SPEECH

■ Evaluating monetary policy[*]

Ten years ago – on 1 January 1999 – a number of legislative changes came into force that made the Riksbank more independent. As a result, the monetary policy decisions since then have been made by an Executive Board consisting of six members who are not permitted to seek or take instructions in the course of their work. These legislative changes can be seen as part of an international trend that has now been underway for a couple of decades – a trend towards an institutional framework for monetary policy with the aim of making monetary policy more effective and more able to promote monetary stability and stability in the real economy.

This institutional framework for monetary policy rests on three pillars:

(1) A government or parliamentary mandate for monetary policy, which is normally to maintain price stability.

(2) Independence for the central bank to conduct monetary policy and fulfil the mandate.

(3) Mechanisms for accountability and supervision.

The central bank's independence gives its governors a lot of power. In a democratic society, it is natural that the activities of the central bank are monitored and evaluated and that its independent management can be called to account. Transparency and regular evaluations are necessary to maintain the legitimacy of the central bank's operations. They also give the central bank stronger incentives to fulfil its mandate and motivate the central bank to develop the monetary policy analysis in the best possible way.

It also appears that detailed evaluations of monetary policy are becoming increasingly common. In Sweden, the parliamentary Committee on Finance conducts an annual evaluation of the monetary policy conducted over the last three years. An external and more comprehensive evaluation of the monetary policy conducted in Sweden between 1995 and 2005 was carried out on behalf of the Committee on Finance by professors Francesco Giavazzi and Frederic Mishkin. The Committee on Finance has decided that Swedish monetary policy should be evaluated by external experts every fourth year. Norges bank (the

central bank of Norway) includes an evaluation of its monetary policy in its Annual Report. On behalf of the Norwegian Ministry of Finance, an annual evaluation is also carried out by Norges Bank Watch, which consists of a group of independent experts. I myself have taken part in two evaluations – an evaluation of ten years of monetary policy in New Zealand on behalf of the country's Minister of Finance in 2001 and an evaluation of monetary policy in Norway as Chairman of Norges Bank Watch in 2002.[1]

Evaluations of monetary policy are thus important and appear to be becoming common practice. One must therefore ensure that reasonable principles and appropriate methods for evaluations are developed and applied. This is what I intend to talk about today. What should we consider when we evaluate monetary policy? What are the principles for a good evaluation of monetary policy and what is practically possible? How can principles and practice be developed compared with how evaluations are carried out today? Here I present a number of preliminary proposals for such development.

Why not just examine whether inflation deviates from the target?

An increasing number of central banks focus their monetary policy on achieving an inflation target. My discussion today will therefore be about evaluations of monetary policy with an inflation target.

Given this, you may ask why an evaluation of monetary policy should be so complicated. When there is an inflation target, is it not simply enough to compare the actual outcome for inflation with the inflation target; that is to evaluate monetary policy after the fact? There are at least two circumstances that make such an evaluation inadequate.

Unforeseen shocks affect outcomes

First, monetary policy does not provide complete control over inflation. A central bank is therefore unable to ensure that inflation will be exactly on target at every point in time. In actual fact, monetary policy is conducted under conditions of great uncertainty. Our knowledge of the economic situation is not complete, and neither is our knowledge of how monetary policy affects inflation and the real economy, the so-called transmission mechanism. There is a considerable time lag before monetary policy measures have an impact on inflation, and the duration of this time lag also varies depending on the circumstances. This impact is normally gradual and becomes apparent over the course of a couple of years.

As monetary policy works with a time lag, it is most effective if it is based on forecasts. In order to achieve an inflation rate of two per cent, it is therefore best to set the policy rate so that the inflation forecast a couple of years ahead corresponds to the inflation target. However, during the time it takes for changes in the interest rate to have a full impact on inflation the economy will be affected by new and unexpected shocks. The inflation outcome a couple of years ahead will therefore have been affected by events that could not be predicted when the monetary policy decisions were made.

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[1] The evaluation of monetary policy in New Zealand and Norges Bank Watch 2002 are available on my website: www.larseosvensson.net.

A direct comparison of outcomes and targets for inflation may therefore lead to the wrong conclusions. The inflation outcome may be in line with the target even if the monetary policy decisions were incorrect because the central bank was lucky and unexpected shocks nevertheless resulted in the right inflation outcome. Alternatively, the inflation outcome may deviate from the target even if the monetary policy decisions were correct because the central bank was unlucky and unexpected disruptions resulted in the wrong inflation outcome.

Inflation targeting is flexible

A second circumstance that means that a simple comparison of outcomes and targets for inflation is inadequate is that the Riksbank and all the other central banks that have inflation targets conduct *flexible* inflation targeting rather than *strict* inflation targeting. Under a flexible inflation targeting regime, the central bank strives not only to stabilise inflation around the inflation target but also to stabilise the real economy. Under a strict inflation targeting regime, the central bank strives only to stabilise inflation without concerning itself about the consequences for the real economy.

In many situations, a conflict of objectives may arise between stabilising inflation and stabilising the real economy. Let us assume that a shock, such as a sharp rise in the oil price, has driven up inflation at the same time as production has slackened significantly. If, in such a case, the aim of monetary policy is to quickly bring inflation back to the target, a significant interest rate increase may be required which will dampen production even further. By quickly stabilising inflation – which would be the case with strict inflation targeting – the central bank would destabilise the real economy. By not aiming to bring inflation back to the target as quickly as possible, the central bank would help to stabilise the real economy. How long it should take to return inflation to the target depends, among other things, on the type, magnitude and duration of the shock that has occurred and the importance that the central bank attaches to real economic stability.

A difference between the outcome and the target for inflation may thus be deliberate. It may be part of an appropriate compromise between stabilising inflation and stabilising the real economy. It is, therefore, simply not good enough to just compare outcomes and targets for inflation in an evaluation of monetary policy.

What does flexible inflation targeting entail?

Before I begin to discuss what evaluations of monetary policy should focus on, let me go into a little more detail about what characterises flexible inflation targeting.

As I have already said, flexible inflation targeting entails the central bank striving to stabilise inflation around the inflation target and at the same time to stabilise the real economy. Stabilising the real economy may be more precisely described as stabilising resource utilisation at a normal level.

There is an asymmetry between the impact of monetary policy on inflation and its impact on the real economy that it is very important to understand. Monetary policy can affect both the average level and the variability of inflation. Monetary

policy can not, on the other hand, affect the average level of real quantities such as production, employment and resource utilisation. Historically, attempts to use monetary policy to affect the average level of real variables such as employment and unemployment have led to serious mistakes and high inflation. In the case of the real economy, monetary policy can only affect, and to a certain extent dampen, fluctuations in real variables around their average levels. For monetary policy, it is thus meaningful to select a certain target for average inflation, but it is not meaningful and in fact counterproductive to select a certain target for average production or employment, other than the normal level that is determined by the workings of the economy and factors other than monetary policy.

With a flexible inflation targeting regime, the central bank then has to set a policy rate and choose a policy rate path that make the forecast for inflation and resource utilisation together "look good". By a forecast that looks good I mean a forecast in which inflation is on target and resource utilisation is normal, or in which inflation is approaching the target and resource utilisation is approaching a normal level at an appropriate pace. To be more precise, it means a forecast for inflation and resource utilisation that as effectively as possible stabilises inflation around the inflation target and resource utilisation around its normal level and, in the event of conflicting objectives, achieves a reasonable compromise between inflation stability and resource utilisation. Different central banks express this in slightly different ways. The Riksbank has often used the term "a well-balanced monetary policy".

We can formalise and specify this reasoning somewhat by saying that it is a case of selecting a policy rate path that minimises a forecast loss function, written as the following common quadratic form:

$$\sum_{\tau=0}^{\infty}(\pi_{t+\tau,t}-\pi^*)^2+\lambda\sum_{\tau=0}^{\infty}(y_{t+\tau,t}-\overline{y}_{t+\tau,t})^2 \ .$$

Here, $\pi_{t+\tau,t}$ denotes the forecast in quarter t for inflation in quarter $t+\tau$, π^* denotes the inflation target, λ is a constant weight placed on the stabilisation of resource utilisation relative to the stabilisation of inflation, $y_{t+\tau,t}$ denotes the forecast for (the logarithm of) production and $\overline{y}_{t+\tau,t}$ denotes the forecast for (the logarithm of) potential production. The output gap $y_{t+\tau,t}-\overline{y}_{t+\tau,t}$ .is thus used here as a measure of resource utilisation. Let us call the difference between inflation and the inflation target the inflation gap. It is then a case of minimising the sum of squares for the inflation-gap forecast, $\sum_{\tau=0}^{\infty}(\pi_{t+\tau,t}-\pi^*)^2$, plus the weight λ times the sum of squares for the output-gap forecast, $\sum_{\tau=0}^{\infty}(y_{t+\tau,t}-\overline{y}_{t+\tau,t})^2$.[2]

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[2] The loss function should be minimised under commitment in a timeless perspective in order to be consistent over time. The former Deputy Governor of Norges Bank, Jarle Bergo, has discussed this in a pedagogical manner in the speech "Interest rate projections in theory and practice", 26 January 2007, www.norges-bank.no. For a more technical approach see, for example, Malin Adolfson, Stefan Laséen, Jesper Lindé and Lars E.O. Svensson (2008), "Optimal Monetary Policy in an Operational Medium-Sized DSGE Model", www.larseosvensson.net.

Evaluation *ex ante* – given the information available at the time of the decision

So, given that a central bank conducts flexible inflation targeting, how should we evaluate the monetary policy the bank conducts? When evaluating monetary policy, as when evaluating decisions in general, we may adopt one of two different starting points. The first option is to base our evaluation on the information that is currently at hand; that is also including the information that has become available since the decision was made. This is, in other words, an evaluation after the fact. We can call this an *ex post* evaluation. The second option is to put ourselves in the position of the decision makers at the time the decision was made and to try to evaluate the decision given the information that was then available. We can call this an *ex ante* evaluation.

When evaluating monetary policy, the most interesting question is not whether the decision could have been better after the fact. As I said earlier, monetary policy is conducted under conditions of great uncertainty – there is a time lag before monetary policy has an impact on inflation and the real economy and the economy is constantly subject to new shocks. It is almost self-evident that monetary policy could have been better if the decision-makers had been aware that these shocks would happen when they made their decision. It is often equally self-evident that it was not possible to foresee the shocks at the time the decision was made. The relevant question is therefore primarily whether monetary policy could have been better *given* the information on the state of the economy and other factors that the central bank had access to when the decisions were made.

How then should an *ex ante* evaluation of monetary policy be carried out? I believe that we must take flexible inflation targeting seriously. For a central bank that conducts flexible inflation targeting it is important, as I mentioned earlier, to choose a policy rate path so that the forecasts for inflation and resource utilisation "look good" in terms of stabilising both inflation and the real economy and, in the event of conflicting objectives, entail a reasonable balance between stabilising inflation and stabilising the real economy. An *ex ante* evaluation should then aim to assess whether the central bank has succeeded in doing this.

Before making such an assessment of the central bank's forecasts it is natural to first examine the general quality of the forecasts. Any assessment of the quality of the forecasts obviously entails an *ex post* analysis with the help of historical forecast errors. If the assessment is that the forecasts are of a reasonable quality it then becomes a question of assessing the monetary policy deliberations held on the basis of the forecasts the central bank makes. This primarily entails an *ex ante* analysis.

Were the forecasts good enough?

The first question we should ask is thus whether the central bank's forecasts are normally good enough. It would of course be going too far to demand that the central bank's forecasts should be perfect. As I have said, the economy is constantly subject to unexpected shocks, which means that the forecasts are always likely to be incorrect to some extent. Analysing the accuracy of a forecast in an individual year thus provides limited information. A significant forecasting

error may indicate that the forecast was poor, but it may also be due to the fact that a shock occurred that could not have been predicted.[3]

Do the forecasts systematically over- or underestimate the actual outcomes?

A reasonable demand is that the forecasts for inflation, resource utilisation and so on do not systematically over- or underestimate the actual outcomes. In other words, the forecasts should not have any bias. If, for example, the forecasts for inflation over a long period of time on average over- or underestimate the actual inflation outcome then this is a sign that there is information that the central bank is missing and that could be used to improve the forecasts. It is, however difficult to determine whether the forecasts are unbiased on the basis of a small number of outcomes, especially if we take into account the uncertainty in the functioning of the economy.

How do the central bank's forecasts compare with other forecasts?

Another reasonable demand is that the central bank's forecasts are on average not poorer than those of other forecasters. If the central bank's forecasts are systemically poorer than those of other forecasters, then this is obviously an indication that it would have been possible to make better assessments than those made by the central bank. This also means that better information was available which the central bank would have been able to use as a basis for its decision-making.

It is important to remember, however, that the preconditions *governing* forecasting at a central bank differ somewhat compared to those for many other forecasters. For the central bank it is not enough that the forecasts are accurate. This is *one* very important quality, but there are others. It must be possible, for example, to understand the driving forces behind the forecasts – why does the forecast look the way it does? How is the forecast affected by changes in assumptions regarding, for instance, demand abroad or the oil price? The central bank also needs a forecasting apparatus that can effectively investigate the consequences of an alternative monetary policy. For the Riksbank, which publishes it own interest rate path, this is extremely important. To put it more technically, the central bank must use so-called structural models to assess the consequences of various policy rate paths, while other forecasts can mainly be produced with the help of statistical models alone. Normally, there are good reasons for believing that structural models provide poorer forecasts than statistical models. However, the Riksbank's main structural model, Ramses, has very good forecasting properties.[4]

When making historical comparisons between the forecasts of central banks and those of other analysts, we also face a number of other difficulties. The first is that it is not certain that the central bank's forecasts are based on what the bank really believes is the best forecast of the policy rate and other variables. For a long time, the Riksbank, for example, based its forecasts on the assumption that the policy rate, that is the repo rate, would remain unchanged during the forecast period. Some central banks base their forecasts on both a constant interest rate and a constant exchange rate, which are often completely unrealistic

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[3] Uncertainty and the revisions of GDP figures and other data make forecasting more difficult and also make it more difficult to evaluate the forecasts.

[4] Adolfson, Malin, Stefan Laséen, Jesper Lindé and Mattias Villani (2008), "Evaluating an Estimated New Keynesian Small Open Economy Model", Journal of Economic Dynamics and Control 32, p. 2690-2721.

assumptions. In such cases, the forecasts for inflation and the real economy are of course not the best forecasts. For a while, the Riksbank instead used the assumption that the repo rate would follow the market's expectations regarding the development of the repo rate. Although this is a more realistic assumption, it is not necessarily the same as the Riksbank's best forecast. These difficulties no longer apply to the Riksbank's forecasts as, since February 2007, the forecasts are based on the Riksbank's best forecast for the repo rate.

In order to arrive at a fair comparison of the forecasts of various analysts, we should also take into account the fact that the forecasts are made at different times and are therefore based on different quantities of information. A forecaster that, for example, always publishes its forecasts later than other analysts has generally speaking more information on the economic situation when the forecasts are made. A comparison of the accuracy of the forecasts should therefore make adjustments for the forecasts being made at different times. Such a forecast comparison is included in the material for the evaluation of monetary policy in the period 2006-2008 that the Riksbank published a month ago.[5]

Figures 1 and 2 show a comparison of the accuracy of the forecasts in the period 1999-2008 for CPI inflation and GDP growth for a number of analysts. The red bars show the absolute mean error adjusted for differences in publication dates. The blue bars show the mean error with positive or negative sign. The shorter the blue bars, the smaller the systematic over- or underestimation has been – and the less bias the forecasts have had. If the bar is above the zero line the mean error has been positive and the forecasts have on average been too low, and vice versa. In the case of both inflation and GDP growth, the Riksbank's accuracy has been relatively good and its bias relatively small compared to other forecasters.

Was monetary policy well-balanced ex ante?

Given that it has been determined that the central bank's forecasts are normally satisfactory, the next step is to analyse, *ex ante*, the monetary policy deliberations the central bank has conducted on the basis of the forecasts.

The first question to answer is whether the monetary policy conducted has been *efficient*. Given the information available at the time the decision was made, would it have been possible, by selecting a different interest rate path, to have stabilised inflation or the real economy better without stabilising the other less well? Would it even have been possible to achieve a better stabilisation of both?

The idea behind an efficient monetary policy can be illustrated using a modified Taylor curve, named after the economist John Taylor.[6] As I have said, under a flexible inflation targeting regime the central bank aims to stabilise inflation and resource utilisation; that is to minimise the deviations from the inflation target and the normal level for resource utilisation. In Figure 3, the sum of squares for

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[5] Material for assessing monetary policy 2006-2008, Sveriges Riksbank, www.riksbank.com.

[6] The original Taylor curve relates to variances of outcomes ex post. Se Taylor, John B. (1979), "Estimation and Control of a Macroeconomic Model with Rational Expectations." *Econometrica* 47, p. 1267-86. A modified Taylor curve for analysis ex ante applies instead to the sum of squares of the inflation-gap and output-gap forecasts ex ante.

the inflation-gap forecast is measured along the horizontal axis and the sum of squares for the output-gap forecasts along the vertical axis. The curve through points A, B and C is the modified Taylor curve, that is, all the efficient combinations of forecasts for inflation and resource utilisation respectively that it is possible to achieve in a certain decision-making situation with the help of different interest rate paths. Points to the left and below the curve cannot be reached due to the initial state of the economy and the transmission mechanism between inflation, resource utilisation and the repo rate. Points to the right and above the curve are inefficient in the sense that it is possible for monetary policy to achieve a smaller sum of squares for the inflation-gap forecast for a given sum of squares for the output-gap forecasts, or vice versa.

In the Monetary Policy Reports, the Riksbank usually presents alternative scenarios with a different repo rate path in addition to the main scenario. These generate other paths for inflation and the output gap. Figures 4 and 5 show examples from February 2008 and February 2009. The sums of squares that can be calculated from these paths are shown in Figure 6. Two observations can be made here. The first observation is that the sums of squares in the main scenario are smaller than in the alternative scenarios – the main scenario is closer to origin in Figure 6. The main scenario is thus more successful in terms of stabilising both inflation and resource utilisation. The alternative scenarios are clearly inefficient compared with the main scenario. This does not necessarily mean, however, that monetary policy is efficient in the sense that the main scenario lies on the modified Taylor curve. There may be a repo rate path that would stabilise inflation and resource utilisation even better. Excluding this possibility requires a comparison with many more alternative scenarios.

The second observation is that the position of the modified Taylor curve may vary considerably depending on the initial state of the economy. The situation in February 2008 was much more favourable than in February 2009. The point in Figure 6 that corresponds to February 2008 is not far from origin, while the point that corresponds to February 2009 is a long way from origin and represents substantial sum of squares for the inflation-gap and output-gap forecasts.

Assessing whether monetary policy has been efficient thus entails attempting to determine whether monetary policy has been on the modified Taylor curve or not. The analysis is therefore *ex ante*, which means that the starting point is the central bank's forecasts for inflation and resource utilisation rather than the actual outcomes. In practice it is of course difficult to perform a more precise analysis, it becomes rather a question of determining to what extent monetary policy has been clearly inefficient in the sense that it is easy to find another repo rate path that would stabilise inflation more without stabilising resource utilisation less, or that would even stabilise both more. A factor that can make the analysis even more complicated is if the central bank, apart from inflation and a measure of resource utilisation, also includes other targets or limitations in its monetary policy deliberations. On such conceivable factor is so-called interest-rate smoothing, in other words that the central bank also chooses to even out the changes in the policy rate and ensure that they are made in relatively small and regular steps, for example by 0.25 percentage points at a time. With such a restriction, monetary policy will be located at a point above and to the right of the modified Taylor curve. Alternatively, it can be said that an additional axis and thus an additional dimension are required that correspond to the sum of squared changes in the interest rate, so that the modified Taylor curve becomes a three-dimensional, bowl-shaped Taylor surface.

A major difficulty in this analysis is that it may be unclear what is meant by stabilising the real economy. From a monetary policy perspective it is the stabilisation of resource utilisation rather than GDP growth that is relevant. This means stabilising resource utilisation around a normal level. The problem is that resource utilisation can be measured in several ways. A reasonable and commonly used measure of resource utilisation is the so-called output gap; that is the difference between actual production and potential production. However, potential production is not a magnitude that can be observed directly – it must be estimated. There is considerable uncertainty, both theoretically and empirically, about the best way to estimate and forecast potential production. The output gap shown in the figures is the so-called HP gap, which has significant weaknesses.[7] It is important and desirable from several points of view that the Riksbank and other central banks develop better and clearer measures of resource utilisation and potential production and that they publish their measurements and forecasts. Such work is underway at the Riksbank.

Assuming, however, that we nevertheless conclude that monetary policy has not been clearly inefficient in the sense that I described earlier, the next step is to focus on what combination of the stabilisation of inflation and the real economy the central bank actually selected or, in other words, which of all the possible points on the Taylor curve the central bank selected. There are many different efficient monetary policy alternatives to choose between every time a monetary policy decision is made. But did the central bank make a good choice? In the event of a conflict between stabilising inflation and stabilising the real economy, did the combination chosen by the central bank represent a reasonable balance between the two? Did the central bank attach reasonable importance to the stabilisation of the real economy in relation to the stabilisation of inflation?

In the literature, as in the case of the forecast loss function I presented earlier, the constant that is the relative weight that the central bank gives to the stabilisation of the real economy in relation to the stabilisation of inflation is usually denoted by the Greek letter lambda, λ. In Figure 3, we can show the forecast loss function with the help of iso-loss curves for combinations of sums of squared inflation-gap and output-gap forecasts that generate equally large losses. Such iso-loss curves are in this case downward-sloping, straight lines with a slope of $1/\lambda$, the reciprocal of lambda. Iso-loss lines closer to origin correspond to lower losses. The ideal, but normally unattainable, situation would be an iso-loss line at the origin, which represents a loss of zero and means that the forecast for inflation is exactly on target and that the forecast for resource utilisation is exactly equal to the normal level. However, the modified Taylor curve shows the minimum sums of squares that are possible on each decision-making occasion. The best monetary policy therefore entails selecting a point on the Taylor curve so that the iso-loss line for the loss function is as close to origin as possible. This is the point at which the iso-loss line is a tangent to the Taylor curve. Figure 3 shows an iso-loss line that is a tangent to the Taylor curve at point B. For the given lambda, which determines the slope of the iso-loss lines, this point thus represents a well-balanced monetary policy.

As I have emphasised, the position of the Taylor curve depends on the initial state of the economy at the time the decision is made. In a situation in which it is more difficult to stabilise resource utilisation, the Taylor curve will be closer to the

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[7] The term HP gap stems from the fact that potential production is estimated using a so-called Hodrick-Prescott filter.

vertical axis than to the horizontal axis, for example like the dashed curve above point A. The point of tangency for an iso-loss line with the same slope, which represents a well-balanced monetary policy, will then be at D. In a situation in which it is more difficult to stabilise inflation, the Taylor curve will instead be closer to the horizontal axis than to the vertical axis, for example like the dashed curve to the right of point C. The point of tangency for an iso-loss line with the same slope will then be at E.

A central bank that has a low numerical value for lambda, that is a lower weight placed on the stability of the real economy, has steeper iso-loss lines. For a central bank with such a lambda, the point of contact with a given Taylor curve for a given decision-making situation will be higher up to the left in the figure, for example at point A, where the Taylor curve is steeper. The inflation forecast will then be closer to the target, but the forecast for resource utilisation will deviate more from the normal level. A central bank with a high numerical value for lambda, that is a high weight placed on the stability of the real economy, has iso-loss lines that are flatter. In the case of such a lambda, the point of contact will be lower down to the left, for example at point C, where the Taylor curve is flatter. The inflation forecast will then be further from the target while the forecast for resource utilisation will be closer to a normal level.

It is of course not so easy to determine what a reasonably large lambda should be for a central bank. Neither the Riksbank nor other central banks have yet announced whether they apply a specific lambda and if so what this lambda is. In those cases where the decisions are made by a committee made up of several members, as at the Riksbank, it is also possible that different members attach different degrees of importance to the stability of the real economy. A question that then arises is how these different views should be aggregated. Nor is it entirely certain that monetary policy decision-makers are even clearly aware of the importance they attach to stability compared with the stability of inflation.

If the central bank's forecasts are only based on a known model, like the Riksbank's main model Ramses, it is possible to determine the position of the modified Taylor curve and which point the Riksbank's main scenario in each Monetary Policy report corresponds to.[8] In practice, the Riksbank's forecasts and those of other central banks are based on several different models and a great deal of judgement. This means that it is not quite as easy to determine the position of the modified Taylor curve. It is still possible, however, to enter the position of various forecast alternatives on the graph and at least assess whether the forecast is extreme in any respect with regard to the deviation of inflation from the target and the deviation of resource utilisation from the normal level. As yet, it is in practice mainly a question of whether the choice of interest rate path was extreme in either direction in the sense that the central bank gave considerable or very little relative weight to the stability of the real economy. Another interesting aspect to investigate is whether the weight attached to the stability of the real economy actually has been constant over time. If it has not been constant then the central bank's loss function has not been consistent over time, or it is more complicated than the quadratic loss function that I have discussed here and that is regarded as normal and reasonable in the literature on monetary policy.

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[8] This can be done using the methods developed in Adolfson, Malin, Stefan Laséen, Jesper Lindé and Lars E.O. Svensson (2008), "Optimal Monetary Policy in an Operational Medium-Sized DSGE Model", www.larseosvensson.net.

■ Figures 4 and 6 can be studied more closely in the light of this discussion. In Figure 4 we can see that the main scenario for February 2008 leads to resource utilisation being stabilised rather well, but that the CPI forecast is a little high in relation to the target of 2 per cent. In Figure 6, we can also see that the sum of squares for the output-gap forecast is much smaller than for the inflation-gap forecast. A higher repo rate path should have been able to push down both the inflation forecast and the forecast for resource utilisation. This would have reduced the sum of squares for the inflation-gap forecast but not increased the sum of squares for the output-gap forecast by very much. This would move the point for February 2008 in Figure 6 to the left and somewhat upwards. Unless the iso-loss line for the forecast loss function is very flat, that is unless the weight given to the stabilisation of resource utilisation is very high, this should give rise to a lower loss and thus to a more well-balanced monetary policy. The main scenario in February 2008 would thus be an example of a monetary policy that was not well balanced. However, in February 2008 the Riksbank attached more importance to the CPIX forecast than to the CPI forecast. The CPIX forecast gives rise to much smaller deviations from the target than the CPI forecast; se Figure 7. With regard to the CPIX forecast, monetary policy in February 2008 was better balanced.

Figures 8 and 9 show the Riksbank's forecasts for inflation and the output gap since the beginning of 2007 and the sum of squares for the inflation-gap and output-gap forecasts.[9] It is apparent that the initial situation for the forecasts can be very different. If, for example, we compare the forecast in February 2007 with the latest forecast from February 2009, it is obvious that it was much easier to make the earlier forecast "look good". The forecast at that time indicated that the deviations for the inflation target and the output gap were small – the sums of squares were close to origin. This can be contrasted to the situation in early 2009 when the fluctuations in both of the forecasts were considerable and the sums of squares were far up to the right in the figure.

Finally, before I move on to discuss the evaluation of monetary policy after the event, I would like to say that *ex ante* evaluations have the major advantage that they can be carried out on an ongoing basis in real time and that you do not need to wait several years to see the outcomes for inflation and the real economy. I would like to see competent *ex ante* evaluations become a lasting feature of the ongoing public debate on monetary policy so that they could constantly encourage the central banks to improve their analyses and their policies.

Evaluation *ex post* – after the event

The most relevant starting point for an evaluation of monetary policy is, as I said earlier, the information and data that was available when the monetary policy decisions were made. That is an *ex ante* evaluation. However, an ex post analysis may also be relevant. The forecast evaluation that I discussed earlier was, for example, ex post. But an evaluation of monetary policy after the event can also provide valuable insights regarding the monetary policy conducted.

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[9] The output gap in the figures is the output gap in real time. As the output gap is revised backwards when new data is published, the gap in the figures does not correspond to the gap published in, for instance, the Monetary Policy Reports.

■ The question we should then ask is: given what we know today, what form would a better monetary policy have taken? Would it have been possible with a different monetary policy to achieve a better stabilisation of resource utilisation without undermining the stabilisation of inflation, or vice versa? As this is an analysis in which we know what actually happened and what the results were, it is rather likely that we will discover that this would in fact have been possible. We would then have to get to the bottom of why such a monetary policy was not chosen. Could any of the outcomes have been predicted *ex ante*? Anyone may of course have luck with a single forecast. But was there another analyst who in a convincing way actually predicted the shocks to the economy that occurred and that the central bank missed?

A large part of this analysis will thus concern evaluating and explaining forecast errors – even individual errors – and deviations from the central bank's targets. It is actually fairer to focus on forecast errors as deviations from targets under a flexible inflation targeting regime may be deliberate on the part of the central bank.

Evaluating the central bank's forecasts is thus important; that is investigating whether the forecasts systematically over- or underestimate outcomes and so on. It is also interesting to compare forecast errors for inflation, for the real economy – irrespective of the measure of resource utilisation used – and for the interest rate if the central bank publishes such a forecast. Which forecast errors are most relevant for explaining why monetary policy, with the benefit of hindsight, could have been better? What were these forecast errors due to?

A disadvantage of an *ex post* evaluation is that we have to wait at least a couple of years for the outcomes for inflation and the real economy for the full impact of the monetary policy measures to become apparent. As I emphasised earlier, an *ex ante* evaluation can on the other hand be performed in real time as a part of the ongoing public debate on monetary policy.

Was monetary policy credible?

The credibility of monetary policy is always an important factor. The credibility of an inflation targeting regime is usually measured by to what extent inflation expectations for different time horizons correspond to the inflation target. The greater the degree of correspondence, the higher the degree of credibility. This provides a direct indication of the level of confidence in the ability of the central bank to meet the inflation target.

Figure 10 shows how inflation expectations among money market agents developed in 2008 and early 2009. It is evident that expectations for both one and two years ahead have been revised significantly downwards recently, which is hardly surprising given the development of the economy. In the longer term, however, the expectations are well anchored around the target.

How well inflation expectations are anchored around the target also has a direct impact on how well the central bank succeeds in meeting the target and on the possibilities the central bank has to also stabilise the real economy. This is because inflation expectations directly affect price and wage setting in the economy. Stable inflation expectations eliminate a potential source of shocks and make it easier for the central bank to stabilise both inflation and the real economy. More stable inflation expectations shift the Taylor curve in Figure 3 closer to origin and

■ make the balance between the stability of inflation and the stability of the real economy more favourable.

As the central bank's inflation forecasts in the short and medium terms may deliberately deviate from the target, it is also interesting to compare inflation expectations with the central bank's inflation forecasts. If the economic agents share the central bank's view of how inflation will approach the target, inflation expectations at different time horizons should be close to the central bank's forecasts. The degree of correspondence between inflation expectations and the central bank's inflation forecasts then becomes a measure of how credible the central bank's inflation forecasts and analyses are. Such a correspondence between expectations and forecasts is of course also desirable for forecasts for the real economy and, not least, for forecasts for the policy rate, which I will now discuss.

Was the implementation of monetary policy effective?

I have spoken earlier about what characterises efficient monetary policy decisions. This was in relation to the balance between stabilising inflation and stabilising the real economy *given* the information available at the time of the decision. Another important aspect is to investigate how effective *the implementation* of monetary policy has been, in the sense of affecting the economy in the desired direction and to the right amount. An effective implementation of monetary policy presupposes that there is a high level of private-sector confidence in the central bank with regard to both the inflation target and the monetary policy analysis. It also requires that the central bank is successful in communicating its analysis and intentions. In other words, a precondition for an effective monetary policy implementation is that the central bank is open and transparent.

Most central banks use a short-term interest rate as the policy rate to implement monetary policy. However, the actual policy rate in the two months prior to the next monetary policy decision plays a very minor role in the economy. Expectations regarding future policy rates, on the other hand, do play an important role. They affect interest rates with longer maturities which in turn are the interest rates that have an impact on the economic decisions of households and companies. The Riksbank and a few other central banks have taken this seriously and publish their own policy rate paths to facilitate the formation of expectations regarding future policy rates and to influence these expectations more effectively.

If the central bank is successful in its communication, the market participants should be able to predict rather well how new information or new shocks will affect the central bank's forecast for the policy rate. If the central bank's analysis is credible, the market's expectations regarding the future policy rate should also change in line with the revised interest rate path of the central bank. One way of evaluating how effectively the central bank implements monetary policy is therefore to simply investigate how well the market participants have predicted the changes in the central bank's interest rate path. We can also analyse how well the expectations regarding the future interest rate adapt to the central bank's new interest rate path after the announcement.[10] Figures 11 and 12 are examples of the type of figure that can be studied in this case. These relate to the

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[10] A preliminary analysis is carried out in Svensson, Lars E. O. (2009), "Transparency under Flexible Inflation Targeting: Experiences and Challenges", www.larseosvensson.net.

first interest rate decision I was involved in making, in June 2007, and to the latest decision from February this year.

Summary

Let me now sum up by first returning to the question I raised at the start: when evaluating monetary policy with an inflation target, why is it not enough to simply compare outcomes and targets for inflation? One reason is that inflation reacts with varying time lags and to different degrees to monetary policy measures. Inflation is also affected by shocks that are difficult to identify or that occur at a later date. The central bank does not therefore have complete control over inflation. Inflation can be on target even if the central bank has acted wrongly but been lucky, or deviate from the target even if the central bank has acted correctly but been unlucky. Another reason is that the Riksbank and other central banks with inflation targets conduct flexible inflation targeting, which means that they strive to both stabilise inflation around the inflation target and to stabilise the real economy. Inflation may then deliberately deviate from the target if this provides a better balance between stable inflation and a stable real economy.

As there is a significant time lag before monetary policy measures have an impact on inflation and the real economy, monetary policy is best when it is based on forecasts. With a flexible inflation targeting regime, it is thus a question of choosing a repo rate path so that the forecast for inflation and the real economy stabilises inflation and the real economy as effectively as possible. It is thus possible and desirable to evaluate monetary policy *ex ante* and in real time by assessing to what extent the central bank's forecasts optimally stabilise both inflation and the real economy. However, before we do this it is necessary to assess whether the central bank's previous forecasts have been reasonably accurate and of good quality, for example in comparison with those of other forecasters.

It is also of interest to evaluate monetary policy *ex post*, that is, after the event. As target deviations and forecast deviations are unavoidable due to the great degree of uncertainty about the future development of the economy and the delayed impact of monetary policy measures, an *ex post* evaluation is mainly a question of whether it would have been possible to predict the shocks and deviations that occurred, particularly if other analysts have systematically been able to predict them.

It is also of interest to measure the credibility of monetary policy in terms of how well inflation expectations correspond to the inflation target. The degree of correspondence between expectations and the central bank's forecasts for inflation and the real economy is also a measure of the credibility of the central bank's analyses and forecasts.

As monetary policy is mainly about managing expectations, particularly expectations concerning future policy rates, it is of great interest to see to what extent a published repo rate path has been predicted by the market and other analysts. It is also interesting to know to what extent market expectations are adapted to the new repo rate path. This can be seen as a measure of how effectively the central bank implements monetary policy.

Figure 1. Forecast errors for a number of analysts 1999-2008, CPI inflation
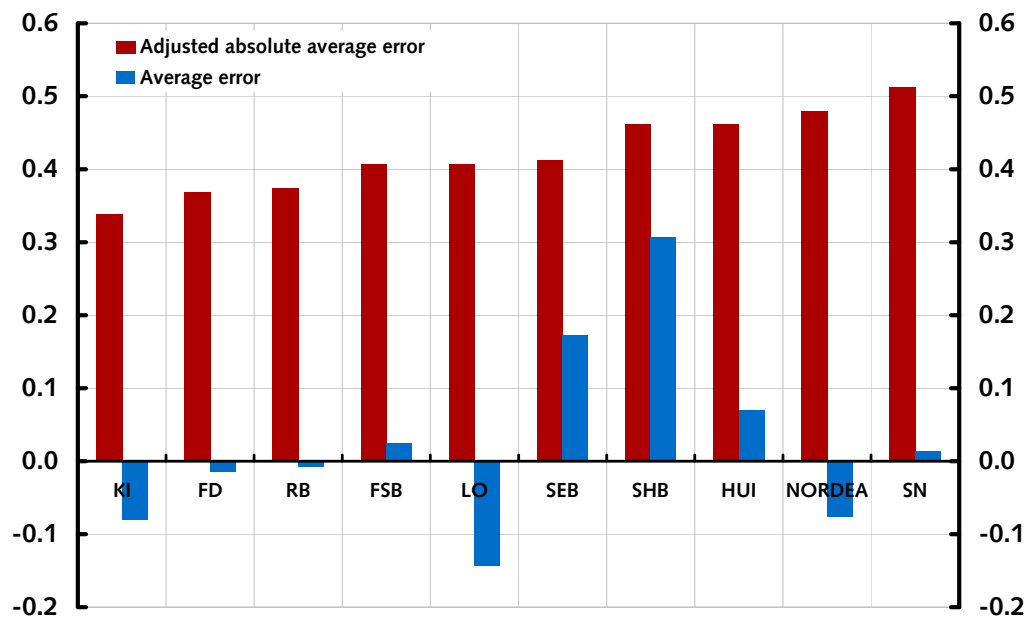
Sources: National Institute of Economic Research and the Riksbank

Figure 2. Forecast errors for a number of analysts 1999-2008, GDP growth
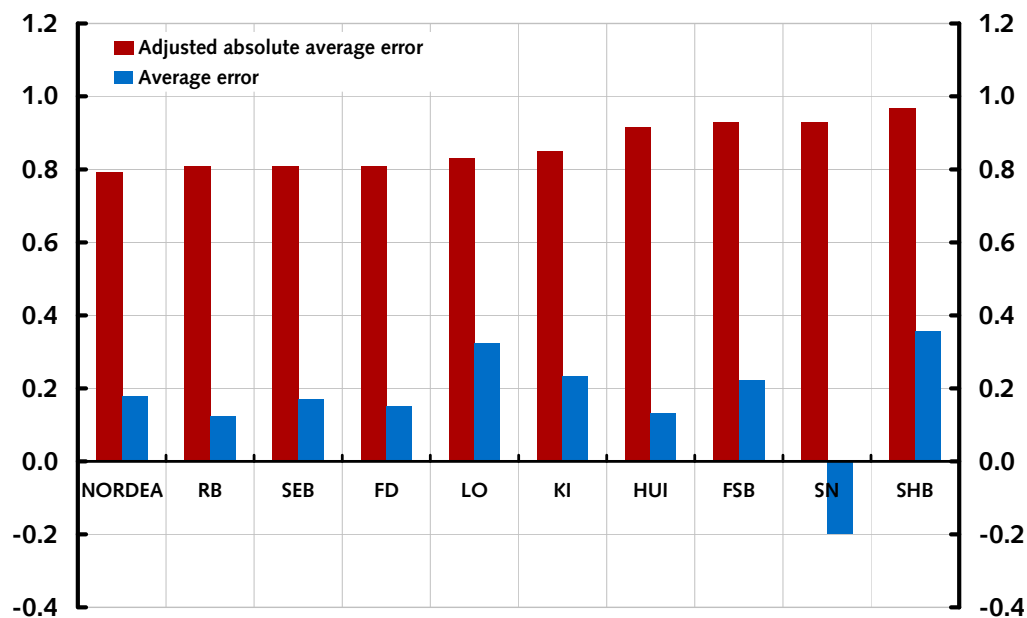
Sources: National Institute of Economic Research and the Riksbank
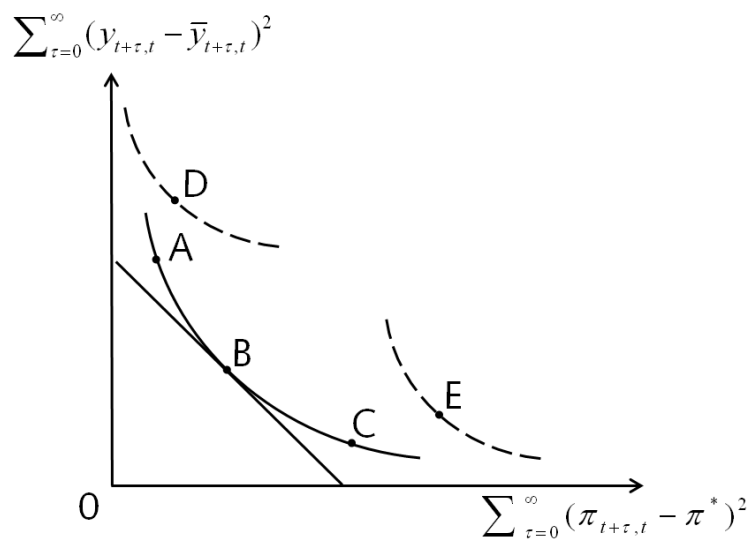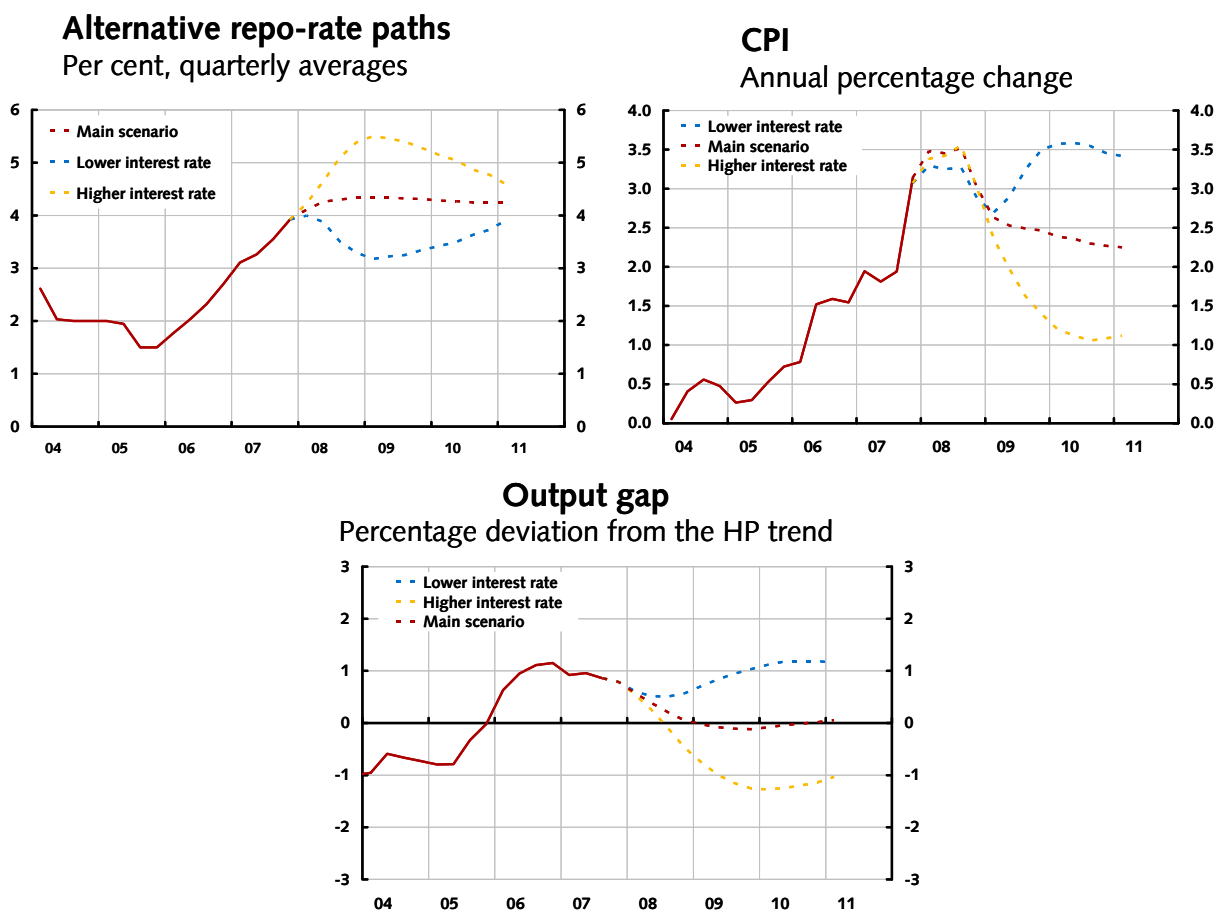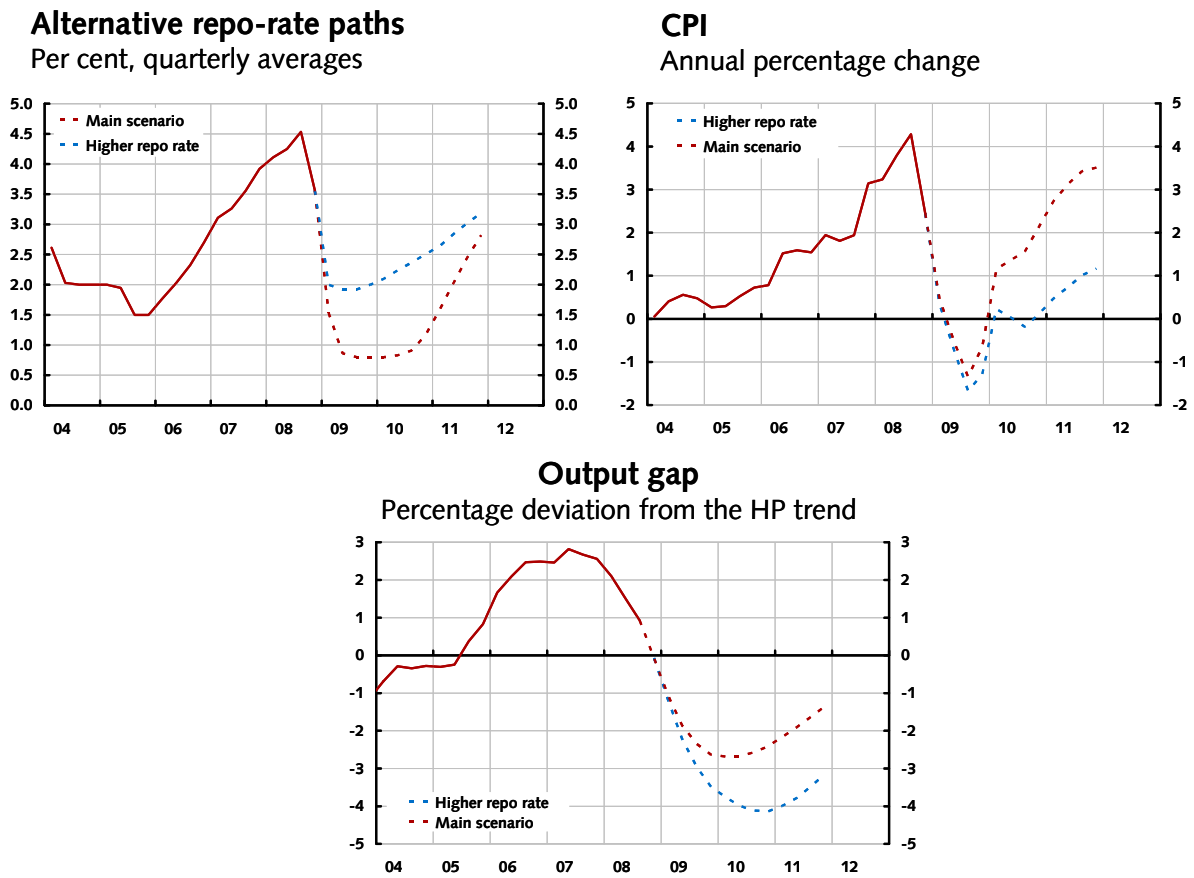
Figure 3. The modified Taylor curve

$$\sum_{\tau=0}^{\infty}(y_{t+\tau,t}-\bar{y}_{t+\tau,t})^2$$

$$\sum_{\tau=0}^{\infty}(\pi_{t+\tau,t}-\pi^*)^2$$

Figure 4. Forecasts for the repo rate, inflation and output gap, February 2008

**Alternative repo-rate paths**
Per cent, quarterly averages

- Main scenario
- Lower interest rate
- Higher interest rate

CPI
Annual percentage change

- Lower interest rate
- Main scenario
- Higher interest rate

Output gap
Percentage deviation from the HP trend

- Lower interest rate
- Higher interest rate
- Main scenario

Sources: Statistics Sweden and the Riksbank

Figure 5. Forecasts for the repo rate, inflation and output gap, February 2009

Alternative repo-rate paths
Per cent, quarterly averages

CPI
Annual percentage change

Output gap
Percentage deviation from the HP trend
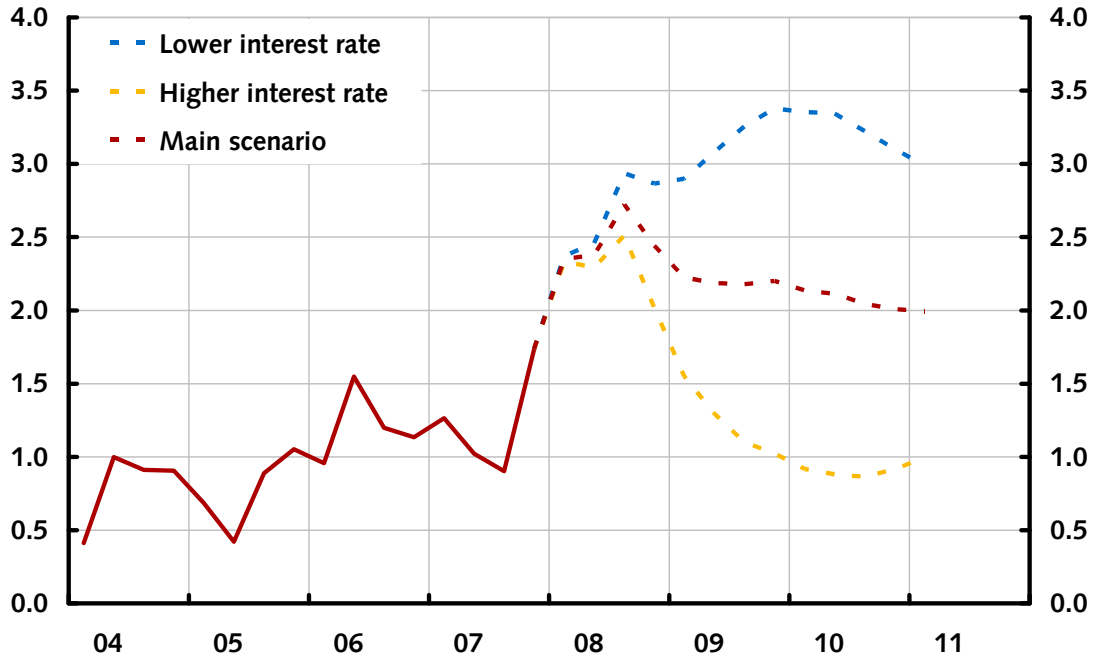

Sources: Statistics Sweden and the Riksbank

Figure 6. Sum of squares for inflation-gap and output-gap forecasts, February 2008 and February 2009
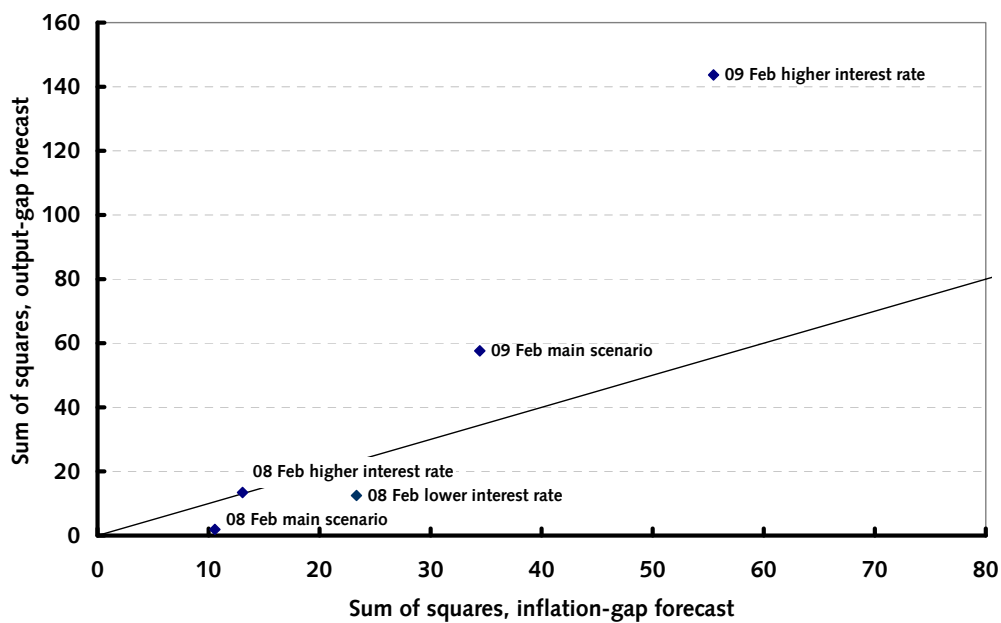
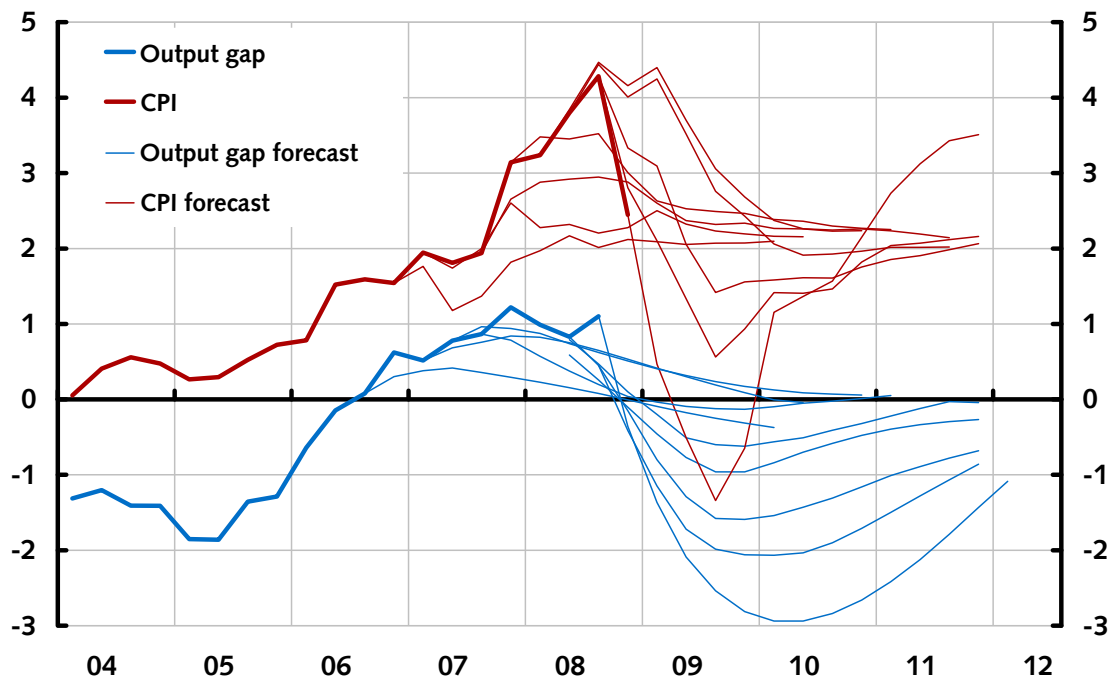Sources: Statistics Sweden and the Riksbank

Figure 7. CPIX, February 2008

Annual percentage change

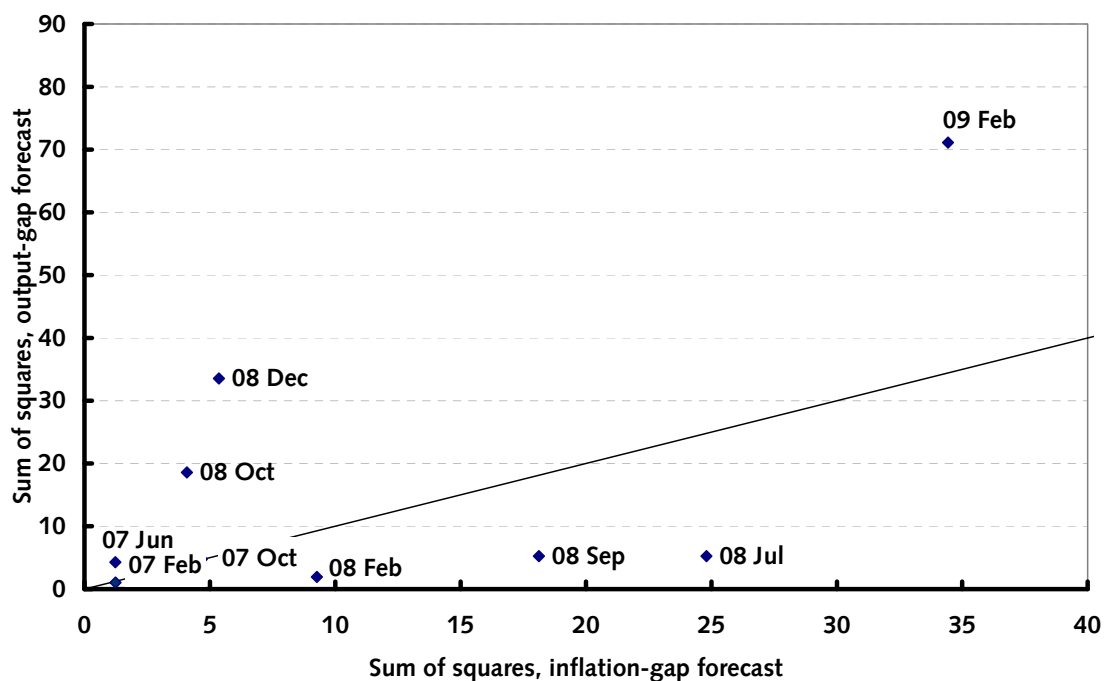Sources: Statistics Sweden and the Riksbank

Figure 8. Outcomes and forecasts for CPI inflation and the output gap

Per cent

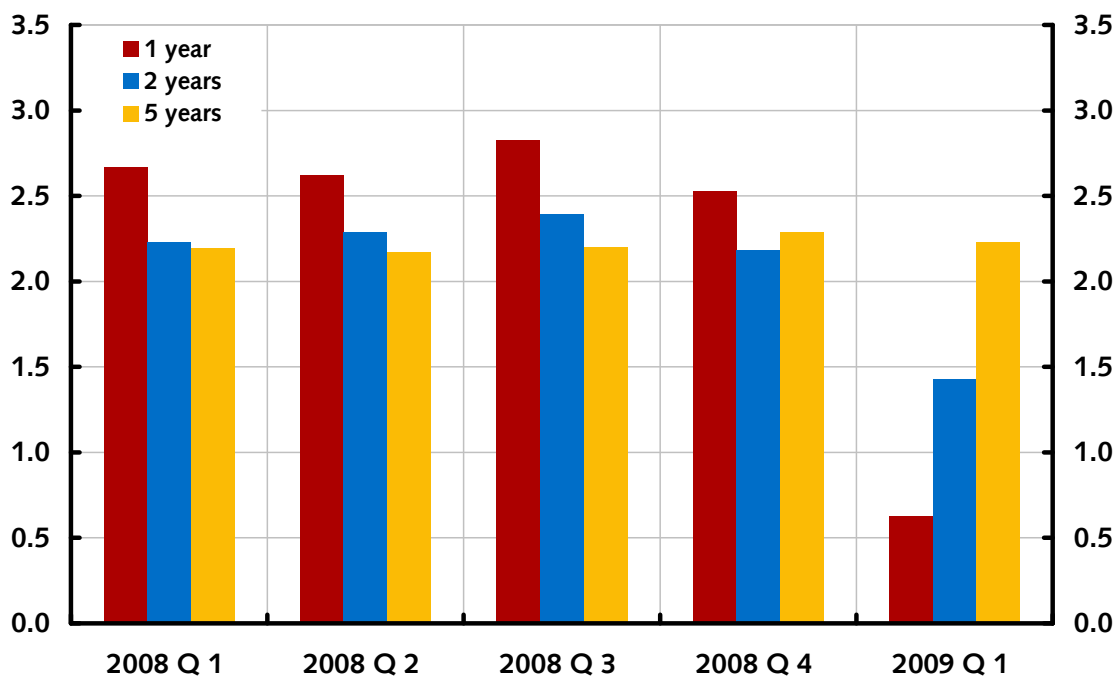Sources: Statistics Sweden and the Riksbank

Figure 9. Sum of squares for inflation-gap and output-gap forecasts, 2007-2009

Sources: Statistics Sweden and the Riksbank

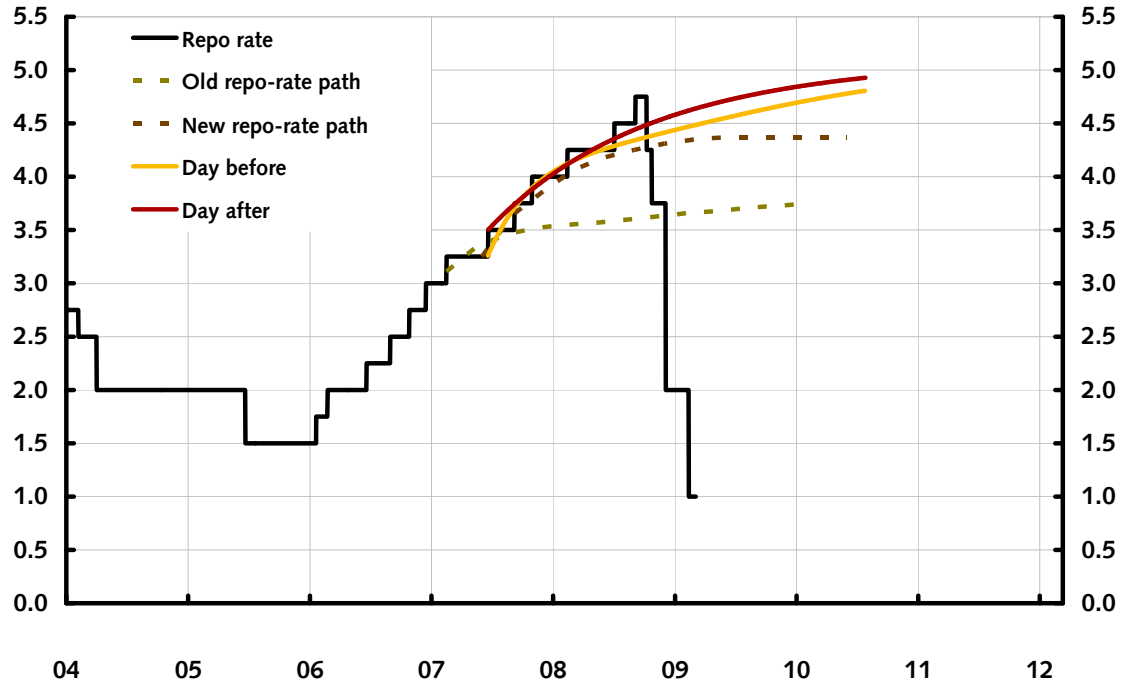Figure 10. Inflation expectations among money market agents 1, 2 and 5 years ahead, Q1 2008 to Q1 2009

Annual percentage change

Sources: Prospera Research AB

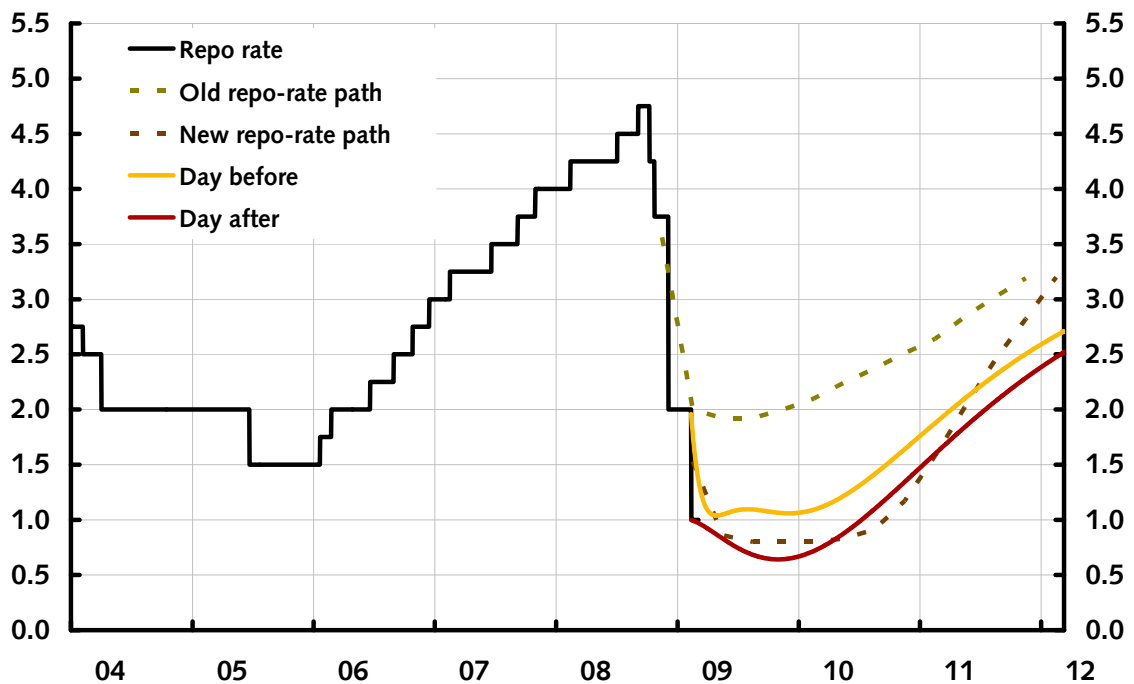Figure 11. The Riksbank's repo rate path and market expectations, 20 June 2007

Per cent

Legend:
- Repo rate
- Old repo-rate path
- New repo-rate path
- Day before
- Day after

Source: The Riksbank

Figure 12. The Riksbank's repo rate path and market expectations, 11 February 2009

Per cent

Legend:
- Repo rate
- Old repo-rate path
- New repo-rate path
- Day before
- Day after

Source: The Riksbank