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Staff Memo

When does an interest rate path "look good"?
Criteria for an appropriate future interest rate path – A practician's approach

by

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Criteria for an appropriate future interest rate path

– A practician's approach

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1   Introduction and summary

When professor Lars E. O. Svensson (Princeton University) visited Norges Bank's conference on monetary policy in 2004, he suggested we should "find an instrument-rate path such that projections of inflation and output gap 'look good'." We took on the challenge of how to translate the theoretical framework into some concrete criteria when evaluating interest rate paths in practice. The criteria should be viewed as necessary conditions for regarding the interest rate path as one that provides a reasonable balance between developments in inflation and the real economy.

In other words, this paper discusses the grounds for the criteria we use when evaluating whether an interest rate path "looks good".

We have drawn up six criteria for an appropriate interest rate path. The criteria are also presented in a box in Norges Banks *Inflation Report* 1/2005. Even though it has proved difficult to satisfy all the criteria at the same time, I think they can function as a normative guideline for an interest rate path that provides a reasonable balance between the objective of stabilising inflation and the objective of stabilising output.

This memo explains the grounds for the criteria. Although the criteria have already been presented in the March 2005 *Inflation Report*, they can to some extent be considered as work in progress. The criteria will probably evolve over time, as new insights and new considerations emerge about how monetary policy should be conducted.

Norges Bank operates a flexible inflation targeting regime, so that weight is given to both variability in inflation and variability in output and employment in interest rate setting. Flexible inflation targeting builds a bridge between the long-term objective of monetary policy, which is to keep inflation on target to provide an anchor for inflation expectations, and the more short-term objective of

stability in the real economy. As monetary policy influences the economy with a lag, interest rate setting must be forward-looking.

According to modern macroeconomic theory, developments in output, employment, income and inflation are affected by current interest rates and expectations about future interest rates. To the extent that the central bank can influence these expectations, they play a key role in monetary policy. Expectations regarding the future path of the interest rate must be based on the assumption that monetary policy keeps inflation close to the target over time and contributes to stabilising developments in output and employment. Often several interest rate paths may produce these results, and it may be difficult to assess precisely which future interest rate path yields the preferred balance between the different considerations. Economic theory provides some guidelines, but they are not easy to apply in practice.

The following criteria may be useful in assessing whether a future interest rate path appears reasonable compared with the monetary policy objective.

Criteria for a "good" interest rate path

1.   If monetary policy is to anchor inflation expectations around the target, the interest rate must be set so that inflation moves towards the target. Inflation should be stabilised near the target within a reasonable time horizon, normally 1-3 years. For the same reason, inflation should also be moving towards the target well before the end of the three-year period.

2.   Assuming that inflation expectations are anchored around the target, the inflation gap and the output gap should be in reasonable proportion to each other until they close.[2] The inflation gap and the output gap should normally not be positive or negative at the same time further ahead. If both gaps are positive, for example, a path with a higher interest rate would be preferable, as it would bring inflation closer to the target and contribute to more stable output developments.

3.   Interest rate developments, particularly in the next few months, should result in acceptable developments in inflation and output also under alternative, albeit not unrealistic, assumptions concerning the economic situation and the functioning of the economy.

4.   The interest rate should normally be changed gradually so that we can assess the effects of interest rate changes and other new information about economic developments.

5.   Interest rate setting must also be assessed in the light of developments in property prices and credit. Wide fluctuations in these variables may constitute a source of instability in demand and output in the somewhat longer run.

6.   It may also be useful to cross-check by assessing interest rate setting in the light of some simple monetary policy rules. If the interest rate deviates systematically and substantially from simple rules, it should be possible to explain the reasons for this.

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[2] The inflation gap is the difference between the inflation target of 2.5% and actual inflation. The output gap measures the percentage difference between actual and potential mainland GDP.

2 Theory and practice

Flexible inflation targeting implies that the central bank in the short run faces a trade-off between price stability and stability in the real economy. In the theoretical literature, the trade-off between price stability and stability in the real economy is often described as minimising a loss function, which includes both inflation variability and output variability. The central bank should then choose the path for the interest rate ahead that minimises the discounted "losses" in all future periods: [3]

$$L_t = E_t \sum_{k=0}^{\infty} \delta^k [(\pi_{t+k} - \pi^*)^2 + \lambda (y_{t+k} - y_{t+k}^*)^2]$$

The loss function includes the deviation between inflation and the inflation target $(\pi - \pi^*)$ and the deviation between output and potential output (y-y*). The deviations are represented quadratically. Substantial deviations are thereby deemed to be considerably more costly than small deviations. The parameter λ is the weight on output fluctuations, relative to inflation deviations.

The first order condition for minimising the "loss" in a given period is that the expected marginal benefit of bringing inflation closer to the target must be equal to the expected marginal cost of this policy for the real economy. [4]

In simplified terms, the first order condition states that the interest rate path should strike a reasonable balance between the objective of stabilising inflation around the target and the objective of stable developments in the real economy.

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[3] See for example Kuttner (2004), Walsh (2003) p. 524 and Svensson (2003). The symbols should be well known.
[4] The cost will according to theory depend on the weight the central bank gives to stabilising output (the size of λ), how strong the correlation between output and inflation is, and the level of the output gap at the start, see for example Kuttner (2004). For simplicity, we disregard the fact that the first order condition will depend on whether monetary policy follows an optimal precommitment policy or a discretionary policy (see Walsh (2003) Chapter 11.3).

As central bankers, we may approach our problem like this also in practice. We would need to assess:

- The current economic situation – the values of "y_0" and "π_0". It is our job to give the best possible assessment of this. This is the most resource-intensive part of our job.

- How the transmission mechanism works – "the model". We already spend a great deal of resources on this issue.

- The preferences of the Executive Board – or more specifically, the value of the parameter λ in the loss function. Attempts at estimating this parameter have been made.

Given this information, our economists could calculate a reasonable path[5] and ask the Executive Board (the monetary policy committee) if they agree. However, for reasons of transparency and communication both internally and externally it may be useful to translate this "model language" into a more "normal" language.

The theoretical framework provides a useful guidance, but can in practice only be a reference. However, what we do in practice, should indeed have a reference to theoretical thinking.

The theoretical framework provides limited concrete and easily communicable guidance. In practice, it may be useful to have some simple points of reference that can help us to evaluate whether an interest rate path seems reasonable in

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[5] The inflation forecasts in Norges Banks's inflation reports are based on market interest rates. As from the July 2004 Inflation Report, the Executive Board's monetary policy strategy and assessments have been published at the beginning of the relevant strategy period. Before this, their assessments were published as an annex to the Inflation Report at the end of the relevant period. In the published assessments, the Executive Board comments on the forecasts based on the market interest rates. For instance in the March 2005 Inflation Report the Executive Board stated that "The interest rate path (…) therefore seems to provide a good balance between the objective of bringing inflation back to target and the objective of stabilising output and employment." For more information about how forecasts are made, see Qvigstad (2005).

relation to the monetary policy objective. In other words, the loss function framework needs to be translated from mathematics into practical guidelines which are easy to understand.

The criteria mentioned above can also be seen as an "ordre du jour" or "main issues for discussion" when a monetary policy committee in a central bank discusses forecasts.

3   The grounds for and assessment of the various criteria

Re criterion 1 – Anchoring inflation expectations
Monetary policy shall ensure that the economy has a credible nominal anchor so that inflation expectations are stable around the inflation target. An appropriate interest rate path must first of all contribute to this. Hence:

1.   If monetary policy is to anchor inflation expectations around the target, the interest rate must be set so that inflation moves towards the target. Inflation should be stabilised near the target within a reasonable time horizon, normally 1-3 years. For the same reason, inflation should also be moving towards the target well before the end of the three-year period.

The criterion must not be interpreted to mean that there is a fixed horizon of 3 years for reaching the inflation target. The horizon will depend on what type of disturbances the economy is exposed to, cf. Norges Bank's external communication:

> "Norges Bank sets the interest rate with a view to stabilising inflation at the target within a reasonable time horizon, normally 1-3 years. The relevant horizon will depend on disturbances to which the economy is

exposed and how they affect the path for inflation and the real economy ahead."[6]

Criterion 1 must thus be seen in relation to the above statement. In order to promote stable inflation expectations, it may be appropriate to be so specific with regard to the time horizon (i.e. 1-3 years). If we decided to apply an even longer normal horizon, the basis for stable inflation expectations around the target might be weakened.

In addition to the requirement that the inflation target shall be reached in three years, it would be an advantage in terms of inflation expectations if inflation is also moving towards the target well before the end of the three-year period.

Norges Bank is a young inflation targeter. We don't have the track record that, for instance, the Bundesbank had – and the credibility that follows from this. We need to build credibility, which means that we must fulfil our task not only in the long term, but also in the medium term. Thus, ensuring that inflation expectations stay well anchored at 2 ½ per cent in the long term is one reason to place emphasis on reaching the inflation target within 1-3 years.

Faust and Henderson (2004) summarize something important when they write: "Common wisdom and conventional models suggest that best practice policy can be summarized in terms of two goals. First, get the mean inflation right, second, get the variance of inflation right."

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[6] See for example Gjedrem (2005a) and Norges Bank (2005).

Chart 1
CPI. Moving 10-year average[1] and variation[2]
1980 – 2004[3]. Per cent.

[1] The moving average is estimated 7 years back, for the current year and for 2 years ahead
[2] The band around the CPI is the variation in the period, measured as +/- one standard deviation
[3] Projections for 2004 – 2006 from IR 3/2004 form the basis for this estimate.
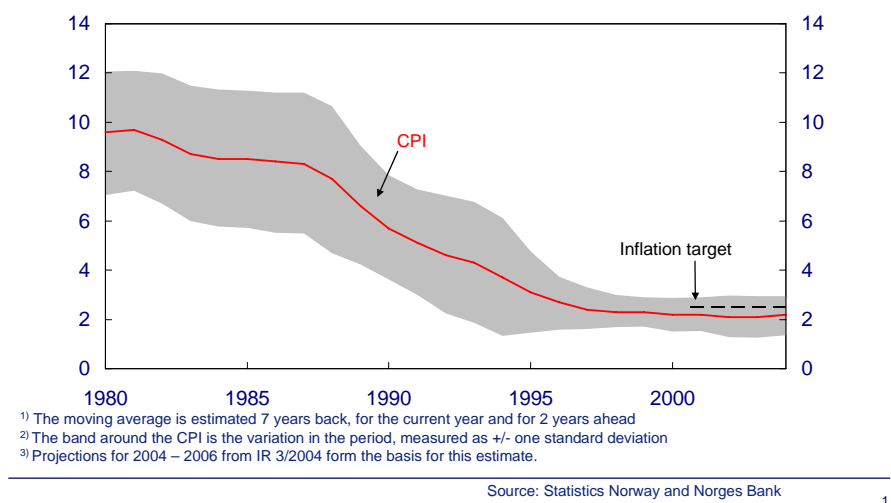
Source: Statistics Norway and Norges Bank

Chart 1 shows that inflation is far lower and is less varied than in the 1980s. The objective of monetary policy is to ensure that inflation is low and stable over time. Criterion 1 may be looked upon as a requirement that must be satisfied if this ambition is to be credible.

Re criterion 2 – Getting the balance between inflation and output right
Norges Bank has based its monetary policy on flexible inflation targeting, so that weight is given to both variability in inflation and variability in output and employment. Monetary policy affects the real economy in the short to medium term. Given that inflation expectations are anchored around the target, it is the central bank's task to choose an interest rate path that strikes the best possible balance between low and stable inflation and stable developments in the real economy over time. This may be operationalised in the following way:

2.   Assuming that inflation expectations are anchored around the target, the inflation gap and the output gap should be in reasonable proportion to each other until they close.[7] The inflation gap and the output gap should normally not be positive or negative at the same time further ahead.[8] If both gaps are positive, for example, a path with a higher interest rate would be preferable, as it would bring inflation closer to the target and contribute to more stable output developments.

The first sentence may appear self-evident and provides scope for exercising judgment. There may be different perceptions as to what is a reasonable relationship between the output gap and the inflation gap, and they will depend on the weight given to stable output in relation to stable inflation (lambda (λ) in a standard loss function). The essential element is that when setting interest rates attempts are made to have consistent assessments over time. In this connection, it may be useful internally to calculate the lambda of decision-makers on the basis of their prioritisation of different interest rate paths. If decision-makers do not have consistent assessments over time, they should be made aware of this before they make the decision. If the statement that we operate a flexible inflation targeting regime is to be credible, lambda should be greater than zero. Assessments that are consistent over time, i.e. a fairly stable lambda, would probably help to make monetary policy more predictable.

Moreover, the interest rate path should normally be as efficient as possible. It should not be possible to move inflation closer to the target without widening the output gap at the same time. This is reflected in the two last sentences in criterion 2. If for example both inflation and output are above target/trend, it

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[7] The inflation gap is the difference between the inflation target of 2.5% and actual inflation. The output gap measures the percentage difference between actual and potential mainland GDP.

[8] However, economic theory indicates that under an optimal precommitment policy, it will under some circumstances (e.g. after a cost push shock) be optimal to keep both the inflation gap and the output gap negative or positive for some time ahead, see for example Walsh (2003) pp. 527-529.

means that a better balance could have been achieved by setting the interest rate higher, so that both the output gap and the inflation gap are smaller.

Chart 2
Projections for the CPI-ATE and the output gap
Interest rate and exchange rate in the baseline scenario
Quarterly figures. 04 Q1 – 08 Q4

Import-weighted exchange rate (I-44) (right-hand scale)

Interest rate (left-hand scale)

CPI-ATE

Output gap

2004 2005 2006 2007 2008

Source: Norges Bank's Inflation Report 1/2005

2

How easy it is to fulfil the criteria simultaneously will depend on the disturbances to which the economy has been exposed, capacity utilisation in the economy at the outset and how far inflation is from the target. Although criteria 1 and 2 were fulfilled in the baseline projections of *Inflation Report* 1/2005, as shown in Chart 2, it will probably not always be possible to fulfil them. This may be a case for further study.

The previous criteria are closely related to a standard loss function including deviations in inflation from target and output gap. In addition, there are other important considerations with regard to the soundness of interest rate paths. These considerations are discussed in the following.

Re criterion 3 – Uncertainty and robustness (What if we are wrong?)

Even if different future interest rate paths are assessed on the basis of expected developments in inflation and output, there will be considerable uncertainty associated with the estimates. Interest rate setting must therefore take into account that the actual state of the economy is not fully known, and that unforeseen disturbances may occur.

Monetary policy decisions are made in the face of considerable uncertainty. There is uncertainty as to the current state of the economy, the underlying driving forces and the economy's functioning, including expectations formation and the impact of monetary policy. Projected developments in output and inflation are based on important assumptions, which are associated with considerable uncertainty.

The literature often distinguishes between two types of uncertainty:

Additive uncertainty is the uncertainty associated with developments in exogenous variables.[9] Examples of additive uncertainty are "add factors" in our economic models and other exogenous factors such as fiscal policy and the oil price. According to theory, additive uncertainty, where uncertain factors are assumed to be independent of the interest rate, shall not be taken into account when setting interest rates. Certainty equivalence applies here, which means that we make an unbiased projection for the uncertain factor and take the projection into account in the same way as if we knew with certainty that it would occur. We are nonetheless of the view that one should also evaluate whether an interest rate path provides an acceptable outcome with realistic, alternative assumptions concerning developments in exogenous variables. This will contribute to a more robust monetary policy strategy.

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[9] See Bergo (2004) and the references made there for more discussion about uncertainty.

Multiplicative uncertainty is the uncertainty about the actual functioning of the economy. Multiplicative uncertainty often involves uncertainty about the structural parameters in the model, such as the effect of the interest rate on demand and the exchange rate and the relationship between inflation and output in the short term. Uncertainty about how economic disturbances influence inflation expectations is also multiplicative uncertainty. Economic theory indicates that monetary policy should sometimes respond more cautiously to economic disturbances when there is uncertainty concerning the effect of the interest rate.[10] On the other hand, theory implies that the central bank should be more aggressive when setting interest rates when faced with certain types of multiplicative uncertainty, for example, uncertainty regarding the extent to which deviation from the inflation target for a period has an effect on market participants' expectations concerning future inflation.

In practice, new information will result in changes in the interest rate. However, information often comes with a lag. It is therefore most relevant to assess whether the interest rate in the next few months (i.e. the strategy period[11]) is robust to other assumptions concerning economic developments and the functioning of the economy. Further ahead, it will in any case be possible to adapt the interest rate as the bank's assessments of economic developments gradually change.

The monetary policy strategy should be robust to various assumptions concerning the current situation in the economy and the possibility that relationships in the economy may be incorrectly described. Thus:

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[10] See Brainard (1967).

[11] By strategy period we mean the four-month period between our inflation reports. Underlying each interest rate decision is a monetary policy strategy drawn up by the Executive Board every four months. The strategy is published directly after it has been approved and at the start of the relevant strategy period.
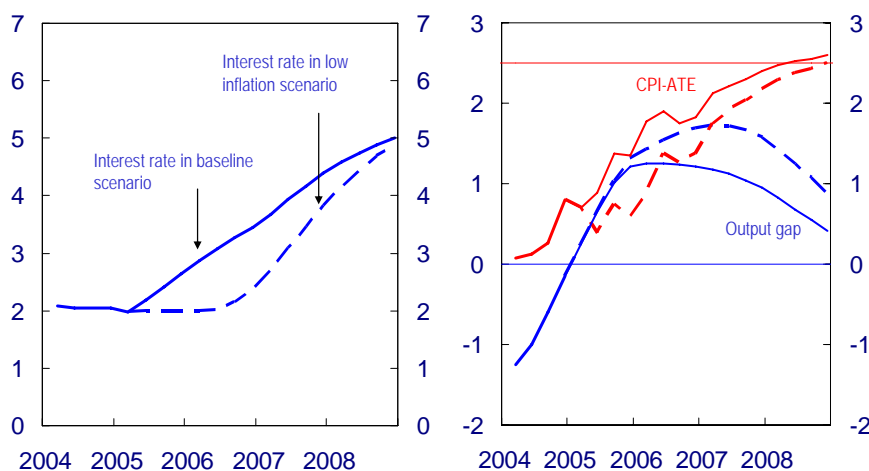
3.   Interest rate developments, particularly in the next few months, should result in acceptable developments in inflation and output also under alternative, albeit not unrealistic, assumptions concerning the economic situation and the functioning of the economy.

In practice, this means that we should test in a suitable model the outcome for inflation and output under other assumptions. Such analyses will reflect discretionary assessments of realistic, alternative assumptions. The choice of alternative assumptions may vary from one *Inflation Report* to another, depending on what risk factors are deemed to be the greatest at the time in question.

Alternatively, a robust monetary policy may entail hedging against particularly unfavourable outcomes. However, the risk associated with this strategy is that unreasonable emphasis is placed on events that are relatively improbable.

Chart 3 shows an example taken from *Inflation Report 1/2005*. The right-hand chart shows projections for inflation (red lines) and output gap (blue lines). The dotted red line shows a path for future inflation that for some reason is significantly lower than expected in the near term. The dotted line in the left-hand chart shows a possible interest rate path in such a low inflation environment. Lower interest rates than in the base scenario result in a weaker exchange rate and higher demand and output. This causes a higher output gap (blue dotted line in right-hand chart). The combination of a higher output gap and weaker exchange rate means that inflation increases faster, so that by the end of 2008 the level of the inflation is basically the same as in the baseline scenario.

Chart 3
Interest rate, output gap and inflation.
Scenario of lower-than-expected inflation
Per cent. 2004 – 2008

Source: Norges Bank's Inflation Report 1/2005   3

Given these assumptions and the initial situation of the economy, the alternative interest rate path may result in acceptable developments in inflation and output. But in practice, monetary policy must also assess the background for and the expected duration of the lower-than-expected inflation level.

Re criterion 4 – Gradual changes (interest rate smoothing)

This criterion must be seen in connection with criterion 3, discussed above.

Experience shows that Norges Bank and other central banks take a gradual approach to interest rate setting. Uncertainty concerning economic developments, including the effect of monetary policy, may imply that this is the correct approach. However, there is also uncertainty concerning the state of the economy at the time of the decision.

The uncertainty concerning the functioning of the economy is considerable; our models only provide indications of relationships in the economy. With a gradual change in interest rates, we can assess the effects of interest rate changes and

other new information concerning economic developments. One should therefore take a gradual approach to interest rate setting. Moreover, a gradual adaptation of the interest rate level may lead to greater predictability and facilitate economic agents' adjustment to the change. [12] Thus:

4.   The interest rate should normally be changed gradually so that we can assess the effects of interest rate changes and other new information about economic developments.

The baseline interest path in Norges Bank's *Inflation Report* 1/2005, as shown in Chart 3, was deemed to fulfil this criterion:

> "The baseline scenario also implies that the interest rate is changed gradually, so that we can assess the effects of interest rate changes and new information concerning economic developments."

However, the question of whether it is appropriate to proceed gradually depends on what disturbances the economy is exposed to. With some types of shocks, when there is a risk that inflation may deviate considerably from the target over a longer period, with the possibility that inflation expectations will be affected and confidence in monetary policy is in jeopardy, a rapid and pronounced change in the interest rate may be appropriate. Hence, with some types of uncertainty and characteristics of the economic situation, pronounced changes in the interest rate may be appropriate (see discussion about multiplicative uncertainty on pp. 12-13).

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[12] Alan Blinder (1998) pp. 17-18 probably captures some standard central bank thinking when he indicates that a central bank should decide on the appropriate interest rate and then move towards this rate slowly in order to see if things turn out as perceived.

Re criterion 5 – Financial imbalances[13]

Financial stability has become an increasingly important objective in economic policymaking during recent decades. One approach to handling threats to financial stability deals with risks originating from outside the financial system. Strong growth in debt and asset prices, as well as other macroeconomic disturbances, can ultimately have an adverse impact on financial stability.

Financial imbalances may also affect output and inflation. For example, a sharp rise in property prices and borrowing might be a source of instability in demand and output in the somewhat longer run. In turn, this may also affect inflation. Consequently, these issues need to be discussed explicitly when assessing the appropriateness of interest rate paths. Thus, when assessing criterion 1 and 2, the developments in debt and asset prices should be considered. In practice, however, discussing issues one by one in a given order may help to structure the debate and ensure that all relevant aspects are dealt with.

Svein Gjedrem, Governor of Norges Bank, discussed the nexus between financial stability and monetary policy in Vienna earlier this year. Let me quote some of his statements:

> "(..), risks to financial stability due to evolving financial imbalances are likely to develop over a long period of time. From this perspective, the question of whether financial stability considerations should be explicitly included in monetary policy is heavily debated, both in academia and within central banks. The answers diverge and international consensus has not yet been reached.
> (..)
> Seen from an institutional perspective, flexible inflation targeting is becoming an increasingly common monetary policy regime. With a target

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[13] For more discussion about financial stability and monetary policy, see Gjedrem (2005b).

horizon that is forward-looking and sufficiently flexible, it is possible to take into account the impact of potential financial imbalances on future inflation and output. However, it is important to keep in mind that the unwinding of financial imbalances may lay many years ahead, well outside the horizon for the inflation target. Some situations may require a careful weighting of the probabilities and costs of not reaching the inflation target within a medium-term horizon against possible economic turbulence further ahead. In the worst case, this turbulence may result in the actuation of a financial crisis.
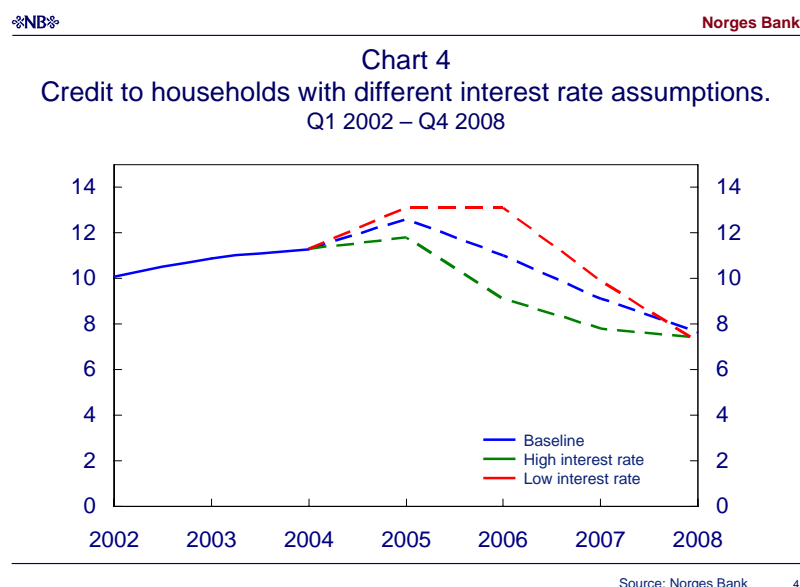
Another interpretation of the role of monetary policy is that it demands that financial instability is taken into account beyond its impact on inflation and output. For instance, structural costs may arise as a result of incorrect decisions by economic agents, based on incorrect information in the period characterised by financial imbalances. The Reserve Bank Act in New Zealand explicitly states that the Bank, in formulating and implementing monetary policy, should "have regard to the efficiency and soundness of the financial system.

In Norway, a flexible inflation-targeting country, we have chosen to incorporate financial stability considerations into the monetary policy decision process. This is partly because financial balances are important for inflation and output and partly because this will secure sufficient attention to potential risks to financial stability. In addition, departments dealing with financial stability gather structural and empirical information about the financial system and the financial position of households and enterprises. In my view, these are important inputs to the monetary policy process."

These considerations are operationalised as:

5.   *Interest rate setting must also be assessed in the light of developments in property prices and credit. Wide fluctuations in these variables may constitute a source of instability in demand and output in the somewhat longer run.*

Chart 4 shows an example from *Inflation Report* 1/2005. Here, different interest rate paths are assessed with regard to their consequences for credit to households. The same exercise was performed for households' debt and interest rate burden and for house prices.
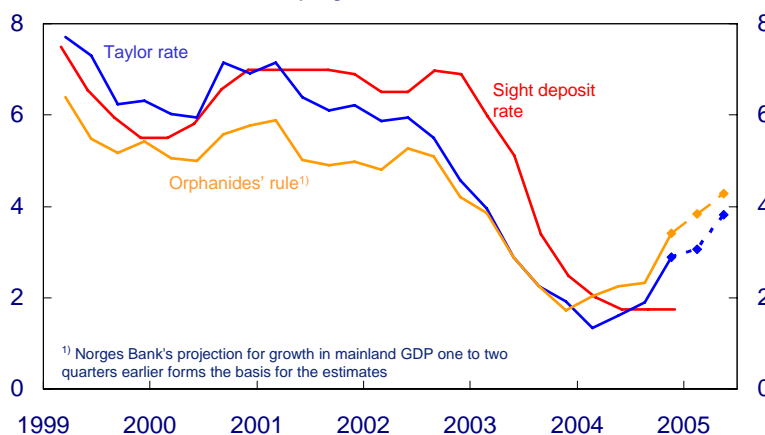

Chart 4
Credit to households with different interest rate assumptions.
Q1 2002 – Q4 2008

Source: Norges Bank

Re criterion 6 – Cross-checking

Interest rate setting may also be assessed in the light of simple monetary policy rules. Examples of such rules are the Taylor rule and the Orphanides rule. These are described in *Inflation Report* 1/2005. Such rules can provide a rough indication of whether the level of interest rates is being set correctly, see Chart 5. At least these cross-checks remind us that we must consider what the appropriate level of interest rates is, and not only think in terms of changes. If the interest

rate deviates systematically and considerably from simple rules, the reasons for this should be explained.

Chart 5
Sight deposit rate, Taylor rule and Orphanides rule
Inflation as in the baseline scenario.
Quarterly figures. 99 Q1 – 05 Q2

Source: Norges Bank's Inflation Report 1/2005   5

However, the rules do not take into account that the krone and inflation are influenced by the interest rate differential between Norway and other countries. The rules therefore have limitations as a reference for a small, open economy like Norway. We also look at rules incorporating foreign interest rates.
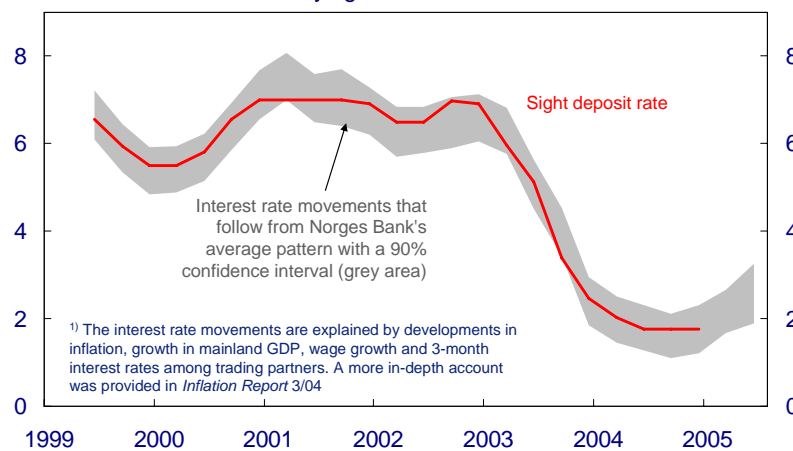
Moreover, the level of real interest rates could also be considered on a general basis – disconnected from simple policy rules. The neutral real interest rate has by Norges Bank been estimated to lie in the range 2.5-3.5 per cent.[14] If real rates deviate substantially from this interval, say, by more than 2.5 percentage points, it gives reason to think at least twice, and explain thoroughly the reasons behind such a deviation.

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[14] See Norges Bank (2005) pp. 44-47.

Alternatively, an estimated average pattern of Norges Bank's setting of interest rates can be used as a cross-check, see Chart 6.[15] The response function provides an indication of what the interest rate would have been if Norges Bank's average response pattern had been followed. However, there may be good reasons for deviating from the interest rate resulting from such an equation.

Chart 6
The sight deposit rate and interest rate movements that follow from Norges Bank's average pattern for the setting of interest rates[1)]
Quarterly figures. 99 Q2 – 05 Q2

Sight deposit rate

Interest rate movements that follow from Norges Bank's average pattern with a 90% confidence interval (grey area)

1) The interest rate movements are explained by developments in inflation, growth in mainland GDP, wage growth and 3-month interest rates among trading partners. A more in-depth account was provided in *Inflation Report* 3/04

1999   2000   2001   2002   2003   2004   2005

Source: Norges Bank's Inflation Report 1/2005   6

These considerations can be operationalised as:

6.   *It may also be useful to cross-check by assessing interest rate setting in the light of some simple monetary policy rules. If the interest rate deviates systematically and substantially from simple rules, it should be possible to explain the reasons for this.*

In addition, one could also consider, as a cross-check, whether the interest rate path yields possible long term imbalances in the relationship between monetary aggregates and other economic variables such as GDP. One important empirical finding in macroeconomics is the long-term relationship between the price level

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[15] See Bernhardsen and Bårdsen (2004).

and money. In the long term, inflation is a monetary phenomenon. In Norway for example, we observe a close link between the long-term development of the CPI and the ratio of broad money (M2) to GDP. There is however uncertainty about the causality and whether there are third factors that influence both money and prices.[16] We will in the future look more into these issues, and try to develop some kind of critical values for the growth rates of money and/or credit.

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[16]See Eitrheim *et al.* (2004) pp 386-388. For more information about the empirical evidence regarding money and prices, see for example Walsh (2003) pp. 9-14.

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