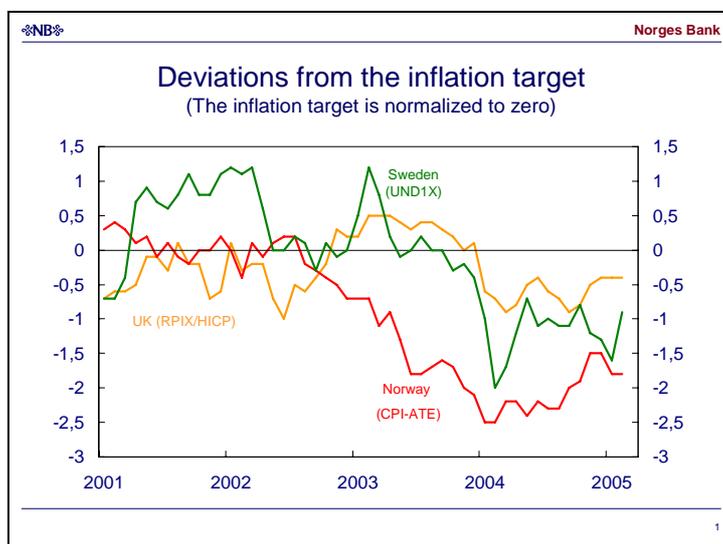


Chart 1 shows the deviation from the inflation target for some inflation targeting countries. The inflation target for each country is normalized to zero in the figure. We see that inflation out-turns below the target have also occurred in Sweden and the UK recently. But inflation

dropped below the target earlier in Norway, and the deviation from the target has been more substantial.

Inflation in Norway has now been below the target since August 2002, and 1.5 percentage points or more below the target since June 2003. This is mainly due to the large shocks to which the economy has been exposed. In evaluating monetary policy ex post, we may group the explanations of why we have deviated from the target into two categories.

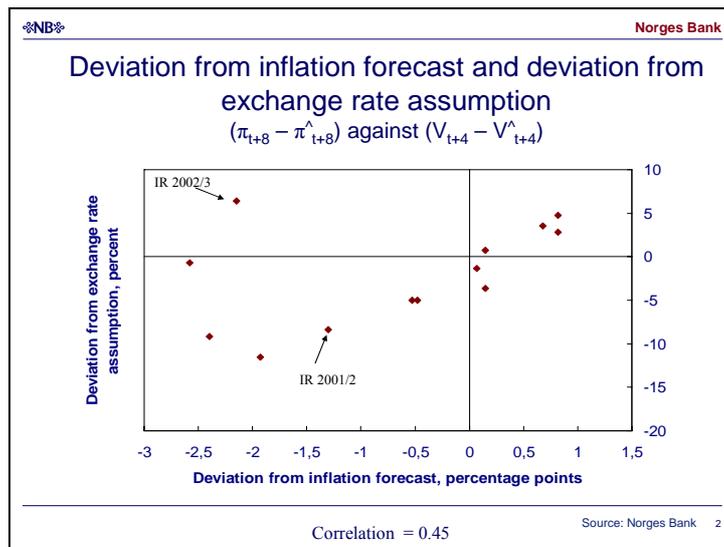
- Did we do a good job in forecasting?
- Did we identify the shocks correctly when they occurred, and was the monetary policy response adequate?

With regards to the forecasting question, the evaluation is complicated by the use of technical assumptions concerning the interest rate and the exchange rate. Thus our published forecasts were not necessarily our best forecasts, but conditional forecasts based on assumptions that were not necessarily expected to materialize. One example is inflation forecasts based on technical assumptions of unchanged interest rates and exchange rate. If such a forecast shows a deviation from the inflation target at a reasonable time horizon, the central bank will obviously not leave the interest rate unchanged in normal circumstances. And if the actual rate is at a historically low level, it should be obvious that the central bank does not intend to keep it there for ever. What we have learned from our experience is that even if we have to condition our forecasts on technical interest rate and exchange rate assumptions, these assumptions must not be totally unrealistic. In my talk today, I will focus on how we may treat the exchange rate assumption.²

The exchange rate is extremely difficult to predict. As Bank of England governor Mervyn King has said: *“I have no idea where exchange rates will go in the future and I have no intention of ever starting to forecast exchange rates. That’s a mug’s game”*. Nonetheless we need to consider future exchange rates in the process of forecasting inflation.

² This issue is discussed in more detail in Bernhardsen, T. and A. Holmsen, (2005): The choice of exchange rate assumption in the process of forecasting inflation. Staff Memo 2005/3, Norges Bank.

Chart 2

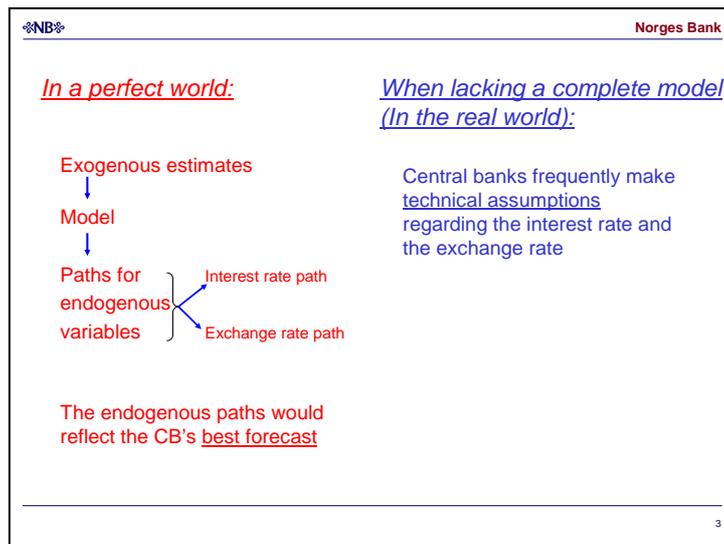


It is obvious that exchange rate errors matter for inflation forecast errors, and this is illustrated in Chart 2. It shows the relationship between the exchange rate assumption error four quarters ahead and the corresponding inflation error eight quarters ahead (based on data from the inflation reports in the period 1999–2003). The lags reflect the inertia in the exchange rate pass-through.

The fact that the exchange rate errors matter is illustrated by the fact that the pairs in the scatter plot are concentrated in the first (upper-right) and the third (lower-left) quadrant. That is, exchange rate outcomes stronger than assumed are associated with inflation outcomes lower than predicted, and vice versa. As an example, compared to the assumption in Inflation Report 2/2001, one year later the exchange rate turned out to be 8 percent stronger, while the core inflation two years later was 1.3 percentage points below target (marked in the figure).

The overall message from the chart is that the exchange rate assumption is of crucial importance in the process of forecasting inflation. As expected the correlation coefficient is positive, 0.45. In the case of a small open economy like Norway, the exchange rate has fluctuated substantially over recent years, causing major deviations in inflation from the forecast values. Other factors have contributed too, but it is clear that better exchange rate forecasts would have improved our inflation forecasts.

Chart 3



In a perfect world, we would have a model for the exchange rate that included all the key driving forces. The forecasts would be consistent with the remainder of the forecasts, including both short-term shocks and long-term equilibrium forces. Given exogenous forecasts for such factors as trading partner growth, the model could be used to produce “best-guess” forecasts for both the interest rate and exchange rate.

In practice, however, the drivers of the exchange rate are constantly changing. They are extremely difficult to recognize ex post, and impossible to anticipate. A complete model of the exchange rate will therefore never be developed. Studies show consistently that it is extremely difficult to beat a random walk assumption for the short-term exchange rate forecasts. In the very long run, on the other hand, one might expect that equilibrating forces, such as inflation or growth differentials, would have an impact. These kinds of influences *can* be built into our economic models. I will discuss how our models can do this shortly.

However, it is clear that in an inflation-targeting framework in a small open economy, the exchange rate is always going to be a problematic variable when it comes to making forecasts. We cannot ignore it; we must make assumptions. Central banks frequently refer to these as “technical assumptions”, implying that they are not necessarily expected to materialize, or even to be “more likely” than a multitude of alternative paths.

Technical assumptions regarding the exchange rate and interest rate path have several advantages compared with attempting to make “best-guess” forecasts:

- They are neutral, in the way that the central bank cannot be interpreted as revealing any normative view on what the exchange rate should be by making technical assumptions.
- As a result of this, it is less likely that a game situation with market agents will occur.
- Besides, the exchange rate is very hard to predict, and it is arguably best for credibility purposes to be completely open about this and recognise the limits of our forecasting ability.

But there are also a number of drawbacks with technical assumptions:

- The implied exchange rate path may be relatively unreasonable. This can be the case if the assumption for instance is that the exchange rate will remain at the same level as the average in the past two weeks, but the most recent movements in the exchange rate are a result of short-lived market sentiments.
- If the exchange rate path the forecasts are based on is not very reasonable, the accuracy of the rest of the forecasts will be compromised.
- The exchange rate path that follows from the technical assumption may be inconsistent with the interest rate path in terms of the usual observed market dynamics.
- Technical assumptions make it more difficult to evaluate the forecasts ex post, as the forecasts were not necessarily the central bank’s best forecast.

In the same way, forecasting exchange rates based on the central bank’s best guess has both advantages and drawbacks. Let me begin with the advantages:

- It will be consistent with the implied interest rate path.
- It reflects the central bank’s best judgement at the time.
- And, since the forecasts now are based on assumptions the central bank believes in, it will be much easier to evaluate the quality of forecasts ex post.

But there are of course also drawbacks:

- As already discussed, forecasting exchange rates is a very difficult exercise and the central bank risks damaging its reputation by consistently making wrong forecasts.
- There is a risk that market participants could misinterpret the projected path as a “desired” path, leading to a potential game-playing situation

But many other institutions publish exchange rate forecasts. Why should not central banks do this as well?

Chart 4

| | | Exchange rate assumption | | Interest rate assumption | |
|------------------|----------|--------------------------|----------|--------------------------|------------------------|
| Inflation Report | Constant | Forward rates | Constant | Forward rates | |
| 1/1999 - 4/2000 | X | | | | X |
| 1/2001 - 1/2003 | X | | X | | |
| 2/2003 - 3/2004 | | X | | | X |
| 1/2005 | | X | | | Adjusted forward rates |

The table in Chart 4 shows how the exchange rate and interest rate assumptions have developed over time at Norges Bank. From Inflation Report 1/1999 and up to Inflation Report 3/2004, different combinations of constant rate and forward rates were used. In Inflation Report 1/2005 the reference path is based on adjusted forward interest rates, as I'll discuss shortly.

The various practices partly reflect the economic situation at different points of time – we have chosen assumptions that do not give “unreasonable” paths for future exchange rates and interest rates.

The model that is being developed at Norges Bank, NEMO – The Norwegian Economy Model - gives endogenous paths for the exchange rate and the interest rate. In the short run, the nominal exchange rate is determined by the uncovered interest rate parity condition, adjusted for an endogenous risk premium. In the long run the equilibrium real exchange rate is determined by structural factors. One example of a shock that would affect the equilibrium is a permanent change in net foreign assets. The exchange rate and the interest rate paths are consistent, and the reference paths and alternative scenarios are consistent with the model.

Nonetheless, we do not anticipate that NEMO will enhance our ability to forecast the exchange rate. The consistency of the model is a useful disciplining device that makes story-telling easier, but we do not claim to have developed the “complete” model I alluded to earlier.

When producing an inflation forecast and forecast for the real economy, we use a suite of models in combination with a core model. I guess that our tools are not so different from those used at other central banks.

Chart 5

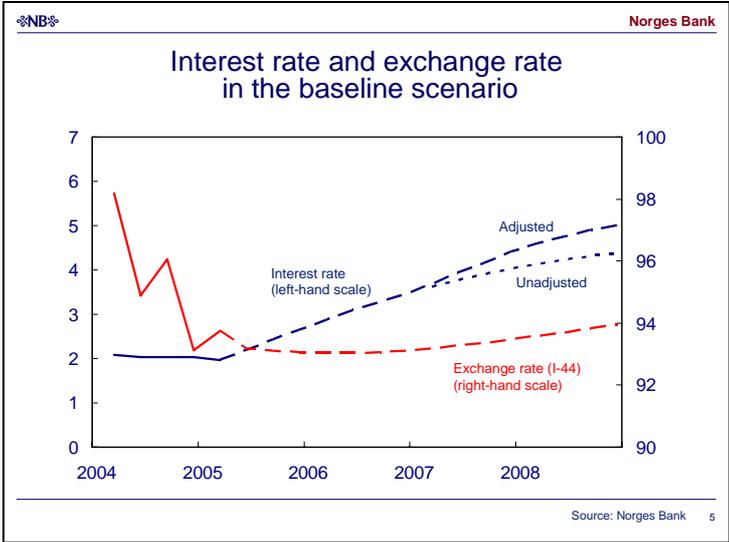
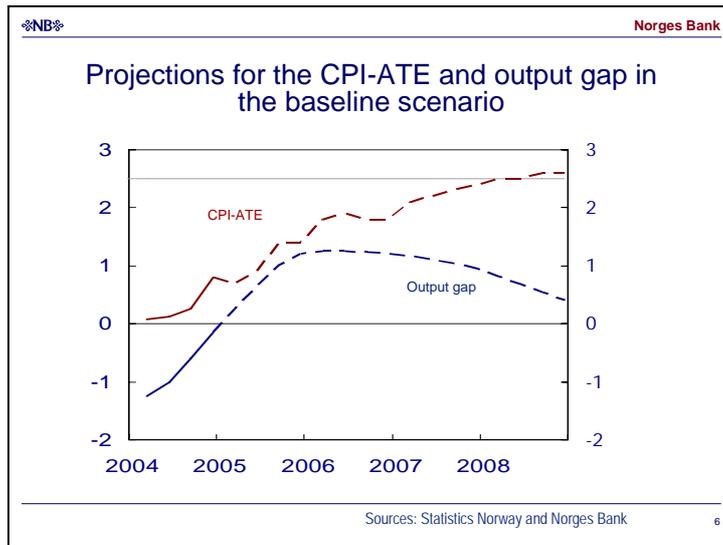


Chart 5 shows the interest rate and the exchange rate assumption in our latest Inflation Report (Inflation Report 1/2005). They are described as technical assumptions. The interest rate path is based on forward rates in the market. However, from 2007 onwards, actual interest rate expectations are assumed to rise somewhat faster than forward interest rates would imply.³ The adjustment implies that money market rates in Norway will move up to about 5% at the end of 2008 and then towards a “normal” level of 5 ½ %. We have also adjusted international interest rates in the same way and continued to use the forward exchange rate.

³ The forward rates from the two-three years horizon implied a lower long-term equilibrium rate than our estimates of a neutral real interest rate over time. There were reasons to assume that the forward rates had been pushed down by temporary, extraordinary factors and did not reflect actual market expectations. See Inflation Report 1/2005, Norges Bank.

Chart 6



The forecast in Chart 6 shows that we reach the inflation target in three years and that the output gap, which indicates that we are moving into a situation with a slightly overheated economy, is moving back towards equilibrium.

Chart 7

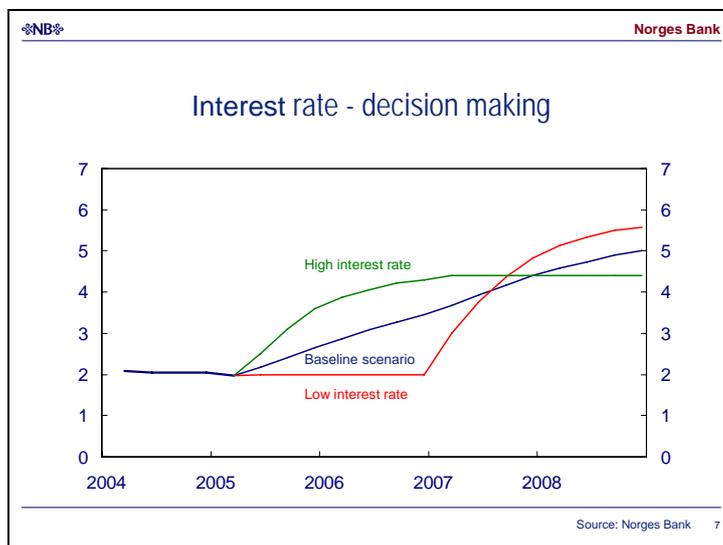


Chart 7 shows the baseline scenario for the interest rate in blue and two alternative scenarios. In one scenario the interest rate is kept low longer than in the baseline scenario, until the end of 2006. In the other scenario the interest rate is increased faster than in the baseline scenario. Both scenarios were realistic and possible scenarios, which the board could have chosen. The

different scenarios for the interest rate would have had different implications for the development of inflation and production.

Chart 8

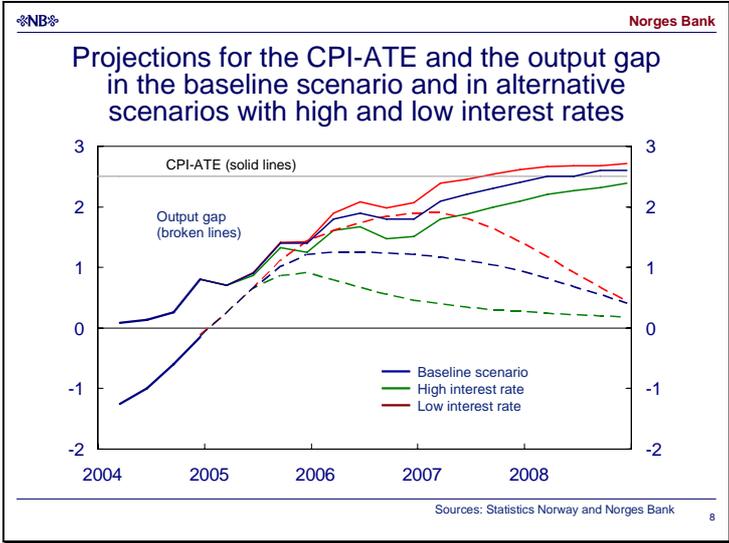


Chart 8 shows projections for inflation and output gap in the three scenarios. In the low interest rate scenario inflation would rise faster and approach the target faster than in the baseline scenario, but at the same time the output gap would also increase more and deviate more from zero than in the baseline scenario. In the high interest rate scenario the output gap would be closer to zero, but then inflation would approach the target more slowly.

Since Inflation Report 2/2004, published in July, we have commented on the interest rate expectations in the market.

In July 2004 we concluded that a monetary policy where the interest rate was kept unchanged for a longer period than indicated by market expectations at the time would be a better monetary policy. In the Inflation Report, we stated that: *”The most appropriate alternative now seems to be that the interest rate should be kept unchanged for a longer period than indicated by market expectations”*. As a result, the expected interest rate increase was postponed in the market.

In November 2004 (IR 3/04) we concluded that the market interest rate would provide a “reasonable” path: *”On the basis of available information ... such [interest rate]*

developments seem to provide a reasonable balance between the objective of bringing up inflation while avoiding excessive growth in output and employment”.

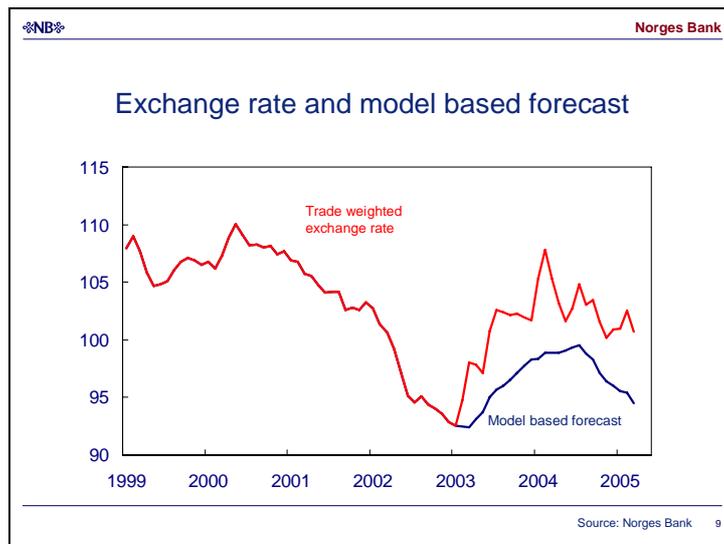
In March 2005 (IR 1/05) we found the market interest rate path to be good in the short run, but we adjusted the interest rate upwards from January 2007. We argued that forward rates from the two-three year horizon had been pushed down by temporary, extraordinary factors, partly stemming from international conditions. The forecasts were based on the adjusted interest rate path, which we concluded would provide a good balance: *”The interest path ... [in the baseline scenario] therefore seems to provide a good balance between the objective of bringing inflation back to target and the objective of stabilising output and employment*

Summing up this discussion, my conclusion is that any assumption regarding the exchange rate and the interest rate must be “reasonable”, as unreasonable assumptions create larger inflation forecast errors. Therefore, even technical assumptions must not be wildly out of line with expected future developments, taking into account that it is very hard to beat the random walk for the exchange rate in the short run. But in the long run, we have some ideas about equilibrium concepts that we would prefer our forecasts to be consistent with.

Other issues regarding the exchange rate

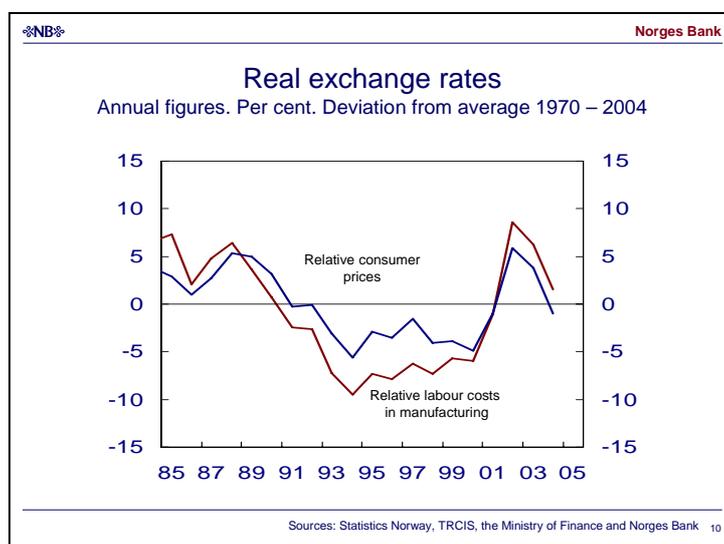
I am now going to discuss some other issues regarding the exchange rate. Even though the exchange rate is very hard to predict, it is still important for us to try to understand the present exchange rate. We know that special themes in the market influence exchange rate movements. This is difficult to measure, but at the central bank of Norway we still perform econometric analyses ex post to try to assess which themes have been most important.

Chart 9



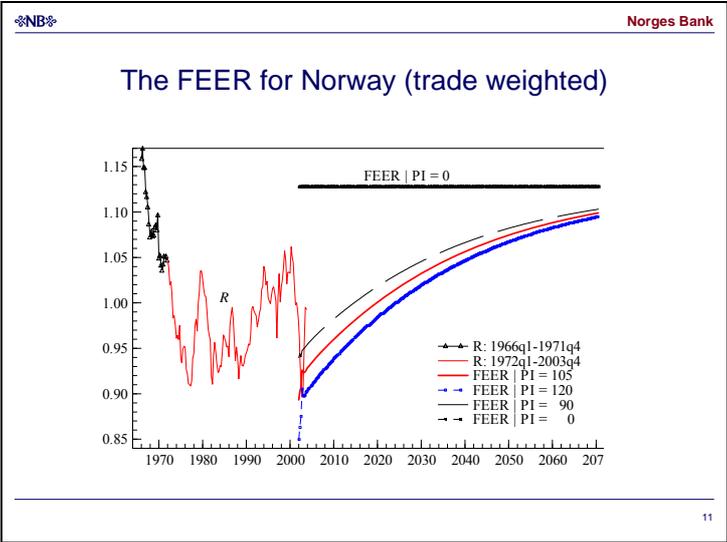
This is illustrated in Chart 9. The chart shows the trade weighted exchange rate from 1999 and a model-based forecast from February 2003. The model is documented in a box in Inflation Report 1/2003. In the model the exchange rate depends on the interest rate differential, the oil price, global stock prices and volatility between major currencies. The model explains the history well, but the model's forecast is poor, as one would expect. The themes in international financial markets are constantly changing, and a model estimated on historical data will not capture the effects of new themes and drivers. Nonetheless, through working with the model we gained new knowledge on how different and varying themes have influenced the Norwegian exchange rate.

Chart 10



Another relevant question is whether the current real exchange rate is at its equilibrium value or not. One approach is to look at the deviation from average since 1970 (Chart 10). The Norwegian real exchange rate, based both on relative consumer prices and relative labour costs in manufacturing, has been relatively stable since 1970, and if we assume that the mean value in this period is the equilibrium value, we observe that the real exchange rate was relatively close to the equilibrium in 2004. The real exchange rate based on relative consumer prices was in 2004 1 percent weaker than the historical average, whereas the real exchange rate based on relative labour costs in manufacturing was 1.5 percent stronger.

Chart 11



Another approach is to discuss the current real exchange rate within the fundamental equilibrium real exchange rate (FEER) framework. This analysis is discussed in more detail in Akram (2004).⁴

Chart 11 shows actual observations of the real exchange rate from 1966 to 2002 together with simulated paths of the FEER in the period from 2002 to 2070. Simulated paths are for different values of permanent income from net foreign assets (PI), when trend growth in Norway and trading partners is assumed to equal 2 percent per year.

⁴ Akram, Q. F. (2004): "Oil wealth and real exchange rates: The FEER for Norway". Working Paper No. 16, Norges Bank.

We observe that the FEER analysis implies a long run depreciation of the Norwegian real exchange rate. Petroleum wealth, defined as the value of oil and gas under the seabed and the value of the Government Petroleum Fund, provides the basis for substantial foreign exchange revenues in the years ahead. These revenues will decline as a share of GDP as the economy grows. The share of imports that can be financed by foreign exchange revenues from petroleum wealth will be reduced. Export earnings other than petroleum revenues will then be necessary. A substantial improvement in competitiveness will be required over time.

Norway's history as an oil nation goes back to the end of the 1960s. Rough estimates suggest that when petroleum wealth no longer has the same significant role in the economy, a real exchange rate that would ensure balance in the balance of payments is more in line with the real exchange rate prevailing in Norway prior to the discovery of oil. This is shown in the chart, where the real exchange rate in 60 years' time, after a sharp appreciation while we phase petroleum wealth into the economy, will have reverted to the level prevailing before petroleum extraction began.

