Interest rate projections in theory and practice[1]

Deputy Governor Jarle Bergo

1. Introduction: The importance of the expectations channel in the conduct of monetary policy

The most important task of monetary policy is to provide the economy with an anchor for inflation expectations – a nominal anchor. In Norway, monetary policy is oriented towards low and stable inflation with an annual rise in consumer prices of close to 2.5 per cent over time. Norges Bank operates a flexible inflation targeting regime, so that weight is given to both variability in inflation and variability in output and employment. Flexible inflation targeting builds a bridge between the long-term objective of monetary policy, which is to anchor expectations of low and stable inflation, and the more short-term objective of stabilising economic developments.

Preventing inflation expectations from becoming entrenched markedly below target was one of the main reasons for reducing the key policy rate to a very low level when inflation fell and approached zero in 2003 and 2004. At that time there was also spare capacity in the Norwegian economy. Between the end of 2002 and the first quarter of 2004 the key rate was reduced by 5¼ percentage points (see Chart 1). We indicated that the interest rate would remain low until we saw clear signs of rising inflation.

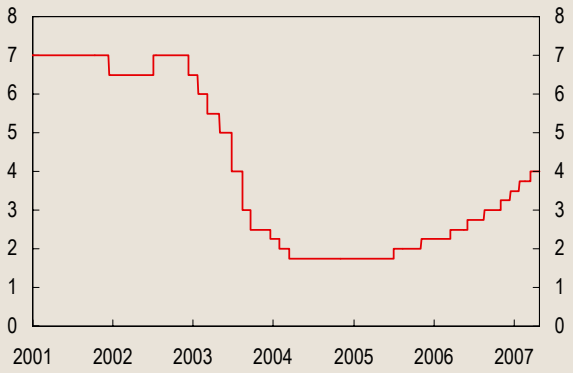
Since summer 2003, the Norwegian economy has been in a clear upswing. Low interest rates, high oil prices and a favourable global environment have been important driving forces. Growth is strong in most industries, and profitability in the business sector is solid. Underlying inflation is still considerably below the inflation target. However, several factors point to higher inflation further ahead. We are now normalising the interest rate gradually. Between the summer of 2005 and the beginning of 2007, the key rate has been increased by 2.0 percentage points and there are prospects of further interest rate hikes.

The shortest money market rates are determined by the central bank via the key policy rate (see Chart 2). But private-sector consumption and investment decisions depend more on expectations regarding future developments in the key rate. To be successful, monetary policy must be able to influence these expectations. The public must therefore understand the central bank's intentions in interest-rate setting. Transparency regarding Norges Bank's monetary policy assessments probably improves the predictability and effectiveness of monetary policy.

In recent years, we have tried to facilitate the public understanding of our actions. The background material for the Executive Board's monetary policy meetings is published and the assessments underlying interest rate decisions are explained. As from the end of 2005, Norges Bank has published its own interest rate forecast. From using technical assumptions or others' assessments, we have now taken ownership of the interest rate path in our projections. In the Monetary Policy Report[2], Norges Bank publishes the interest rate path that in the Bank's view provides a reasonable trade-off between stabilising inflation at target and stabilising developments in output and employment.

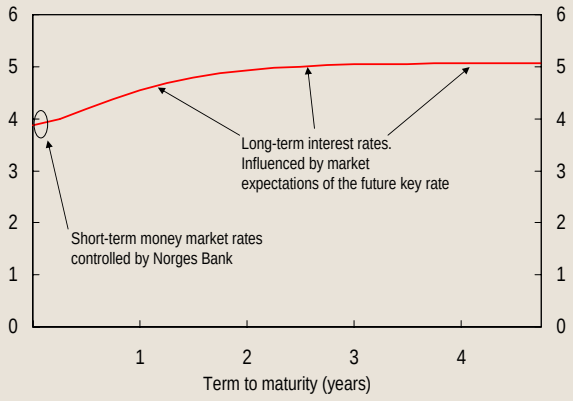
So far, the experience of publishing our own interest rate forecasts has been positive. It seems that economic agents

Chart 1 Key policy rate in Norway



Source: Norges Bank

Chart 2 Yield curve mid-January 2007[1)]



[1]Estimated on the basis of swap rates with up to ten years maturity

Source: Norges Bank

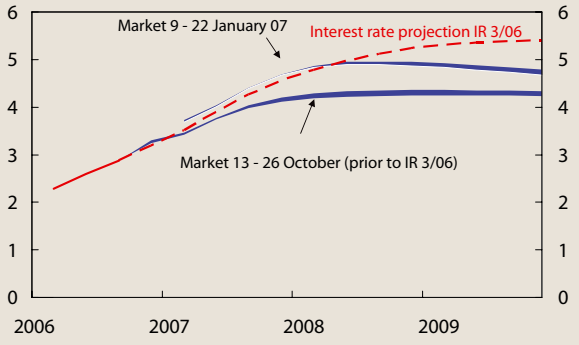
1 The article is based on the speech of the same title, given at the Foreign Exchange Seminar of the Association of Norwegian Economists at Sanderstølen on 26 January 2007.

2 As from 2007, the title of the Report has been changed from *Inflation Report* to the *Monetary Policy Report.*

have understood the nature of the forecasts. Nevertheless, there is considerable uncertainty surrounding the interest rate path, which is why we present fan charts with uncertainty intervals around the forecasts. In addition, the Monetary Policy Report contains several different sensitivity analyses to illustrate alternative interest rate paths that would be preferable should economic developments deviate from the baseline scenario. We also present a kind of "interest rate accounts", where we explain any changes in the interest rate path since the previous Report, for instance caused by actual developments in key variables differing from our assumptions. The specific interest rate path cannot and must not be looked upon as a guarantee, a path to which we unconditionally have committed ourself. To the contrary, should economic developments deviate from the projected path, the interest rate path will also shift. Instead, it can be said that through our communication we commit ourself to a pattern of behaviour, a response pattern. If interest rate expectations can be influenced, it will in many cases be useful for a central bank to commit itself to a predictable response pattern. This kind of commitment can, if it is perceived as credible, enhance the effectiveness of monetary policy.

A relevant question is the extent to which our communication actually influences interest rate expectations. Forward interest rates derived from yields at various maturities will in the absence of term premia and other risk premia normally reflect the market's short-term interest rate expectations[3]. When *Inflation Report* 3/06 was published in the beginning of November last year, the forward interest rate was on a par with our forecast for the next six months, but considerably lower thereafter (see Chart 3). Since then, forward rates have increased and approached Norges Bank's interest rate path. It is of course debatable whether it is our communication and actions or new information that has brought about the alignment. It is probably both. Forward rates somewhat further out are still lower than our forecast. The reason may be that market participants have a different perception of the interest rate path that is necessary to stabilise inflation at target and to achieve stable developments in output and employment. Alternatively, the market may have the same short-term interest rate expectations as Norges Bank, but because of extraordinary conditions long-term bond prices are being pushed up and, consequently, long-term bond yields are being pushed down.

Chart 3 Norges Bank's interest rate projection and forward rates



Source: Norges Bank

2. What is the normal interest rate level?

When preparing an interest rate forecast, we must have a view of what the normal interest rate level is. Long-term bond yields have been at historically low levels in recent years. From lying in a broad range around 10 per cent at the end of the 1980s, they have fallen to around 4 per cent in the past few years (see Chart 4). Developments in nominal interest rates must be seen in the light of inflation developments. Since 1960, inflation has been relatively low and stable only in the past 10–15 years, i.e. since the first half of the 1990s (see Chart 5). High and variable inflation pushed up nominal interest rates earlier, both directly and via an inflation risk premium. Uncertainty about future inflation generates uncertainty as to the real value of investments and investors may require an extra compensation – a risk premium – for this. Low and stable inflation over the past 10–15 years has probably led to a decline in the normal interest rate level. Nevertheless, it would appear that long-term interest rates have been lower in recent years than one would believe to be a sustainable level, at least in the very long run.

According to economic growth theory, in the long term the real interest rate is determined by structural fundamentals such as productivity and population growth and households' long-term saving preferences, that is,

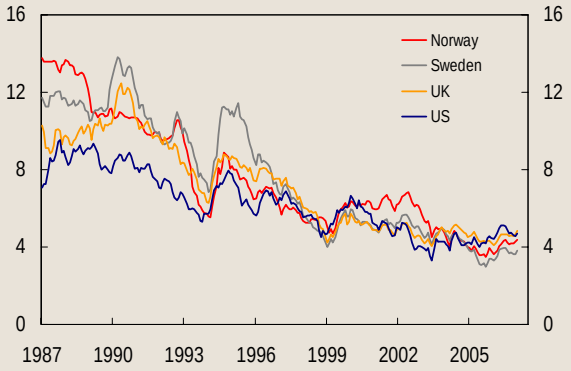
$$r^* = g + n + \rho,$$

where r^* is the long-term normal real interest rate, g is productivity growth, n is population growth and ρ is housholds' time preference rate regarding saving and consumption.[4] It seems reasonable that there is a positive long-term relationship between an economy's potential growth and the real interest rate. If potential growth is higher than the real interest rate, the return on fixed investment will be higher than the cost of investing. This provides an incentive to increase fixed investment. Higher demand for fixed investment

[3] Forward interest rates – often referred to as implied interest rates – are calculated so that a short-term bond, when rolled over and reinvested at the implied interest rates, generates the same yield as a long-term bond. For example, if we observe today's one- and two-year interest rates ('short-term' and 'long-term' interest rate respectively), the implied forward interest rate one year ahead will be expressed by the equation $(1+i_{0,2})^2 = (1+i_{0,1})(1+i^*_{1,1})$, where $i_{0,2}$ is the two-year interest rate, $i_{0,1}$ is the one-year interest rate and $i^*_{1,1}$ is the implied one-year rate one year ahead. The expectations hypothesis holds that the implied interest rate is equal to the market's interest rate expecations and the expected return from rolling over short-term bonds is equal to the return on a long-term bond. However, if term premia exist, the expected return from rolling over short-term bonds is dfferent from the return on a long-term bond. If the term premium is positive, forward interest rates will overstimate expected future short-term interest rates, while they will be understimated if the term premium is negative.

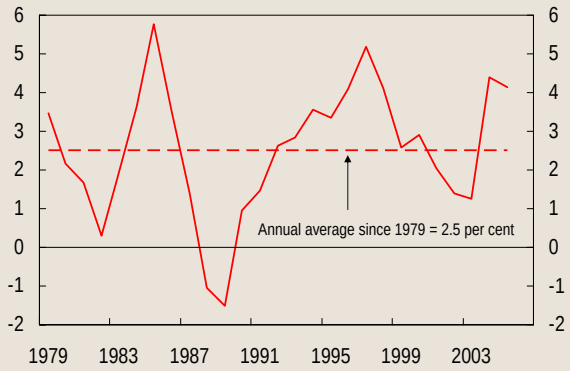
[4] The expression above builds on a variant of the Ramsey model, which is a standard theory of economic growth. For a further discussion of this model, see Blanchard and Fisher (1989) 'Lectures on Macroeconomics', MIT Press and Romer (2001) 'Advanced Macroeconomics', McGraw Hill.

Chart 4 Long-term bond yields (10 year)



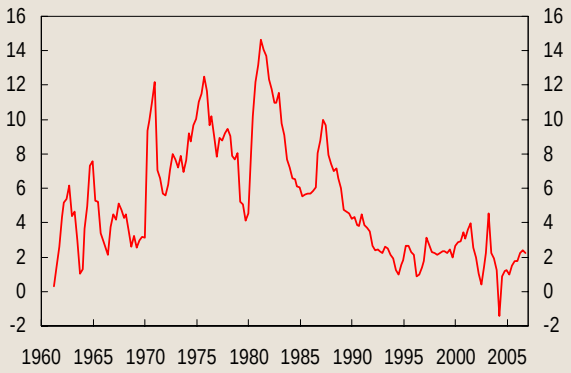
Source: Reuters/EcoWin

Chart 6 Annual growth in GDP mainland Norway. 1979-2005



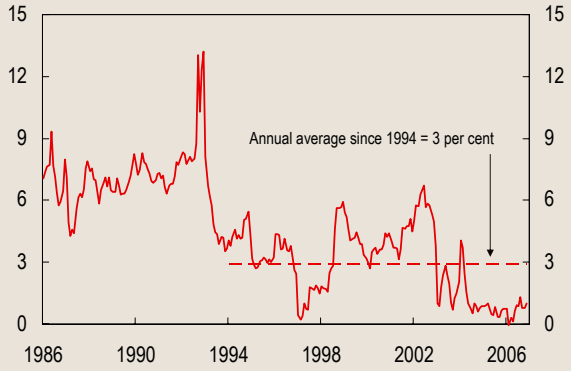
Source: Statistics Norway

Chart 5 Inflation in Norway (Annual change in consumer prices)



Source: Statistics Norway

Chart 7 Short-term real interest rate in Norway[1]



[1]Three-month nominal money market rate minus annual change in consumer prices. Source: Statistics Norway

normally leads to higher real interest rates.

Higher potential growth can also influence real interest rates in the long term as households seek to smooth consumption over time. Higher potential growth generates expectations of higher future income. Households may then want to borrow against expected future income and thereby reduce saving already today. Lower saving implies higher real interest rates. The time preference rate can be looked upon as an expression of households' impatience in consumption. The higher the degree of impatience, the more households will want to consume today at the expense of future consumption, and the higher the real interest rate has to be in order to provide sufficient savings to meet investment demand.

It is important to stress the long-term perspective of this analysis. In the really long term, it seems reasonable that it is potential growth and saving preferences that determine the relationship between desired saving and desired investment and thereby also the real interest rate. In the short- and medium-term, however, the economy is regularly exposed to shocks that influence economic developments, and thereby also the interest rate. It is not unlikely that we might see sizeable deviations of actual rates from the theoretical rates over longer periods. Such deviations may be exactly what are needed to bring the economy back towards a new and sustainable equilibrium. Moreover, uncertainty and risk premia are often disregarded in the theoretical world. In the real world, different types of risk premia exist that can lead to deviations from these stylised theoretical considerations.

Potential growth and particularly the time preference rate are difficult to estimate. From 1979 to the present, average annual growth in GDP in mainland Norway has been about 2.5 per cent. If we confine ourselves to the past 10–12 years of low and stable inflation, average growth has been somewhat higher at around 3 per cent (see Chart 6).

There have been wide variations in the short-term real interest rate in Norway. In the 1980s and the beginning of the 1990s, the real interest rate was high and varied around 6–7 per cent. Since the mid-1990s, the real interest rate has been considerably lower and varied around 3 per cent (see Chart 7). The period of low and stable inflation is probably more representative of the future than the 1980s when inflation was high and volatile.

Against the background of historical developments in

growth and real interest rates over the past 10–12 years, it may seem reasonable to assume that the normal real interest rate level in Norway is in the range of 2½–3½ per cent. If we add the inflation target to this, a range of around 5–6 per cent may be a reasonably normal level for the nominal interest rate. On an uncertain basis, the normal interest rate for Norway is now estimated to lie in the lower end of this range.

Long-term interest rates seem to have been lower in recent years than the normal level determined by growth and inflation prospects. The cause of the low level of long-term interest rates has been a theme of discussion in the international financial literature in recent years.[5] One reason that is cited is the high level of saving in some Asian countries, particularly China, and in oil-exporting countries. Moreover, it has been pointed out that investment has been low in several regions of the world, possibly as a result of previous periods of over-investment. A preference for higher saving and a preference for lower investment both contribute to lower interest rates. Moreover, monetary policy in China and other Asian countries is oriented towards exchange rate stability. To ensure exchange rate developments in line with the objectives of monetary policy, the Asian central banks buy US dollars and invest in US government bonds. This contributes to keeping US long-term interest rates at a low level, which in turn have a considerable impact on developments in long-term interest rates in other parts of the world.

In addition, new accounting and solvency rules are being introduced in many countries. The new rules provide pension funds in particular with incentives to lengthen asset maturities, improving the balance between asset and debt maturities. Increased demand for long-term bonds pushes up bond prices and pushes down yields.[6]

Normally, an investor will, on an expectations basis, be compensated in the form of a positive term premium for holding long-term bonds instead of rolling over short-term bonds. Various conditions relating to saving and investment patterns in the world economy and new accounting and solvency rules may have led to a marked fall in term premia in recent years. In some markets, they can even be negative.

The level of long-term interest rates is frequently used as an indicator of the normal interest rate level. If low long-term interest rates are caused by extraordinary conditions and not expectations of low growth and low inflation, long-term market interest rates may underestimate the normal interest rate level.

3. Optimal monetary policy and commitment

In order to produce a forecast that reflects a reasonable trade-off in monetary policy, we have drawn up a set of guidelines, which are presented in the Monetary Policy Report.The criteria cannot provide an absolutely precise guide as to how the interest rate should be set, but point to factors we should have considered and assessed.

The central trade-off in a flexible inflation targeting regime is between inflation prospects and the prospects for capacity utilisation in the economy. 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. The inflation gap and the output gap should also be in reasonable proportion to each other until they close.

Let us now look at monetary policy within a theoretical framework. In the literature on optimal monetary policy, the trade-offs are often specified in the form of a loss function, which the central bank attempts to minimise. In principle, many goal variables can be included in such a loss function, but it is normal to assume that inflation and the output gap are included. The cumulative loss can then be expressed by the following equation,

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

Here π is inflation, π^* is the inflation target and y is the output gap. β is a discount factor. λ is a parameter that expresses how much weight is given to stable output versus low and stable inflation. If λ is greater than 0, this is often referred to as flexible inflation targeting.

Thirty to forty years ago, economic policy was widely regarded as an optimal control problem where the authorities could minimise society's loss function directly and mechanically. Economic policy could in a sense be viewed as an engineering art. However, in 1977 Finn Kydland and Edward Prescott warned against this approach to economic policy conduct.[7] In their work, for which they were later awarded the Nobel Prize, they showed that if the authorities in each period attempt to optimise on a discretionary basis, a suboptimal equilibrium may arise. The reason lies in economic agents' expectations formation.

Kydland and Prescott argued in favour of a rule-based policy, where policymakers commit to a certain pattern of behaviour. They also pointed out that it would generally be tempting to "reoptimise" at a later time and thereby ignore earlier promises. This temptation is often referred to as the "time inconsistency problem". For a rule-based policy to be successful, it must be credible so that economic agents can fairly safely assume that decision-makers will actually follow their announced response pattern.

Norway's experience of various fixed exchange rate

5 Though the literature is vast, see for example Ahrend, R., P. Catte and R. Price (2006) 'Factors behind low long-term interest rates', Working Papers 490, OECD, www.oecd.org, IMF (2005) 'Global Imbalances A Saving and Investment Perspective', World Economic Outlook September 2005, www.imf.org, IMF (2006) 'Awash with cash: Why are corporate savings so high?', World Economic Outlook April 2006, www.imf.org, and Rajan, R. G. (2006) 'Is there a global shortage of fixed assets?', Remarks 1 December, www.imf.org.

6 For more details, see "Implications of changes in pension fund regulations for the bond market", box in Financial stability 1/2006, Norges Bank, see norges-bank.no.

7 Kydland, F. and E. Prescott (1977), "Rules rather than discretion: The inconsistency of optimal plans", Journal of Political Economy, 85, 473–490.

regimes during the post-war period provides a good illustration of the difference between discretionary policy and commitment policy. In the period 1946–1971, the krone was pegged to the US dollar. The IMF had to authorise any changes in the exchange rate. By participating in an international system we achieved credibility as to the authorities' commitment to the fixed exchange rate. The period was marked by high economic growth and low inflation.

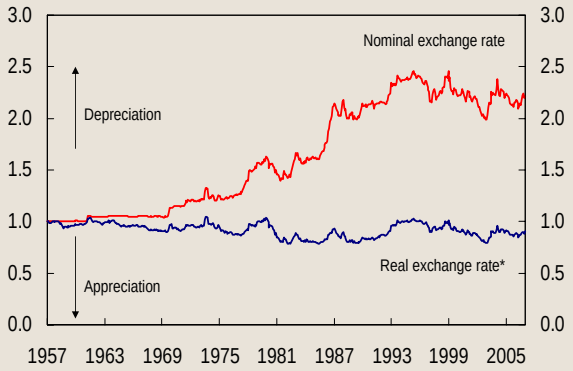
During the devaluation period in the 10 years between 1976 and 1986, the credibility of the fixed exchange rate regime was severely impaired. In this period, a total of ten devaluations or "technical adjustments" that entailed a devaluation were made, often aimed at correcting the previous deterioration in Norway's relative cost position. Chart 8 shows that while the Norwegian krone gradually lost value in nominal terms against the Deutsche mark, in real terms the value was broadly constant. Such repeated "reoptimisations" eventually led to expectations that the authorities would not honour their promise of a fixed exchange rate in the future. Instead, there were growing expectations that if price and cost inflation became too high, the authorities would devalue the krone. The social partners and businesses then factored in higher inflation in their wage demands and price-setting. The result was higher cost and price inflation without the desired effect on competitiveness and employment.

The Norwegian economy was lacking a nominal anchor during the devaluation period in the 1970s and 1980s, which fuelled inflation and instability. The ten-year period of devaluations is an example of how purely discretionary policymaking can lead the economy onto a suboptimal path, pointed out by Kydland and Prescott.

The last devaluation came in 1986. Thereafter, the interest rate was used to keep the exchange rate fixed. The Norwegian economy had to undergo an extensive turnaround operation. Confidence in the Norwegian krone had to be restored in order to avoid persistently high inflation. This required very high interest rates. It took a long time for foreign exchange markets to gain confidence in the strategy shift in exchange rate policy. It was not until 1990 that Norwegian interest rates were on a par with external interest rates. By tying ourselves to a reaction pattern, monetary policy credibility was restored and the way was paved for more stable economic developments.

In the wake of Kydland's and Prescott's recommendations, both fiscal policy and monetary policy have become more rule-based in many countries. Policy rules are useful in that they give weight to long-term objectives when faced with day-to-day economic policy challenges. Since the early 1990s, many countries have implemented institutional reforms, such as central bank independence in the conduct of monetary policy to reach government-defined objectives. At the same time, the objectives of monetary policy have become clearer, with the primary objective normally being low and stable inflation. Thus, the authorities in many countries have thereby committed to give priority to the long-term goals in monetary policy.

Chart 8 Nominal and real exchange rate. NOK/DEM. (As from 1999 calculated implicitly via the euro exchange rate). Index 1957=1



*Nominal rate deflated by relative consumer prices

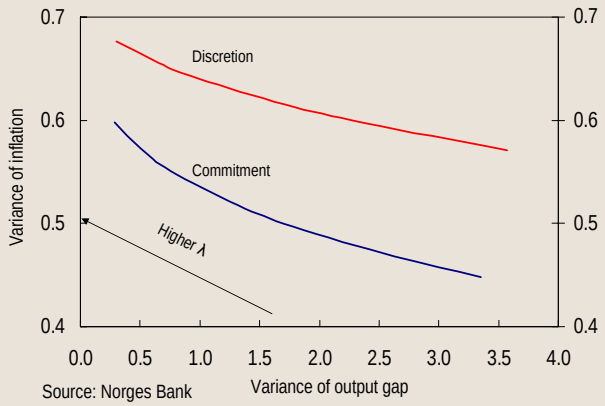
Source: Reuters/EcoWin

The conduct of monetary policy under a flexible inflation targeting regime, given the defined objectives, also gives rise to challenges concerning commitment to a pattern of behaviour. However, the benefit of a commitment policy in relation to a discretionary policy is perhaps not as straightforward as for example that of a fixed exchange rate regime.

The benefit of commitment to a pattern of behaviour lies in the fact that today's prices, wages and exchange rates depend on expectations concerning future activity levels and interest rates. If, for example, a shock brings down inflation to a level that is considerably lower than the target in the short run, it is not only a low interest rate today, but even more so expectations of low interest rates in the future that will push up inflation. By committing to a response pattern that implies an expansionary monetary policy, not only in the immediate term but also somewhat further ahead, inflation may pick up faster. But if economic agents expect the central bank to discard this promise, inflation will not pick up to the same extent as would otherwise be the case. Over time such a commitment policy will improve stability in both inflation and the activity level compared to a policy based on discretion.

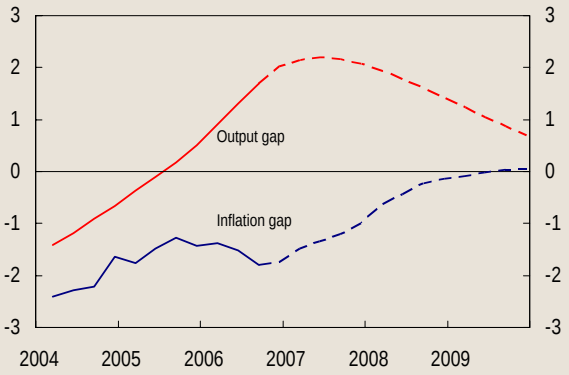
Let me attempt to illustrate the gains of committing to a response pattern rather than pursuing a purely discretionary policy. We have developed tools that allows us to find interest rate paths that minimise the loss function, given a model of the economy's functioning and given economic shocks. Within the framework of a small macroeconomic model, we have estimated the magnitude of the shocks to which the Norwegian economy has been exposed over the past 10–15 years. Under the two different assumptions about monetary policy, discretion and commitment, we have estimated how large the variance of output and inflation will be over

Chart 9 Discretion versus commitment



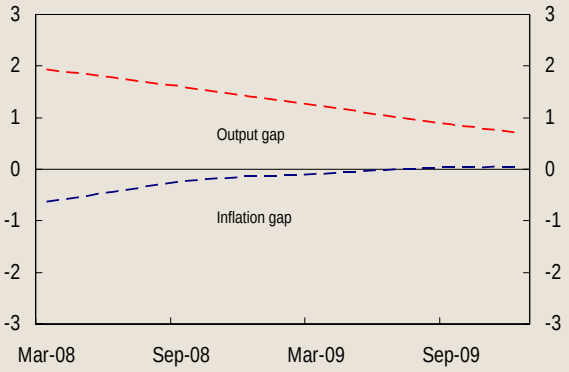
Source: Norges Bank

Chart 10a Trade-off in Inflation Report 3/06



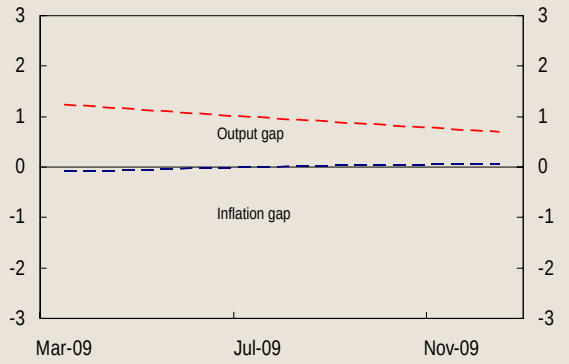
Source: Norges Bank

Chart 10b Trade-off in Inflation Report 3/06. 2008 - 2009



Source: Norges Bank

Chart 10c Trade-off in Inflation Report 3/06. 2009



Source: Norges Bank

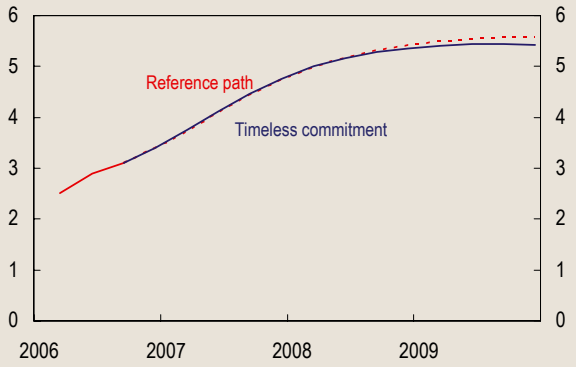
time. We have assumed that the economy is exposed to the same shocks as in history. It should be emphasised that this exercise is only meant as an illustration based on a stylised economic model.

Chart 9 shows the variance of inflation on the vertical axis and variance of the output gap on the horizontal axis. By minimising the loss function above under discretion and commitment respectively, subject to the model of the economy, we obtain different combinations of the variance of inflation and the variance of the output gap. By varying the weight on the output gap, lambda, in the loss function, we obtain a line for each strategy. The lines represent the minimum loss that can be achieved under commitment and under discretion. As long as private-sector decisions are partly based on expectations about the future, and the central bank through its actions and communication can influence these expectations, the chart illustrates a result that is independent of the explicit economic model: If the central bank can commit itself credibly to a response pattern, it will be able to achieve a better outcome over time than if in each period it attempts to optimise the situation. This is illustrated in the chart in that the line that represents a commitment strategy lies closer to the origo point than the line that represents a discretionary strategy. If, however, economic agents are purely backward looking, there would not be any differences between the two approaches, and the two lines would converge into one. The more forward-looking the economic agents are, the greater the difference between the outcomes will be. The way in which monetary policy is implemented and communicated may therefore influence the functioning of the economy through the expectations channel. By committing to a pattern of behaviour, the expectations channel can be used effectively.

Let us now take a closer look at our projections in *Inflation Report* 3/06 (see Chart 10a). The inflation gap closes gradually from below, while the output gap closes from above. According to the Bank's view, these paths provide a reasonable trade-off between the objective of stabilising inflation at target and stabilising developments in output and employment.

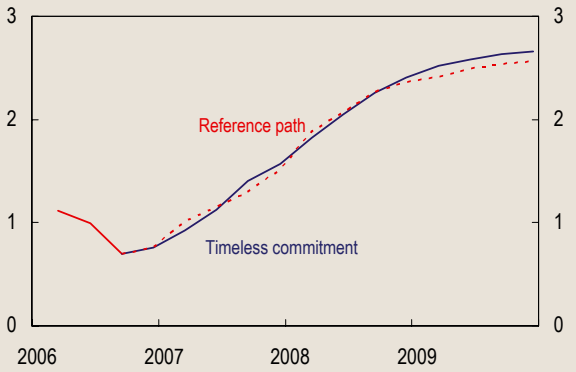
Let us now use a time machine and travel forward to 2008. Chart 10b, which is a magnified part of Chart 10a, gives an impression that we now put less weight on the output gap. The picture becomes even clearer if we travel forward yet another year in time to 2009, as shown in Chart 10c. Inflation is now very near the target, while the output gap is still clearly positive. It may thus seem as if we are placing more weight on the output gap in

Chart 11a Reference path IR 3/06 and timeless commitment: Interest rate



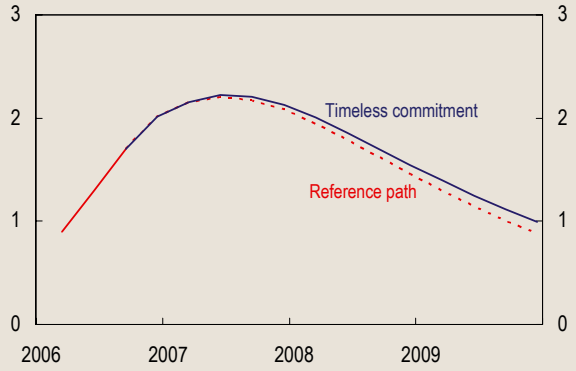
Source: Norges Bank

Chart 11b Reference path IR 3/06 and timeless commitment: Inflation



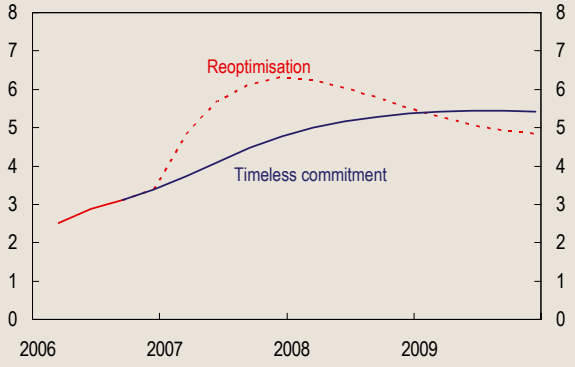
Source: Norges Bank

Chart 11c Reference path IR 3/06 and timeless commitment: Output gap



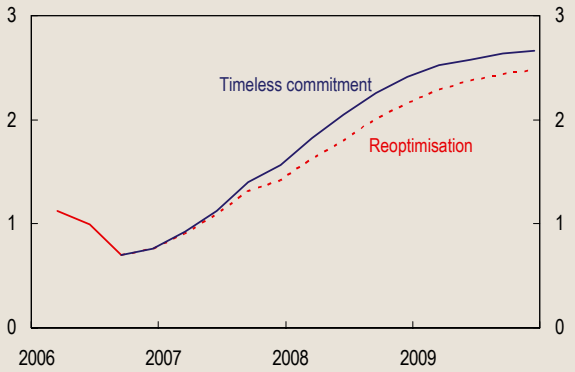
Source: Norges Bank

Chart 12a Timeless commitment versus reoptimisation: Interest rate



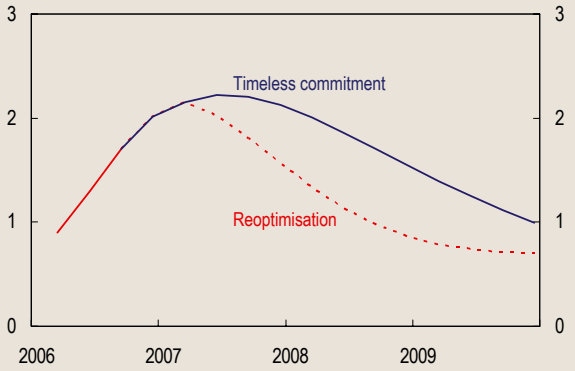
Source: Norges Bank

Chart 12b Timeless commitment versus reoptimisation: Inflation



Source: Norges Bank

Chart 12c Timeless commitment versus reoptimisation: Output gap



Source: Norges Bank

the beginning of the period than at the end of the period. This suggests that the reference path in *Inflation Report* 3/06 is not consistent with a discretionary policy, where you make the best out of the situation in each period. Such a strategy would have involved a higher interest rate in order to provide a better balance between inflation and output towards the end of the projection period. Rather, it seems that the reference path has elements of commitment.

Let us therefore assume that we follow the response pattern we have committed ourselves to earlier. In the literature, one such strategy is referred to as commitment under a timeless perspective.[8] It is possible to calculate, within the confines of our models, an optimal interest rate path based on such a strategy (see Charts 11a–c).

In this example, we have been able to reconstruct (approximately) the reference path in *Inflation Report* 3/06 by minimising a loss function under commitment in a timeless perspective. To reconstruct the reference

8 See for example Woodford, M. (1999) "Commentary: How should monetary policy be conducted in an era of price stability?", Paper presented at the Jackson Hole conference, see http://www.columbia.edu/%7Emw2230/jhole.pdf <http://www.columbia.edu/%7Emw2230/jhole.pdf>.

path, the weight on the output gap in the loss function, lambda, has been set at 0.3. We also had to place a weight on changes in the interest rate in the loss function. This weight, which penalises large changes in the interest rate, can be defended based on considerations regarding robustness and financial stability.

What is the outcome if we depart from our established response pattern, that is, if we succumb to the temptation of reoptimising? On the basis of a theoretical exercise given a very simple model of the economy, Charts 12a–c illustrate what might happen if the central bank reoptimises today, but promises never to do so again. In the model, this will result in a marked rise in interest rates today. But such an approach has been criticised in the literature. If the central bank departs from its response pattern today, it is easy to believe that it will do the same in the future. It may therefore be difficult to gain credibility for such a policy. Even if it may feel tempting, it is important to be aware of the possible costs associated with departing from an established response pattern. It will then be more demanding to influence private-sector expectations. Frequent reoptimisations will in practice undermine the benefit of commitment and lead to a discretionary policy.

The benefit of commitment hinges on the credibility of the central bank's actions and communication. Thus, it can be argued that it is important to adhere to the previously communicated response pattern and behave consistently over time. This puts the central bank in a better position to utilise the expectations channel. Inflation can then over time be stabilised with smaller fluctuations in output and employment than would otherwise be the case.

Here it is crucial to reinvoke the point made above. Even if monetary policy follows a commitment strategy, the interest rate path may well change from one report to the next. If for example new information concerning economic developments leads to a change in the outlook, the interest rate path will normally shift as well. In this respect, one can say that the commitment is to a response pattern, not to a specific interest rate path. Reacting to new information is part of a predictable pattern of behaviour.

4. Final remarks

I have discussed some of the aspects of the conduct and communication of monetary policy based on our own experience of presenting an interest rate forecast, but also based on monetary policy theory as described in the international economics literature. Theory can often provide a useful platform for analysing the challenges we are facing with regard to practical monetary policy.

In practice, we are facing more challenges than we can address within the confines of economic models. The models can, for example, seldom help us in assessing uncertainty and risk. The monetary policy strategy we are pursuing must also take account of and guard against particularly adverse developments. While economic models as a rule are based on the assumption that the inflation target is fundamentally credible, in practice we must be on guard with respect to developments that weaken the credibility of the inflation target as a nominal anchor in the economy. Normally, the interest rate will be changed gradually. In cases where there is a risk of inflation deviating substantially from target over a longer period or when high financial market volatility or a wage-cost shock indicates that the credibility of monetary policy is in jeopardy, it may be appropriate with more pronounced interest rate changes.

Models and theory can never provide a perfect recipe for how to set the interest rate – they are only tools. Norges Bank's response pattern will also be based on judgment and qualitative analyses. We have drawn up a set of criteria which are given emphasis when we prepare the interest rate forecast. Gains can be derived from predictable and consistent behaviour over time. Economic models can help us to systematise and challenge judgment. Monetary policy can probably make a more effective contribution to low and stable inflation and to stablising economic developments when the central bank is transparent about its assessments and analyses.