Sveriges Riksbank Economic Review

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The Riksbank's communication of macroeconomic uncertainty

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When the forecasts of GDP growth, inflation and the repo rate are presented in Sveriges Riksbank's Monetary Policy Report they are supplemented by associated forecast intervals. In that way the Riksbank emphasizes that forecasts are always uncertain. This article describes in detail how Sveriges Riksbank uses historical forecast errors to calculate these intervals. We propose a number of potential improvements to the current method, including how to handle the repo rate having a lower limit, and how time variation can be introduced in the interval width to automatically adjust for temporary fluctuations in macro-economic uncertainty.

Point forecasts and forecast intervals

The Riksbank has had an inflation target of 2 per cent since 1995. To achieve this target the Executive Board of the Riksbank regularly decides on the repo rate level. Research has shown that monetary policy works with a time lag of 1–2 years before achieving its maximum effect (Christiano, et al., 2005). Consequently, effective monetary policy must be forward-looking and a central part of the Riksbank's work consists of forecasting future economic developments.

In most discussions on forecasts it is implicitly assumed that a forecast is in some sense a qualified *guess* concerning the future value of a variable. In some cases this *point forecast* is supplemented by an estimate of uncertainty in the forecast, normally presented as a *forecast interval*[2], i.e. a region of values within which the outcome is predicted to land with

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[1]   This article has been translated from swedish.
[2]   It is really more suitable to call these uncertainty intervals, since it is the future outcome that is uncertain, not the forecast. However, it is difficult to find equivalent terminology for what is normally called the forecast distribution (see below) and we will therefore continue to use the term forecast interval.

a given probability, such as 90 per cent, see for example Chatfield (2001, Ch.7) for an introduction. Figure 1 shows how Sveriges Riksbank communicates its forecast of the most important macroeconomic variables in its *Monetary Policy Report*. The solid line is the historical development of the variable and the continuing dashed line is the Riksbank's point forecast 1–12 quarters ahead. The coloured areas illustrate forecast intervals for the respective forecast horizons with three different probabilities: 50, 75 and 90 per cent respectively. The coloured areas are sometimes called forecast bands.

In more general terms one can speak of the *forecast distribution*, i.e. a complete probability distribution for the future value that we are attempting to predict. We make a Bayesian interpretation of the forecast distribution, in which the future value of the variable is unknown at the time of the forecast and can therefore be described with a (subjective) probability distribution. A Bayesian argues as follows: If you do not know the value of a variable (for example CPI inflation in the next quarter) or some other quantity (for example a model parameter) you should describe your lack of knowledge in the form of probabilities. It simply does not matter if the event is random in any deeper sense.[3]

It is natural to describe uncertainty in a decision-making situation (for example before a repo rate decision) in Bayesian terms. The Princeton Professor Chris Sims expressed it as follows: 'Policy discussion at central banks uses the language of Bayesian decision theory' (Sims, 2002).[4] Most of what we describe in this article is, however, applicable even in a non-Bayesian approach, but we opt to make a Bayesian interpretation of the results.

There is an important difference between the Riksbank's point forecasts and the interval around these forecasts. The Riksbank's point forecast for the repo rate conveys its **intentions** for monetary policy, i.e. the policy that the Riksbank intends to implement **if** the economy develops as the Riksbank predicts today. In a similar way, the forecast paths for GDP growth and CPI inflation describe development of these variables *given* that the Riksbank does not deviate from its proposed repo rate path. On the other hand, the forecast intervals around the point forecasts represent **general** macroeconomic uncertainty (i.e. not only the Riksbank's view

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[3]   The Bayesian pioneer Bruno de Finetti's classical quotation is: "The only relevant thing is uncertainty – the extent of our own knowledge and ignorance. The actual fact of whether or not the events considered are in some sense determined, or known by other people, and so on, is of no consequence" (De Finetti, 1975, page xi).

[4]   A Bayesian approach is not only preferable in purely conceptual terms but also has many other practical advantages, for example for estimation and model comparison; see for example Bernardo and Smith (1994) for a general discussion or Adolfson et al. (2007b) from a central bank perspective. Three of the Riksbank's most important models, a dynamic general equilibrium model (Adolfson et al., 2008a), a statistical vector autoregressive model (Villani, 2009) and a state-space model with time-varying parameters (Giordani och Villani, 2009), are for example analysed using Bayesian methods exclusively.

Figure 1. Forecast distributions in the Moneatary Policy Report July 2009

Repo rate

CPI inflation

GDP growth

Outcome — ■ — Forecast ▨ 50% ▨ 75% ▮ 90%
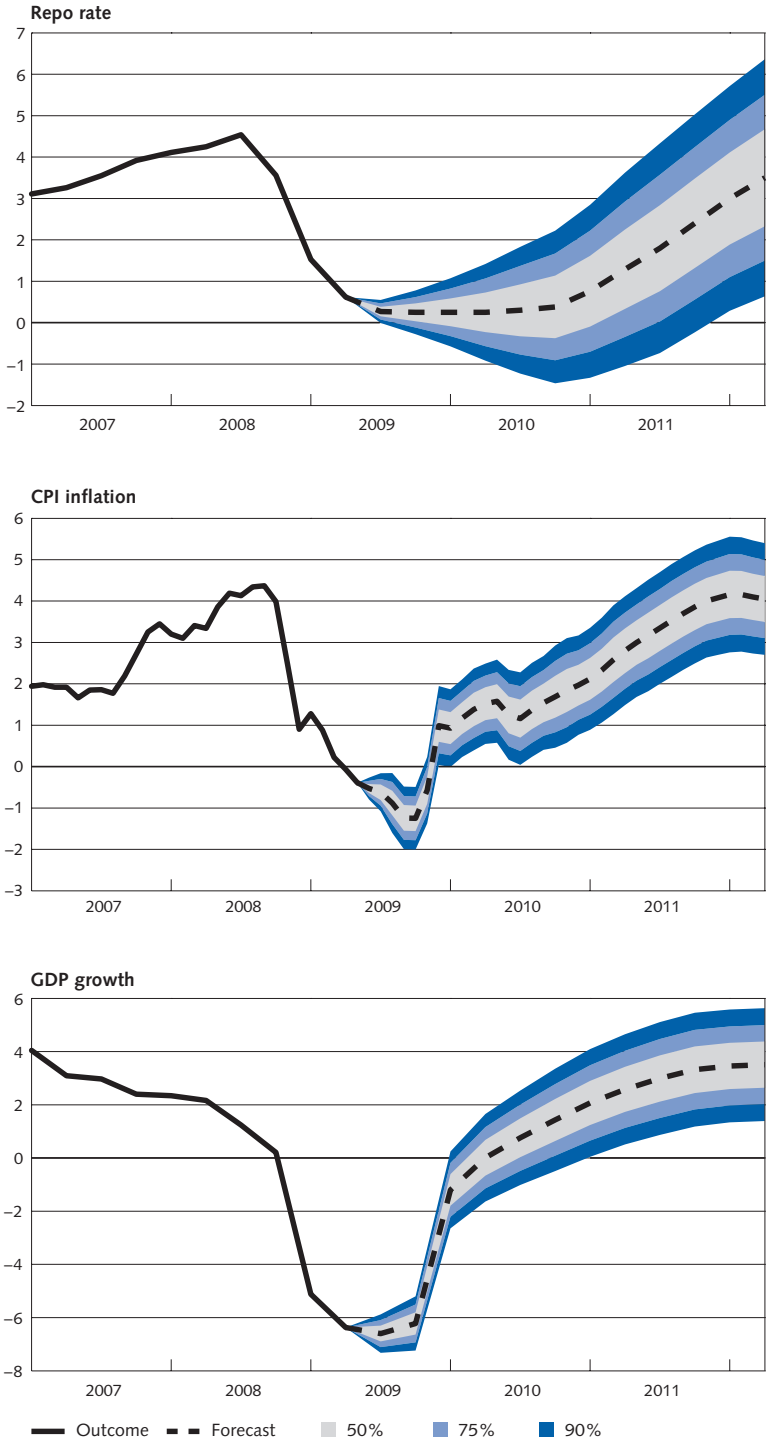
of uncertainty). The Riksbank wants to communicate that the future is uncertain and consequently may deviate from today's intentions.[5]

The purpose of this article is to describe in detail how Sveriges Riksbank calculates the forecast bands in Figure 1 on the basis of historical forecast errors. We will give a brief account of alternative approaches, but our ambition is mainly to focus on the method currently used at the Riksbank. After that we describe three potential improvements to the calculations of the Riksbank's forecast interval. The first proposal for improvement is a method that makes it possible to introduce time variation in the forecast interval width so that the intervals can pick up more temporary changes in macroeconomic uncertainty. The second proposal is a simple extension of the Riksbank's present method that takes into account the fact that the repo rate cannot be (too) negative. Finally we point out that the forecast bands in Figure 1 are connected marginal intervals that are to be read forecast horizon by forecast horizon. We then review different ways of designing forecast bands that describe uncertainty in the entire outcome *path* for a variable.

Forecast intervals based on historical forecast errors

In this section we will describe the Riksbank's interval method that is based on the variation in historical forecast errors. There are a number of reasons for this relatively simple idea having gained approval at the Riksbank:

- Using intervals based on historical forecast accuracy is an easily understood way of communicating the uncertainty in the Riksbank's forecasts.
- The Riksbank's point forecast is produced by means of an informal process in which forecasts from structural economic models and statistical forecast models are combined with expert assessments (Hallsten and Tägtström, 2009). The point forecast is therefore well-defined, but cannot be described on the basis of a probability model. Forecast intervals based on historical forecast errors are an attractive alternative when there is no formal probability model that generates the point forecast.
- The correctness of these intervals does not hinge upon on a specific model. The intervals reflect the Riksbank's actual forecast accuracy, regardless of whether the Riksbank's models provide a good description of the economy or not.

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5   However, it is possible to construct forecast bands using intention interpretation, see Svensson and Williams (2007).

A disadvantage of this type of interval is, however, that it is back-ward-looking and that the interval width is constant over time[6]. In other words the intervals do not automatically become wider in uncertain eco-nomic times. In this article we propose a method to introduce time varia-tion into the Riksbank's forecast intervals.

FORECAST INTERVALS FOR GDP GROWTH AND INFLATION

To calculate the forecast intervals for inflation and GDP growth forecasts the Riksbank uses its historical forecast errors for the respective variables. These forecast intervals are illustrated in Figure 1. The forecast errors are defined as a historical forecast for a given quarter minus the outcome for the quarter. This historical spread of forecast errors for each respective forecast horizon is measured by the *root mean squared error* (RMSE)

$$\mathrm{RMSE}(h) = \sqrt{\sum_{t=T}^{T+n-1} (y_{t+h} - y_t^{(h)})^2 / n},$$

where $y_t^{(h)}$ is the h-step forecast made at time t, y_{t+h} is the realised out-come and n is the number of forecast events analysed.

The Riksbank makes forecasts for at least 12 quarters ahead and the spread of the Riksbank's historical forecast errors is calculated for each specific forecast horizon, giving twelve different RMSE values. The rele-vant RMSE values for CPI inflation and GDP growth that are used in Figure 1 are shown in Table 1.[7, 8]

TABLE 1. RMSE FOR DIFFERENT FORECAST HORIZONS FOR THE RIKSBANK'S FORECASTS OF CPI INFLATION AND GDP GROWTH, 2000–2007.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
CPI inflation	0.30	0.50	0.60	0.65	0.73	0.78	0.81	0.85	0.85	0.85	0.85	0.85
GDP growth	0.44	0.62	0.88	1.00	1.08	1.17	1.23	1.27	1.30	1.30	1.30	1.30

The forecast intervals are calculated on the basis of the assumption that the future forecast errors will follow a normal distribution[9] with an expected value of zero and the same standard deviation as the RMSE of the historical forecast errors. To illustrate the uncertainty in the forecasts as in Figure 1 the distribution of forecast errors for each forecast horizon

[6] This is a truth with modification, since the historical forecast errors are continually updated with new out-comes.
[7] The forecast of CPI inflation is on a monthly frequency. Here we have only reported the RMSE for the fore-cast horizons +2, +5, +8, etc. months ahead.
[8] The RMSE estimates for long forecast horizons are very uncertain. Consequently, the RMSE for forecast horizons 9–12 quarters have been approximated using the standard deviation in the historical outcomes for CPI inflation and GDP growth.
[9] One alternative is the *t* distribution which has heavier tails, which may be more realistic if only a few large forecast errors have been observed.

is centred round the respective point forecast from the Riksbank. For example, a forecast interval is calculated with probability $(1-\alpha)$ in accordance with the following equation

$$y_t^{(h)} \pm z_{\alpha/2} \times \text{RMSE}(h), \quad h = 1,\ldots,H, \tag{1}$$

where $y_t^{(h)}$ is the Riksbank's point forecast of the variable y_{t+h} at time t, $z_{\alpha/2}$ is the $\alpha/2$ percentile in the normal distribution with expected value 0 and standard deviation 1. Accordingly, $z_{\alpha/2}$ is the value that in a standardised normal distribution has probability mass $\alpha/2$ to the left of point $z_{\alpha/2}$. Thus for a 90 per cent interval we have $\alpha = 0.1$ and $z_{\alpha/2} = z_{0.05} = 1.645$. The RMSE calculations are updated about once a year and for the Monetary Policy Report of July 2009 were based on forecast errors for the period 2000 to 2007.

FORECAST INTERVALS FOR REPO RATE FORECASTS

Since February 2007 the Riksbank has also published a repo rate forecast and 16 forecast paths have been presented since then. The repo rate forecast is also presented with a forecast interval, see Figure 1. The period in which the Riksbank has been forecasting the repo rate is, however, too short for making reliable RMSE calculations of the spread in the Riksbank's own forecast errors for the repo rate.[10] To achieve agreement with the calculation of the forecast interval for inflation and GDP it would of course be best to use the Riksbank's own repo rate forecasts, but for the time being the Riksbank must use an alternative method to calculate the spread of forecast errors for repo rate forecasts. By using the market implied forecast for future short-term interest rates (see next section) we can approximate the Riksbank's forecast capability, assuming that the historical forecast accuracy of market participants and the Riksbank are equivalent.[11]

The problem of having too few observations of forecast errors will disappear as more forecast errors can be recorded. In the near future the Riksbank can start to include its own forecast errors from the repo rate forecasts when calculating the RMSE, particularly for the shorter forecast

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[10] The Riksbank's first repo rate forecast was made in February 2007 and runs to the first quarter of 2010. Since the quarterly mean for the repo rate in the first quarter of 2010 is not yet known it is not yet possible for example to compute any forecast error for the longest forecast horizon. Hence it will take a long time before the longer forecast horizons have sufficient outcomes to compare the forecasts with so as to be able to gain an idea of how great the forecast error spread is.

[11] In the short term, however, the Riksbank should have an advantage as regards the repo rate forecast, i.e. the forecast uncertainty should be less for the Riksbank than for the market participants. This indicates that the forecast intervals for the shortest forecast horizons should be based on the Riksbank's own forecast accuracy as soon as there is sufficient data for this.

horizons. For a long transition period forecast errors from both market pricing forecasts and the Riksbank's forecasts can be used together to measure the historical forecast accuracy for the repo rate.

The academic literature proposes an alternative, more forward-looking method to estimate uncertainty of short-term interest rates that is based on using interest rate options in various ways (see for example Svensson and Söderlind (1997) and Aguilar and Hördahl (1999)). Since the market price of options reflects the need of market participants to insure themselves against large fluctuations in interest-related securities it also gives a picture of the expected uncertainty during the validity period of the option contract. Based on the pricing of interest options it is therefore possible to calculate an implied probability distribution for a short-term interest rate at a given time. This probability distribution can then be used to calculate and illustrate forecast intervals. Unfortunately the Swedish market for this type of interest rate derivatives is relatively small, which means that there is an insufficient amount of reliable price data.

MARKET IMPLIED FORECASTS

According to the theory of effective financial markets and the expectations hypothesis, a market rate for a bond with a two-year maturity will for example reflect the expected yield from investing the money at the overnight rate day to day for two years. The yield curve, which shows how interest rates differ for different maturities at a given point in time, can therefore provide information on how market participants believe the repo rate will develop in future. By calculating implied forward rates the market participants' average forecast for short-term interest rates is obtained. According to the expectations hypothesis, the built-in expectations of the forward rates can be interpreted as the market participants' collective mean value forecast of the future interest rate level, given that the participants have rational expectations.[12] This means that market rates reflect the mathematical expected value of the market's overall forecast distribution, after excluding risk and maturity premiums. It is these expectations that are used as an approximation instead of the Riksbank's own repo rate forecasts, since this allows forecast errors to be studied a long way back in time.

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[12] The overall mean value will thereby be a weighted volume of the individual participants' expected short-term interest rate outcome, on the basis of how much money they invest to make the interest rate higher or lower. If the largest investors in the fixed income market build on the belief that the interest rate will rise in the future then forward rates will also indicate higher interest rates. This means that the largest value participants' mean value forecasts will carry more weight than those of participants with smaller investment portfolios.

However, there is an important drawback associated with using forward rates to forecast the repo rate. Both academics and market participants have noted that market rates are not only based on expected repo rate development, which means that the expectations hypothesis does not give the whole answer to how a market rate is priced; see for example Campbell and Shiller (1991) and Alsterlind and Dillén (2005). What has been noted is that the interest rates, apart from the expected overnight rate, also include compensation to investors for any risks or costs associated with tying up their lending through longer maturities. This form of compensation is usually called risk and maturity premiums.

If the forward rates deviate to a certain extent from the expectations hypothesis, the interest rates should be adjusted for the different premiums causing the deviation. The premiums contain no information about market participants' expectations of the overnight rate and must therefore be excluded from forward rates to obtain the market participants' implied overnight rate forecast. Unfortunately, it is difficult to calculate the size of these premiums. We can observe a market rate for a certain maturity, for example a government bond rate, but there is no simple way to determine how much of the market rate reflects the expected average overnight rate and how much is some form of premium.

To identify forecast errors for forward rates the Riksbank at first used to opt for the simple assumption that the premiums for a specific forecast horizon can be estimated as the average forecast error for the unadjusted forward rates with corresponding maturities; see article in the Monetary Policy Report 2007:1. If, for example, the forward rates for four quarters ahead on average exceeded the realised repo rate outcome by 0.30 of a percentage point during the evaluation period, 0.30 of a percentage point was excluded from all forward rates with a maturity of four quarters. Adjustment of forward rates in this way was intended to make them better reflect the market participants' repo rate forecast. The deviations between the mean value adjusted forward rates and the repo rate path in the period 1998 to 2005 are the forecast errors that were used by the Riksbank to calculate forecast intervals for its repo rate forecasts up until September 2008.[13]

Assuming that the premiums in forward rates are equal to the entire average forecast error does not have any strong theoretical support. If the fixed income market participants have rational expectations one could expect that the average forecast error would be zero, which would certainly mean that an average deviating from zero can reflect the average

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[13] The method is outlined in the article "Calculation method for uncertainty bands" in the Monetary Policy Report 2007:1.

size of the premium. However, it is important to observe that the average forecast error can deviate from zero even if there were no premiums. One reason may be that the size of the sample is so small that it only covers one or two economic cycles. The average forecast error therefore includes both forward premiums and consistent forecast errors (positive or negative) during the period of evaluation.

In an attempt to improve the assumption about forward rate premiums and estimation of these premiums the Riksbank has used a model for the yield curve where risk premiums can be estimated (see Appendix for a more detailed description of the model). The model uses Swedish government bond rates in the form of an estimated yield curve for zero coupon rates. On the basis of theoretical relationships and interest rate movements from January 1998 to February 2008 the model identifies three underlying factors that have driven the changes in the yield curve. With the help of these three statistical factors the model can also identify average forward rate premiums for different maturities. The market participants' short-term interest rate forecasts implied in market rates of Swedish government bonds can thus be estimated by excluding forward rate premiums from forward rates. Since October 2008 it is the forecast accuracy of these adjusted forward rates that generates the RMSE values that determine the width of the forecast intervals for the repo rate forecast in Figure 1. The RMSE values are shown in Table 2.

TABLE 2. DIFFERENT FORECAST HORIZONS' RMSE FOR FORWARD RATE FORECASTS FOR ONE-MONTH RATE, JANUARY 2001 – FEBRUARY 2008.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Forward rates	0.17	0.33	0.50	0.71	0.93	1.12	1.28	1.42	1.54	1.60	1.66	1.74

ALTERNATIVE WAYS OF CALCULATING FORECAST INTERVALS

In the above we have given an account of the Riksbank's method of calculating forecast intervals on the basis of historical forecast errors. Here we will give a very brief account of two alternative ways of calculating uncertainty intervals: forecast intervals from formal probability models, and forecast intervals produced through expert assessments.

Given a formal probability model it is possible to calculate the full forecast distribution of a system of variables, possibly with the help of simulation methods. This distribution is simultaneous over both variables and forecast periods (see below). If Bayesian methods are used to estimate the model, parameter uncertainty in the model it is possible to take into account, or even some form of model uncertainty.

Scientific studies of the forecasting performance of economic and statistical models have often focused on the accuracy of the point forecast. Here is a short summary of the results of these studies:

- In the class of statistical models, simple models are usually equally good or better than more complicated models.
- Older structural economic models with microfundamentals (such as the Real Business Cycle (RBC) models, see King et al. 1988) perform worse than simple statistical models (Zimmermann, 2001).
- Modern structural economic models with micro fundations (such as the Dynamic Stochastic General Equilibrium (DSGE) models; see for example Christiano et al., 2005) are essentially just as good as statistical forecasting models (Smets and Wouters, 2003, Adolfson et al., 2007c, Edge et al., 2008), but structural models have are simpler to interpret and provide greater opportunities to calculate forecasts conditional on well-defined scenarios.
- Only at the very shortest forecast horizons do advanced expert assessments (for example the Federal Reserve's and Sveriges Riksbank's inflation forecasts) give more correct forecasts than statistical and structural models (see for example Sims, 2002 and Adolfson et al., 2007a).

Evaluations of forecast intervals and forecast distributions have started relatively recently to take a place in the macroeconomic literature, see for example Cogley et al. (2005), Adolfson et al. (2007c), Clark (2009), Jore et al. (2009) and Giordani and Villiani (2009). An important conclusion of these studies is that the disturbance variability has fluctuated substantially over time and that macroeconomic models therefore need time varying disturbance variances if the forecast interval is in fact to reach the probability coverage intended (for example 90 per cent for a 90 per cent interval).

The forecast intervals used by the Bank of England are of an entirely different nature. The Bank of England describes its method as the 'best collective judgement', which should be interpreted as a consensus of expert assessments. It would be going too far to discuss the model and expert-based forecast distributions in detail. We content ourselves here by very briefly mentioning the most important advantages and disadvantages of the two methods:[14]

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[14] See also Adolfson (2007a) for a more detailed discussion and examples of episodes in the work of the Riksbank that the different approaches have treated in different ways.

- Advantages of model-based methods:
  – Provide a comprehensible intellectual framework and handle complex relationships in a system of endogenous variables.
  – Transparency. It is relatively easy after the event to understand the origin of the forecast and to learn from past mistakes.
- Disadvantages of model-based methods:
  – Formal models may be overly simple, thereby giving misleading results or forecasts.
  – Formal models find it difficult to take into account recently received information about the economy, particularly when this information is in a form that is difficult to adapt to the model structure.
  – Forecast intervals from formal models are often too narrow, since these intervals are based on a given model and therefore disregard the uncertainty of the model's specification (Chatfield, 1993).
- Advantages of expert assessments:
  – Can take into account recently received information in principle in any form (given that the expert can interpret and process the information)
- Disadvantages of expert assessments:
  – Not transparent. The expert seldom provides enough information about how he produces the forecast to enable an assessment of his mistakes. For the same reason it is difficult to learn from the expert's mistakes.
  – It is very difficult for an expert to handle systems of (endogenous) variables without an explicit model.
  – Experts often give forecast intervals that are too narrow; see for example Lawrence et al. (2006) which gives a number of reasons for this excess optimism.

Expert assessments are to a great extent the direct antithesis of model-based methods, and much could be gained if the two could be combined. It is already well-known how different model-based methods can be combined in the work of forecasting (for example via Bayesian model averaging, see Hoeting et al., 1999), and a certain amount has been written on how to combine expert assessments (French and Insura, 2000), but no practical, explicit and rigorous method of combining models and expert assessments has yet been proposed.

Improvements in the Riksbank method using historical forecast errors

TIME VARYING WIDTH OF FORECAST INTERVALS

One characteristic of the RMSE-based intervals is that their width are independent of the state of the economy. Hence uncertainty is assumed to be the same, regardless of whether we are in a downturn or an upturn, or even in times of economic crisis, which can be regarded as a disadvantage. However, it must be said that the most frequently used economic and statistical models are linear, with constant parameters and accordingly have exactly the same characteristic.[15]

In principle it is possible to generalise the method based on historical forecast errors so that the variance of forecast errors follows a model, for example by letting the variance of forecast errors (in logarithms) be time varying in accordance with an autoregressive process or by modelling the forecast error variance as a function of macro variables. The problem is that there are relatively few historical forecast errors available and estimation of these more complex models is therefore probably far too uncertain.

Nevertheless, it is natural to wonder whether RMSE-based intervals can be modified so that the interval width is dependent on the state of the economy. One obvious solution is to multiply the RMSE figures by an uncertainty factor which is, for example, greater than one in periods of extra uncertainty. This factor can be determined subjectively by the decision-maker on the basis of his/her perception of the current uncertainty in the economy. The Riksbank has previously used a method with a similar idea (Blix and Sellin, 1999).

A more objective and transparent method is to estimate a model with time-varying variance for the time series itself rather than for the forecast errors for this variable. This gives an idea of the uncertainty of the variable about which a forecast is being attempted, and this uncertainty can then be used for example to increase the RMSE figures in times of extra uncertainty. Assume for example that we are modelling GDP growth with an AR process in which the residuals follow a stochastic volatility model:

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[15] Even in models with time-invariant parameters some time variation will of course arise in the parameter *estimates* over time.

$$y_t = \mu + \sum_{k=1}^{K} \phi_k \, (y_{t-k} - \mu) + \lambda_t \varepsilon_t, \; \varepsilon_t \overset{iid}{\sim} N(0,1), \qquad (2)$$

$$\ln \lambda_t^2 = \ln \lambda_{t-1}^2 + \nu_t,$$

where λ_t is the time varying standard deviation for the disturbances. The innovations to volatility, ν_t, are assumed to be independent $N(0,\psi)$. It is simple to generalise this model so that $\ln \lambda_t^2$ follows a general AR process, but we will focus here on the most common model where $\ln \lambda_t^2$ is a random walk. A Bayesian estimate $\hat{\lambda}_t$ can be calculated for λ_t for $t=1,\dots,T$.[16] A measure of something that could be called the *relative volatility* at time T can now be defined as

$$\kappa_T = \frac{\hat{\lambda}_T}{n^{-1} \prod_{t=t_1}^{t_2} \hat{\lambda}_t^{1/n}},$$

where t_1 and t_2 are the opening and closing quarter for the time period in which the RMSE figures for one-stage forecasts are calculated, and $n = t_2 - t_1 + 1$ is the number of quarters during this period. Hence κ_T measures the volatility at time T in relation to the geometrical mean volatility during the period used to calculate the RMSE.

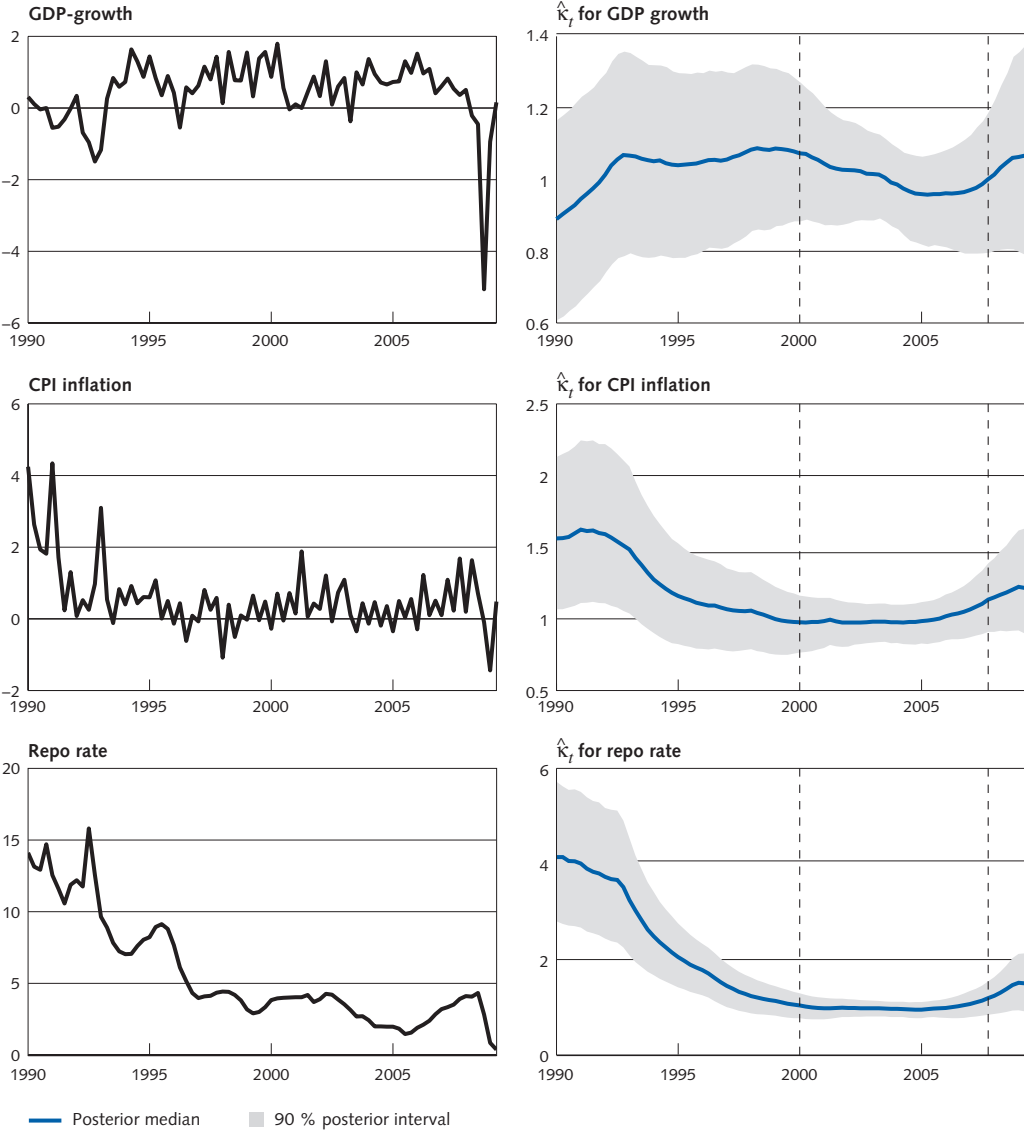RMSE-based intervals can now be calculated in accordance with the method presented above, but replacing RMSE*(h)* by $\kappa_T \cdot$ RMSE*(h)*. Note that the RMSE values are multiplied by the same factor regardless of forecast horizon, which is analogous to multiplying the disturbance variance in a linear model by a constant.

Figure 2 shows the estimation results for κ_t for the quarterly percentage changes of seasonally adjusted GDP and CPI as well as for the repo rate, during the period between the second quarter of 1980 to the second quarter of 2009.[17] The results show that volatility has in principle been constant for GDP growth, but varied substantially for inflation and the repo rate. Figure 1 shows fairly clear indications that the long period of successively decreasing volatility of inflation and the repo rate was broken 1–2 years ago. The median in the posterior distribution for κ_{2009Q2}, the relative volatility for the second quarter of 2009, is 1.10, 1.27 and 1.55 for GDP growth, inflation and the repo rate. This means that the RMSE figures for example for inflation in Table 1 should increase by 27 per cent

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[16] Using Bayesian estimation methods (see for example Clark, 2009) the posterior distribution of the entire sequence $\lambda_1,\dots,\lambda_T$ can be calculated based on data up to and including period $t = T$. It would be going much too far to give all the details of the estimation here. The prior distribution of the time-invariant parameters is the same as in Villani (2009). The most important parameter is ψ, the innovation variance. We follow Giordani och Villani (2009) here and use an inverse gamma distribution as prior for ψ with expected value 0.01 and 10 degrees of freedom, which implies a reasonable time variation.

[17] Data up to and including the fourth quarter of 1988 are used as training observations to create an a prior distribution for λ_0 and the remaining observations are utilised to estimate the model.

Figure 2. Left column: Time series of quarterly growth of GDP and CPI, as well as the repo rate. Right column: Posterior median ($\hat{\kappa}_t$) and the 90 per cent interval for the relative volatility, κ_t. The start and end dates for the RMSE sample are marked with vertical broken lines.

GDP-growth

$\hat{\kappa}_t$ for GDP growth

CPI inflation

$\hat{\kappa}_t$ for CPI inflation

Repo rate

$\hat{\kappa}_t$ for repo rate

—— Posterior median   ▦ 90 % posterior interval

due to the extra uncertainty today compared with the period 2000-2007. The increase in the RMSE figures for the repo rate of 55 per cent seems to be on the large side. One reason for the substantial fluctuations in volatility may be the assumption of normally distributed disturbances in the model in Equation 2, which results in extreme observations (called outliers) being overinterpreted as a drastic change in variance. Another problem with the model is that changes in variance are assumed to be fre-

quent and consequently estimated as small. The variance in the repo rate seems rather to have been constant for long periods and then changed more abruptly on a few isolated occasions. The LASER model in Giordani and Villani (2009) is better at handling these problems, and may be an interesting alternative for this analysis. The LASER model allows non-normal disturbances and innovations, and the model's variances can be constant for long periods and then make bigger jumps.

The method above gives a scaling factor κ_T for each macroeconomic variable. An alternative is to scale the interval width of all variables with a common scale factor for the economy as a whole. A simple solution is to calculate a geometric mean value from the individual scale factors. A more advanced alternative is to estimate a vector autoregressive model with time varying covariance matrix that is time invariant up to common a scale factor:

$$x_t = \mu + \sum_{k=1}^{K} \phi_k (x_{t-k} - \mu) + \lambda_t \varepsilon_t, \varepsilon_t \overset{iid}{\sim} N(0, \Sigma)$$

$$\ln \lambda_t^2 = \ln \lambda_{t-1}^2 + \nu_t,$$

where x_t is a vector with observations on p time series at time t, ε_t is a p-dimensional vector with disturbances with covariance matrix Σ, and $\nu_t \overset{iid}{\sim} N(0, \psi)$ are the innovations to the univariate common volatility factor λ_t.

FORECAST INTERVALS THAT TAKE THE LOWER BOUND OF THE REPORATE INTO ACCOUNT

The exceptionally low interest rate levels that arose during the financial crisis create new problems. How does one design forecast intervals that take into account the fact that the repo rate cannot be negative? It must be pointed out that in principle it is possible to have a negative repo rate (Beechey and Elmér, 2009; Söderström and Westermark, 2009), but the repo rate can probably not lie too far below zero. Consequently, we will make the assumption that the repo rate floor is zero, but our method can easily be generalised for an arbitrary lower bound.

We have described above how the Riksbank's RMSE based forecast interval is based on the normal distribution, whose domain of possible outcomes is the interval $(-\infty, \infty)$. Thus the drawback is that the intervals for the repo rate can include negative values. This does not entail any problems in practice as long as the interest rate is not very low, since the probability of negative interest rates is then essentially zero. But at times

of low interest rates the probability of a negative repo rate is substantial and the normal distribution assumption becomes more problematical. The Riksbank has tried two ways of tackling this problem. The first solution (used in the Monetary Policy Report in February 2009) consists of cutting the forecast bands for the repo rate in Figure 1 below zero. In the following Monetary Policy Report in July 2009 the forecast bands were retained in their original form, i.e. intervals containing negative values were allowed (see Figure 1). Intervals with negative values can be justified using two complementary arguments: i) the lower bound is not exactly zero, moderately negative interest rates cannot be ruled out (Beechey and Elmér, 2009) and ii) negative repo rates in the forecast distribution represent alternative monetary policy measures with the same effect *as though* the repo rate were negative, but are not to be interpreted as the repo rate actually being negative.
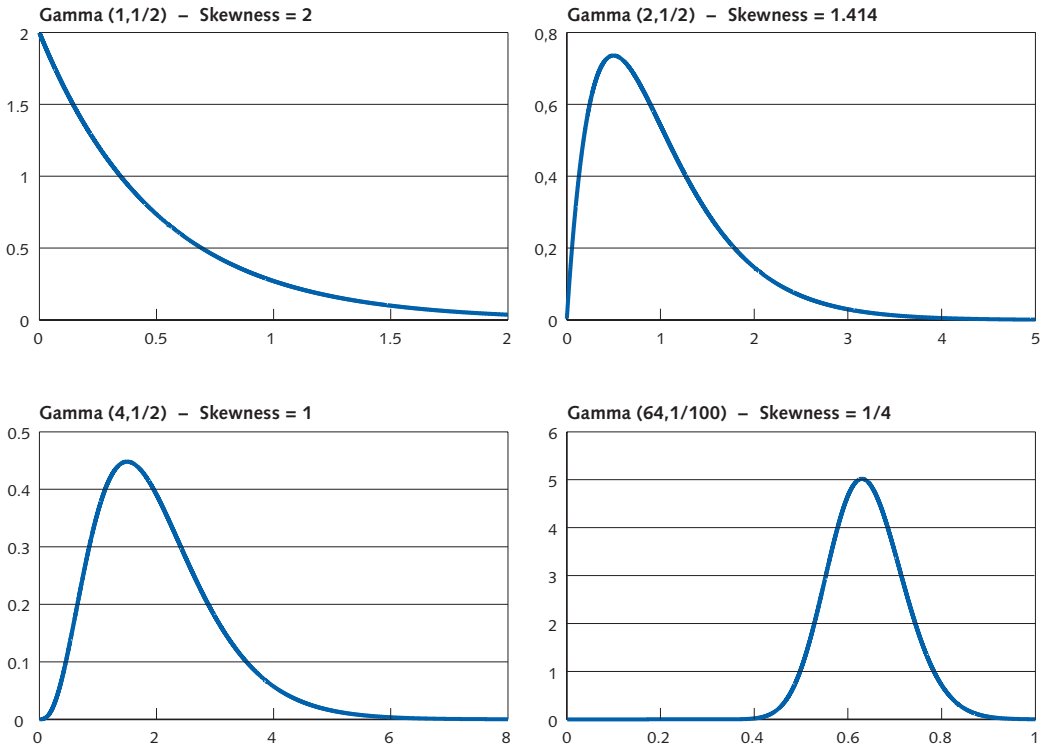
We will propose an alternative method here in the same spirit as the Riksbank's current method based on historical forecast errors, but which gives a forecast distribution in which the domain of possible outcomes is the interval $[0,\infty)$. There are many distribution families for non-negative random variables. We will focus here on *the gamma distribution*[18] whose probability density function is of the form

$$f(y; \alpha, \beta) = \frac{1}{\Gamma(\alpha)\beta^{\alpha}} \, y^{\alpha-1} \exp(-y/\beta),$$

where $\alpha > 0$ is called the *shape parameter* (because it determines the degree of skewness in the distribution) and $\beta > 0$ is the *scale parameter* (because if Y is *Gamma(α,β)* distributed then $cY \sim Gamma(\alpha,c\beta)$, where c is a scaling constant). Figure 3 shows some examples of distributions that are included in the gamma distribution family. The gamma distribution has an expected value $\alpha\beta$ and variance $\alpha\beta^2$. An important characteristic of the gamma distribution is that it converges towards the normal distribution when $\alpha \to \infty$. It can also be shown that the gamma distribution's skewness is $2/\sqrt{\alpha}$, and that the skewness is therefore small when the expected value is large in relation to the standard deviation, which for example is the case when the repo rate is close to its long-term equilibrium level. In times of normal interest rate levels the gamma distribution is therefore almost symmetrical. Note also that the gamma distribution can be easily generalised to the case of an arbitrary lower limit. If the lower limit is u then $y + u$ follows a generalised gamma distribution on the interval $[u,\infty)$.

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[18] One alternative is a lognormal distribution. This distribution is, however, very skewed, even when the distribution mass is a long way from zero. This means that the lognormal distribution will be considerably skewed even when the repo rate is in equilibrium, which may be seen as a disadvantage.

Figur 3. Some examples of gamma distributions

Gamma (1,1/2) – Skewness = 2

Gamma (2,1/2) – Skewness = 1.414

Gamma (4,1/2) – Skewness = 1

Gamma (64,1/100) – Skewness = 1/4

We will now describe how historical forecast errors can be used to esti-
mate the gamma distribution parameters. The Riksbank's prediction inter-
val for a given forecast horizon can be seen as an estimate of a normal
distribution $N(\mu_h, \sigma_h^2)$ where

$$E_t(Y_{t+h}) = \mu_h = y_t^{(h)}$$

$$Std_t(Y_{t+h}) = \sigma_h = \text{RMSE}(h).$$

Expressed in words it can be said that the Riksbank matches the location
of the normal distribution μ_h with the point forecast, while the standard
deviation of the normal distribution σ_h is coupled with matched RMSE.

If we now assume that the forecast distribution h quarters ahead is
given by a $Gamma(\alpha_h, \beta_h)$ distribution, then its parameters can be calcu-
lated analogously (see Appendix B) by matching i) the expected value in
the gamma distribution with the Riksbank's forecast and ii) the standard
deviation in the gamma distribution with the RMSE for historical forecast

errors[19]. In the gamma case, however, it makes a difference whether the Riksbank's repo rate forecast is seen as an expected value or a median. In the standard theory of modern monetary policy analysis 'certainty equivalence' prevails, and therefore only the expected value forecast for the repo rate is of consequence for economic agents' decisions; other elements play no part (Woodford, 2003). This result appears to be the solution to our problem: the Riksbank's forecast is an intention and according to the result on certainty equivalence the Riksbank should therefore communicate an expected value forecast. Unfortunately certainty equivalence does not apply when taking into consideration the lower bound of the interest rate, since this restriction makes the model non-linear. Precisely where the choice of point forecast makes a difference (that is when the repo rate is close to zero and the distribution probably is skewed) we cannot rely on the support of economic theory in the area.[20] The Riksbank does indeed communicate that its point forecast is an expected value, but the Riksbank's informal process for producing the forecast means that other types of point estimates, such as a median forecast, cannot be ruled out; see for example the monetary policy minutes of the Executive Board meeting of 1 July 2009. Box 1 discusses the terms under which various point forecasts are optimal from a statistical perspective.[21] In Appendix B we provide detailed solutions for the gamma model in the two cases where the Riksbank's forecast is an expected value or a median respectively.

Box 1 – How to choose an optimal point and interval forecast?

OPTIMAL POINT FORECAST

The choice between different point forecasts, such as expected value, median or type value, is determined by one's loss function, i.e. the loss one makes when forecasting a variable with the value $\hat{y}$ and the actual outcome is y. The classical example is the squared loss function

$$L(y, \hat{y}) = (y - \hat{y})^2$$

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19 It can be questioned whether the spread of historical forecast errors is really relevant in this new situation with low interest rate levels, without precedent in historical data. The question then arises whether uncertainty about the repo rate is currently greater or smaller than normal. The lower bound of the rate indicates that uncertainty is less, since the rate in principle cannot be much lower, but on the other hand the repo rate may need to be raised faster than expected if the financial crisis and recession are more short-lived than expected.

20 Certainty equivalence can, however, serve as a good approximation and this is worth studying more carefully.

21 It is important to point out that using modern simulation methods we can in principle always calculate the entire forecast distribution and it is not self-evident that we must in fact opt to reduce this distribution to one or more summary measurements, such as a point forecast. An important reason for a central bank deciding to stress a point forecast rather than an entire forecast distribution is that it simplifies communication to the market and the general public. But when the forecast distribution is asymmetrical it is difficult to get away from the fact that a point forecast gives a very rough and perhaps even misleading summary of the distribution.

that results in the forecast distribution's expected value $E(y)$ being the optimal point forecast. If the loss function is instead linear in the absolute forecast error

$$L(y, \hat{y}) = |y - \hat{y}|$$

then the median is the optimal point forecast. One may think that the mode, the most probable value, is a natural point forecast, but in that case it should be remembered that this forecast is only optimal with the rather peculiar all or nothing loss

$$L(y, \hat{y}) = 0 \text{ if } y = \hat{y}, \text{ but } L(y, \hat{y}) = 1 \text{ if } y \neq \hat{y},$$

i.e. that one suffers the same loss regardless of the size of the forecast error, except from when a completely accurate forecast is given and the loss is zero. Another interesting loss function is the lin-lin loss, where underestimation and overestimation are treated asymmetrically:

$$L(y, \hat{y}) = c_1 \text{ if } \hat{y} \leq y, \text{ but } L(y, \hat{y}) = c_2 \text{ if } \hat{y} > y,$$

where c_1 and c_2 are constants. In that case the optimal forecast $c_1/(c_1 + c_2)$ is the percentile in the forecast distribution. If, for example, the loss of underestimating inflation is twice that of overestimating it ($c_1 = 2c_2$) then the 66th (2/3) percentile in the forecast distribution is the optimal point forecast.

OPTIMAL FORECAST INTERVAL

A slightly fuller summary of a forecast distribution is given by a probability interval. For intervals too there is more than one type to choose from for a given interval probability. Perhaps the most common interval is one that excludes as much probability mass below the lower limit as above the upper limit. This *centred* interval is optimal if the loss is of the form (Wallis, 1989)

$$L(y, [a, b]) = \begin{cases} c(b-a) + d(a-y) & \text{if } y < a \\ c(b-a) & \text{if } a \leq y \leq b \\ c(b-a) + d(y-b) & \text{if } y > b \end{cases}$$

that is to say if the loss is linear in the distance between outcome y and interval .
   If instead the loss is in the all or nothing form

$$L(y, [a, b]) = \begin{cases} c(b-a) + d & \text{if } y < a \\ c(b-a) & \text{if } a \leq y \leq b \\ c(b-a) + d & \text{if } y > b \end{cases}$$

then the interval [a, b] is optimal if the endpoints a and b have the same density in the forecast distribution (Wallis, 1989). This interval has the shortest length for a given coverage probability and includes the points with highest density, and is therefore called the *Highest Posterior Density* (*HPD*) interval.
   Figure B1 illustrates these two interval types for various forecast distributions. If the forecast distribution is symmetrical, centred intervals coincide with HPD

intervals. This is probably the reason that the choice of forecast intervals is rarely discussed explicitly. But for asymmetrical distributions the interval type plays an important role. Note also that the centred interval can exclude points with very high density (the distribution on the bottom left of Figure B1), and include points with very low density (the distribution on the bottom right of Figure B1). The example of the skewed monotonous distribution in Figure B1 is particularly relevant here since this distribution appearance arises when the gamma distribution is used to model the forecast distribution for the repo rate at very low interest rate levels. Figure B1 shows that 75 per cent HPD intervals in this example will include the zero repo rate case, but that this point will fall outside the centred 75 per cent interval.

Figure B1. Comparison of 75 per cent HPD intervals (shadowed areas) and 75 per cent centred intervals (blue horizontal line)

Symmetrical distribution

Skewed distribution

Skewed monotonous distribution

Bimodal distribution
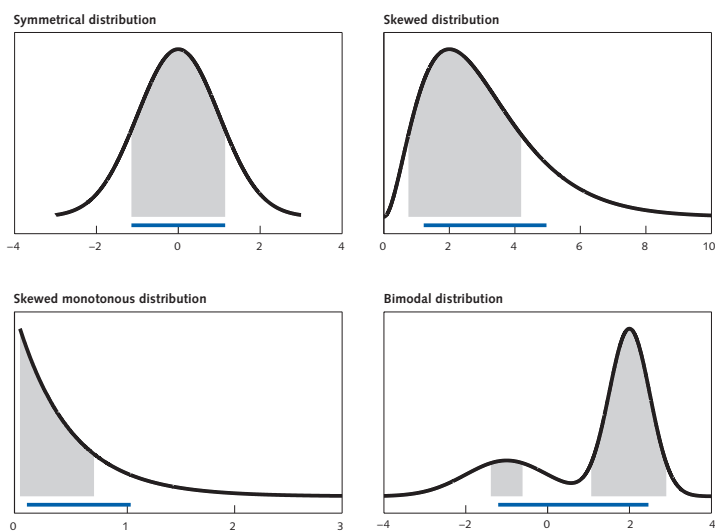
One example of a forecast interval from the gamma model is shown in Figure 4. The top left graph of the Figure replicates the Riksbank's point forecast and forecast interval for the repo rate from the normal model published in the Monetary Policy Report of July 2009. The corresponding forecast interval for the gamma model is shown on the right of this graph, assuming that the Riksbank's forecast is an expected value. Notice that the forecast interval does not include negative interest rates (a consequence of the gamma distribution), and that the lower limit of the interval can be zero (a consequence of the highest posterior density (HPD) interval used in the figure, see Box 1. The actual forecast distribution has the shape illustrated in the lower left corner in Figure B1 when the repo rate forecast is close to zero). The pronounced skewness of the distribution (cf. for example the 75 and 90 per cent forecast intervals) is a consequence of the very low expected value (the Riksbank's point forecast) in combination with a relatively large standard deviation (given by historic RMSE).
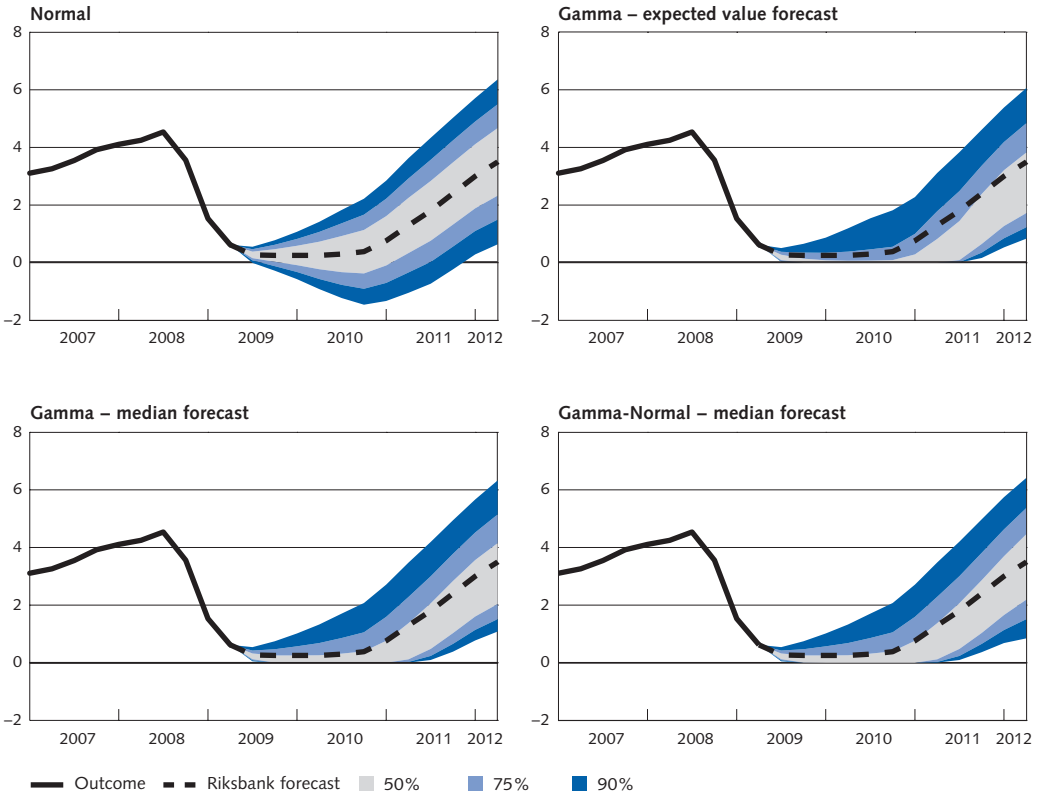
The graph in the lower left corner is also based on the gamma distribution, but now under the assumption that the Riksbank's repo rate forecast is a median forecast. Under this assumption the distribution is considerably less skewed, and has a generally reasonable appearance. A slightly less attractive side-effect of the gamma distribution is that it is still somewhat skewed even when the repo rate reaches more 'normal' levels.

The final subgraph in Figure 4 shows a way of retaining the attractive characteristics of the gamma distribution at low repo rate levels while more rapidly approaching a symmetrical distribution when the repo rate assumes more normal levels. This forecast distribution is a hybrid of a gamma distribution and a normal distribution:

$$p(y_{T+h}|y_1,y_2,\ldots,y_T) = \pi_h \cdot I_0(y_{T+h}) + (I-\pi_h) \cdot Gamma(y_{T+h}|\alpha_h,\beta_h),$$

where $N(y|\mu,\sigma^2)$ designates the probability density function for a $N(\mu,\sigma^2)$ distribution and $Gamma(y|\alpha,\beta)$ is the density function for a gamma distribution. The weight of the normal distribution $\omega(\hat{y}_{T+h})$ is a logistics function of the Riksbank's point forecast

$$\omega(\hat{y}_{T+h}) = \frac{\exp(c_0 + c_1\hat{y}_{T+h})}{1+\exp(c_0 + c_1\hat{y}_{T+h})},$$

where $c_0 = -10$ and $c_1 = 3$, which gives the function in Figure 5. When the repo rate forecast is close to zero the forecast distribution is in principle the same gamma distribution as before. The weight of the normal distribution then increases with the level of the repo rate and already at a rate of about 4.5 per cent the forecast distribution is in principle the same as the normal distribution.

Figure 5. Weight of the normal distribution component in the gamma-normal hybrid
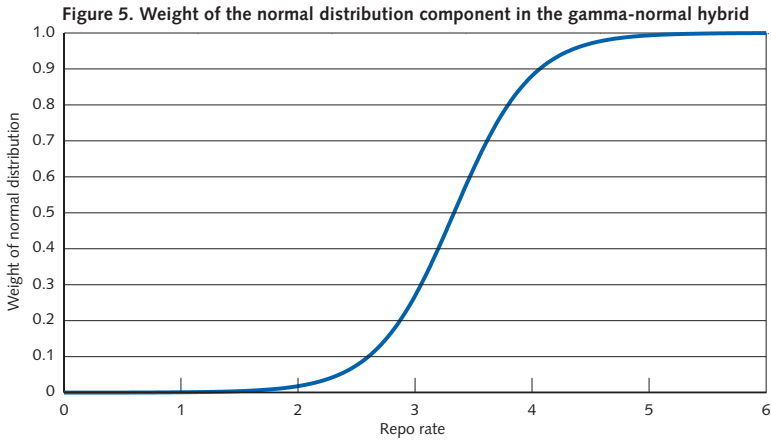
Figure 6 is a repetition of Figure 4, but now with the more normal interest rate levels that applied when the Monetary Policy Report 2008:3 was published. All four forecast distribution variants are relatively similar, but the two gamma distributions present some skewness that is not found in the normal or gamma-normal models.

An objection to the above analysis with the gamma distribution is that the outcome with a repo rate at exactly zero is not treated differently from any other point. It is possible to argue for the appropriateness of the more general distribution

$$p(y_{T+h}|y_1,y_2,\ldots,y_T) = \pi_h \cdot I_0(y_{T+h}) + (1-\pi_h) \cdot Gamma(y_{T+h}|\alpha_h,\beta_h),$$

where $I_0(y_{T+h})$ is a point mass at zero with probability π_h. This means that with probability π_h the repo rate is exactly zero and with probability $1-\pi_h$

Figure 6. Reconstruction of the forecast distribution for the repo rate in the Monetary Policy Report 2008:3 under various assumptions on distribution form and various assumptions on the Riksbank's point forecast
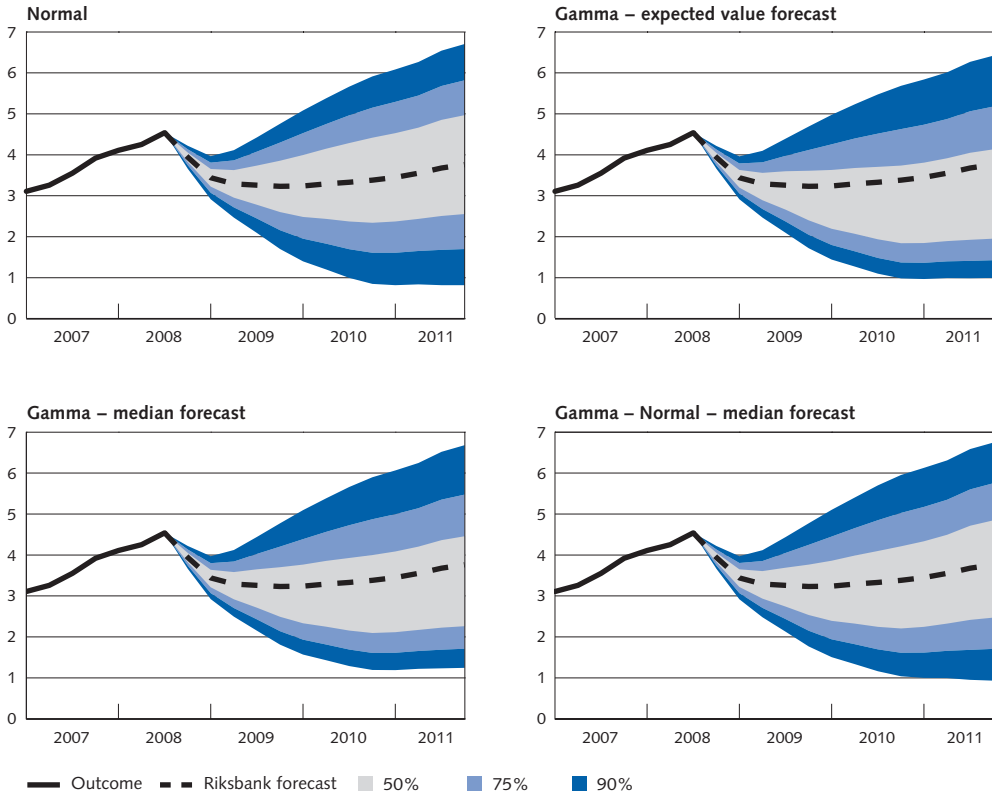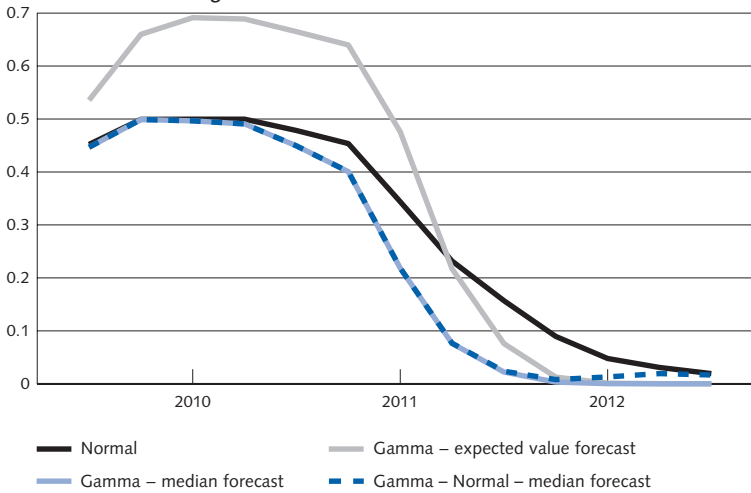
it follows the gamma distribution. The problem with this formulation is that it is very difficult to estimate π_h from historical predictions since the repo rate has never actually been zero historically. An obvious solution is to determine π_h subjectively and then estimate the parameters in the gamma distribution conditional on π_h in accordance with our earlier method.

Even if the gamma distribution does not provide a separate discrete probability to the outcome of a repo rate at exactly zero, it should be noted that this distribution still assigns a large probability to outcomes so close to zero that they are practically equivalent to a zero rate. Figure 7 displays the probability of a repo rate lower than 25 basis points for the four models in Figure 4. All four models therefore imply a substantial probability of a repo rate that is practically zero until the end of year 2010.

During the second half of 2009 the Riksbank has noted that the market repo rate forecast (calculated from implied forward rates, see above)

Figure 7.The figure displays the probability of a repo rate lower than 25 basis points for the four models in Figure 4

Legend:
- Normal
- Gamma – expected value forecast
- Gamma – median forecast
- Gamma – Normal – median forecast

is higher than the Riksbank's point forecast. This could be seen as an indication that the market does not share the Riksbank's view of the macroeconomic outlook or that the Riksbank has not succeeded in gaining support for its intentions. However, it is fully possible that the Riksbank's and the market *point forecasts* can diverge despite having the same underlying forecast distribution, see Box 1. If, for example, the Riksbank's forecast is a median, while the market forecast is an expected value, the skewness of the gamma distribution when interest rates are low will lead to the expected value forecast being higher than the median forecast. Figure 8 compares the market repo rate forecast on two occasions with the Riksbank's implied expected value forecast for the gamma-normal model (where the Riksbank is assumed to publish a median forecast). It is clear that the market forecasts are considerably higher than the Riksbank's published forecast in the second year of the forecast period, but that the Riksbank's implied expected value forecast lies much closer to the market forecast in the same period of time. Hence a reinterpretation of the Riksbank's point forecast as a median rather than an expected value could explain a great deal of the gap between the market expectations and the Riksbank's forecast.

SIMULTANEOUS FORECAST BANDS

The forecast bands in Figure 1 are a number of forecast intervals, one for each forecast horizon, that are connected by lines. The forecast intervals for each forecast horizon are *marginal intervals*, over both variables and forecast horizons. This means that the intervals do not contain any

Figure 8. Comparison of the Riksbank and the market repo rate forecasts with expected value forecasts in the gamma-normal model. July 2009

Legend:
- Outcome
- Riksbank forecast
- RB – implied expected value forecast
- Market forecast
- 50%
- 75%
- 90%
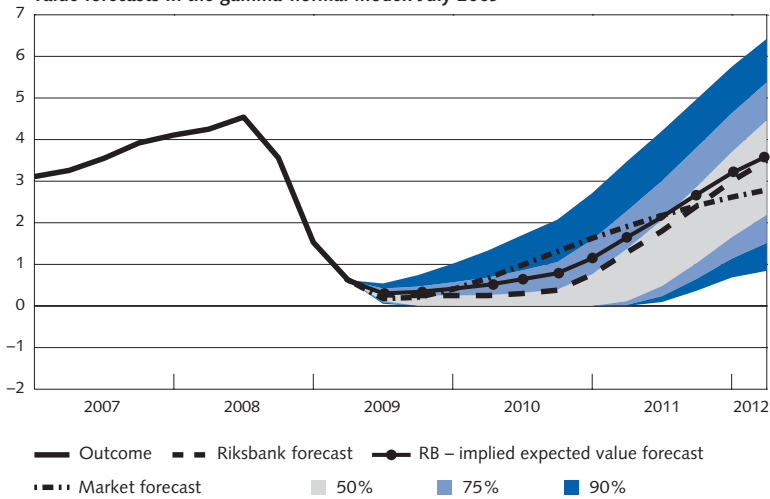
information on relationships between variables (for example the correlation between GDP growth and inflation) or relationships over different forecast horizons (for example the correlation between inflation one or two years ahead respectively). In this section we will describe these facts in detail, as well as give an account of different types of forecast bands proposed in scientific literature to describe relationships over forecast horizons.

In situations with more than one variable, simultaneous probability distributions are used to describe the co-movement of the variables. From a simultaneous probability distribution of $p(y,\pi)$ for GDP growth (y) and CPI inflation (π) one can for example calculate the probability of negative growth $(y<0)$ *at the same time* as inflation exceeds the Riksbank's tolerance interval $(\pi>3)$. There are two important distributions that can be derived from a simultaneous distribution: conditional distributions and marginal distributions.

Conditional distribution is the distribution for inflation π given a certain value of GDP growth y and is denoted $p(\pi|y)$. This distribution is more geared to scenario analysis and can answer questions of the type: what is the forecast distribution of inflation *given* that GDP growth is zero per cent?

The *marginal distribution* for π is the distribution for inflation alone, taking in account all possible outcomes for GDP growth by means of probability weighting for these different outcomes.[22] It is important to

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22 The marginal distribution of inflation is calculated as $p(\pi) = \int p(\pi|y)p(y)\mathrm{d}y$, where $p(y)$ is the marginal distribution of y.

understand that the marginal distributions can be derived from the simultaneous distribution, but not vice versa: it is not possible to recreate the simultaneous distribution from the marginal distributions. In other words, the marginal distributions say nothing of the dependence between variables; see the illustration in Figure 9 that shows that two bivariate distributions with different correlation coefficients can have identical marginal distributions. The uncertainty bands that the Riksbank presents in the Monetary Policy Report are marginal distributions for GDP growth, CPI inflation and the repo rate, hence they contain no information about the Riksbank's view of the future *covariance* between variables.

However, the marginal distributions must be consistent between variables and in this sense there is some relation between the variables remaining in the marginal distributions. If, for example, the repo rate is determined by a simple Taylor rule without regard to the real economy, i.e. $r_t = 1.5\pi$ then $\mathrm{Var}(r_t) = 1.5^2\mathrm{Var}(\pi_t)$ is applicable, in other words the interval width for the repo rate should be 1.5 times greater than for inflation.

In the same way as it is possible to speak of relationships *between variables* for a given forecast horizon, it is possible to speak of the relation of an individual variable *over the forecast horizons* (for example what is the probability of inflation exceeding 3 per cent in **both** a 1 and 2 year perspective?). But the uncertainty regions in Figure 1 are a number of *marginal* forecast intervals that are linked together with lines, which thus do not contain any information about covariance over forecast horizons.[23] Consequently the 90 per cent forecast bands in the Monetary Policy Report do *not* describe the area where the future outcome *path* will be with a probability of 90 per cent, since this event includes all the 12 forecast horizons simultaneously. The forecast bands in Figure 1 must be read forecast horizon for forecast horizon, and it may therefore be slightly misleading to link these marginal intervals by lines as in Figure 1, but this representation has been adopted by all central banks that present forecast intervals. From now on we will call the linked marginal intervals in Figure 1 *marginal bands*, to differentiate them from *simultaneous bands* that represent the simultaneous distribution over all forecast horizons.

The actual simultaneous probability that an outcome path for example for the repo rate will fall inside the 90 per cent marginal bands in Figure 1 is considerably lower than 90 per cent. If, for example, we

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[23] The interval around for example the four-step forecast ($h = 4$) has thus been computed from the marginal distribution

$$p_T(y_{T+4}) = \iiint p_T(y_{T+1}, y_{T+2}, y_{T+3}, y_{T+4})\, dy_{T+1}\, dy_{T+2}\, dy_{T+3},$$

where the uncertainty around the outcomes y_{T+1}, y_{T+2} and y_{T+3} has been integrated out.

Figure 9. Illustration showing that two simultaneous distributions with different correlation coefficients can have identical marginal distributions. The simultaneous distributions are represented by elliptical contours of the same density and the marginal distributions are indicated by shadowed areas in the diagrams
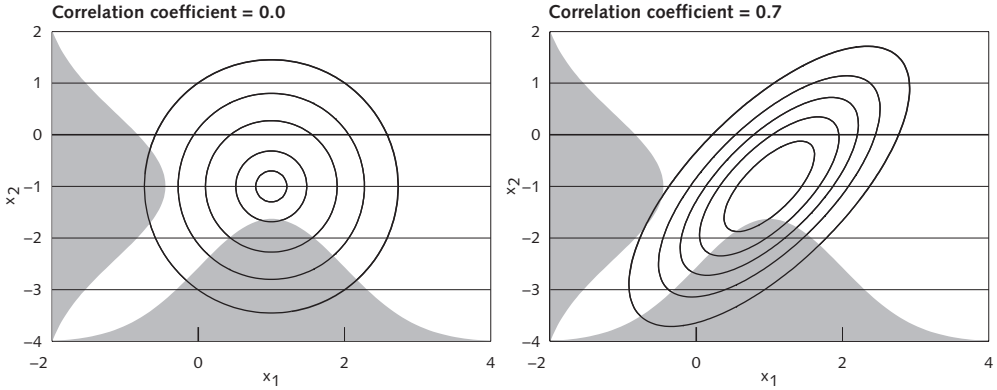
assume an extreme case where a variable follows an independent process entirely without persistence then the probability that the outcome path will fall within the marginal bands is $0.9^{12} \approx 0.282$. To calculate the equivalent probability for a more persistent process, we simulate 1000 time series with 200 observations each from an autoregressive process of the first order (AR(1)):

$$y_t = \mu + p(y_{t-1} - \mu) + \varepsilon_t, \; \varepsilon_t \overset{iid}{\sim} N(0, \sigma^2), \tag{3}$$

with $\mu = 2$, $\sigma = 0.25$ and $p \in \{0.25, 0.5, 0.75, 0.9\}$. For each simulated time series we estimate the AR(1) model in Equation 3 recursively over the entire random sample, and as of time $t = 100$ a point forecast is calculated in each time period with associated forecast interval 1–12 quarters ahead. The forecast interval is only calculated using the historical forecast errors that are available at the time of the calculation. The first forecast is made in period $t = 100$ and then uses all available forecast errors as of $t = 51$ up to and including period $t = 100$. This design is intended to imitate the Riksbank's way of calculating forecast intervals, with the important difference that here we know the data-generating process (but not its parameters). For each simulated time series we register the proportion of intervals that include the entire outcome path $y_{t+1},\ldots,y_{t+12}$, which is a simulation approximation of the forecast bands' simultaneous coverage probability. This exercise is similar to that in Table 3 in Jorda and Marcellino (2010), but here we take into account the estimation uncertainty in both the point forecast and the estimated RMSE figures in an attempt to better imitate the actual situation of the Riksbank.

The results of the simulations are reported in Table 3, which shows that the actual probability that the *entire* outcome path will fall inside

all the 12 marginal intervals is very much lower than the coverage probability of the marginal intervals even for very persistent processes (see the lines called 'Marginal bands'; the results of the other lines in Table 3 are explained below).

One could consider supplementing Figure 1 with a corresponding graph with the simultaneous forecast bands. The problem here is to reduce a 12-dimensional simultaneous distribution to something that is drawn in a two-dimensional figure in the form of forecast bands. A simple approach is to utilise the Bonferroni inequality to create simultaneous forecast bands. Bonferroni bands with simultaneous probability $1 - \alpha$ are calculated using a formula similar to that for the marginal interval (cf. Equation 1) [24]

$$y_t^{(h)} \pm z_{a/2H} \times \text{RMSE}(h), \tag{3.3}$$

but note that here we use the $a/2H$ percentile in the $N(0,1)$ distribution, where H is the maximum number of forecast horizons in the figure, i.e. $H = 12$ in Figure 1.[25] Where we in the previous case of 90 per cent marginal intervals used the value $z_{0.05} = -1.645$, here use the value $z_{0.05/12} = -2.638$ for a 90 per cent Bonferroni band. Bonferroni bands are conservative: a 90 per cent Bonferroni band has a simultaneous probability of *at least* 90 per cent (if the model is correct and its parameters known). Table 3 shows that the Bonferroni bands come very close to the target probability for the 75 per cent and 90 per cent bands, but give far too wide 50 per cent bands, particularly if the process is persistent. Higher order Bonferroni bands have been studied in Ravishanker et al. (1991) who found them more correct than the ordinary (first order) Bonferroni bands.

The Bonferroni bands are designed to control the simultaneous probability for outcome paths. Somewhat vaguely it can be said that a secondary effect of this is that the highest priority of these forecast bands is to prevent the outcome paths being outside the bands too often for one single forecast horizon; see Jorda and Marcellino (2010) for a more precise formulation. Jorda and Marcellino (2010) argue that this fixation on single forecast horizons may be suitable for certain applications in financial economics, but that it is less reasonable for macroeconomic analysis. They instead advocate Scheffé's S-method (Scheffé, 1959) for creating simultaneous forecast bands. Scheffé bands are designed to control the Maha-

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[24] Bonferroni's inequality says that $\Pr(\cap_{h=1}^{H} E_h) \geq 1 - \sum_{h=1}^{H} \Pr(\bar{E}_h)$, where E_h is the event in which the outcome y_{T+h} lies within the marginal interval at the forecast horizon h, $\bar{E}_h$ is the complementary event of E_h, i.e. that the outcome will lie outside the marginal interval. If the probability for each marginal interval is set at $1-\alpha/H$ we thus get $\Pr(\bar{E}_h) = \alpha/H$, and the simultaneous probability for the forecast band then fulfils the inequality $\Pr(\cap_{h=1}^{H} E_h) \geq 1 - \alpha$, i.e. Bonferroni bands give a simultaneous probability of at least $1-\alpha$.

[25] It should be mentioned that Bonferrroni bands **do not** assume independence over forecast horizons, which is too often wrongly asserted in the literature.

50-per cent forecast band				
	$\rho = 0.25$	$\rho = 0.50$	$\rho = 0.75$	$\rho = 0.90$
Marginal bands	0.0006	0.0009	0.0046	0.0168
Bonferroni	0.5880	0.6142	0.6508	0.6909
Scheffé	0.0693	0.1916	0.3826	0.4896
Scheffé top-down	0.0083	0.0473	0.1868	0.2904
75-per cent forecast band				
	$\rho = 0.25$	$\rho = 0.50$	$\rho = 0.75$	$\rho = 0.90$
Marginal bands	0.0435	0.0609	0.1198	0.1857
Bonferroni	0.7622	0.7628	0.7879	0.7859
Scheffé	0.1537	0.3190	0.5287	0.5968
Scheffé top-down	0.1846	0.3635	0.5686	0.6295
90-per cent forecast band				
	$\rho = 0.25$	$\rho = 0.50$	$\rho = 0.75$	$\rho = 0.90$
Marginal bands	0.2912	0.3427	0.4153	0.4967
Bonferroni	0.8865	0.8830	0.8804	0.8825
Scheffé	0.2453	0.4530	0.6252	0.6956
Scheffé top-down	0.5759	0.7414	0.8252	0.8564

lanobis distance between the forecast path and outcome path, which means that this method lays more weight on deviations at more than one forecast horizon. In Table 3 we see that the Scheffé bands are too narrow at the 50, 75 and 90 per cent level, but that they become more correct at higher persistence levels. Note, however, that the Scheffé bands are not designed to control the simultaneous probability for outcome paths in the sense that we measure in Table 3. However, the Scheffé bands are much better than the Bonferroni bands at controlling the Mahalanobis distance between the outcome path and the point forecast; see the simulation results in Table 3 of Jorda and Marcellino (2010).

In the academic literature on forecast bands it is implicitly assumed that simultaneous forecast bands should always be presented. However, there are two good reasons for using marginal bands in practice: i) simultaneous bands have the disadvantage that it is not possible to identify for example the forecast interval for inflation 1 year ahead, ii) the width of simultaneous bands depends on the choice of maximum forecast horizon, H; in other words the simultaneous bands will be different if the Riksbank decides to present them for 1–8 quarters compared with 1–12 quarters. In the same way the simultaneous bands for inflation will be very different if they are presented as monthly outcomes ($H=36$) or quarterly outcomes ($H=12$). The latter problem is discussed in Jorda and Marcellino (2010) and they propose a top-down approach in which the simultaneous intervals no longer depend on H. The simulation results in Table 3 show that

these modified Scheffé bands actually give a more correct simultaneous probability for the 75 per cent and 90 per cent forecast bands than the original Scheffé bands, but the top-down approach works less well for the 50 per cent forecast band.

Figure 10 illustrates the different forecast bands for the repo rate in the Monetary Policy Report of July 2009. All types of simultaneous bands are considerably wider than the marginal bands, particularly for the lower coverage probabilities 50 and 75 per cent.

Conclusions

We have described how Sveriges Riksbank computes forecast intervals for the repo rate, CPI inflation and GDP growth using a method based on the variation in historical forecast errors. The method is simple and easy to understand and has the advantage of not being dependent on a specific model. This means that the intervals also include uncertainty about the functioning of the economy. However, Sveriges Riksbank started to publish its own repo rate forecast only relatively recently, which means

Figure 10. Illustration of different ways of designing simultaneous forecast bands for the repo rate in the Monetary Policy Report, July 2009
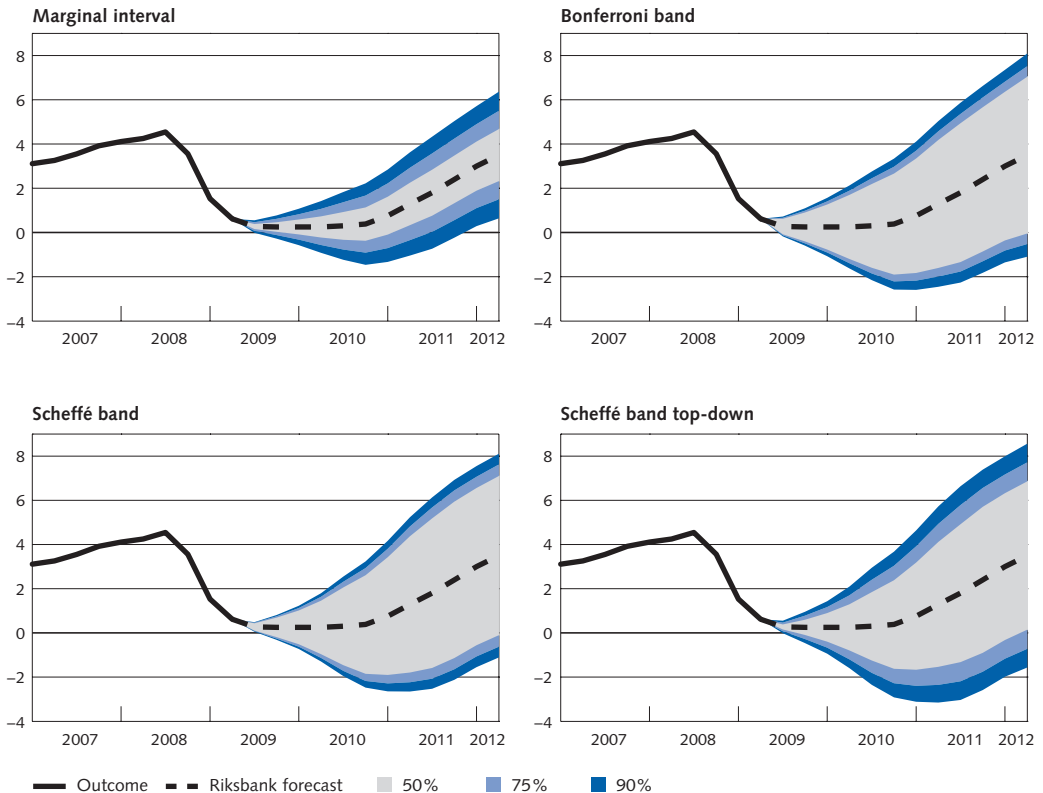
that only a few forecast errors are available for this variable, particularly for the longer forecast horizons. We describe how the Riksbank has chosen to solve this problem by instead using the implied repo rate forecast, adjusted for forward premiums, from the financial market.

We have proposed a number of potential improvements to the Riksbank's current interval structure, including a method of introducing time variation in the width of the forecast intervals. This change has the advantage of allowing the forecast bands to be wider in times of more uncertainty, for example. The fact that the repo rate is very close to its lower bound (which is zero or slightly lower) also makes new demands on the forecast bands. We have therefore introduced a simple way of designing forecast intervals for the repo rate in the same spirit as the current method, but where the repo rate cannot be negative. Finally, we also discussed the pros and cons of different methods of designing forecast bands that describe the simultaneous uncertainty over all 12 forecast horizons.

We want to conclude this article by again pointing out that the Riksbank's forecast interval describes general economic uncertainty, hence differing from the point forecast, which should be understood as the Riksbank's intention; see Section 1. However, it must not be ruled out that the forecast bands will in future be supplemented or replaced by forecast bands with an intention interpretation. The Riksbank's main model for structural analysis, Ramses (Adolfson et al., 2007b), was implemented relatively recently with optimal monetary policy (Adolfson et al., 2008b), and could therefore be used for this purpose. It is an open question whether this model generates forecast bands with reasonable width or if the model needs to allow time variation in the disturbance variances to achieve correct interval probability.

Appendix A. Financial model of the yield curve for Swedish interest bearing government securities

The Riksbank uses a three-factor model to model how the yield curve for Swedish interest-bearing government securities develops over time; see for example Backus et al. (2000) for an examination of multi-factor models. According to the model, both the short-term interest rate and more long-term bond rates depend on three factors $x_t = (x_{1t}, x_{2t}, x_{3t})$ which are assumed to follow the model

$$x_{t+1} = \Phi x_t + \varepsilon_t,$$

where ε_t is an exogenous stochastic shock with diagonal covariance matrix Σ, and the shocks are here assumed to be independent innovations. The short-term interest rate is determined according to the equation

$$r_t = d_0 + x_{1t} + x_{2t} + x_{3t}.$$

In the model it is also assumed that it is not possible to make risk-free arbitrage profits between bonds with different maturities, and that the interest on all bonds follows the fundamental pricing relation

$$P_t = E_t(P_{t+1} M_{t,t+1})$$

which states that the bond price is the expected discounted future price of the bond. The discount is determined by the stochastic discount factor M, which is determined by the short-term interest rate, the price of risk λ, the shocks to x_t and the covariance matrix of the shocks

$$M_{t,t+1} = e^{-r_t - \lambda' \Sigma \lambda/2 - \lambda' \varepsilon_{t+1}}.$$

On the basis of these assumptions it can be shown that the interest y on zero coupon bonds with maturity n is also dependent on the three factors, the short-term interest rate, the risk price and the variance of the factors (see Ang and Piazzesi (2003) for a derivation)

$$y_t(n) = -\frac{1}{n} [A(n) + B(n)' x_t]$$

where

$$A(n) = A(n-1) + B(n-1)' \Sigma B(n-1)/2 - d_0 - B(n-1)' \Sigma \lambda$$

and

$$B(n) = B(n-1)' \Phi - 1.$$

Maturity premiums that depend on the risk price λ are included in $y_t(n)$. But because the model can identify risk premiums for different maturities the model can also be used to compute forward rates where the risk premium component is excluded. This forward rate f_t^* for short-term interest rate r in n time units can be written as

$$f_t^*(n) = d_0 + \Phi^n x_t.$$

By calculating $f_t^*(n)$ for all n up to the forecast horizon (36 months) and for all observed (monthly) forward rate curves since 1998 the model's interpretation of the market priced short-term interest rate forecast is obtained. $f_t^*(n)$ is the forecast used to calculate the RMSE values that describe the historical forecast accuracy of the repo rate.

The three underlying factors of x_t are not directly observable. To provide a statistical inference for the x_t-process the three factors are linked to observable measurement variables. The measurement variables used by the Riksbank are computed zero coupon rates (to avoid the complexity of coupon interest rates) for government bonds and survey responses concerning market analysts' repo rate expectations (Kim and Orphanides, 2005). The data is monthly and the short-term interest rate in the model is therefore the one-month rate, which is considered to be a decent approximation of the Riksbank's policy rate. The Kalman filter is used to infer the underlying factors of x_t on the basis of the observed measurement variables (Hamilton, 1994). Simultaneously with this filtering the model's parameters are estimated with the maximum likelihood method.

As the Riksbank further develops this model it may include risk premiums that are allowed to vary over time. However, that type of development requires a more advanced estimation procedure and evaluation of the estimated model's properties.

Appendix B. RMSE-based interval from a gamma distribution

THE RIKSBANK'S FORECAST AS AN EXPECTED VALUE

If we regard the Riksbank's forecast as an expected value the gamma distribution's parameters can be computed by solving the following equation system for α_h and β_h

$$E(Y) = \alpha_h \beta_h = \hat{y}^{(h)}$$

$$Std(Y) = \sqrt{\alpha_h} \beta_h = RMSE(h)$$

which gives the solution

$$\alpha_h = \left(\frac{\hat{y}^{(h)}}{RMSE(h)} \right)^2$$

$$\beta_h = \frac{RMSE(h)^2}{\hat{y}^{(h)}}.$$

THE RIKSBANK'S FORECAST AS A MEDIAN

If we instead regard the Riksbank's forecast as a median the forecast errors are $e_t = y_t - Median(y_t \mid y_{t-1}, y_{t-2}, \ldots)$, where $Median(y_t \mid y_{t-1}, y_{t-2}, \ldots)$ is the median in the gamma forecast distribution. To solve for the two parameters of the gamma distribution α_h and β_h we now need expressions for the median in a gamma distribution and for $E(e_t^2)$ (which is matched with $(1/T)\sum_{t=1}^T e_t^2) \sim Gamma(\alpha, \beta)$ then the following holds

$$Median(Y) = \beta \Gamma^{-1}(\alpha, 1/2)$$

and

$$E[Y - Median(Y)]^2 = \beta^2 \{ \alpha(1+\alpha) - 2\alpha\Gamma^{-1}(\alpha, 1/2) + [\Gamma^{-1}(\alpha, 1/2)]^2 \}$$

where $\Gamma^{-1}(\alpha, 1/2)$ is the inverse of the regularised incomplete gamma function (Abramowitz and Stegun, 1965). If the forecast distribution is *Gamma* (α_h, β_h) and the Riksbank's point forecast is to be regarded as a median then the forecast distribution parameters can be computed by solving the non-linear equation system

$$\beta_h \Gamma^{-1}(\alpha_h, 1/2) = \hat{y}^{(h)}$$

$$\beta_h^2 \{ \alpha_h(1+\alpha_h) - 2\alpha_h\Gamma^{-1}(\alpha_h, 1/2) + [\Gamma^{-1}(\alpha_h, 1/2)] \} = RMSE(h)$$

for α_h and β_h. If we substitute $\beta_h = \hat{y}^{(h)}/\Gamma^{-1}(\alpha_h, 1/2)$ in the second equation we can then solve the equation

$$(\hat{y}^{(h)})^2 \left[\frac{\alpha_h(1+\alpha_h)}{(\Gamma^{-1}(\alpha_h, 0, 1/2))^2} - \frac{2\alpha_h}{\Gamma^{-1}(\alpha_h, 0, 1/2)} + 1 \right] = RMSE(h)$$

numerically for α_h using for example Newton's method. The solution for β_h is now given by $\beta_h = \hat{y}^{(h)}/\Gamma^{-1}(\alpha_h, 1/2)$.

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Ten years as an independent central bank

On 11 September 2009, the Riksbank arranged
a conference to mark the fact that it
became formally independent ten years ago.
At the conference, three papers were presented and
commented on by selected individuals.
These papers and comments are presented below.

Policy expectations and policy evaluations: The role of transparency and communication

Author: Lars E.O. Svensson, Deputy Governor of the Riksbank

Comments: Jan F. Qvigstad, Deputy Governor of Norges Bank

The Executive Board of the Riksbank and its work on monetary policy – experiences from the first ten years

Authors: Mikael Apel, Carl Andreas Claussen and Petra Lennartsdotter of the Riksbank's Monetary Policy Department

Comments: Lars Heikensten, member of the European Court of Auditors and former Governor of the Riksbank

How has the Riksbank managed the financial crisis?

Author: Johan Molin of the Riksbank's Financial Stability Department.

Comments: Peter Englund, Professor, Stockholm School of Economics

Policy Expectations and Policy Evaluations: The Role of Transparency and Communication[*]

Lars E.O. Svensson
Sveriges Riksbank and Stockholm University
First version: July 2009
This version: November 2009

Abstract

The development of the Riksbank's transparency and communication since its independence in 1999 is reviewed. The Riksbank's record on the management of market expectations of future policy rates after the publication of policy-rate paths in February 2007 is examined, with a focus on the exceptional deviations of market expectations from published policy-rate paths since April 2009. The possible explanations discussed include differing views of future economic developments, communication challenges associated with very low interest rates and perhaps exaggerated lower-bound problems. The consequences of such large deviations of market expectations may be severe and potentially imply a much more restrictive monetary policy than intended. Whether the Riksbank's transparency and communication are sufficient for effective accountability and evaluation is assessed, and it is shown that tools are available for the effective real-time evaluation of the Riksbank's policy. Some conclusions and suggestions for possible improvements in the Riksbank's transparency and communication are offered.

1. Introduction

The arguments in favor of transparency in monetary policy are strong and well known. Transparency will improve private-sector information, reduce uncertainty about central-bank information and policy intentions, and therefore contribute to better decisions by economic agents. Transparency permits a more effective external scrutiny and evaluation of monetary policy and thereby improves the incentive of central banks to achieve their targets. It may also improve the implementation of monetary policy by allowing central banks to affect private-sector expectations more effectively, especially about future policy rates. Transparency also strengthens the democratic accountability of independent central banks.

The Riksbank is ranked as one of the world's most transparent central banks (Dincer and Eichengreen 2007, Eijffinger and Geraats 2006).[1] The Riksbank is not only very transparent; it is also very transparent about its transparency and communication. After much internal work, the Riksbank's Executive Board adopted a revised communication policy for all the Riksbank's activities in May 2008 (Sveriges Riksbank 2008a). In particular, a new communication of monetary policy was introduced and is described in a separate appendix (Sveriges Riksbank 2008b). A separate document presents the Riksbank's detailed rules for communication (Sveriges Riksbank 2008c). These documents are all available on the Riksbank's website, www.riksbank.com. The Riksbank also publishes a separate document each year to assist the Parliament's Finance Committee in its assessment of monetary policy (Sveriges Riksbank 2009a).[2] An appendix lists the main events in the evolution of the Riksbank's transparency and communication.

The paper is outlined as follows. In section 2, I will very briefly describe how the Riksbank's transparency and communication have evolved since the Riksbank became independent in 1999.[3] In section 3, I will examine to what extent the Riksbank has succeeded in managing expectations of future policy rates after it started publishing its own repo-rate path in February 2007. Since April 2009, there has been a large and unprecedented difference between market expectations of future repo rates and the published repo-rate path, and the Riksbank has hence faced substantial problems in managing such expectations and maintaining the credibility of the repo-rate path. Therefore, most of the discussion will

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[1] Geraats (2008) provides a survey of transparency trends in central banking. Blinder, Ehrmann, Fratzscher, De Haan, and Jansen (2008) provide a survey of theory of and evidence on central-banking communication and monetary policy.

[2] Previously, this material was included in one issue of the *Monetary Policy Report*.

[3] Apel and Vredin (2007) provide a thorough account of the development of the Riksbank's transparency and communication up to the early spring of 2007.

focus on this very recent period. Then, in section 4, I will discuss to what extent the Riksbank's transparency and communication permit the effective accountability and evaluation of its monetary policy, with examples from a few of the recent policy decisions. In section 5, I will use tools developed for evaluation purposes to discuss the possible consequences of a lack of credibility of the repo-rate path and thereby how important it is for a central bank to achieve credibility for its policy-rate path. Finally, in section 6, I will end with some conclusions and suggestions for possible improvements in the Riksbank's transparency and communication. An appendix lists the main events in the evolution of the Riksbank's transparency and communication.

2. How have the Riksbank's transparency and communication evolved?

In January 1999, changes in the Constitution and a new Riksbank Act made the Riksbank more independent. Since then, monetary policy decisions have been made by an Executive Board with six members. Minutes from the Board's monetary policy meetings were published from the start. In February 1999, the new Executive Board issued a "clarification" which noted that the inflationtargeting that the Riksbank conducted before 1999 would continue and explained that monetary policy did not aim exclusively at achieving the inflation target but also took the real economy into account in the sense of avoiding excessive variability in the real economy. The Riksbank had announced an inflation target of 2 percent in January 1993, to be applied from January 1995, and had published an *Inflation Report* since October 1993 (initially it was called *Inflation and Inflation Expectations in Sweden* and was a publication of the Riksbank's Economics Department only). The *Inflation Report* gradually became more elaborate and informative with forecasts of inflation and the real economy. These forecasts were conditional on a constant policy rate. [4]

The Riksbank had developed a simple policy rule with a strong emphasis on the inflation forecast at a two-year horizon, conditional on the policy rate remaining constant within the forecast horizon. According to this rule, if the two-year inflation forecast was above the inflation target of two percent the policy rate was raised, and if it was below the target the policy rate was lowered. The clarification of February 1999 and later pronouncements emphasized that the horizon was not necessarily fixed at two years but could be adjusted depending on the real economy,

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[4]   Apel and Vredin (2007) provide a description of the Riksbank's inflation-targeting policy before 1999.

in particular in order to avoid too much variability in output and employment.

The assumption of a constant policy rate was associated with numerous problems. It was often very unrealistic, led to inconsistent forecasts and made forecast evaluations difficult (see, for instance, Woodford 2007a).[5] Therefore, from 2005, forecasts were instead conditional on a policy-rate path given by market expectations of future policy rates. Although this assumption was more realistic, it was not without problems. The Riksbank and the market did not necessarily share the same view of the future policy rate, especially when inflation forecasts conditional on market expectations of the policy rate deviated from the inflation target. In February 2007, following the previous practice of the Reserve Bank of New Zealand since 1997 and Norges Bank since 2005, the Riksbank started publishing its own forecast for the policy rate and consequently made a conscious decision about what future policy rates were appropriate (Rosenberg, 2007). The forecast horizon for published forecasts was also extended from two to three years. The *Inflation Report* was renamed *Monetary Policy Report* and the new report included a more extensive monetary policy discussion and not just forecasts conditional on market expectations of future policy rates.[6]

Some central-bank observers remain sceptical about the value of publishing policy-rate forecasts, for instance, on the grounds that there is considerable uncertainty about future policy rates and that forecast errors will be large. However, because of the lags in the response of inflation and the real economy to policy-rate changes, good monetary policy requires that central banks base their policy decisions on forecasts. Furthermore, in order to make forecasts of inflation and the real economy, central banks need to condition forecasts on some interest-rate path. The whole policy-rate path matters; the policy rate for the first few months matters very little for the forecasts of inflation and the real economy. For a central bank, not to discuss and select a particular policy-rate path would entail an incomplete decision-making process. Not to publish the policy-rate path would be to hide the most important information.

In May 2007, the Riksbank announced that press conferences will be held after each monetary-policy meeting, that normally no information about the repo-rate decision (signaling) will be conveyed before monetary-policy meetings and that the minutes of the monetary policy meetings, which are published about two weeks after the meetings, will

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[5] Jansson and Vredin (2004) provide a discussion of decision-making at the Riksbank and related problems before the introduction of the Riksbank's own repo-rate path.

[6] It may still be of interest to compute forecasts conditional on market expectations of future policy rates, in order to examine the possible consequences of a lack of credibility of the published policy-rate path, as we shall see in section 5.

be attributed. In May 2008, the Riksbank announced an updated explicit communication policy for all Riksbank activities, including monetary policy. Before monetary-policy meetings, some public comments on data and outcomes relative to previous Riksbank forecasts and on policy trade-offs may be given, but Board members agreed to give no indication of the coming repo-rate decision since this would in effect bring the policy decision forward and arguably make it harder to hold the board accountable for its decisions. (The signaling practice is further discussed below.)

In April 2009, the Riksbank decided to publish how individual members had voted at the same time as the monetary-policy decision is announced. This makes it immediately apparent whether the decision was unanimous or whether there were any reservations. Furthermore, any reservations are published with names and brief explanations.

3. How has the Riksbank succeeded in the management of policy-rate expectations?

A major ingredient in transparency about monetary policy is the publishing of a policy-rate path. The Reserve Bank of New Zealand started doing this in 1997. Norges Bank followed in 2005, the Riksbank in February 2007, the Sedlabanki Islands in March 2007 and the Czech National Bank in 2008. Monetary policy works through the expectations about future policy rates that it gives rise to and monetary policy is largely the management of expectations (Woodford 2005). Therefore, it would seem that publishing a policy-rate path is the best way to manage interest-rate expectations, especially since central banks should have better information about their own intentions than anyone else. Given this, it remains a bit of a mystery why still so few central banks choose to publish a policy-rate path.

The Riksbank publishes and explains a forecast of the repo rate, inflation and the real economy after each policy meeting. What is the Riksbank's record on managing interest-rate expectations? The period from February 2007 until now (November 2009) is too short for any substantive empirical analysis. A simple way to examine the management of policy-rate expectations is to compare the published policy-rate path to market expectations immediately before and after the announcement.[7] I made such a preliminary comparison in Svensson (2009c). The conclusion through 2008 is that the management of policy-rate expectations has

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[7] Market expectations are implied forward-rate curves that have been adjusted by the Riksbank staff for possible risk premia so as to be the staff's best estimate of market expectations of future repo rates. Depending on the maturity, the forward-rate curve is derived from the rates for STINA (Tomorrow-Next Stibor interest-rate swaps) contracts, FRAs (Forward Rate Agreements), or interest-rate swaps.

been pretty good, but not a complete success. In many cases, expectations were already prior to publication in line with the repo rate path, which is a tribute to the market's ability to predict and understand monetary policy and to the Riksbank's ability to conduct a predictable policy. When there were some discrepancies, in most cases the market adjusted its expectations towards the policy-rate path after the announcement. There are a couple of exceptions, discussed in Svensson (2009c). The conclusion in that study is that, overall, the policy-rate path seems to be taken more seriously over time by the market, and the credibility of the policy-rate path in the sense of proximity between the path and market expectations has mostly been good.

SIGNAL OR NOT?

One of the exceptions is February 2008. Then the Riksbank kept its repo-rate path unchanged and increased the repo rate in accordance with the path. The market had expected a constant repo rate and a shift down of the repo- rate path and was much surprised (see Svensson 2009c for a more detailed discussion). Particularly after the February 2008 surprise, the market was quite insistent about receiving more information about future decisions. In previous years, the market had become used to receiving some hints about the forthcoming decision and the Riksbank had developed a practice of signaling the forthcoming decision. There are at least two problems with such signaling. First, it would require a decision by the Executive Board on what to signal. This would in practice move the policy decision to a point in time earlier than the final policy meeting. Alternatively, individual board members could signal for themselves, but this could turn into a cacophony before each meeting. Second, it would not necessarily reduce the element of surprise but rather move the surprise to an earlier date. Evaluating the predictability of monetary policy in terms of the degree of surprise at the official policy announcement would then be misleading, and the "true" predictability might not have improved. This does not exclude that there are some special situations when temporary signaling might be warranted, for instance, if market expectations of the future repo rate differ significantly from the Riksbank's published repo rate, a situation that I will discuss further below.

During 2007, the Riksbank instituted changes in its Rules of Procedure and Instructions that, among other things, reinforce the principle that all Board members should have an equal influence not only on the monetary-policy decisions but also equal influence on and information about the whole decision-making process, thus strengthening the individualistic character of the Board and the individual accountability of its

members. Since the majority decision is not made until the final policy meeting, any signaling by a member might pre-commit him or her and distort the final decision, and since the published repo-rate path should provide a fair amount of forward-looking information, the Riksbank decided in May 2007 not to signal future decisions between policy meetings unless there are exceptional changes in the economic situation. However, in order to accommodate the persistent demands from the market and other interested parties, in the new communication policy of May 2008 Board members agreed that they may comment on new developments in relation to previous Riksbank forecasts and the relevant trade-offs, still without anticipating the member's or Board's position on upcoming decisions unless there are exceptional circumstances.

THE CREDIBILITY PROBLEM FROM APRIL 2009

Whereas my conclusion from Svensson (2009c) was that the Riksbank's management of policy-rate expectations had been pretty successful through December 2008, the experience so far during 2009 is different and quite interesting. Since April 2009, there has been a dramatic and unprecedented decrease in the credibility of the published repo-rate path, which in effect makes actual monetary policy tighter than intended, perhaps much tighter. Figure 1 shows the situation in February 2009. The solid step-shaped black line shows the actual repo rate. The gray curve shows the previous repo-rate path, from the announcement on December 4, 2008. The blue dotted curve shows the new repo-rate path published on February 11, 2009. The repo rate was lowered from 2 percent to 1 percent, and the path was shifted down by slightly more than 100 basis

Figure 1. Repo-rate path and market expectations: February 11, 2009

Legend: Repo rate — Old repo-rate path — New repo-rate path — Day before — After announcement
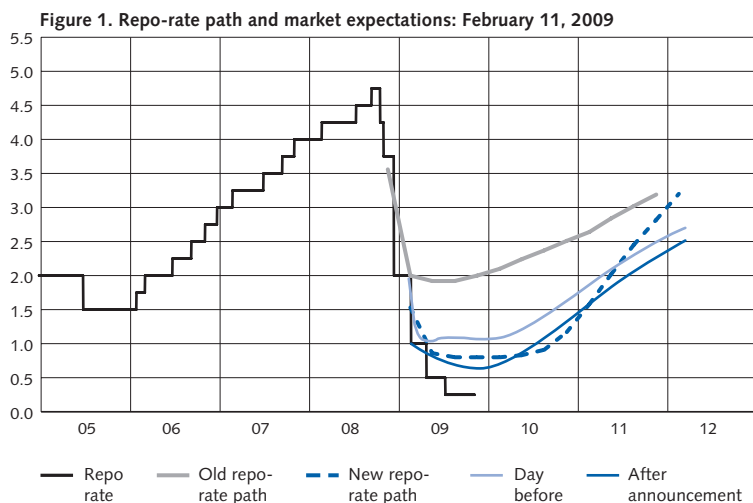
points. The light blue solid curve shows market expectations of the repo-rate path at the end of the day before the announcement. Even though this was a big shift in the repo-rate path, it was anticipated pretty well by the market. The ability of the market to predict and understand monetary policy and the Riksbank's ability to conduct a predictable policy both seemed good. The dark blue solid curve shows the market expectations after the announcement. The alignment between market expectations and the published path is pretty good, at least for the first two years. We can say that the repo-rate path published in February had good credibility.

Figure 2 shows the situation when the new repo-rate path was published on April 21, 2009. The repo rate was lowered by 50 basis points to a new level of 50 basis points. The repo-rate path was shifted down by about 50 basis points and remained flat at 50 basis points through 2010. The light blue curve shows that the market expected the repo rate to be lowered to 25 basis point the dark blue curve shows and that expectations after the announcement shifted up a bit. Importantly, both before and after the announcement, the market expected a substantially higher repo rate during 2010 than the announced repo-rate path.

Hence, April 2009 represents a major exception to the Riksbank's previous mostly successful management of expectations. Since then, the market has expected a repo-rate path that after a few quarters is significantly above the published repo-rate path.[8] This is the way expectations have been since the first day following publication in April. The credibility of the repo-rate path published in April has therefore been low and the

Figure 2. Repo-rate path and market expectations: April 21, 2009

Legend: Repo rate, Old repo-rate path, New repo-rate path, Day before, After announcement

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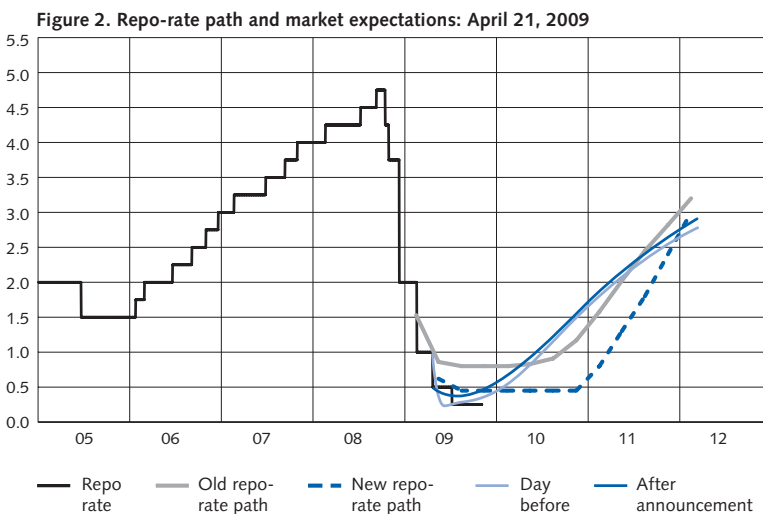
8   Interestingly, there seems to be a discrepancy between the market expectations extracted from market
    prices and the predictions made by market analysts. The latter are closer to the Riksbank's repo-rate path.

Riksbank has failed to bring repo-rate expectations into line with the repo-rate path.

Figure 3 shows the situation in July 2009. The market expected the repo rate to remain at 50 basis points and was surprised that the repo rate was lowered to 25 basis points. The repo-rate path was shifted down by about 25 basis points. After the announcement, market expectations shifted down and agreed with the announced path through 2009 but, as after April, the market expected repo rates in 2010 to be much above the published path.

Figure 3. Repo-rate path and market expectations: July 2, 2009

| | Repo rate | Old repo-rate path | New repo-rate path | Day before | After announcement |
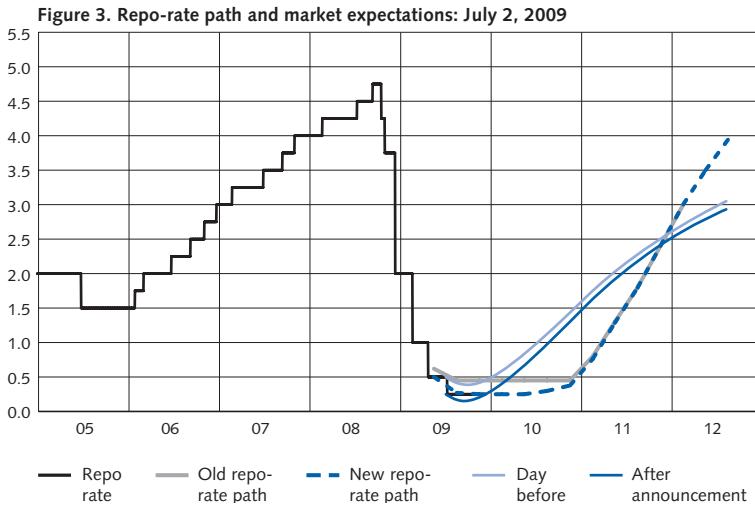
Figure 4 shows the situation in September 2009. The repo rate and repo-rate path were left unchanged from July. Market expectations of future repo rates remained higher than the published repo-rate path. Figure 5 shows the situation in October 2009, which is similar to the one in September.

Figure 6 shows the difference between market expectations and the published repo-rate paths after the announcements of the policy decisions from February 2007 through October 2009, as a function of the number of quarters after the quarter of the policy decision. We see that April through October 2009 stand out with exceptionally large positive differences 3–9 quarters ahead.

Figure 4. Repo-rate path and market expectations: September 3, 2009

| Repo rate | Old repo-rate path | New repo-rate path | Day before | After announcement |
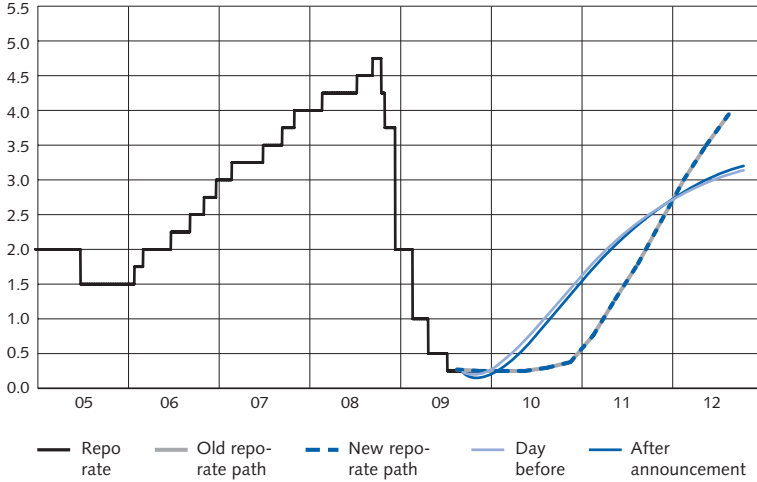
Figure 5. Repo-rate path and market expectations: October 21, 2009

| Repo rate | Old repo-rate path | New repo-rate path | Day before | After announcement |
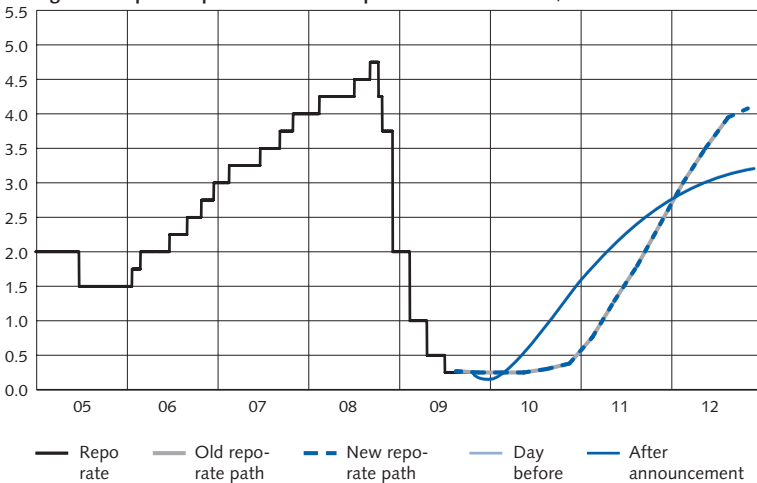
WHY THE LACK OF CREDIBILITY OF THE APRIL AND LATER REPO-RATE PATHS?

What explains the lack of credibility since April, when the credibility of the repo-rate path at previous announcements, and in particular in February the same year, was much better? Why are repo-rate expectations for 2010 and 2011 much higher than the published repo-rate paths since April?

A MORE OPTIMISTIC VIEW OF THE ECONOMY BY THE MARKET?

One possibility is that the market had a more optimistic view of the economy than the Riksbank in April and onwards. The market might have

Figure 6. Differences between market expectations and the repo-rate path, February 2007 through October 2009

Legend:
- Feb 07
- Jul 07
- Oct 07
- Dec 07
- Feb 08
- Apr 08
- Jul 08
- Sep 08
- Oct 08
- Dec 08
- Feb 09
- Apr 09
- Jul 09
- Sep 09
- Oct 09
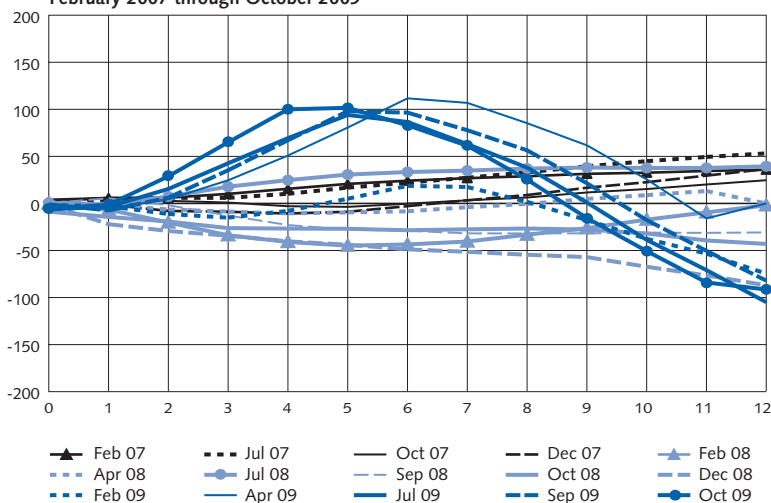
expected higher GDP growth and higher inflation, which might warrant a higher repo rate. However, the GDP and inflation forecasts of other forecasters and in the Consensus forecast in April and thereafter were not systematically higher than the Riksbank forecasts. One would then have to argue that the GDP and inflation forecasts of market participants were significantly higher in April and later than those of other forecasters. I am not aware of any evidence of this. One would also have to argue that such differences arose between February and April.

On the contrary, according to the TNS SIFO Prospera survey,[9] expectations of GDP growth among the money market participants were, in fact, lower than those of the Riksbank. Table 1 shows, for the first and second year, money-market expectations and Riksbank forecasts for GDP growth for in July, September and October 2009.

TABLE 1. MARKET EXPECTATIONS AND RIKSBANK FORECAST 2009 OF GDP GROWTH IN THE COMING FIRST AND SECOND YEAR

	July		September		October	
	Market	**Riksbank**	**Market**	**Riksbank**	**Market**	**Riksbank**
Year 1	−0.78	0.76	1.03	1.85	0.93	2.57
Year 2	1.58	2.99	2.31	3.43	2.33	3.69

Note: In the column for July, the Prospera survey was published in June.

As shown in Table 2, the same survey shows that expectations of inflation among market participants for the first and second year were lower

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9   TNS SIFO Prospera has been commissioned by the Riksbank to undertake a series of surveys, twelve times a year, aiming at mapping expectations of inflation, GDP and future repo rates in Sweden among money market players.

in July, September and October 2009 than the Riksbank forecasts for both CPI and CPIF inflation (except for September and year 1 when the Riksbank's CPI forecast and market expectations were very similar).

TABLE 2. MARKET EXPECTATIONS AND RIKSBANK (RB) FORECAST 2009 OF INFLATION IN THE COMING FIRST AND SECOND YEAR

	July			September			October		
	Market	RB CPIF	RB CPI	Market	RB CPIF	RB CPI	Market	RB CPIF	RB CPI
Year 1	0,80	1,69	1,25	1,10	1,26	1,08	1,10	1,31	1,35
Year 2	1,60	1,95	3,17	1,90	1,94	3,62	1,90	1,95	3,89

Note: In the column for July, the Prospera survey was published in June.

Thus, the discrepancy between market repo-rate expectations and the published repo-rate path in April and later is unlikely to be due to a more optimistic view of the economy.

COMMUNICATION PROBLEMS ASSOCIATED WITH VERY LOW REPO RATES AND THE EFFECTIVE LOWER BOUND FOR THE POLICY RATE?

Another possibility is that very low policy rates and the discussion about the effective zero lower bound for the policy rate posed exceptional communication challenges since April and later for the Riksbank.[10] Since the February 2007 *Monetary Policy Report*, the forecasts that the Riksbank publishes are all supposed to be *mean* forecasts, including the repo-rate path. The Riksbank has frequently repeated the mantra that "the repo-rate path is a [mean] forecast, not a[n unconditional] promise" (my clarifying insertions) and emphasized that the future repo rate may therefore be above as well as below the repo-rate path, with the probability mean equal to the repo rate path.

However, the *Monetary Policy Update* and the minutes from April may have been interpreted to mean that the Riksbank was unlikely to lower the repo rate below 50 basis points. Although the *Update* stated that there was "some probability of a further cut in the future", it also emphasized that "[t]he repo rate is now close to its lower limit" and "[w]ith a repo rate at this level, the traditional monetary policy has largely reached its lower limit". After the repo rate was lowered to 25 basis points in July, the *Monetary Policy Report* stated that "[t]he Riksbank's assessment is that after cutting the repo rate to 0.25 per cent it will have

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10   See Söderström and Westermark (2009) and Svensson (2003) for discussions of monetary policy with zero interest rates and references to the literature on the topic.

reached its lower limit in practice", indicating that a further cut was very unlikely.

It is possible that the market effectively interpreted these statements to some extent in April, and more definitely in July and later as an uncon-ditional promise by the Riksbank not to cut the repo rate further, counter to the principle of the repo rate being "a forecast, not a promise". If the current repo rate is perceived as a minimum, uncertainty about the future repo rate implies that the probability mean of the future repo rate is above the current repo rate. In such circumstances, it is not surprising if the market expects future repo rates to be above the published repo-rate path, and the Riksbank hence fails to gain credibility for the repo-rate path.

Arguably, by allowing the current repo rate to be interpreted as a minimum, the Riksbank's *Update*s and *Report*s of April and later risked becoming contradictory. The forecasts of inflation and resource utiliza-tion were supposed to be contingent on the repo-rate path being a mean forecast, but if the current repo rate was effectively a minimum the true mean repo-rate path would be higher. If the forecasts of inflation and resource utilization were contingent on the higher true mean repo-rate path, they would then be lower than the published ones.[11]

Although unclear communication about means and lower bounds for the repo rate may explain some of the deviations of market expectations from the published repo-rate path in April and onwards, they can hardly explain all of the large deviations on those occasions.

One possibility that probably cannot be excluded is that market expectations made little sense. If this is the case, it is arguably even more important that the central bank is able to affect market expectations, if the difference between market expectations and the published repo-rate path matters.

DOES THE DIFFERENCE BETWEEN MARKET EXPECTATIONS AND THE REPO-RATE PATH MATTER?

If there is a difference between the repo-rate path that the Riksbank publishes and the path that the market expects, it is the expected path that counts. It is the expected repo-rate path that affects what the actual market rates at different maturities will be and that thus affects the real economy. All else being equal, an expected path that is higher than the published path means that the actual and effective monetary policy will

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[11] These issues were debated by the Board in the July and September 2009 minutes, available at www.riks-bank.com.

be tighter than the published and intended one. All else being equal, the actual real interest rates will then be higher than the real interest rates published in the April and July *Update* and *Report*. A true forecast for inflation and resource utilization that takes account of this discrepancy will thus be lower than that in the April and July *Report* and *Update*. I will return to the issue of how serious a problem this is in section 5, after having developed some useful tools in section 4.

WHAT CAN BE DONE TO IMPROVE THE CREDIBILITY OF A LOW REPO-RATE PATH?

In the case since April, the credibility problem is that repo-rate expectations are too high, and improving credibility means moving repo-rate expectations down towards the repo-rate path. What can be done to improve the credibility of a low repo-rate path?

LENDING AT LONGER MATURITIES AT A FIXED RATE?

Lending by the central bank at longer maturities at a fixed rate equal to the policy rate may reduce interbank rates of corresponding maturities and also indicate that the central bank takes the repo-rate path as a mean forecast seriously (under which assumption the expected cost for the central bank of this operation would be zero), which may shift repo-rate expectations towards the repo-rate path. In July, September and October, the Riksbank did provide 12-month loans (11-month in October) at a fixed rate plus a term premium of 15 basis points. The effect on the interbank rate and repo-rate expectations may have been reduced by the fact that the volume was limited and that bids exceeded the volume. However, for the October loan, bids fell short of the maximum volume.

PLAY DOWN THE EFFECTIVE LOWER BOUND? IS IT ACTUALLY SOFT AND NEGATIVE?

One possibility is that the effective lower bound and any associated problems for financial markets in handling negative interest rates have been overemphasized and could be played down. Perhaps the Riksbank could have acknowledged that the lower bound for the repo rate is soft, not hard, and may even be negative. Something of a zero interest-rate mystique seems to have arisen and exaggerated any problems with a zero rate for the financial markets.

It is possible to argue that the zero interest rate bound does not actually apply to financial markets; that they can handle substantial negative

interest rates if necessary. It is the relative prices between financial assets that matter or, equivalently, the relative rates of return. Interest rates are only one way of expressing relative prices; the price today of kronor tomorrow. Take an example of a zero-coupon bond such as a 12-month Treasury bill of a nominal face value of 100 thousand kronor. There is no fundamental difference in the ability of financial markets to trade this asset whether its price is 99, 100 or 101 thousand kronor, because securities are typically traded in price terms. If the bond has a price today of 99 thousand kronor, the nominal yield on the bond is 1 percent. If its price today is 101 thousand kronor, the nominal yield is –1 percent. In other words, there is nothing strange about negative nominal yields and interest rates.[12] Furthermore, it may be possible for commercial banks to introduce new charges on transactions accounts to make effective interest rates on deposits negative, thereby maintaining their margins.

It seems that the only reason why a zero interest rate has attracted so much attention is that there is cash in the form of banknotes. Banknotes yield zero interest. If households, firms and investors think that the rate of interest on their accounts is too low they can withdraw cash from these accounts and instead keep large amounts of banknotes in their safes, suitcases and mattresses. However, taking the handling costs into account, including crime-prevention measures, storage costs and so on, banknotes provide an actual yield that corresponds to a negative interest rate. The effective lower limit for the policy rate is thus not dependent on the financial markets but is determined by the interest rates at which households, firms and investors would begin to hoard large volumes of cash in the form of banknotes. Interest rates will probably have to become negative before this happens, but it is difficult to know precisely where the lower limit is. It is possible to draw the conclusion that a policy rate of zero percent would not entail any significant problems (or any problems at all) for banks and financial markets, especially in the light of the experience in Japan, where the policy rate has been 0 and is at the time of writing (November 2009) 10 basis points, in Switzerland, where the Swiss National Bank has a target for the three-month Libor rate of 25 basis points and has had a repo rate of 2 basis points, and in the USA, where the Fed has restricted the federal funds rate to the interval between 0 and 25 basis points. After the repo rate was lowered to 25 basis points in Sweden in July, there has been no report of any related

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12   Moreover, it is mainly real interest rates and not nominal interest rates that are important when making economic decisions (although nominal interest payments do matter for liquidity-constrained households and firms). With an expected inflation rate of 2 percent, the real price of 100 thousand real kronor in the example above will be 101, 102 or 103 thousand kronor. That is, the real interest rate will be –1, –2 or –3 percent, respectively.

problems in the financial markets.[13] Besides, any large withdrawals of cash would show up very quickly in weekly data on the outstanding currency in the Riksbank's balance sheet.

A CONSISTENT PROBABILITY DISTRIBUTION OF THE FUTURE POLICY RATE?

The uncertainty intervals normally published around the repo-rate path have traditionally been based on the distribution of historical market forecast errors. There are yet too few repo-rate paths to compute a distribution of Riksbank repo-rate forecast errors. From a Bayesian decision-theory point of view, the most consistent and informative role of the uncertainty intervals would be as the executive board's subjective probability distribution of future repo rates. However, normally the uncertainty intervals do not matter for policy considerations, only the mean repo-rate path matters, so there may not be much point in an elaborate determination of uncertainty intervals; we should instead just use them as a reminder that forecasts are uncertain. However, with very low repo rates, the probability distribution of future repo rates takes on some special significance.

In order to maintain the principle of the repo rate being a mean forecast, the explicit or implicit distribution of the future repo rates conveyed by the Riksbank must be consistent with the published mean repo-rate path. If there is some probability of a higher repo rate, there must also be a probability of a lower repo rate. This may require positive probabilities for negative repo rates and small probabilities for repo rates much above the repo-rate path. Although I am generally all in favor of transparency, one has to be aware of indicating false precision about everything, including where the effective lower bound for the repo rate is. Perhaps with regard to the effective lower bound for the repo rate, there are good reasons for some ambiguity!

Another possibility is to accept a probability distribution of future repo rates that implies that the mean repo-rate path differs from the published repo-rate path and temporarily interpret the latter as a modal repo-rate path, that is, the repo-rate path that has the highest probability. Then both should be published, and the forecast of inflation and resource utilization should be conditional on the higher mean repo rate.[14]

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[13] Repo transactions by the National Debt office and other traders have occurred at rates down to minus 25 basis points.

[14] Consciously using the probability distribution of the repo rate as a policy instrument raises many new questions and brings inflation targeting into the realm of "distribution forecast targeting" rather than "mean forecast targeting" (Svensson and Williams, 2007).

4. How can the Riksbank's policy be evaluated?

Transparency is necessary for the more effective external scrutiny and evaluation of monetary policy and thereby increases the Riksbank's incentive to achieve its objectives. Transparency also strengthens the democratic accountability of independent central banks. Given the independence of the Riksbank, it is important that external observers can evaluate whether the Riksbank is doing a good job and, in particular, achieving a "well-balanced" monetary policy.[15]

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 therefore has *incomplete 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.

A second reason why a simple comparison of outcomes and targets for inflation is inadequate is that the Riksbank and all the other inflation-targeting central banks conduct *flexible* inflation targeting rather than *strict* inflation targeting. Flexible inflation targeting means that monetary policy aims at stabilizing *both* inflation around the inflation target *and* the real economy, whereas strict inflation targeting aims at stabilizing inflation *only*, without regard to the stability of the real economy, what Mervyn King (1997) has described as being an "inflation nutter".[16] [17]

In many situations, a conflict may arise between stabilizing inflation and stabilizing 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 policy-rate increase may be required which will dampen production even further. By quickly stabilizing inflation – which would be the case with strict infla-

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[15] This section builds on Svensson (2009a).

[16] The terms "strict" and "flexible" inflation targeting were to my knowledge first introduced and defined in a paper of mine presented at a conference at the Bank of Portugal in 1996, later published as Svensson (1999). The term "inflation nutter" for a central bank that is only concerned about stabilizing inflation was introduced in a paper by Mervyn King at a conference in Gerzensee, Switzerland, in 1995, later published as King (1997).

[17] Heikensten and Vredin (2002) state that "[s]ince the mid-1990s, however, the Riksbank has explicitly declared that it is not a 'strict' but a 'flexible' inflation targeter (like most other central banks today)." They also clarify that this is consistent with the Riksbank's mandate: "This policy also has legal support. In the preparatory documents on [the law on] the Riksbank's independence it is said that the 'Riksbank, as an agency under the Riksdag, should accordingly have an obligation to support the general economic policy objectives to the extent that these do not conflict with the price stability objective'. The task of the Executive Board is thus to implement this notion of 'flexible' inflation targeting."

tion targeting – the central bank would destabilize the real economy. By not aiming to bring inflation back to the target as quickly as possible, the central bank would help to stabilize 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 stability of the real economy. A difference between the outcome and the target for inflation may thus be deliberate. It may be part of an appropriate compromise between stabilizing inflation and stabilizing the real economy. It is, therefore, simply not good enough to just compare outcomes and targets for inflation when evaluating 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 characterizes flexible inflation targeting.

As I have already said, flexible inflation targeting entails the central bank striving to stabilize inflation around the inflation target and at the same time to stabilize the real economy. Stabilizing the real economy may be more precisely described as stabilizing resource utilization 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 cannot, on the other hand, affect the average and long-run level of real quantities such as production, employment, resource utilization and growth (although bad monetary policy can arguably hurt long-term growth). Historically, attempts to use monetary policy to affect the average level of real variables such as production or employment 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.

Because of the lags between monetary-policy actions and the effect on inflation and the real economy, effective flexible inflation targeting has to rely on forecasts of inflation and the real economy. Flexible inflation targeting can be described as "forecast targeting". The central bank

chooses an instrument-rate path so that the forecast of inflation and resource utilization "looks good." By a forecast that looks good I mean a forecast in which either inflation is already on target and resource utilization is already normal, or in which inflation is approaching the target and resource utilization is approaching a normal level at an appropriate pace. To be more precise, it means a forecast for inflation and resource utilization that as effectively as possible stabilizes inflation around the inflation target and resource utilization around its normal level and, in the event of conflicting objectives, achieves a reasonable compromise between inflation stability and resource utilization. Different central banks express this in slightly different words. The Riksbank has often used the term "well-balanced" monetary policy. [18]

We can formalize and specify this reasoning somewhat by saying that it is a case of selecting a policy-rate path that minimizes an intertemporal forecast loss function, written as the following standard quadratic form:

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

Here, $\pi_{t+\tau,t}$ denotes the mean forecast in quarter t for inflation in quarter $t+\tau$, π^* denotes the inflation target, λ is a constant weight placed on the stabilization of resource utilization relative to the stabilization of inflation, $y_{t+\tau,t}$ denotes the mean forecast for (the logarithm of) production and $\bar{y}_{t+\tau,t}$ denotes the mean forecast for (the logarithm of) potential production. The output gap $y_{t+\tau,t} - \bar{y}_{t+\tau,t}$ is thus used as a measure of resource utilization here. Let us call the difference between inflation and the inflation target the inflation gap. It is then a case of minimizing the sum of squares of the inflation-gap forecast, $\sum_{\tau=0}^{\infty} (\pi_{t+\tau,t} - \pi^*)^2$, plus the weight λ times the sum of squares of the output-gap forecast, $\sum_{\tau=0}^{\infty} (y_{t+\tau,t} - \bar{y}_{t+\tau,t})^2$. [19] [20]

In its *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 7, 8 and 9 show examples from February 2008, February 2009 and July 2009. Panel a in each figure shows the alternative repo-rate paths

[18] The idea that inflation targeting implies that the inflation forecast can be seen as an intermediate target was introduced in King (1994). The term "inflation-forecast targeting" was introduced in Svensson (1997), and the term "forecast targeting" in Svensson (2005). See Svensson and Woodford (2005) and especially Woodford (2007a, b) for more discussion and analysis of forecast targeting.

[19] For simplicity there is no discount factor in the sums of squares, but such a discount factor can easily be added. The sums of squares of the mean forecast gaps normally converge also for a discount factor equal to one.

[20] The loss function should be minimized under commitment in a timeless perspective in order to ensure consistency over time of policy. The former Deputy Governor of Norges Bank, Jarle Bergo, has discussed this in a pedagogical manner in Bergo (2007). For a more technical approach see, for example, Woodford (2003), Svensson and Woodford (2005), Adolfson, Laséen, Lindé and Svensson (2009), or Svensson (2009a).

Figure 7. Forecasts for the repo rate, inflation, and output gap with mean squared gaps, February 2008

a. Alternative repo-rate paths
Percent, quarterly averages

c. CPIX
Annual percentage change

b. Mean squared gaps

d. Output gap
Percentage deviation

Main ● High ● Low

—— Main —— High —— Low
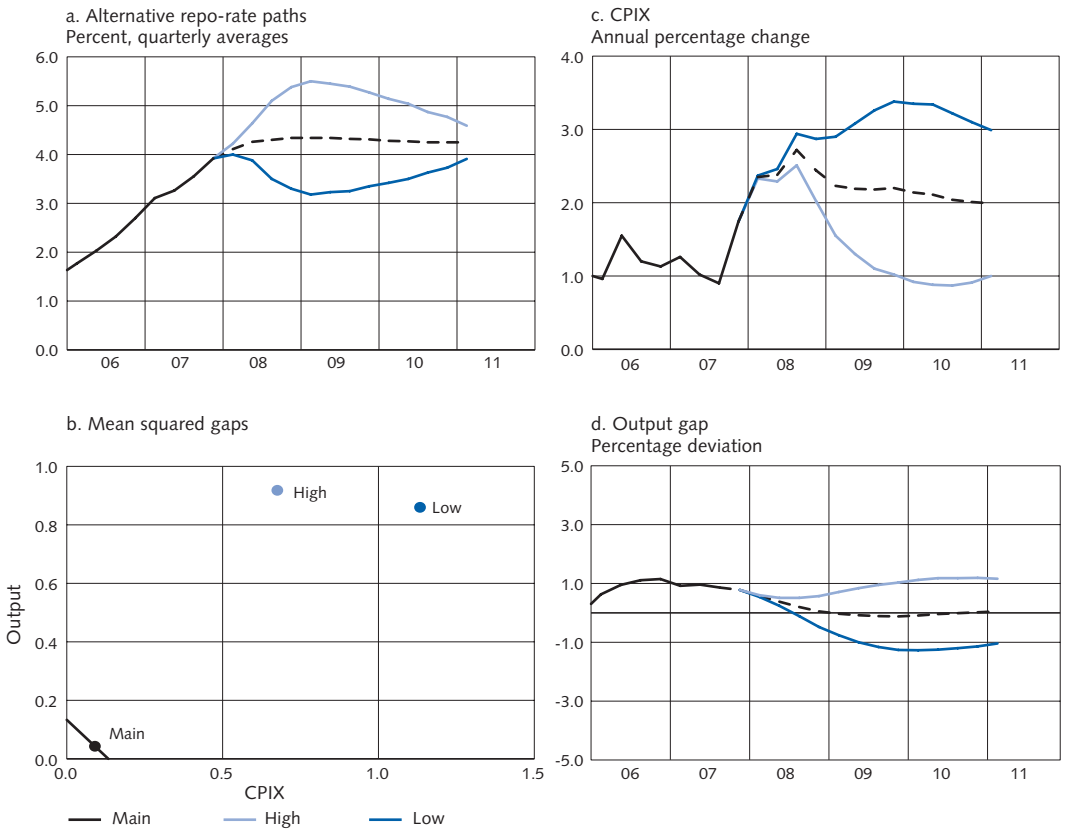
Sources: Statistics Sweden and the Riksbank.

(with "Main" denoting the majority decision and what is called the main scenario in the corresponding *Monetary Policy Report* or *Update*), panel c shows the corresponding inflation forecasts (the underlying CPI inflation measure CPIX is shown for February 2008 whereas CPIF, the CPI with housing costs calculated for a constant interest rate, is shown for February and July 2009), and panel d shows the corresponding output-gap forecasts (with the output gap measured as deviation from an HP trend).[21] Panel b shows the corresponding mean squared gaps (calculated over the forecast horizon of normally 12 quarters).[22]

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[21] Before June 2008, the Riksbank emphasized the CPIX, a core inflation price index that excludes mortgage costs and effects of indirect taxes and subsidies from the CPI. After June 2008, the Riksbank has downgraded the role of the CPIX and increased the emphasis on the CPI. During 2009, when the repo rate has been adjusted in large steps, the interest-rate effects on the CPI have been large and the Riksbank has therefore increased the emphasis on the CPIF, the CPI adjusted for a constant interest rate (see Wickman-Parak 2008).

[22] The mean squared gaps for the inflation-gap and output-gap forecasts are calculated as $\sum_{\tau=0}^{T}(\pi_{t+\tau,t}-\pi^*)^2/(T+1)$ and $\sum_{\tau=0}^{T}(y_{t+\tau,t}-\bar{y}_{t+\tau,t})^2/(T+1)$, where T is the forecast horizon (normally 12 quarters).

Figure 8. Forecasts for the repo rate, inflation, and output gap with mean squared gaps, February 2009

a. Alternative repo-rate paths
Percent, quarterly averages

c. CPIF
Annual percentage change

b. Mean squared gaps

d. Output gap
Percentage deviation from HP trend

Main   High

Sources: Statistics Sweden and the Riksbank.
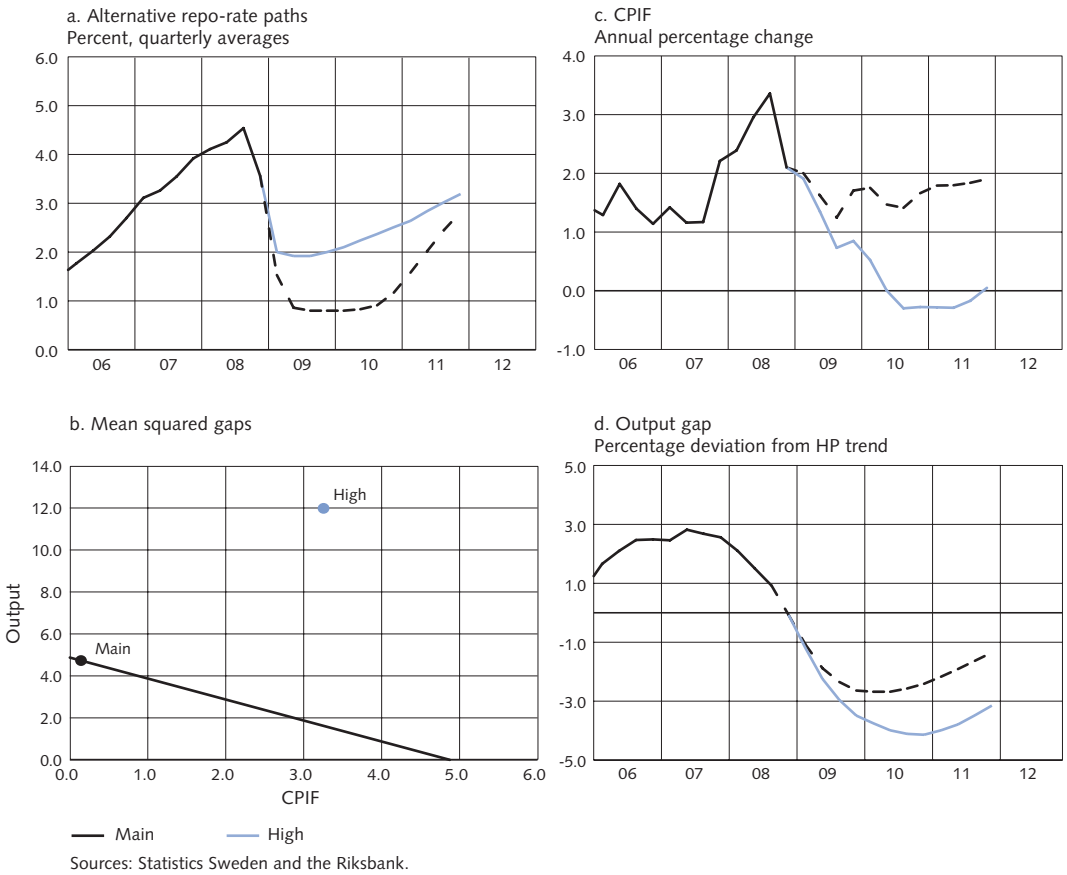
Figure 10 shows the mean squared gaps from these examples in the same figure. Several observations can be made here. First, for February 2008 and 2009, the mean squared gaps for the main scenario are smaller than in the alternative scenarios; the main scenario is closer to the origin of the axes. The main scenario is thus more successful in terms of stabilizing both inflation and resource utilization. The alternative repo-rate paths are clearly inefficient compared to the main scenario.

The concept of *efficient* monetary policy can be clarified further. Given the information available at the time the decision was made, would it have been possible, by selecting a different policy-rate path, to have stabilized inflation or the real economy better without stabilizing the other less well? Would it even have been possible to achieve a better stabilization of both?[23] If this is not possible, the policy is efficient.

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[23] Norges Bank has specified a few criteria for an appropriate interest-rate path that are reported in each issue of its *Monetary Policy Report* and were developed by Qvigstad (2005) and further elaborated by Holmsen, Qvigstad, and Røisland (2007).

Figure 9. Forecasts for the repo rate, inflation, and output gap with mean squared gaps, July 2009

a. Alternative repo-rate paths
Percent, quarterly averages

c. CPIF
Annual percentage change

b. Mean squared gaps

d. Output gap
Percentage deviation

— Main   — High   — Low

Sources: Statistics Sweden and the Riksbank.
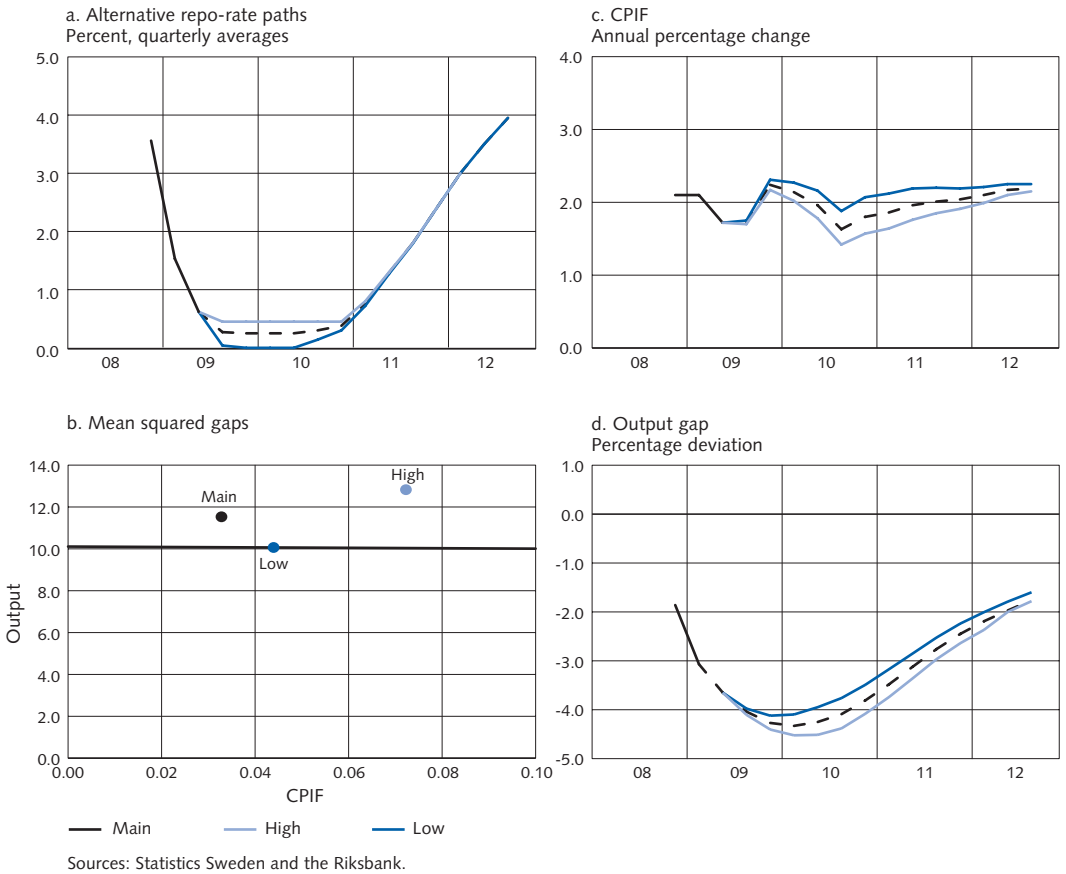
This means that it is not possible to choose an instrument-rate path that results in mean squared gaps of the inflation- and output-gap forecast that is to the left or below it, or both, in figures 7–9, panel c.[24] The fact that the alternative repo-rate paths are clearly inefficient compared with the main scenarios in February 2008 and 2009 does not necessarily mean, however, that monetary policy is efficient in those cases. There may be a repo-rate path that would stabilize inflation and resource utilization even better. Excluding this possibility requires a comparison with more alternative repo-rate paths.

24 In Svensson (2009a) efficient monetary policy is illustrated in terms of what I call a modified Taylor curve, the forecast Taylor curve. The original Taylor curve (not to be confused with the Taylor rule) illustrates the efficient tradeoff between the unconditional variances of inflation and output (Taylor 1979). The modified Taylor curve, what I call the forecast Taylor curve, illustrates the efficient tradeoff between the conditional variability of the inflation- and output-gap forecasts. The original figure in Taylor (1979) plotted the unconditional standard deviation of the output deviation from trend against the unconditional standard deviation of inflation. Svensson (2009b) provides more details on the forecast Taylor curve and shows how evaluation with the help of the forecast Taylor curves can be adjusted to take into account commitment in a timeless perspective, following Svensson and Woodford (2005).

Figure 10. Mean squared gaps of inflation-gap and output-gap forecasts: February 2008, February 2009, and July 2009
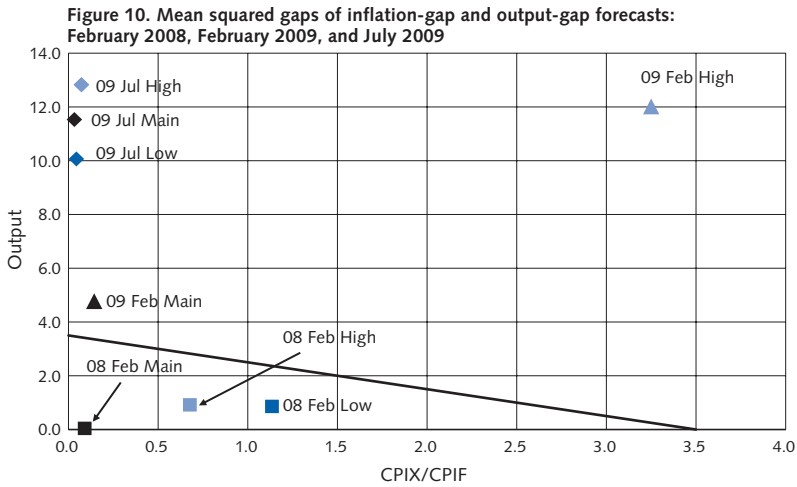
Sources: Statistics Sweden and the Riksbank.

In this context, as discussed in more detail Svensson (2009a, 2009b), it would be a be great advantage to generate policy alternatives by constructing forecasts of the repo rate, inflation and resource utilization that are optimal for alternative values of λ. Then the policy alternatives to choose between would all be efficient. Such techniques to generate policy alternatives have been in use at Norges Bank for several years (Holmsen, Qvigstad and Røisland 2007).[25]

Second, for July 2009, the main and alternative repo-rate paths are very similar with regard to the degree of inflation-gap stabilization, although the main repo-rate path results in a slightly smaller mean squared gaps for the inflation gap, as can be seen in panel c of figure 9. However, the repo-rate paths result in different degrees of output-gap stabilization, where the low repo-rate path stabilizes the output-gap better and the high repo-rate path worse than the main scenario. The high repo-rate path results in an inefficient outcome with higher mean squared gaps for the inflation- and output-gap forecasts.

Third, the tradeoff between stabilizing the inflation-gap and output-gap forecasts may vary considerably depending on the initial state of the economy. The situation in July 2009 was worse than that in February 2009, which was worse than that in February 2008. The point in Figure 10 that corresponds to February 2008 is not far from the origin, while the points that correspond to February 2009 and July 2009 are much further away from the origin.

Assessing whether monetary policy has been efficient thus entails attempting to determine whether monetary policy could have stabilized

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[25] See Adolfson, Laséen, Lindé and Svensson (2009) for how this can be done with the Riksbank's model Ramses.

the inflation-gap or output-gap forecast better without stabilizing the other less. The analysis is *ex ante*, in the sense that the starting point is the central bank's forecast for inflation and resource utilization 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 policy-rate path that would stabilize inflation more without stabilizing resource utilization less, or that would even stabilize 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 utilization, also includes other targets or limitations in its monetary policy deliberations. One 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 25 basis points at a time. With such a restriction, an additional axis and thus an additional dimension are required that correspond to the sum of squared changes in the policy rate, so that the trade-off becomes three-dimensional. A separate issue is whether there is any good reason for such implicit or explicit interest-rate smoothing. During the dramatic events of 2008, several central banks have adjusted their policy rates in larger steps than usual, and it remains to be seen whether there will be less interest-rate smoothing during more normal times in the future.

A major difficulty in this analysis is that it may be unclear what is meant by stabilizing the real economy. From a monetary policy perspective it is the stabilization of resource utilization rather than GDP growth that is relevant. This means stabilizing resource utilization around a normal level. The problem is that resource utilization can be measured in several ways. A reasonable and commonly used measure of resource utilization 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 define, estimate and forecast potential production. The output gap shown in the figures are output deviations from an HP trend, which has significant weaknesses. It is important and desirable from several points of view that the Riksbank and other central banks develop better measures of resource utilization 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 stabilization of inflation and the real economy the central bank actually 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 stabilizing inflation and stabilizing 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 stabilization of the real economy in relation to the stabilization of inflation?

In the literature, as in the case of the forecast loss function I presented earlier, the relative weight that the central bank gives to the stabilization of the real economy in relation to the stabilization of inflation is often denoted by the Greek letter lambda, λ. In figures 7-9, panel b, and figure 10, we can show the intertemporal forecast loss function with the help of isoloss curves for combinations of sums of squared inflation-gap and output-gap forecasts that generate equally large losses. Such isoloss curves are in this case downward-sloping, straight lines with a slope of $1/\lambda$, the reciprocal of lambda. Isoloss lines closer to the origin correspond to lower losses. The ideal, but normally unattainable, situation would be an isoloss 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 utilization is exactly equal to the normal level. The best monetary policy entails selecting a point such that the isoloss line through that point is as close to the origin as possible.

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 isoloss lines. A central bank with a high numerical value for lambda, that is a high weight placed on the stability of the real economy, has isoloss lines that are flatter.

Neither the Riksbank nor other central banks, except Norges Bank, have yet announced whether they apply a specific lambda and if so what this lambda is.[26] In those cases where the decisions are made by a committee made up of several members, as at the Riksbank, it is possible that different members attach different degrees of importance to the stability of the real economy.

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[26] Bergo (2007) and Holmsen, Qvigstad and Røisland (2007) report that optimal policy with = 0.3 has replicated policy projections published by Norges Bank (with a discount factor of 0.99 and a weight on interest-rate smoothing of 0.2).

It is possible to plot the policy alternatives as in figures 7–9, panel b, and figure 10 and assess whether the policy alternative is extreme in any respect with regard to the deviation of inflation from the target and the deviation of resource utilization from the normal level. It is possible to assess whether the choice of policy-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. It is also possible to investigate whether the weight attached to the stability of the real economy actually has been constant over time. Given a voting record of individual committee members, it is possible to assess what weight a particular member reveals in his or her votes on different policy alternatives and whether the weight is consistent over time.

As a reference point, I here take an equal weight on the stability of the inflation and output gaps, that is a λ equal to one. The solid negatively sloped lines in figures 7–9, panel b, and in figure 10 hence show an isoloss line for a forecast loss function with equal weight on inflation- and output-gap stabilization.[27]

Figures 9 and 10 and the situation in July 2009 can be studied more closely in the light of this discussion. For July 2009, the main and alternative repo-rate paths are very similar with regard to the degree of inflation-gap stabilization, although the main repo-rate path results in a slightly smaller mean squared gap for the inflation gap, as can be seen in panel b of figure 9. However, the repo-rate paths result in different degrees of output-gap stabilization, where the low repo-rate path stabilizes the output-gap better and the high repo-rate path worse than the main scenario.[28]

For an equal weight on inflation- and output-gap stabilization the low repo-rate path results in lower intertemporal forecast loss. This is apparent from the isoloss line for λ equal to one that is shown in both figures 9 and 10 (in figure 9 the isoloss line looks horizontal because the scales for the horizontal and vertical axes are so different). For the main repo-rate path to give a lower loss than the low repo-rate path, one needs a value of λ lower than 0.08.

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[27] As an example of the use of an equal weight, in the Bluebook for the Federal Reserve's FOMC meeting in May 2002 (Federal Reserve Board 2002) there is a description of a method involving what is arguably somewhat misleadingly called a "Perfect Foresight Policy" that minimizes an intertemporal forecast loss function with equal weight on inflation-gap and output-gap stabilization (and with a small weight on interest-rate smoothing). This method was used in the Bluebooks at the time to present policy alternatives for the FOMC. Svensson and Tetlow (2005) provide a detailed description of this method, which calculates optimal policy in the Federal Reserve's FRB/US model using information from the Greenbook forecast. They argue that "Optimal Policy Projections" is a better name, since perfect foresight need not be assumed. Bluebooks and other material from the FOMC meetings are published with a five-year lag and are available at www.federalreserve.gov.

[28] I use expressions such as "stabilizing the inflation gap" and "stabilizing the inflation-gap forecast" interchangeably. The conditional variance of the future inflation gap equals the squared inflation-gap forecast plus the variance of the forecast errors and the variance of the forecast errors is here considered exogenous.

At the policy meeting of July 2009, the main repo-rate path entailed lowering the repo rate from 50 basis points (from the April 2009 decision) to 25 basis points and keeping it there through 2010. The low repo-rate path entailed lowering the repo rate to zero. The detailed discussion at the meeting is published in Riksbank (2009b), including arguments about the lower bound for the repo rate.[29]

Finally, I would like to emphasize that these *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. It is hence possible to evaluate whether monetary policy *is* well-balanced currently, not only whether it *was* well-balanced in the past. 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 policy and analysis.

5. Consequences of low credibility of the repo-rate path

What are the consequences of market expectations of future repo rates that are higher than the published repo rate, the possible problem that I mentioned above at the end of section 3? Does it matter if market expectations differ significantly from the repo-rate path? Figure 11 shows an attempt to answer that question. It also uses the graphs of mean squared gaps that I have introduced in section 4.

In panel a of figure 11, the black curve labeled Main shows the repo-rate path in the main scenario in the *Monetary Policy Update* of April 2009. The black curves labeled Main in panels c and d show the corresponding inflation and output-gap forecast, respectively, in the main scenario of the *Update*. The main-scenario forecasts reported by the Riksbank are conditional on the assumption that they are credible with the private sector, that is, that both the Riksbank and the private sector have equal mean forecasts of the repo rate, inflation and the output gap. The black inflation- and output-gap forecast in panel c and d can hence be interpreted as the Riksbank's mean forecast under the assumption that it is believed by the private sector, in particular that the published repo-rate path is also the private sector's mean forecast of the future repo rate.

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[29] At the meeting, I dissented in favor of the low repo-rate path, on the grounds that it would entail a better-balanced monetary policy, with higher resource utilization and without inflation deviating too far from the target.

Figure 11. Forecasts for the repo rate, inflation, and output gap with mean squared gaps, April 2009

a. Alternative repo-rate paths
Percent, quarterly averages

c. CPIF
Annual percentage change

b. Mean squared gaps

d. Output gap
Percentage deviation

Main — Market — Unanticipated

Sources: Statistics Sweden and the Riksbank.
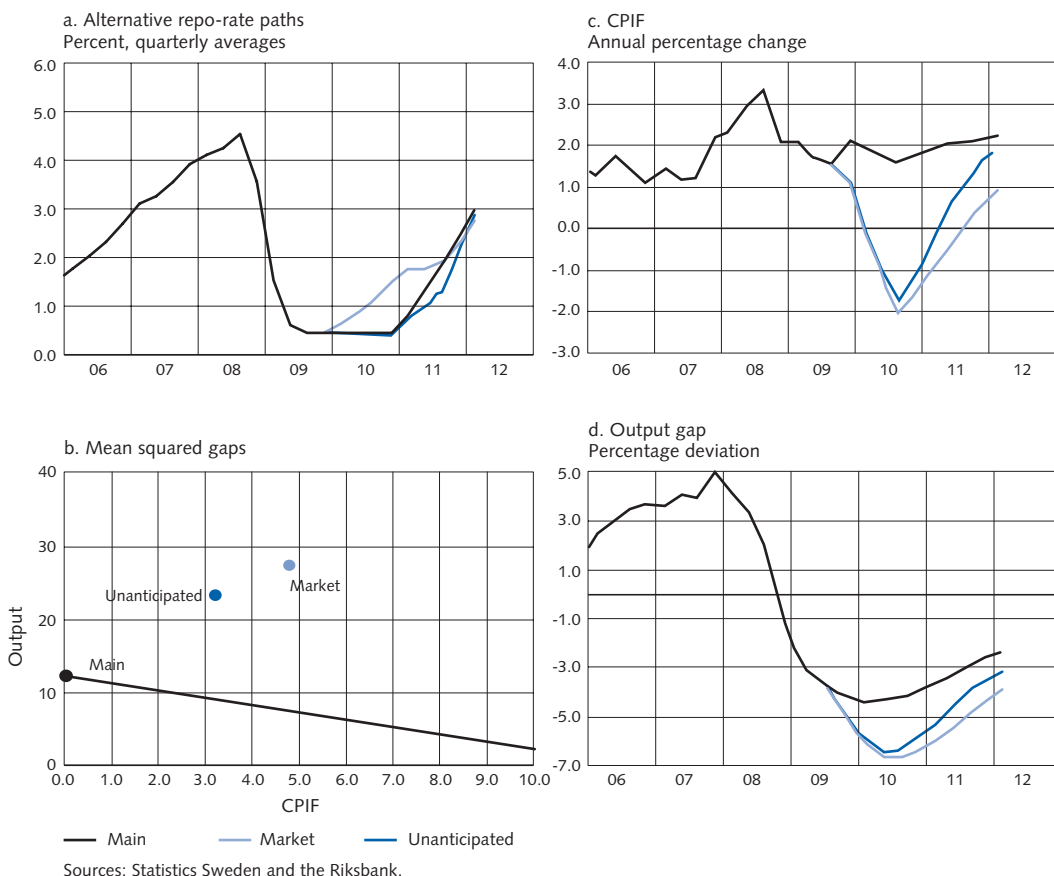
As we have seen, the repo-rate path published in April was not credible with the market. Instead, the market's mean forecast was higher. Let me now for the sake of the argument assume that the market's mean forecast is representative of the whole private-sector's mean forecast of future repo rates. The light blue curve shown in panel a is similar to those private-sector (and market) expectations. We can now make three possible thought experiments. The *first* thought experiment is that the Riksbank publishes the repo-rate path of the Main scenario, that the private sector believes in this repo-rate path, and that the Riksbank intends to implement the published repo-rate path, so the repo-rate path is the best mean forecast of future repo rates. Then the best mean forecasts of inflation and the output gap are given by the black curves of panel c and d, respectively. This is the main scenario of the April 2009 *Update*.

However, this first thought experiment is contra-factual, since the published repo-rate path is not credible. A *second* thought experiment

is that the Riksbank would publish a repo-rate path in line with market expectations, that is a repo-rate path like the light blue curve labeled Market in panel a. Furthermore, I assume that the private sector continues to believe in this path, and finally that the Riksbank intends to implement the path, so that the path is the best mean forecast of the future repo rate. Finally, I assume that the economy's sensitivity to changes in the repo-rate path, and indeed the whole transmission mechanism, is correctly represented by the Riksbank's DSGE model Ramses (Adolfson, Laséen, Lindé and Villani, 2007). This is hence an example of constructing forecasts conditional on market expectations of the future policy rate, something that the Riksbank was doing before it started publishing its own repo-rate path in February 2007.

The Market repo-rate path is higher than the Main repo-rate path and hence represents a tighter monetary policy. This will result in a lower inflation and output-gap forecast. The light blue curves labeled Market in panel c and d show the corresponding inflation and output-gap forecast. Since the Market repo-rate path is substantially higher than the Main repo-rate path and given the sensitivity to interest-rate changes in Ramses, the inflation forecast falls to almost minus 2 percent in 2010. The output-gap forecast falls to almost minus 7 percent in 2010.[30]

The consequences for the inflation and output-gap forecast of this thought experiment are dramatic. One interpretation is that the market expectations of the future repo rate are so much higher than the Riksbank's published repo-rate path that they are difficult to reconcile with a rational-expectations equilibrium of the Riksbank's DSGE model Ramses. They require an extremely low inflation and output-gap forecast to make sense. That market expectations are extreme from the point of view of Ramses does not contradict but rather underscores the possibility that they are very problematic.

This second thought experiment is also contra-factual, since it assumes that the Riksbank intends to implement the Market repo-rate path. The *third* thought experiment is instead that the Riksbank publishes the Main repo-rate path and intends to implement it, but that the private sector does not believe so but instead believes in the Market repo-rate path. Under the assumption that the Riksbank actually implements the Main repo-rate path, the market will then be surprised in the beginning of 2010 when the Riksbank continues to follow the Main repo-rate path. Assume now that the market expectations shift down a bit but that the market still believes the Riksbank will follow a higher repo-rate path than the Main path, so that the market continues to be surprised when the

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[30] The second thought experiment is constructed using the techniques of Laséen and Svensson (2009).

Riksbank follows the Main repo-rate path. Under this assumption, the surprises of a lower repo rate and the gradual downward shifts of market expectations of the future repo-rate path will imply a less tight monetary policy. The best mean inflation and output-gap forecast is then given by the dark blue curves labeled Unanticipated in panels c and d.[31]

This third thought experiment, where the Riksbank implements its announced repo-rate path but the private-sector remains sceptical, is probably the most realistic one of the three. In panel b, the mean squared gaps for the inflation- and output-gap forecasts for the three thought experiments are plotted. The negatively sloped line shows an isoloss line corresponding to λ equal to unity. We see that the Main thought experiment stabilizes inflation and the output gap best, while Unanticipated is much worse, and Market is even worse. The difference between Unanticipated and Main shows the cost of low credibility of the repo-rate path and points to the importance of making the announced repo-rate path credible so that market expectations are in line with it.

6. Conclusions and possible improvements

I have reviewed the development of the Riksbank's transparency and communication since its independence in 1999. This development has led to the Riksbank being considered one of the world's most transparent central banks. I have also examined the Riksbank's record on the management of market expectations of future policy rates after the publication of policy-rate paths in February 2007, with a focus on the new problems present since April 2009 and on possible explanations, consequences and remedies. Finally, I have discussed whether the Riksbank's transparency and communication are sufficient for the effective accountability and evaluation of its monetary policy and demonstrated that tools are available for effective real-time evaluation of the Riksbank's policy.

What can be learned from the recent experience on how to make and keep the published repo-rate path credible with the market and the private sector? In my review of the Riksbank's record on managing expectations in Svensson (2009c), which included developments up to and including December 2008, I concluded that the Riksbank had overall been quite successful in managing expectations. Now, from April 2009 and thereafter, the record is different, with market expectations of future repo rates in 2010 and 2011 much above the repo-rate path. The new situation with a deep recession and very low repo rates has posed exceptional communication challenges for the Riksbank. The good principle of the

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[31]   The third thought experiment is constructed using the techniques of Leeper and Zha (2003).

repo-rate forecast being a mean forecast and not an unconditional prom-
ise has been difficult to maintain. Statements about the lower bound for
the repo-rate may have been interpreted as unconditional promises, and
the explicit or implicit probability distribution of future repo rates that has
been communicated has arguably been inconsistent with the published
repo-rate path being the mean.

One solution to such a problem might be to acknowledge that the
lower bound for the repo rate is not known, that it is probably negative,
and that it is soft and not hard. Given this, one could then communicate
a probability distribution that is consistent with the published repo-rate
path being the mean (the required probability distribution is likely to be
asymmetric). Alternatively, one could acknowledge that the published
repo-rate path temporarily should be seen as a modal repo-rate path and
that the mean repo-rate path is higher, and then condition the forecasts
of inflation and the real economy on that higher mean repo-rate path (in
which case they would be lower). Lending at longer maturities at a fixed
rate may serve to bring down both interbank rates and repo-rate expecta-
tions in a situation like this, although any limits on the lending and over-
subscription may reduce the effect.

However, the market expectations for the repo rate in 2010 and the
beginning of 2011 are so much above the published path that they can
hardly be explained by lower-bound issues alone. By publishing a forecast
for inflation and the real economy conditional on those market expecta-
tions, an exercise similar to the second thought experiment in section 5,
the Riksbank could perhaps convincingly show that such a monetary
policy would lead to very undesirable outcomes for inflation and the real
economy and therefore was unlikely to be followed by the Riksbank.
Maybe there are good reasons to regularly publish forecasts conditional
on both market expectations and the Riksbank's own repo-rate path
when there are risks of a sizeable difference between the two.

Standard forecasts at the Riksbank and by the main model Ramses
are explicitly or implicitly made under the assumption of rational expecta-
tions, including that the Riksbank's and the private sector's expectations
and views of the economy are the same and based on the same informa-
tion. The discrepancy between market expectations and the repo-rate
path after April 2009 points to the need to be able to analyze, explain
and handle situations with non-rational and non-homogeneous expec-
tations. Situations with different private-sector views from those of the
Riksbank about inflation and economic developments also call for such
analysis, as well as situations with heterogeneous expectations between
different private-sector agents. More information about the expectations
and forecasts of different economic agents would be useful, for instance

in the form of more questions asked in the surveys that the Riksbank commissions from Prospera.

Regarding whether Riksbank transparency and communication is sufficient for the effective accountability and evaluation of its monetary policy, I have shown that policy alternatives can be illustrated in a graph with mean squared gaps of the inflation-gap and output-gap forecasts along the axes. This makes it possible to assess how alternative repo-rate paths succeed in stabilizing inflation around the target and resource utilization around a normal level, conditional on the initial state of the economy and the outlook for important exogenous variables. In particular, it can be assessed whether the Riksbank's policy decision is *efficient*, in the sense of not wasting an opportunity to stabilize inflation without destabilizing resource utilization, and vice versa, and whether the policy decision results in a *well-balanced* policy, in the sense of a reasonable compromise between the stability of inflation and the stability of resource utilization. In particular, such evaluations can be performed in real time by outside observers. For this, it is crucial that the Riksbank publishes forecasts for alternative repo-rate paths and not just one main scenario. The Riksbank may also want to follow the example of Norges Bank (and the Federal Reserve, to judge from five-year old bluebooks) and generate policy alternatives by optimal policy projections.

In this context, and in general, since flexible inflation targeting aims at stabilizing both inflation around the target and resource utilization around a normal level, I believe that it is very important that the Riksbank develops better estimates and better forecasts of resource utilization, including estimates and forecasts of potential output, and transparently publishes and explains them.

Appendix. Major Events in Riksbank Communication

January 1993. The Riksbank announces the inflation target of 2 percent, to be applied from 1995.

October 1993. The Riksbank starts to publish the report *Inflation and Inflation Expectations in Sweden*, which includes a discussion of the inflation pressures.

June 1995. The Riksbank starts to publish approximate inflation forecasts under the assumption of a constant repo rate in *Inflation and Inflation Expectations in Sweden*.

March 1996. The report *Inflation and Inflation Expectations in Sweden* is renamed *Inflation Report*.

December 1997. The Riksbank starts to publish more precise inflation forecasts in the *Inflation Report*.

January 1999. The new Executive Board announces that the minutes of the monetary-policy meetings shall be published.

February 1999. The Riksbank publishes a clarification of the monetary-policy framework.

March 2005. The Riksbank starts to publish an alternative forecast under the assumption of a repo-rate path given by implied market forward interest rates. The horizon for this forecast is lengthened to three years.

October 2005. The Riksbank starts to publish a main scenario in the Inflation Report under the assumption of implied forward rates and a horizon of three years.

May 2006. The Executive Board publishes the document *Monetary Policy in Sweden*, which describes the monetary-policy objectives and strategy and replaces the clarification of February 1999.

February 2007. The Riksbank starts to publish a repo-rate path. The *Inflation Report* is renamed *Monetary Policy Report* and includes an extensive explanation of the monetary-policy decision. The Riksbank also starts to publish more explicit and extensive alternative scenarios for the repo-rate path and under alternative assumptions about the future development of important national and international variables.

May 2007. The Riksbank announces that press conferences will be held after each monetary-policy meeting, that no information about the repo-rate decision will normally be conveyed before monetary-policy meetings and that the minutes of monetary policy meetings will be attributed.

September 2007. The Riksbank announces that it will, from December 2007, publish a repo-rate path at each of the six monetary-policy meetings, not only after the three meetings at which a *Monetary Policy Report* is published.

May 2008. The Riksbank announces an updated communication policy for all Riksbank activities, including monetary policy. Before monetary-policy meetings, some public comments on data and outcomes relative to previous Riksbank forecasts and on policy trade-offs may be now given, but no indication of the coming repo-rate decision.

April 2009. The Riksbank decides to publish how individual members voted at the same time as the monetary-policy decision is announced. This makes it immediately apparent whether the decision was unanimous or whether there were any reservations. Any reservations are published with names and short explanations.

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Jan F. Qvigstad*, Deputy Governor , Norges Bank,
Comment regarding Lars E.O. Svensson's lecture "Policy expectations and
policy evaluations: the role of transparency and communication"

1. Introduction

In his contribution, Lars Svensson talked about communication, credibility
and the evaluation of monetary policy. He uses the Riksbank as an exam-
ple, but also discusses more general problems for central banks with the
ambition of influencing expectations of the future interest rate[1]. I will not
examine the Riksbank's valuations in my commentary, but will elucidate
similar problems on the basis of the experience we, in Norges Bank, have
of interest rate forecasts.

2. When does the interest rate path "look good"?

Svensson addresses the issue of whether monetary policy is well-bal-
anced, not just *ex post*, after the event, but also *ex ante*. In his presen-
tation, he presents a system for the evaluation and ranking of different
policy alternatives. The system involves employing Taylor diagrams to
evaluate whether one interest rate forecast gives smaller fluctuations in
inflation and the real economy than another. If a forecast indicates an
inflation rate closer to the target at the same time as it indicates a smaller
production gap during a forecast period, this forecast is chosen. On other
occasions, the choice between two interest rate forecasts can involve
more conflict. The forecast chosen depends upon the decision-maker's
preferences and the considerations deemed to be most important.

I am in complete agreement with Lars Svensson's statement that
decision-makers must proceed from their own preferences when ranking
different policy alternatives. Sometimes decision-makers wish to keep the
interest rate high, and sometimes we prefer a low interest rate. However,
it is equally important to consider these preferences over time – that is, to
have a system to control whether the main scenario in a report is based
on the same preferences as the main scenario in the previous report. If
preferences are first formalised into a loss function, it becomes compara-
tively simple to find the optimal interest rate path for a given model. In

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E-mail: jan.qvigstad@norges-bank.no. This text may deviate from the actual presentation.

1 Cf. Woodford's (2005) formulation: "For not only do expectations about policy matter, but … very little
else matters."

such a case, the choice of interest rate path depends upon the preferences of the decision-maker. It is, naturally, possible for a decision-maker to change preferences over time, but I generally like the starting point of the analysis to be formed by the same set of preferences that were most recently used as a basis. This also contributes to keeping communications free of contradictions over time.

3. Criteria for a "good" interest rate path

Inspired by Svensson, Norges Bank has developed a set of criteria to identify a "good" interest rate path. These criteria, which are presented in Figure 1, are intended to make it easier for external parties to understand our reasoning – in addition to this, however, the criteria also set the agenda for internal discussions.[2]

FIGURE 1: NORGES BANK'S CRITERIA FOR A "GOOD" INTEREST RATE PATH

1.	Stabilisation of inflation close to the target
2.	Reasonable balance between inflation and output gap
3.	Caution and freedom from contradictions
4.	Robustness
5.	Cross-checking is performed

The first criterion for a good interest rate path is that the interest rate should be such that inflation, following a shock, can return to the inflation target over the medium term. Its primary aim is to ensure the fulfilment of the inflation target. The second criterion refers to the flexibility of inflation management. The target can be achieved by many strategies – but which strategy should we choose? The criteria encourage us to prioritise the selection of an interest rate path that also stabilises the development of production and employment.

So far, we are following Svensson's theoretical model quite well, although we have deviated somewhat from the analytical apparatus he presents in his article. The most important difference is that we have chosen to aim directly at the target and to utilise a loss function to describe monetary policy. The method proposed in the article only becomes meaningful if the policy is first described using various rules, and the loss is thereafter calculated with the aid of the loss function.

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2   See Holmsen et al. (2008) for a discussion of the implementation and communication of optimal monetary policy.

As the model, first and foremost, is a model, and reality, first and foremost, is reality, a degree of customisation is required to get model and reality to fit together. Consequently, we have a few additional criteria. These criteria are necessary as we are uncertain of our models and cannot always take confidence in monetary policy for granted. These do not conflict with Svensson's monetary policy research but should be seen as forming a bridge between model and reality.

Let me demonstrate the manner in which the criteria were employed in the work of preparing the monetary policy report last March by briefly describing the intellectual process involved. The figure I will use is an abstraction, but serves to illustrate the working method. If only the first and second criteria are utilised, our valuation of the current situation and the forecasts – with inflation below target and a large negative output gap – may indicate that the interest rate should be set at a very low or even negative level towards the end of 2009. This is illustrated by the light blue line in Figure 2. However, we chose not to take such a drastic approach, due to the Executive Board's consideration of the other criteria.

The third criterion says that we should consider previous patterns of action and that, as a rule, the interest rate should only be changed gradually. Placing an emphasis on interest rate smoothing in the loss function (i.e. criteria 1+2+3) gives us the black line. This interest rate path is still very low – lower than the path actually chosen.

The fourth criterion says that monetary policy should be robust, while the fifth criterion says that cross-checking should be performed. In the prevailing turbulent economic situation, we were uncertain whether we had an accurate model of the Norwegian economy and wished to protect ourselves against errors in the model. In an economy in which

Figure 2. Alternative interest rate paths
Quarterly figures on an annual basis, as a percentage, Q1 2008 – Q4 2012

Criteria 1 and 2   Criteria 1, 2 and 3   Taylor rule   MPR Jan 09
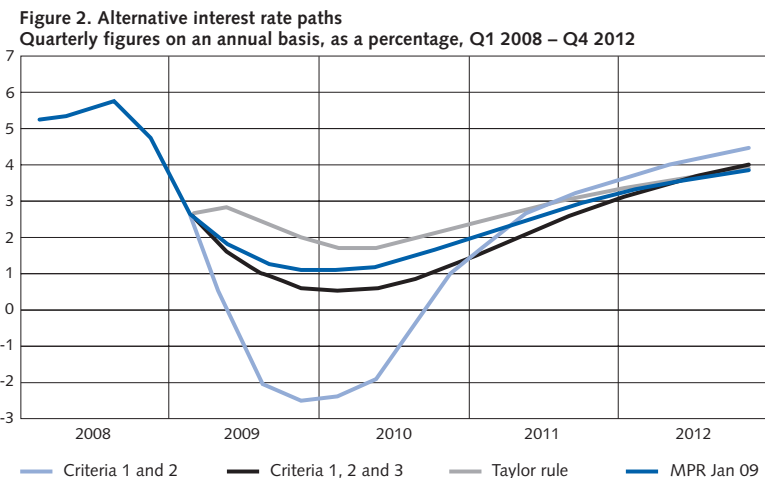
unemployment lies at around three per cent and inflation lies on target, we considered that reducing the interest rate all the way to zero would be an excessive measure.

A practical adjustment to the uncertainty in the model is to cross-check it against simple monetary policy rules, such as the Taylor rule (criterion 5). In addition to the normal Taylor rule, we usually utilise a variant in which international interest rates are included, together with a variant in which the output gap is replaced by GDP growth. If we had followed the Taylor rule without variation, the forecast would have looked approximately similar to the grey line in the diagram, i.e. considerably higher than the interest rate path chosen. At the same time, a higher interest rate path would result in a more negative output gap and inflation gap. Inflation would not reach its target for another ten years.

Using the criteria as a foundation provides us with an interest rate interval in which the optimal policy (with interest rate smoothing) forms the lower limit and the Taylor rule forms the upper limit. After a collective assessment, we arrived at an interest rate forecast equivalent to the dark blue line. As a rule, interest rate decisions are taken on the basis of discussions by the Executive Board. This is also the case in Norway. Criteria 3, 4 and 5 introduce conditions that cannot easily be observed. This requires us to use our judgement. The criteria help avoid contradictions and aid in the structuring of discussions.

The Riksbank also uses its judgement in the selection of interest rate forecasts. However, Svensson does not discuss possible weaknesses in the macroeconomic model. In Figure 10, he demonstrates how the different interest rate forecasts, which differed by approximately half a percentage point last summer, can result in differences in inflation of nearly four percentage points by as soon as next autumn. The monetary policy seems to be having a very powerful impact. It would be interesting to hear whether Svensson considers it to be robust to rely so heavily on such a model in setting the interest rates, as well as how possible errors in the model should be counteracted.

We have also found that the opinions of market actors may differ from ours, particularly as regards developments slightly further away in time. There may be various causes for such differences and Svensson discusses several of these. It would also be interesting to study the volatility arising when major macroeconomic disruptions are made public. We would like there to be less volatility around the interest rate meetings and for any relative surprises to be shifted to the dates for new macroeconomic data. Solberg-Johansen (2008) – who was awarded the Bertil Ohlin scholarship for outstanding research in international economics by the Stockholm School of Economics – investigates volatility in the yield

curve. She finds a certain degree of support for the suggestion that volatility has declined in conjunction with interest rate meetings, but finds no strong evidence to suggest that volatility on the fixed income market has changed in conjunction with the publication of new data since we started publishing interest rate forecasts. Another example that it may be beneficial to examine in more depth is Ehrmann and Fratzscher's (2007) analysis of the development of US market interest rates between interest rate meetings during two different communication orders.

4. Conclusion

In conclusion, I would like to agree with Blinder et al. (2008), who wrote "… the publication of projected paths for the central bank's policy rate appears to be the "new frontier" in central bank communication. But it has been practised in so few countries for so few years that we have little empirical knowledge of its effects as yet. As more data accumulates, this should be a high-priority area for further research." It is reassuring to see that Lars Svensson has started this important work.

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The Executive Board of the Riksbank and its work on monetary policy – experiences from the first ten years

BY MIKAEL APEL, CARL ANDREAS CLAUSSEN AND PETRA LENNARTSDOTTER[1]

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On 1 January 1999 the price stability target was confirmed by law. At the same time an Executive Board was appointed, consisting of six members employed full-time to make decisions on monetary policy issues and to govern the Riksbank. In our article we first describe the background to the establishment of the Executive Board and some characteristics of the Board's working methods during its first decade. We then summarise the results of a unique survey where we have asked all present and past members who have served on the Board questions about their experiences. It turns out, for instance, that many members consider the Executive Board to be slightly too large. Another result is that despite the members acting as individuals, there appears to be a willingness to compromise when the interest rate decisions are made – many members have sometimes refrained from entering reservations and say that there is a "bargaining margin" in the interest rate decisions.

More than a decade of a statutory price stability target and an Executive Board

On 1 January 1999 the laws governing the Riksbank's activities were radically amended. The monetary policy objective of maintaining price

stability was now also put in print in the law. At the same time the management structure of the Riksbank was altered in that an Executive Board with six full-time employees was appointed to govern the Riksbank and to decide on monetary policy issues. The law text also contained an explicit ban on public authorities trying to influence the Riksbank's decisions in monetary policy matters.

The purpose of the amendments to the law was to reinforce the Riksbank's position and make it more independent. According to the bill that formed the basis for the decision, there were two reasons for doing so (Bill 1997/98:40, *Riksbankens ställning* (*The position of the Riksbank*), p. 48). Firstly, it was considered easier for an independent Riksbank with a clearly-stated price stability target to give monetary policy the long-term perspective required to give credibility to the target. Secondly, as a result of EU membership, Sweden had undertaken to reinforce the Riksbank's independence – a requirement that was of course also based on an ambition to promote long-term thinking and credibility for monetary policy.

Although the amendments in the law were in formal terms rather radical, one can to a great extent regard them as a codification of the existing practice. The inflation target, which had been introduced in 1993 at the initiative of the Riksbank, was already well established. During the entire period with an inflation target the Riksbank had also in practice been able to act with a high degree of independence. Although political representatives had from time to time commented on and criticised monetary policy, the support for interest rate decisions being made by the Riksbank without political intervention had increased and was quite firmly rooted by 1999. In this sense the amendments in the law entailed no major differences in conducting monetary policy in practice, but could be regarded more as an insurance that the present system would continue to apply.

The amendment that had the largest practical consequences was the appointment of an Executive Board. From June 1994 the system had been that the Governing Council of the Riksbank, of which the Governor of the Riksbank was a member, made decisions regarding what was known as the interest rate corridor, that is, the Riksbank's lending and deposit rates. The Governor of the Riksbank then decided where in the interest rate corridor the repo rate would lie (Hörngren 1994).

This meant that even earlier, the interest rate decisions had been made, or at least influenced, by a group of people. However, unlike the Governor, the other members of the Governing Council were not full-time employees of the Riksbank and they often had other time-consuming assignments in addition to monetary policy. Therefore, the Governor's

views probably carried considerable weight when the decisions were made.

After 1 January 1999 these conditions changed fairly radically. The decisions were now to be made by a committee of six full-time employees voting on the interest rate. The Governing Council instead became the General Council, with a controller function and with the main task to appoint the members of the Executive Board.

Sweden is far from the only country to have introduced a system where the monetary policy decisions are made by a group of persons. During the past ten to fifteen years there has been an international trend towards allowing monetary policy to be determined by a committee rather than by an individual central bank governor.

With regard to monetary policy decision-making in committees, one can say that "practice has been ahead of theory" in the sense that the establishing of monetary policy committees around the world gave an impetus to research. Today there is relatively widespread and growing research into different aspects of monetary policy decision-making by committees.

Given the interest in this subject, it is somewhat surprising that no one has yet systematically surveyed people who have taken part in monetary policy committees with regard to their experiences. This is what we have done as part of this study. We have asked all of the people who have been members of the Executive Board of the Riksbank during some period since its inception in 1999 to respond to a questionnaire. The questions largely concern subjects that have been discussed in the research literature and may, for instance, aim to examine how well the members of the Executive Board feel that a particular theory fits in with their own experiences. The responses thus relate research to the views of initiated practitioners in a way that has not been done before. The results are summarised in the second part of this article. First, however, we shall provide a brief background to the establishment of the Executive Board, examine some specific characteristics of the way the Executive Board has chosen to work and report some statistics regarding the composition of and voting by the Executive Board over the years.

Why an Executive Board and why six members?

One explanation for the trend of delegating the monetary policy decisions to a committee is that the central banks have become increasingly independent. Previously, when the central banks were often more or less agents of the government, there was little reason to appoint more than one person to make the interest rate decision (Blinder 2007). As the

central banks have become more independent it has probably also been perceived as more appropriate from a legitimacy perspective to delegate the monetary policy decisions to a group of people rather than to one individual (Svensson 2001).

Another explanation could be that groups tend to make better monetary policy decisions than individuals. There is some support for this theory in the research. For example, Blinder and Morgan (2005, 2008b) and Lombardelli et al. (2005) find in experiments where students make simulated monetary policy decisions that the decisions are better if made by a group than if made by individuals.

In the bill that forms the basis for the amendments to the law in Sweden in 1999 there does not appear to have been any consideration given to delegating the monetary policy decisions to one individual central bank governor. The starting point appears to have been to find a solution that was relatively close to the previous system with a Governing Council (although during the period with a Governing Council the governor had a decisive influence over the interest rate decisions). For instance, it is said that: "In a situation where the role of the Governing Council is severely limited and the responsibility for monetary policy and other ESCB[2]-related issues is transferred to the Executive Board, it seems appropriate to introduce a more collegial decision-making system where the Governor of the Riksbank is primus inter pares (chairman)." (Bill 1997/98:40, *Riksbankens ställning* (*The position of the Riksbank*), p. 70.) One interpretation is that the legislator gave great importance to the argument that decisions should for democratic reasons be made by a group of persons rather than by an individual.

The argument that the decisions on average are better if they are made by a committee also appears to have carried some weight. For instance, that the Executive Board was to consist of six members was justified by stating that it will thus have "the requisite competence without being unnecessarily large". However, this probably did not merely refer to the competence to make good monetary policy decisions, but also to the competence to manage the Riksbank as a whole.

The quotation above is the only actual explanation as to why exactly six members were chosen. It is also noted in the bill that "it may be discussed whether an Executive Board consisting of one governor and two deputy governors might be adequate". However the conclusion is drawn that "given that the Executive Board shall manage the Riksbank and be responsible for most of the tasks that were previously the responsibility

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[2] The European System of Central Banks, that is, the cooperation body that consists of the European Central Bank and the National Central Banks of the countries in the EU.

of the Governing Council, the working group finds reason to consider an Executive Board that consists of a larger number of members".

So what does the research have to say about the appropriate size for a monetary policy committee? As we have already noted, there is some support in the research that groups on average make better decisions than individuals. If this was merely due to a group's total knowledge being greater than that of an individual, then the bigger the group the better. However, there are factors which mean that the advantages with increasing the size of a monetary policy committee begin to decrease or may even vanish if the group becomes too large. It could be a question of the monetary policy process being more unwieldy and that it is more difficult to conduct a good monetary policy discussion in an overly large group. At present there is no very precise consensus view as to what is an appropriate size for a monetary policy committee. The research appears to have resulted in the conclusion that 5-9 members is the preferable size (Erhart and Vasquez-Paz 2007). Moreover, the appropriate size of the monetary policy committee most likely varies according to the specific conditions prevailing in different countries (see, for instance, Berger et al. 2008). Internationally, the size of monetary policy committees varies, from 3 members in Switzerland to 22 in the European Central Bank (ECB).

The size of the Executive Board of the Riksbank has been discussed on some occasions since 1999. As early as 2000 the General Council proposed a review of the question of the size of the Executive Board. While awaiting this review the General Council proposed that the Sveriges Riksbank Act should be amended, setting the number of Executive Board members at a maximum of six and a minimum of three (General Council of the Riksbank 2000). However, the Riksdag (the Swedish Parliament) Committee on Finance rejected this proposal (Riksdag Committee on Finance 2000). The size of the Executive Board was also discussed in the evaluation of monetary policy in Sweden between 1995 and 2005 made by Francesco Giavazzi and Frederic Mishkin (2006) at the request of the Riksdag Committee on Finance. There it was stated that the Executive Board "could very well run with five or even four members" (p. 75). On this occasion both the Riksdag Committee on Finance and the General Council were negative to the idea of reducing the size of the Executive Board (Riksdag Committee on Finance 2007, General Council of the Riksbank 2007).

With the Executive Board in place

When it became clear that an Executive Board with six members would govern the Riksbank with effect from January 1999 and would make decisions on the interest rate, preparations began internally to adapt the monetary policy decision-making process and communication to the new situation. Many of the guidelines laid down as part of this work still apply and have made their mark on the Riksbank's activities over the past decade.

THE STAFF PLAYS AN IMPORTANT ROLE IN THE MONETARY POLICY DECISION-MAKING PROCESS

Fairly soon after the Executive Board came into force the monetary policy decision-making process also began to take form.[3] The process of producing a Monetary Policy Report takes around six weeks, while the time required to produce a Monetary Policy Update is slightly less. A preliminary draft for the forecasts is produced at a relatively early stage by the Monetary Policy Department following a series of meetings. These meetings are primarily intended as working meetings for the staff at the Monetary Policy Department, but the members of the Executive Board are also invited to attend. At a meeting of what is known as the monetary policy group the draft forecasts are then presented to the Executive Board and the Board members give their views on this and ask questions. On the basis of these forecasts and other background material the Executive Board then tries to reach a view which a majority will probably be able to support and which may be presented as the main scenario of the Monetary Policy Report (or Update). The Monetary Policy Department continues its work and compiles a preliminary draft of the Monetary Policy Report (or Update) in close collaboration with the Executive Board. The editorial work continues until the monetary policy meeting and the texts are regularly checked with the members of the Executive Board. The staff are well-represented at most of the meetings held during the process and can take part in the discussions. At the monetary policy meeting, too, some higher officials may attend and may express their own views.

Although the basic features of the monetary policy process have remained the same over the past decade, there have nevertheless been some changes. One such change is when the Riksbank in February 2007 began publishing its own repo rate forecast. As the Riksbank became more explicit about its own view on future interest rate developments,

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[3]   For a more detailed description of the current monetary policy decision-making process, see Rosenberg (2008) or Hallsten and Tägtström (2009). For a description of the earlier process, see Heikensten (2003).

more discussion about alternative repo rate forecasts during the monetary policy process was necessary. Therefore, the Executive Board needed to participate in the forecasting process in a more concrete manner, for example by taking part in dicussions about different risks and possible alternative economic outcomes.

Although the interest rate decisions are of course made by the Executive Board, the staff plays an important role throughout the entire process. This has been a deliberate strategy right from the start. Heikensten (2003) writes for example: "In some aspects the Riksbank chose to go its own way. For example, the officials working on the background reports have a stronger position here than at many other central banks. They are requested to make an overall assessment of inflation, which is different from, for instance, at the Bank of England, where this is done by the corresponding body to the Executive Board, the Monetary Policy Committee. For several reasons we considered this a good idea. It is a question of both making good use of the competence of the staff at the Riksbank and of ensuring a form of continuity in the assessments. But it is also important for developing the competence of the staff and making their work more interesting." (p. 363).

EMPHASIS ON OPENNESS AND CLARITY

Something that was emphasized from the start was that the Riksbank would remain open and clear, or transparent, as it is usually termed, with regard to the assessments it made and why it acted in one way or another. Ever since the inflation target was introduced in 1993, openness and clarity had been guiding principles for the Riksbank. This was considered important, not least to quickly win confidence for monetary policy and the inflation target following the crisis at the beginning of the 1990s. The amendments to the law in 1999 made a high degree of transparency even more important. As observed in Heikensten (1999): "The strong statutory independence makes it extra important that openness is practised as much as possible and that what we do can be examined and evaluated." (p. 4).

To some extent the transparency was regulated in the text of the law. The Sveriges Riksbank Act Chapter 6, Section 4, states that: "The Riksbank shall submit a written report on monetary policy to the Riksdag Committee on Finance at least twice a year." Chapter 10, Section 3, states that: "Each year, before 15 February, the Executive Board shall submit an Annual Report of the Riksbank's activities during the preceding accounting year to the Riksdag, the Swedish National Audit Office and the General Council. … The Annual Report shall comprise … an account

of foreign exchange and monetary policies and on how the Riksbank has promoted a safe and efficient payments system."

But beyond these paragraphs, the Sveriges Riksbank Act does not say very much about how transparent the Riksbank should be. The Executive Board has thus decided on its own initiative to be much more transparent than is required by law.

The Executive Board decided at its first meeting on 4 January 1999 that the minutes of its monetary policy meetings should be published. This has been done since October 1999, with a time lag of around two weeks. The minutes were to contain a review of the discussion conducted and information on the individual Executive Board members' final decisions. It was also decided that after the monetary policy meetings a press release would be published, containing a brief summary of the discussion. In the event of major changes in monetary policy and when Inflation Reports were published, the Riksbank would also hold a press conference. The members of the Executive Board would in addition give speeches, interviews and write articles.

The work on increasing the transparency of the policy has since continued in various ways. The Inflation Reports were gradually developed and in February 2007 replaced by Monetary Policy Reports, which also contain an in-depth account of the monetary policy deliberations. Forecasts are now published six times a year instead of the earlier four times a year. On three occasions this takes the form of a Monetary Policy Report, and on the other three it takes the form of a Monetary Policy Update, which contains forecasts for a more limited number of central macroeconomic variables. Clarifications of the monetary policy framework have been published on two occasions in the form of special documents – in February 1999 and in May 2006. Press conferences are now held after every monetary policy meeting and not only when the repo rate is changed, and the minutes of the monetary policy meetings, in addition to revealing how the members of the Board have voted, now also attribute the contributions to the discussion to individual members. The two latter changes were made in May 2007. From May 2009 the Riksbank began to publish the voting figures directly after the monetary policy decisions. If any of the Board members have entered a reservation, it is possible to read in the press release who this was and their main reason for doing so.

One change in recent years that has attracted much attention is that mentioned above – that the Riksbank began publishing its own repo rate forecast in February 2007. At that time the only other central banks publishing interest rate forecasts were those in New Zealand and Norway. Since then the Icelandic and Czech central banks have decided to follow suit.

The Riksbank's continuous work on becoming more open and clear has received attention both in the academic world and from other central banks. Studies that try to measure the degree of transparency in central banks around the world place the Riksbank in the top drawer (Eijffinger and Geraats 2006, and Dincer and Eichengreen 2007, 2009).

THE EXECUTIVE BOARD AND THE MONETARY POLICY MEETINGS – SOME STATISTICS[4]

Since its establishment in 1999, a total of 13 persons have served on the Executive Board under three different Governors (see Table 1). All in all, there have been six different numerically complete constellations of the Executive Board. During brief periods, when a member has left the Bank before a new member has been recruited, the Executive Board has consisted of five or even four members.

TABLE 1. THE COMPOSITION OF THE EXECUTIVE BOARD 1999–2009.

	Governor Urban Bäckström
1 January 1999–31 December 2000	Lars Heikensten, Eva Srejber, Villy Bergström, Kerstin Hessius, Lars Nyberg
1 January 2001–30 April 2001	Lars Heikensten, Eva Srejber, Villy Bergström, Lars Nyberg
1 May 2001–31 December 2002	Lars Heikensten, Eva Srejber, Villy Bergström, Lars Nyberg, Kristina Persson
	Governor Lars Heikensten
1 January 2003–31 December 2005	Eva Srejber, Villy Bergström, Lars Nyberg, Kristina Persson, Irma Rosenberg
	Governor Stefan Ingves
1 January 2006–29 March 2007	Eva Srejber, Lars Nyberg, Kristina Persson, Irma Rosenberg, Svante Öberg
30 March 2007–30 April 2007	Irma Rosenberg, Lars Nyberg, Kristina Persson, Svante Öberg
1 May 2007–20 May 2007	Irma Rosenberg, Lars Nyberg, Svante Öberg
21 May 2007–31 December 2008	Irma Rosenberg, Lars Nyberg, Svante Öberg, Lars E O Svensson, Barbro Wickman-Parak
1 January 2009–14 March 2009	Svante Öberg, Lars Nyberg, Lars E O Svensson, Barbro Wickman-Parak
15 March 2009–	Svante Öberg, Lars Nyberg, Lars E O Svensson, Barbro Wickman-Parak, Karolina Ekholm

The Executive Board of the Riksbank is what is usually referred to as an individualistic committee (Blinder 2007), where each of the members stands for his or her own opinion and communicates it externally. Interest rate decisions are made at monetary policy meetings by means of a vote. The Governor of the Riksbank is the Chairman of the Executive Board and has the casting vote if two proposals should have an equal number

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[4]   A more thorough compilation of statistics on the Executive Board can be found in Ekici (2009).

of votes. The members have the possibility to enter a reservation against the interest rate decision and/or the forecasts supported by the majority of the members.

Up to December 2009 the Executive Board had held 96 monetary policy meetings. During 1999 as many as 20 meetings were held, but it was noted that there was little justification for such a high meeting frequency. Since then, seven to nine monetary policy meetings have been held every year. In September 2007 the Executive Board made a decision that with effect from 2008 only six ordinary monetary policy meetings would be held each year.

At almost two thirds of the monetary policy meetings the interest rate decisions have been unanimous. This means that at around one third of the meetings at least one member of the Executive Board has entered a reservation. On four occasions the vote has been tied and the Governor's casting vote has decided the outcome – 5 July 2001, 1 December 2005, 3 May 2007 and 3 September 2008.

Most of the Executive Board members have entered a reservation against an interest rate decision at least once. The only exceptions (up to the end of December 2009) are Governors Urban Bäckström and Stefan Ingves, and the most recently-appointed member, Karolina Ekholm, who at the time of writing has only taken part in five monetary policy meetings. Lars Heikensten has entered a reservation against one decision, but this was in April 1999, before he took office as Governor of the Riksbank. The Governor in office has thus never entered a reservation against an interest rate decision, and has thus always been part of a majority. In our survey one of the questions was why the members believe this to be the case.

The Executive Board members' own experiences – the results of a survey

We sent a questionnaire to all 13 members who have served on the Executive Board since its start in 1999 and received 12 responses.

The survey takes up to a great extent changes that have been discussed in the growing research into decision-making in groups in general, and in monetary policy committees in particular. As far as we know, there has not previously been any similar systematic collection of information from people who have taken part in a monetary policy committee. In total, the survey covers around ten areas. The focus is on the monetary policy part of the Executive Board's work. The compilation below is a relatively brief summary of the results. A more detailed account can be found

in Apel, Claussen and Lennartsdotter (2010), which also contains a more detailed review of the research into monetary policy committees.

BETTER DECISIONS WITH A COMMITTEE

As we have concluded above, there are mainly two explanations for the international trend towards having monetary policy decided by a committee rather than an individual. One is that central banks have on the whole become more independent and that it is regarded appropriate for democratic reasons to delegate the decisions to a group of people. The other is that there are arguments in favour of groups tending to make better monetary policy decisions than individuals, although the research is not unequivocal on this point.[5] In the survey we asked the members of the Executive Board to express their opinion, based on their experiences of conditions in Sweden and of the Riksbank's Executive Board, on the following two statements:

"To gain sufficient acceptance among the general public and politicians for a system where the Riksbank is independent it is required that the monetary policy decisions are made by a group of persons and not by an individual."

and

"Over time the monetary policy decisions will be better if they are made by a group of persons instead of by one individual."

A large majority of the members responded that both statements "apply completely". Thus, the members find that the interest rate decision on average are better if they are made by a group of people. But why, more specifically, would this be the case? We asked the members to rate the importance of three potential reasons for this. The first was that the decisions are better when a group of people with different backgrounds, experience and knowledge *discuss and interact* prior to a repo rate decision – what one might call pooling by talking. One could express this as the monetary policy committee "pooling" its experiences and knowledge through the discussions and that the decision can thus have a better and broader foundation. The second reason was that the decisions are better if a group of persons with different backgrounds, experience and knowledge *vote* on the repo rate – pooling by voting. Unlike the first reason, it is the actual voting that is central rather than the discussion and interac-

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5   See Sibert (2006) for a survey of problems associated with decision-making in groups.

tion between the members prior to the decision.[6] The third reason was that if the decisions are made by a group of people, this functions as an *insurance* against extreme preferences held by one individual. For example, this could be a central bank governor wanting to keep inflation down at any cost, without giving any consideration to the real economy, or the reverse, taking the task of combating inflation too lightly.

All three reasons are regarded as good arguments for interest rate decisions being better on average if made by a group of people, see Figure 1. The first statement – that the decisions are better because the Executive Board discusses and interacts – appears to be the most important; all of the members considered this to be "fairly important" or "very important".

Figure 1. If you find that monetary poliy decisions improve if they are made by a group, how important are the following reasons for your response?

When the Executive Board, a group of persons with different backgrounds, experiences and skills, discusses and interacts, the basis for decision-making is enriched and the decisions are better than what even the most competent member of the Executive Board could achieve alone. A "collective wisdom" is created.

The fact that a group of persons with different backgrounds, experiences and skills votes on the decisions means that they are better than they would have been if made by one individual.

Group decisions function as an insurance against extreme preferences held by on individual.

Unimportant   Slightly important   Fairly important   Very important

STAFF MORE IMPORTANT THAN COLLEAGUES

The stylized picture of how monetary policy decisions are made probably shows a group of initiated people sitting down to discuss the appropriate level of the policy rate. Arguments are put forward and discussed, knowledge and experience are "pooled", and the group gradually reaches a view that most can support (pooling by talking). The discussion is central to the quality of the decision. As can be seen from the previous question, the Executive Board members consider the discussion prior to a repo

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[6]   One could say that this is an application of Condorcet's jury theorem from the end of the 18th century, which states that a committee which makes decisions (between two alternatives) by a majority rule has a greater probability of making the best decision than any of the individual members would have if they acted on their own. The theorem also states that the probability of making the right decision approaches one when the number of members on the committee approaches infinity.

rate discussion to be important. But what does the "pooling" involve in greater detail? What type of information is exchanged?

To learn more about this we asked the members how important contributions from colleagues on the Executive Board, and contributions from the Riksbank staff respectively, have been for their own assessments regarding three different aspects:

(i)   The current economic situation and trends that the Riksbank is unable to influence, such as future oil prices and international economic developments.

(ii) How the Swedish economy functions and thereby how things will develop if the Riksbank acts in one particular way or another.

(iii) How quickly inflation should be brought back on target, that is, prioritising between stabilising inflation and stabilising the real economy.

In more technical terms the breakdown represents (i) the exogenous variables; (ii) the model and (iii) the preferences regarding stabilising inflation relative to stabilising the real economy (the relative weights in the monetary policy objective function).

For all three aspects the most common response was that the colleagues were only "slightly important", see Figure 2. The results contrast somewhat with the view that the monetary policy decisions are better because a group of persons with different backgrounds, experience and knowledge discuss and interact – a statement which was given relatively high scores. The discussion within the Executive Board is thus considered important, but at the same time the colleagues' possibilities to influence one another's decisions appear fairly limited.

One reason for this could be the central role the staff plays in the monetary policy process. A large majority of the members considered the staff to be very important for their own assessment of (i) and (ii), see Figure 2. As shown in the same Figure, however, the importance of the staff for the members' assessment of how quickly inflation should be brought back on target, point (iii), is much lower. This is quite natural and supports the notion that the members' deliberations in this respect reflect their personal preferences.

SEVERAL CONSIDER THE EXECUTIVE BOARD TO BE TOO LARGE

What is the appropriate number of members for a monetary policy committee? This is a question that has been much discussed, as we observed

Figure 2. How important were/are your colleagues on the Executive Board to you…

i)… as sources of information on the current economic situation and on developing trends that the Riksbank is unable to influence, such as the way the oil price and international economic activity develop?
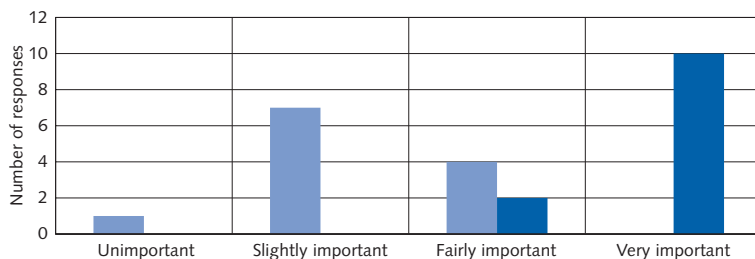
ii)…for your view on how the Swedish economy functions and thereby how things will develop if the Riksbank acts in one particular way or another?
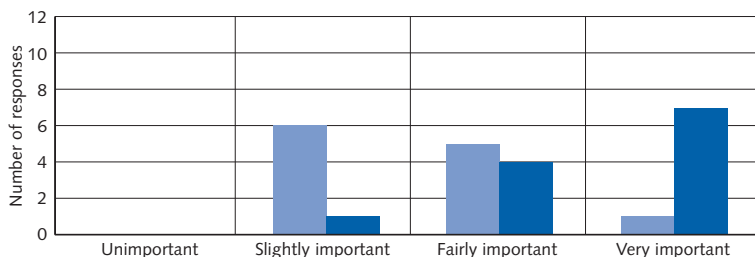
iii)… for your assessment of how quickly inflation should be brought back on target/prioritising between stabilising inflation and stabilising the real economy?
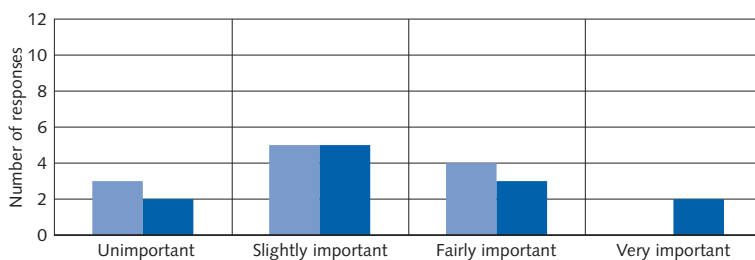
■ Executive Board ■ Staff

earlier. According to the survey responses, six of the members considered the Executive Board to be too large, five appropriate, and only one considered it too small.

We then asked what they consider to be the appropriate size for the Executive Board, again from a monetary policy perspective. For those who considered the Executive Board too large the responses varied from 3 to 5 persons, see Figure 3.[7] The member who considered the Executive Board too small thought an Executive Board of 9 or 11 members was appropri-

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[7]   Some members stated two alternatives, for example "3 or 5", or "6 but it could just as well be 5". Figure 3 shows the highest alternative.

Figure 3. What do you believe to be the most appropriate number of members for the Executive Board, seen from a monetary policy perspective?
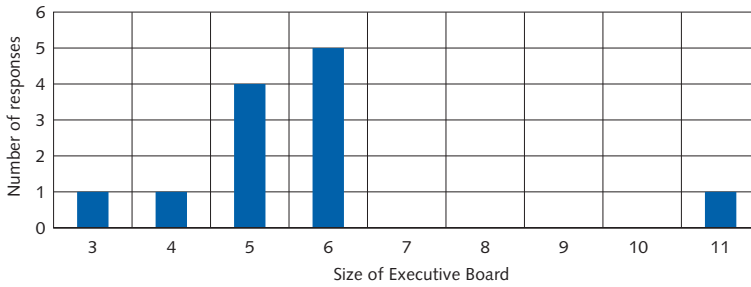
ate. Several members also commented that the Executive Board should have an uneven number of members.

In an international perspective, the Riksbank has a relatively small monetary policy committee, see Figure 4. Nevertheless, many members find that it can be reduced further. The members thus prefer a committee size in the lower region of the span of 5 to 9 members that the academic research points to as suitable.

SCEPTICISM TOWARDS EXTERNAL MEMBERS

The size of the monetary policy committees differs between countries. The composition of the committee also varies, see Figure 4. In some countries, for instance Norway and the UK, some of the members of the monetary policy committee are external and employed on a part-time basis. At the Bank of England the purpose of having external members is said to be "to ensure that the MPC benefits from thinking and expertise in addition to that gained inside the Bank of England".

According to studies using voting data from the Bank of England's Monetary Policy Committee, the external members enter reservations against policy rate decisions more often and tend to prefer lower policy rates compared with the internal members (see for instance Gerlach-Kristen 2003, 2009).

The results of the survey reveal some scepticism towards a solution where a number of the Executive Board members are external, although opinions vary, see Figure 5. The scepticism may indicate that most members consider there to be no lack of "external perspective" or risk of groupthink on the Riksbank's Executive Board. The members have different backgrounds and they may retain much of their own way of thinking and their own channels of information even during their period of office at the Riksbank. The fact that the Riksbank's policy from the start has been that the members of the Executive Board shall act as individuals and

**Figure 4. Monetary policy committees in inflation targeting countries.
Size and share of external members**
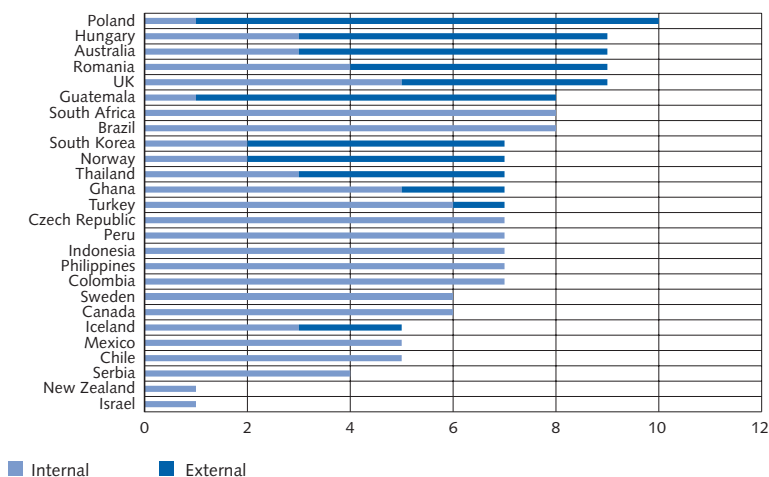
Internal ■ External ■

Source: Hammond (2009)

Figure 5. External members. How well do you think that the following statements apply?

External Executive Board members could contribute information, knowledge and an "external" perspective that would otherwise not be taken into account.

If one or more of the six members of the Riksbank's Executive Board were employed part-time, this would require less resources without the monetary policy decisions being of poorer quality.

□ Does not apply at all ■ Applies to some extent ■ Applies only to a slight extent
■ Applies completely

represent their own opinions externally may have reduced the risk of an overly narrow perspective.

The scepticism may also indicate that the members consider the process leading to the repo rate decision, with an intensive interaction with the Riksbank staff and within the Executive Board, to be essential to a good repo rate decision. It is possible that it may be difficult for someone who is not full-time at the Riksbank to fully participate in this process.

MUCH IN PLACE BEFORE THE MONETARY POLICY MEETING

To obtain more information about the final phase of the monetary policy decision-making process, we asked the members to stipulate the frequen-

cy of some incidences, for instance, how often they had decided how they would vote prior to the monetary policy meeting, or how often they had a firm idea of the other members' views prior to the meeting.

Our results show that the majority of the members have *always* made up their minds as to how they intend to vote, and do not change them during the meeting, see Figure 6. It is very common that members prior to the meeting have a clear idea of how the *majority* of their colleagues intend to vote. It is slightly less common that they have a firm idea of how *all* of their colleagues intend to vote. It is unusual that new information or arguments come up at the monetary policy meeting. Furthermore, most members never change their minds during the meeting and it is very rare that members do not know prior to the meeting how they will vote themselves.

On the whole the results show that although the final decision is made at the monetary policy meeting, most of the pieces are already in

Figure 6. How often has it happened that…

...you have in principle decided how you intend to vote before the monetary policy meeting and have not changed your mind during the meeting? — 4 | 7

...information and arguments that are new to you have been presented at the monetary policy meeting? — 4 | 5 | 2

...you have changed your mind during the monetary policy meeting despite the fact that you had in principle decided before the meeting how you intended to vote? — 7 | 4

...you have not known how you would vote prior to the monetary policy meeting? — 9 | 2

...you have a clear impression of how the majority of your colleagues intend to vote before you go into the monetary policy meeting? — 1 | 4 | 6

...you have a clear impression of how all of your colleagues intend to vote before you go into the monetary policy meeting? — 2 | 2 | 7

Never   Sometimes   Often   Always

place prior to the meeting. This is not surprising, given the design of the monetary policy process at the Riksbank. A detailed and thorough Monetary Policy Report (previously Inflation Report) or Monetary Policy Update is published at the same time as the repo rate decision is announced, explaining and providing the foundation for the decision made. This makes it necessary to work out forecasts and alternative scenarios on which a majority can probably agree prior to the monetary policy meeting. As stated by Svensson (2009, p. 26): "The discussion and exchange at the final monetary policy meeting do not start from scratch, but are the culmination and summary of [a long series of]…meetings. Therefore, one would not expect too much spontaneity but rather the presentation of the essential summaries and the reasons for the decision by each member." Changes at the last minute are of course always possible and there is a preparedness for this. As pointed out in Hallsten and Tägtström (2009), the work process is designed so that the forecasts and the Monetary Policy Report can be changed after the meeting if a majority of the Executive Board so desires.

The way the members have perceived the situation prior to and during the monetary policy meeting is of course something that may have varied over time. The more intense and comprehensive the process leading up to the policy rate decision, the more likely it is that the members have a firm idea of their own and their colleagues' views, and the less new material will come to light at the policy meeting. As we have noted above, both the method of working internally with the forecast and the method of communicating externally changed when the Riksbank began to publish its own forecast for the repo rate in February 2007. The monetary policy process, with preparatory meetings and interaction with the staff and within the Executive Board, then became even more intense and comprehensive than it was before.

One hypothesis is thus that the members who have been active on the Executive Board after the Riksbank began publishing its own repo rate forecast might perceive that even more is in place prior to the monetary policy meeting. We divided the responses into two groups – prior to and after the Riksbank began publishing repo rate forecasts and we examined whether the responses differed.[8] The results appear to support the hypothesis. Members who had been active on the Executive Board after the Riksbank began publishing the repo rate forecast had more often decided how they would vote prior to the monetary policy meeting and more often had a firm idea both of how the majority of their colleagues

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[8]   Members with reasonably long experience of both conditions were asked to respond both with regard to the situation prior to the publication of the repo rate forecast and with regard to the situation afterwards.

would vote as well as how all of the others would vote. They also considered that new information and new arguments were more rarely put forward at the monetary policy meetings, they more rarely changed their opinion during the meeting and were more rarely uncertain as to how they would vote prior to the meeting.

We also put a follow-up question to the members, asking them to state why they had a firm idea of how the others intended to vote. Also the responses to this question support the hypothesis that publication of the Riksbank's own repo rate forecast has changed the monetary policy process and meant that more is in place prior to the meeting. Members who have served on the Executive Board after the publication of the repo rate forecasts considered that the others' views often became clear at the preparatory meetings, for instance, within the monetary policy group and less often from the members' public statements[9] or from the fact that the members have a predictable reaction pattern. However, the publication of the repo rate path does not appear to have had any effect on how common it is for the members to obtain information on one another's views in discussions outside of the meetings, in private or in groups.

WILLINGNESS TO COMPROMISE DESPITE MANY RESERVATIONS

Many of the interest rate decisions have not been unanimous. On average, one or more members has entered a reservation against approximately one in three repo rate decisions. We asked the members to stipulate the importance of three alternative reasons for their reservations, see Figure 7.

There was large variation in the responses. For each alternative some members found the explanation "very important" and others found it "unimportant" or "slightly important".

Although there have been many reservations, members might still *refrain* from entering reservations, despite having a different opinion from the majority. In such cases there is a risk that the diverging opinion will not be very well expressed in the minutes.

We asked the members whether they had refrained from entering a reservation against one or more monetary policy decisions, despite considering that another decision would have been better. A majority of seven members responded that they had. Judging by the survey responses, the single most important reason for this was that the majority decision was *reasonably close* to their own assessment. There is a "bargaining

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9   One important explanation is probably that the Riksbank decided, in connection with the publication of its own repo rate forecasts, that Executive Board members would no longer "signal" in advance how they considered the repo rate should be set at the coming monetary policy meeting.

Figure 7. If you have entered a reservation against one or more interest rate decisions, how important were the following reasons for your stance?

I made a different assessment of the current economic situation and of developing trends that the Riksbank is unable to influence, such as the way the oil price and international economic activity develop.

I made a different assessments of how the Swedish economy functions and thereby how things will develop if the Riksbank acts in one particular way or another.

I made a different assessment of how quickly inflation should be brought back on target/ prioritisation between stabilising inflation and stabilising the real economy.

☐ Unimportant ☐ Slightly important ■ Fairly important ■ Very important

margin" in the repo rate decisions. According to all but one of the seven members who responded to this question, this reason is "very important". A few members also state that they have refrained from entering a reservation out of consideration for the general public's confidence in monetary policy or to avoid creating unease in the financial markets. One explanation that is dismissed by all is that the reservation would change the majority and this in turn would lead to costs for changing the forecasts and reports at the last minute.

As we have observed above, the Executive Board of the Riksbank is usually referred to as an individualistic committee, where lack of unanimity is considered natural. Nevertheless, our results show that there is willingness to compromise. The members' own views must differ sufficiently from the majority view before they enter a reservation. The members "choose their battles". Thus, there is some collegial element in the individualistic committee. The results probably also relate to the fact that members do not regard monetary policy as an exact science.

THE GOVERNOR'S INFLUENCE

As we have noted, approximately every third interest rate decision has not been unanimous. Reservations have thus been relatively common. However, something that has never occurred is for a Governor to be in a minority and to enter a reservation. During the Executive Board's first decade, all members except the Governor had entered a reservation at

least once.[10] One explanation for this could be that the Governor holds the casting vote if the outcome of the voting is completely even. The governor has used the casting vote on four occasions. But even if four votes are required for the Governor to be in a minority, it nevertheless appears somewhat surprising that this has never happened. In one way or another, the Governor appears to differ from the other Executive Board members.[11]

The role of the central bank governor has been discussed in research (see, for instance, Blinder and Morgan 2008a and Gerlach-Kristen 2008). We asked the members to stipulate the relevance of some explanations to why the Governor of the Riksbank has never been in the minority, explanations that were based on research literature or which we otherwise considered might be relevant. The members did not appear to consider any of the explanations to be particularly convincing. The hypothesis that the Governor has greater influence over the forecasts and other materials, for instance, was only considered to apply to a slight extent. The explanations that members tend to support the Governor's view, or vice versa, that the Governor tends to support the majority view, were considered slightly more important. The median response there was "applies to some extent". These results, like the earlier results for the question of why one has refrained from entering a reservation, indicate that there is some willingness to compromise when making repo rate decisions.

There seems to be particular scepticism towards the hypothesis that the Governor as chairman at the monetary policy meeting can influence the discussion and thereby the interest rate decision. This result is well in line with the above result, namely that members have in principle decided before the meeting how they will vote. No particular explanation as to why the Governor has never been voted down is highlighted. But at the same time, the members respond that it is not mere coincidence that the Governor has never been in a minority.

POSITIVE WITH ATTRIBUTED MINUTES

In June 2007 the Executive Board decided that the minutes of the monetary policy meetings are to contain the names of the members together with their contributions to the debate. The Riksbank is one of few central banks in the world to apply this practice. Previously, names of individual

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[10] The most recently-appointed member of the Executive Board, Karolina Ekholm, who joined in March 2009, had at the time of writing this not yet entered a reservation, either.

[11] The results are similar for other central banks with individualistic committees. In the United Kingdom, for instance, the central bank governor has actually been voted down, although this has only happened on two out of more than 150 decision-making occasions (and where around 60 per cent of these have not resulted in a unanimous decision).

members were only revealed in association with the votes. The purpose of the change was to make it easier for external analysts to evaluate each member's analysis and reasoning and how consistent they are over time.

Exactly how transparent a central bank should be is debated both within academic research and in central bank spheres (see, for instance, Eijffinger et al. 2008). One argument that is put forward against publishing attributed minutes – and sometimes against publishing the minutes of monetary policy meetings at all – is that the discussion may then be more limited and "tied to a script". One advantage of attributed minutes, apart from increasing transparency, could be that the members' individual responsibility becomes even clearer. This could in turn result in the members preparing even more thoroughly for the meetings (Gersbach and Hahn 2008). It could also reduce the risk of groupthink.

The survey responses indicate that the members only to a slight extent consider that the discussion becomes more inhibited and less spontaneous. There is more support for the assertion that attributed minutes lead to a better discussion; the median response indicates that members on the whole consider that it "applies to some extent". That attributed minutes lead to more time and work being put into the monetary policy process, and to greater focus on the individual members are also assertions considered to apply to some extent.

The publication of an own repo rate forecast (in February 2007) coincides roughly with the Riksbank beginning to publish attributed minutes (in June 2007). If one examines the responses in the same two groups as before, prior and after publication of an own repo rate path, it is clear that opinions appear to have changed slightly over time. The members who actually have experience of a system where the contributions are attributed in the minutes are much more positive than those who lack this experience. For instance, none of these think that the statement that the discussion becomes more inhibited and less spontaneous applies. The results are perhaps not surprising given that many of the members in this group have taken part in the decision to introduce names into the minutes.

DIFFERENCES OF OPINION MORE INFORMATIVE THAN CONFUSING

Questions regarding the Riksbank's communication and how well it has functioned can of course best be answered by people outside the bank. But we nevertheless found it interesting to ask the members for their views on a couple of aspects discussed in the academic research.

When communicating monetary policy, monetary policy committees have to strike a balance between two potentially opposing effects. On the one hand information on the opinions of the different members helps explain the monetary policy decisions and can make monetary policy more predictable. On the other hand uncertainty may increase if members give different, conflicting signals. As Blinder (2007) put it: "A central bank that speaks with a cacophony of voices may, in effect, have no voice at all" (p. 114). At the same time, the basic idea behind an individualistic committee is that its members shall be able to express, in speeches and otherwise, their own individual opinions as to how monetary policy should be conducted. Economic agents thus receive valuable information regarding the differences in opinion and the relative strengths prevailing in the committee and can use this as a base to form an opinion of the future policy.

Figure 8. How well do you think that the following statements apply?

The fact that all members of the Executive Board can express their own views publicly as individuals makes the Riksbank's communication less clear.

The fact that each member publicly describes his or her views (e.g. in speeches and the minutes of the meeting) is important so that economic agents will understand the Riksbank's policy ("the way we think").

I have felt bound by other members' statements in public.

Does not apply at all   Applies only to a slight extent   Applies to some extent   Applies completely

We asked the members to judge the following two statements:

"That all members of the Executive Board can express their own views publicly as individuals makes the Riksbank's communication less clear",

and

"That each member publicly describes his or her views (for example, in speeches and the minutes of the meeting) is important so that economic agents will understand the Riksbank's policy ("the way we think").

regarding their own view, or even to support, against their will, an opinion already expressed by someone else.

The balance tipped in favour of the second argument, see Figure 8. The majority of the members consider it important that each member explains his or her opinions so that the economic agents will understand the Riksbank's policy. The statement that communication may be unclear if all of the members of the Executive Board comment publicly receives less support, although only a couple of members dismiss this entirely. A much larger number dismiss the statement that they have felt bound by other member's statements in public.

Some concluding remarks

The conventional picture of a monetary policy decision-making process puts considerable focus on the monetary policy meeting. A monetary policy committee is gathered to one single meeting to discuss how the current policy rate should be set. Prior to this the members have deliberated separately. During the discussion the members put forward arguments which are mulled over. Gradually, the committee reaches a decision as to whether or not the current policy rate needs to be changed and if so, by how much. The interest rate decision is announced and only a relatively brief explanation given.

The monetary policy decision-making process at the Riksbank differs substantially from this picture. As we have described above, the process spans a number of weeks and involves a series of meetings, in which both the staff and the Executive Board participate and discuss together. The process concludes in a repo rate decision and detailed forecasts for a number of central variables, including the future development of the repo rate. The forecasts and the monetary policy stance are presented and explained in detail in the Monetary Policy Report (or Monetary Policy Update) that is published at the same time as the repo rate decision.

Several of the results in the survey appear to be linked in various ways to the monetary policy decision-making process at the Riksbank and to the way the repo rate decision is communicated. Much appears to have fallen into place already before the monetary policy meeting, although this is of course where the final repo rate decision is made. The members have almost always decided how they will vote before the meeting and it is only occasionally that new information or new arguments are put forward at the actual meeting. It also appears to be the case that during the process the members form a good idea of how most of their colleagues intend to vote. This should come as no surprise, since the report published

in connection with the repo rate decision is supposed to reflect the majority view.

The design of the decision-making process could also explain to some extent the relatively positive attitude to the attributed minutes. The members have had the opportunity during the series of preparatory meetings to test their arguments on their colleagues and the staff, to hone them and possibly to revise them. The arguments can therefore be put forward in a concise and well-reasoned manner at the monetary policy meeting. It is also possible that the apparent scepticism towards a system with external board members is partly due to the belief that it is important that all members take part in all stages of the monetary policy decision-making process.

It is probably not particularly unusual for central banks to work in a similar manner to the Riksbank – where forecasts and opinions on what should be done gradually emerge as the result of a series of meetings and are presented in relatively great detail in a written report published at the same time as the policy rate decision. The conventional picture of the monetary policy decision-making process, where the discussion at the monetary policy meeting starts more or less from scratch, and where the policy rate decision is justified relatively briefly, appears to better describe the situation in, for instance, central banks where the members are located in different parts of the country, have their own staff and only get together at the monetary policy meetings.

Another result that may be worth highlighting – and which would probably have been difficult to attain other than by means of a questionnaire – is that a majority of the members has at some time refrained from entering a reservation, despite the fact that they considered a different decision than the one made by the majority would have been better. Although the Executive Board is individualistic, there thus appears to be some element of collegiality when the decisions are made. The main justification given is that the decision made was nevertheless reasonably close to the member's own assessment and that there is some "bargaining margin" in the policy rate decisions.

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Lars Heikensten, member of the European Court of Auditors and former Governor of the Riksbank comments on the paper by Mikael Apel, Carl Andreas Claussen and Petra Lennartsdotter:

The Executive Board of the Riksbank and its work on monetary policy – experiences from the first ten years

Let me begin by thanking you for the invitation. It is very nice to be back here at the Riksbank.

The article written by Mikael Apel, Carl Andreas Claussen and Petra Lennartsdotter is interesting both because the survey they have carried out appears to be the first of its kind, and because the article takes up a number of questions raised in the academic research concerning collective decision-making on monetary policy issues.

As I was very much involved in the work on producing a proposal for the system for preparing, making and communicating monetary policy decisions which was adopted by the Riksbank in 1999, when an Executive Board was established, it is natural for me to use the deliberations we had then as a starting point for my comments. On the whole I will discuss questions related to the way the new system, with the changes that have occurred later on, has functioned in practice.[1]

Four questions that have followed the Riksbank, at least since it has had an Executive Board, form the focal point of my comments. One factor that these questions have in common is that they are still worth discussing. Perhaps a 10-year jubilee like this is an appropriate time to play the devil's advocate, particularly as I believe there is a consensus that the system applied has worked well on the whole.

1. The decision-making process works well

The first question we had to consider in autumn 1998 was how the new Executive Board would organise the preparation and decision-making processes. The article shows that we chose to give Riksbank employees a central role, including taking part in various preparatory meetings with the

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[1]   See Heikensten L., (1999), "Monetary policy and the new Executive Board", (speech held at the Autumn Conference of the Centre for Business and Policy Studies), Sveriges Riksbank, for a simple description of the system introduced in 1999.

Executive Board and some of them also being present at the final meeting where the decision was made.

This system, with a strong presence by the bank employees concerned, may now appear self-evident, but this was certainly not the case in autumn 1998. In many of the central banks we looked at, such as the Bundesbank in Germany, the employees were kept outside of the discussions where the decisions were made, and this is still the case at, for instance, the European Central Bank (ECB).

There were many good reasons for choosing the model we have; if the staff were more involved they would better understand what information needed to be provided and they would probably be more motivated. Another reason why we chose to have employees present was that it would ensure that all of the Board members had access to the same information and that the Governor and the Deputy Governor responsible for drafting monetary policy issues (which was part of the system then) would not have an information advantage.

The article appears to support the stance we took. The members of the Executive Board have evidently often been influenced by employees' reasoning, even more so than by one another's reasoning. The presence of the employees – and the close contacts they have had with the Executive Board – have probably contributed to this. Hopefully this has also meant that monetary policy has become better, although there are of course no guarantees for this. It would also appear – from this article – that the members have not perceived the Governor to have an information advantage.

The number of preparatory meetings has increased over time, and so has the interaction with the staff. I believe that this has been a fairly natural consequence of the system chosen, which encourages dialogue and contacts with the staff. Another contributing factor has been that model tools have been created, which have made it possible to simulate the way the economy as a whole would develop in the event of different exogenous assumptions and different monetary policy strategies. When the Riksbank began to publish its own path for future monetary policy a couple of years ago, it became inevitable to conduct the monetary policy discussion at an early stage in the forecasting process. All in all, this development has as far as I can understand contributed to the preparation of the monetary policy decisions gradually becoming more and more professional.[2]

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[2] Personally, I only have one concern with regard to the development of the preparation work. If too much focus is placed on future paths for monetary policy, there is a risk that the discussion aimed at the future will crowd out the arduous – but very important – work on interpreting the new data received and determining what phase the economy is in at the time of the decision. It might be important to take measures to avoid this.

2. Minutes of meetings are good, but do they still fulfil their original role?

Another of the questions we had to consider in 1998-1999 was how we would develop the forms for accountability, when the Bank became formally independent. The Riksbank had earlier taken several initiatives to conduct an open dialogue with our principals – the general public and the Riksdag. The principles for the Riksbank's policy had been made clearer, Inflation Reports – which had presented an overall view of developments in the economy and inflation since 1996 or so – had begun to be published and so on. The direct contacts with the Riksdag had also been strengthened, for instance the Governor and other members of the Board regularly appeared before the Riksdag Committee on Finance. The question now was whether these forms should be further developed, or whether one should examine other means of opening up the Bank and making monetary policy clearer.

After some discussion the new Executive Board decided to work with minutes, which would show - albeit in a revised version - what had been said at the meetings where the decisions on monetary policy were made. When we made this decision we were largely inspired by the Bank of England, which we visited in autumn 1998 to be able to air views on the advantages and disadvantages of the system they had introduced on site.

I believe that this is the single most important decision regarding the Riksbank's methods of working taken since the new Sveriges Riksbank Act was launched. This has been decisive for the way the Riksbank has come to work and to be perceived. The individual responsibility for the decisions was clearly highlighted with the aid of the minutes, in a way that went far beyond our expectations. There may also be reason to point out that at this point in time, many people both inside and outside of the Riksbank were sceptical about the new system, would it perhaps mean that the monetary policy meetings became merely grandstanding and perhaps that the conditions for a good discussion deteriorated?[3]

The arguments in favour of the new system concerned the fact that it would strengthen individual responsibility; it would not be possible for members of the Executive Board to have a free ride. Ultimately, this – six individual, well-prepared members forced to argue their cases – should lead to better policies. Moreover, there were several more reasons in favour of minutes than those we chose to highlight when the decision was made. Not least I myself believed that minutes of this kind – in a small country like Sweden – would help stimulate both a livelier debate

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[3]   See, for instance, Dennis, B, Riksbankens nya kläder (The Riksbank's new clothes), Special Report, SEB Merchant Banking, 1999.

and the building-up of knowledge about monetary policy. Finally, I was convinced that the clear individual responsibility would ensure that the political system appointed members with a higher competence in this field than might otherwise have been the case. I still believe that this may very well have been one of the most important aspects of the choice we made, although I have never seen this argument mentioned in any research.

At the same time, there was a risk, which I do not believe one should ignore, that this type of minutes and this kind of openness could have a negative influence on the discussion and in the worst case ultimately on the decisions, too. To some extent I think that the discussion was affected; it was not always as open and searching as I had perceived the internal discussions to be prior to this. However, these problems were not sufficiently large to change my mind about publication of the minutes being a good idea. On the other hand I do think that they are one reason why we should not be too confident in the superiority of our own model. It is important to constantly seek methods that contribute to the freest possible discussion within the chosen framework.[4]

There is another issue here, which there may be reason to consider in this context. The chosen model, with a specified future development for the repo rate, means in practice that the decisions are taken before the meeting which is minuted (although it is possible to make revisions at this meeting). This was not the case before in the same self-evident manner, as the forecasts reported then were based either on an unchanged repo rate or on the rate expected by the market. The change appears to be confirmed by the survey results. These show that members prior to 2007 – under the system prevailing then – generally knew how they would vote and also how the others intended to vote before they went into the monetary policy meeting. But perhaps the average values from this period are only natural given that they all worked in the same building, knew one another, etc. Since the current system was introduced, however, *all* members appear to have *always* made their minds up prior to the meeting.

The question is then whether the minutes fulfil the role most people expect, of giving the general public a picture of how the discussion went and how the decision emerged? A closely-related issue is whether the General Council as principal can now follow how the decisions have been reached in the way that was intended? Regardless of exactly how one answers these questions, it is essential that the Riksbank clarifies the role of the minutes in the current system. The decisions have in practice been

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[4]   In the survey on which the article is based, we Executive Board members were asked whether we believed that the fact that the minutes were now written in a way so that each comment is attributed to a member had an effect on the meeting. I myself find it unlikely that this would play any major role in the way the meetings function, as there was already before such great openness.

made earlier. What the minutes mediate is normally a picture of how the different members put forward their arguments after the real discussion has been concluded and the future path for the repo rate has been established.

3. Communication with the market can be improved

The value of openness does not merely lie in its leading to better decisions and anchoring monetary policy in society. Open and clear communication can also pave the way for monetary policy in ensuring that the political intentions are understood by the markets, which will act accordingly. In the best of worlds the financial markets can make their own assessments and work out what the decisions will be. It is therefore unsurprising that central banks' communications with the general public and the markets are an important and sometimes much-discussed issue.

In recent years the Riksbank has made several changes in this field, for instance, as already mentioned it now publishes paths for the future repo rate. This ought to contribute to better grounds for understanding where monetary policy is heading. But there have also been changes made in the principles for communication to which I am more sceptical. Let me therefore say a few words about this.

The system that prevailed earlier regarding communication by Executive Board members could be described in fairly simple terms. Each member of the Board had the possibility to speak whenever he or she wished about whatever he or she wished. We could discuss the principles of our policy, how our picture of economic activity had changed or what considerations we might have concerning the future. However, we had agreed that we would regularly show our draft speeches to one another in advance to gather views and to avoid unnecessary contradictions or conflicts. We had also agreed to try to avoid holding speeches too close to a monetary policy meeting, where we risked sending signals that could be interpreted as set positions on the repo rate.

The freedom we each had, to speak freely as part of our individual responsibility, was of course freedom with responsibility. Each of us expressed our own personal views and had to take the consequences of what we said. What was said by one or more members could not be used to commit the others. The survey seems to support the theory that this

actually worked as it was intended. It would appear that members rarely felt committed by what other members said.[5]

Some years ago the Riksbank abandoned this system. The idea was now that one would avoid giving guidance on what the policy rate might become by not communicating forward-looking messages. One argument in favour of this was that the members would not commit themselves, the decision would be taken at the final meeting, and until then the members should remain open. This is an argument with which I can sympathise, perhaps one becomes less open and sensitive to other views if one has already publicly expressed a particular view. But we have already seen that this was not in practice a major problem, there was some openness with regard to the meetings. Paradoxically - as we saw earlier - this openness has not now increased, but instead decreased.

The problem with an approach like this is that, in my opinion, it is not possible in practice to draw a practicable line between communicating what has happened and signalling what will happen. To repeat a few weeks after a monetary policy meeting what one said there can be perceived as a new message. And commenting on new figures most certainly is. (If one wants to talk about history without sending any signals, one should do as Alan Greenspan did when he was in Sweden some years ago in a sensitive monetary policy situation: talk about the expansion of the railway network in the previous century).

In practice, by commenting on what has happened one can send just as many clear signals about what one thinks of the coming interest rate as when one discusses the question directly. It is therefore unwise, in my opinion, to try to draw a line; it is better to use the entire richness offered by the Swedish language when communicating.

Just over a year ago the Riksbank revised its communication policy once again, after some difficulties, so that it is now more like the previous policy. But I cannot entirely grasp what rules apply now, given the arguments put forward by some representatives of the Riksbank.[6] There is thus scope for the Riksbank to clarify its stance on this matter.

4. Review the Executive Board model

Allow me in conclusion to take up a further issue, which is also mentioned in the survey, the question of the size and role of the Executive Board.

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[5] In practice, it of course means that we all had to be careful when we were giving messages that could affect the markets. The messages also had to be adapted to the individual situation. If one was sure what one thought the interest rate should be and secure in most of one's colleagues having the same idea, one could say so. On the other hand, if one was uncertain what one thought and uncertain what the others thought, this was the message one conveyed, etc.

[6] Se, for instance, Svensson, L., Transparency under flexible inflation targeting: experiences and challenges, Sveriges Riksbank Economic Review, 1/2009.

The survey responses imply that the Board members largely agree that the current size is fairly reasonable, that having members employed full-time is a good system and that the Governor of the Riksbank's position is well-balanced. I do not find much to object to here, if one merely focuses on monetary policy, but there are other aspects of the composition of the Board and its methods of working.

Personally I consider, on the basis of my experiences at the Riksbank and elsewhere, that there are considerable problems with a system where the responsibility for running an organisation lies with a committee. I could talk about this at length, but I will not do so. Sufficient to say that few companies or other types of organisation have chosen this management model. What is good with regard to policy decisions – having an all-round picture, and so on, of course applies to more operational activities too. But in this case it is more important to have a clear leadership which gives the organisation direction and the power to make decisions.

The Executive Board of the Riksbank has struggled with these issues from 1999 onwards. During the early years, the management was more divided, in that the responsibility for various departments was divided between the different members of the Executive Board. Later in 2004-2005 there was a change, which in practice transferred most of the operational management to the Governor of the Riksbank. One reason for this was that the pace of the work on making the Riksbank more efficient had slowed down during the early years of an Executive Board and there were problems in phasing out cash management, where there were too many conflicting wills. After this, as I have understood it, management responsibility has been further centralised to the Governor and made clearer.

I believe that this has been good for the organisation. It is also reasonable, as it leads to a better balance than before, when the formal position of the Riksbank Governor was not at all on a par with the personal responsibility required by the general public, the Riksdag, and so on. But the Riksbank's management forms have changed significantly and this is not necessarily codified in the law. The system is dependent on personalities, can change quickly (become better or worse) and is governed – to put it plainly – by the internal distribution of power in the Executive Board. This is not good.

Another aspect concerns the competence profiles the members of the Executive Board should have. It is not at all self-evident that the persons chosen to manage monetary policy are those most suited to run an organisation, with a much broader field of activities, and vice versa. Recently we have certainly seen the need for high-level professional competence regarding the financial system. Nor is it certain that those chosen to manage monetary policy have the feeling for, and experience of, policy

that is required to effectively represent Sweden in international contexts. This is an important aspect for small countries like Sweden, particularly as the high-level officials at the Ministry of Finance, who represent Sweden together with the Riksbank in the central international discussions on economic policy, for various reasons tend to be quickly replaced.

The perfect solution to this is of course a matter for discussion. Personally, I prefer a model that in many ways is like that in the United Kingdom. The Riksbank should have – at least as long as Sweden remains outside the euro area – an operational management with three members, a head and two deputies. The head should have a strong position, which is in proportion to the responsibility which he or she will have in practice. The two deputies should have responsibility for monetary policy and financial stability respectively. They should have broad experience of economic policy and financial issues; have experience of leading organisations and the right profile to be potential successors to the Governor.

A monetary policy committee can be linked to the Bank. This should include persons with special qualities in this field, both in terms of academic competence and other relevant experience, including the ability to communicate. I think four external members would be appropriate on this committee, together with the three managers of the Riksbank. Of course, their position must be such that they have full insight into what is happening in the bank.

One important question, which has risen to the fore in recent years (and which could well have been illustrated in this survey), is how matters regarding financial stability should be handled. The links to monetary policy are very strong in various ways. At the same time, there is a need in this field for close relations with Finansinspektionen (the Swedish financial supervisory authority) and the Ministry of Finance. I do not have such strong opinions on this, more than to say I would like to warn against throwing the baby out with the bathwater. We have had reasonably good intellectual clarity in this field in Sweden, which could easily be lost. Nor is it easy to pursue the theory that the problems we have experienced are in some simple way linked to the organisation model chosen. If changes are made, it is also important to consider how they will affect monetary policy independence.

Let me conclude by wishing my successors continued success in their important work on developing the Riksbank within the current framework. At the same time, I propose that the Riksdag Committee on Finance should celebrate today's jubilee by initiating a review of the Riksbank's legislation, particularly with regard to its management forms.

Thank you.

How has the Riksbank managed the financial crisis?

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September, 2009

Introduction

The Swedish Parliament is the principal for the Riksbank, and the Riksbank's mission is defined in the Sveriges Riksbank Act. In addition to maintaining price stability, the Riksbank is required to promote a safe and efficient payment system. Simply put, the Riksbank's two main tasks are to conduct monetary policy and to maintain the stability of the financial system. The first of these tasks, monetary policy, is no doubt familiar to most people, at least on a superficial level. Few people can be unaware, especially those who hold or are considering applying for a mortgage, that the Riksbank's Executive Board sets a "repo rate", which in turn affects the interest rates charged to those who borrow from the banks. The Riksbank's monetary-policy decisions generally attract a lot of attention in the media and are widely analysed and commented on. The Riksbank's other task – promoting a safe and efficient payment system – is probably less well known among the public. It rarely hits the headlines, except perhaps during those times when financial stability is under threat.

In this article we will attempt to explain the need for a public safety net for financial activities as well as the role played by the Riksbank and the tools it employs to promote financial stability. To do this, we first need to understand the significance of banks in the economy and the particular risks that are associated with banking activities. Another purpose is to present the concrete measures the Riksbank has taken during various phases of the financial crisis that is now entering its third year. In this context a brief review of the progress of the crisis will be helpful. Towards the end of the article we will also attempt to describe some of the effects that the measures have had so far. But before we address these issues, we should perhaps attempt to explain what is meant by financial stability.

What is financial stability?

Financial stability can be defined as a state where the financial system is able to perform its basic functions (e.g. to *transfer capital*, *perform payment services* and *manage various types of risk*) in a safe and efficient manner while also benefiting the economy as a whole. Financial stability is thus a necessary condition for a safe and efficient payment system.

Promoting financial stability is partly about reducing the risk of serious disruptions in the financial system that threaten the functionality of the system, and partly about minimising the negative social consequences if such disruptions were to occur. The task thus involves preventive measures as well as crisis management.

The fact that central banks, in particular, often have a role linked to the stability of the financial system is due to their special ability to add liquidity to the banking system. In order to describe this role in greater detail, we first need to understand what function the banks perform in the economy.

Banks help to ensure more efficient use of capital

Banks act as intermediaries between depositors and borrowers. Savers who want to spread their consumption evenly over their lives can deposit money in an account at a bank and withdraw it (plus interest) at a later time. At the same time the bank can issue loans to businesses and households that need to invest. The bank is a specialist in valuing, monitoring and managing credit risks in those households and businesses to which it lends. By using a bank, it is sufficient for private individuals or business owners to convince *the bank* of their own or their projects' creditworthiness; they do not need to convince a large number of individual savers/investors. Similarly, savers do not need to assess each borrower's creditworthiness or each project's potential to turn a profit; they only need to be convinced that *the bank* has a strong financial position to feel confident about depositing money in exchange for a return in the form of interest. It could be said that the bank hereby solves a problem created by the fact that all participants do not have access to the same information. The result is that the capital in the economy can be used more efficiently and benefit society in the form of more investment and thus higher growth and employment.

In addition to helping to allocate capital, banks also improve the efficiency of *payment* transactions in the economy. Each payment, except outright cash payments, involves a transfer between different bank accounts. This applies, for example, to payments made using a payment

card, credit card, giro transfer or cheque. These methods of making payments enable goods and services to be exchanged in a simple and economically efficient manner. It is the banks that provide the accounts that are used in these transactions. Many banks also participate in the system for settlement of large-value payments that is provided by the Riksbank, the RIX system.[1] The banks and their account systems thus constitute an important part of the payment system and of the economy as a whole.

Illiquid lending and liquid deposits and borrowing create instability in banks

The banks' assets consist largely of loans to businesses and households. These loans are subject to credit risks that are hard to value for outside parties. The difficulty of valuing the banks' loan assets makes them *illiquid* in the sense that they cannot quickly be sold without significant discounts to their longer-term value. Borrowers may also find it difficult to repay their loans at short notice, as this generally presupposes that they are able to obtain loans from somewhere else.

On the other hand, the banks' funding consists largely of deposits, which depositors can withdraw without prior notice, or of other short-term credits, such as borrowing in the interbank and securities markets. The banks' borrowing in securities markets is largely short-term. Unlike their assets, the banks' funding is thus extremely *liquid*.

Funding long-term projects using short-term funding and converting illiquid assets (lending) into liquid assets for the banks' funders (depositors) is thus one of the banks' key functions in society. As long there is confidence in a bank's solvency, the difference in liquidity between its assets and liabilities is not a problem. It is sufficient that the bank has a certain margin of liquid assets that enables it to manage normal fluctuations in deposits and other commitments.[2]

But if the bank's ability to pay its debts were for some reason to be put in doubt, this imbalance in liquidity could constitute a risk for the bank. If all depositors wanted to withdraw their deposited funds at the same time, or if funding in the securities markets were to be unavailable, the bank would face problems.

This is of course something that the bank's lenders realise. In order not to lose their money, all depositors would therefore want to withdraw their money as quickly as possible while other lenders would want to

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[1] On an average day about SEK 400 billion flows through RIX.
[2] Efficient central payment systems and well-functioning interbank markets help to reduce the need for a margin in the form of a liquidity reserve.

withdraw their funding from the moment a bank is suspected of having financial problems. This is what is known as a *bank run*.

To meet all demands for payment, the bank may need to realise assets rapidly and on a large scale. But as the assets can only be sold quickly if they are sold at a large discount, a fire-sale of this type can quickly result in a situation where the bank's assets are worth less than its liabilities, i.e. where it faces solvency problems.

All that may be required to trigger a run on the bank, eventually forcing the bank to close down once it runs out of liquid assets, is an originally entirely unfounded rumour that the bank faces problems. An expectation of problems can thus become self-fulfilling. The big difference in the liquidity of their assets and liabilities thus creates an inherent instability in banks. This means that a bank is extremely dependent on the confidence of its customers and lenders.[3]

Bank runs have occurred many times in history. In fact, the creation of the Riksbank is itself the result of a bank run, which took place in the 1660s. The victim of the run was Sweden's first bank, *Stockholms Banco*.[4] Thanks to the introduction of various safeguards to protect depositors' money, the sight of depositors forming long queues outside banks to withdraw their money is now rare. Yet bank runs still occur from time to time, such as in Argentina and Malaysia around the turn of the millennium and in the United Kingdom, where the mortgage lender *Northern Rock* became the victim of a bank run as recently as September 2007.

As mentioned, a bank run does not necessarily involve only ordinary depositors. The share of bank funding that is provided through deposits from the public has gradually declined. Instead, a growing portion of banks' funding requirements is now met through borrowing in financial markets. The interest and currency risks that arise in these markets are managed in the derivatives markets. Banks have thus become increasingly

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[3] One feature of the present crisis that needs to be commented on is that many banks around the world have to a large degree chosen to repackage their credit risks as quickly as possible and sell them on. It might be thought that the banks through this securitisation have also offloaded a large portion of their credit risks and thus made themselves less exposed to the possibility of a bank run. As we all know, the truth was quite the opposite. In practice, the explicit and implicit guarantees that the banks provided to the special purpose vehicles (SIVs, conduits, etc.) they had created outside their balance sheets to house and structure their securitised credits meant that the risks passed straight back onto their own balance sheets. In the end, because of the complex and obscure structure created by securitisation, no one knew where the risks were located. This resulted in a crisis of confidence which made it difficult for many banks to obtain funding. Although the description of the banks provided here is somewhat simplified to make it more intelligible, the basic principles behind the discussion on the inherent instability of banks still apply.

[4] In 1656 Johan Palmstruch received a royal warrant to form Sweden's first bank, *Stockholms Banco*. One of Palmstruch's ideas was to issue a form of credit paper known as *kreditivsedlar*. These were interest-free promissory notes for specified amounts backed by metal coins deposited with the bank. The notes initially proved successful but when questions arose about the bank's ability to pay the specified value in coins this resulted in a run on the bank, which was forced to close. Palmstruch was ousted and sentenced to death but was later reprieved. *Stockholms Banco* was taken over by the Riksdag of the Estates, which formed *Riksens Ständers Bank*, later *Sveriges riksbank*, from the remnants of the bank. In 1668 *Riksens Ständers Bank* thus became the world's first central bank, although its activities did not start to resemble those of a modern central bank until shortly before the turn of the twentieth century.

dependent on the interbank and securities markets.[5] Investors in these markets are extremely sensitive to actual or feared negative changes in banks' creditworthiness. Because of this, they are liable to very quickly withdraw their funding by not renewing their lending to the banks. The securities markets thus constitute a highly volatile source of funding for the banks.

Problems in one bank can spread to other banks

The emergence of problems in an individual bank need not in itself constitute a major problem for society. What causes concern is rather that problems in one bank can spread like wildfire to other banks. This can happen in a variety of ways.

Firstly, problems can spread directly, through the exposures that banks have to each other in payment systems and in connection with trading in currencies and securities. These exposures can sometimes be significant, which means that the domino effects can also be significant if customers of an affected bank are denied access to their means of payment. This makes it difficult to make payments to other households and businesses, which in turn can lead to liquidity problems and eventually to credit losses and payment problems for these customers' banks.

On the other hand, banks are often exposed to the same types of risk, which increases the probability that a macroeconomic shock, for instance, will affect more than one bank. Such fears can cause the banks' lenders to become overly cautious about renewing their lending. A situation where problems spread from one bank to another can thus arise even as an indirect effect, because of expectations that other banks may be affected by similar problems as those affecting the bank that was hit first, or through more or less well-founded suspicions about banks' exposures to each other.

Financial problems in one bank can thus undermine confidence in an entire banking system. In the worst case, problems which initially affect only a small institution can evolve into a crisis of confidence affecting the rest of the financial system. In a domino-like manner, problems (or the mere suspicion of problems) which originally affect only one bank can lead to problems for the entire banking system. Risks that can have knock-on effects on the rest of the financial system are normally termed *systemic risks*.

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5   See, for example, the article "Financial stability – new challenges", *Financial Stability Report* 2007:2 (Sveriges Riksbank).

Systemic financial risks can have major repercussions on the real economy

A crisis affecting large parts of the financial system can also have significant consequences for the economy as a whole. How large this impact will be depends on which functions in the financial system are affected and to what extent. The payment system is a part of the infrastructure of society. If businesses and households are unable to make payments it will not be long before large parts of the economy are affected. Because of the large amounts that circulate daily through various transactions, an interruption of payments can very quickly have consequences that are hard to predict.

The supply of credit in the economy is another central function. Credit is a key factor enabling businesses in the real economy to operate. If a crisis results in sharply escalating financial expenses or a rapid contraction in the availability of credit this can also have significant consequences for the real economy, which in turn can further aggravate the situation in the financial sector.

A case in point is what happened when the current financial crisis escalated in early autumn 2008. As conditions in global financial markets deteriorated rapidly, premiums on credit risk increased across the board (see Figure 1 in Appendix). Premiums increased more for those borrowers that were deemed to be most risky than for others. Banks and other financial institutions in all regions started to reduce their exposures and leverage.[6] The sharp curtailment of lending exacerbated the downturn in the global economy. The decline in economic activity in turn added to the negative trend, resulting in sharply falling asset prices and growing credit losses for banks. A vicious circle arose in the global economy in which financial worries intensified the downturn in the real economy and vice versa.

The need for a public safety net

We have established that banking activities are associated with an inherent instability and that problems in one bank can easily spread to other parts of the financial system with potentially significant repercussions on the rest of society. A large portion of the costs incurred as a result of problems affecting an individual financial institution can thus affect not only the institution itself and its customers and lenders, but in the long run also other institutions and society at large. Although individual play-

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[6] However, there are currently no clear indications that Swedish banks cut back on their lending.

ers can have sufficiently strong motives to value and protect themselves against risks that can hit their own wallets directly, such incentives are not always sufficient to take full account of effects on third parties and society as a whole. As this type of external effect can be particularly significant in crises in the financial sector, the normal mechanisms of the market economy need to be supplemented with various public initiatives.

There is, in other words – and in an entirely different way than for most other forms of enterprise – a need for a public safety net for financial activities. This safety net normally has certain definite components. Firstly, there is an extensive body of regulations that financial companies are obliged to comply with. Secondly, financial companies are subject to special supervision. Thirdly, there is often a government insurance scheme covering depositors' assets in bank accounts, thus reducing the risk of bank runs. Fourthly, central banks have an array of tools for promoting stability in the financial system. In the next chapter we will take a closer look at the tools that are available to the Riksbank.

But before we address this issue, we need to mention that the safety net for financial activities does not have only positive effects on financial stability. One of the less desirable effects is that it can also encourage a less cautious approach to risk. Because the safety net makes the bank's lenders immune to certain risks in various ways, it can be tempting to let the bank take bigger risks than would be optimal from the point of view of the economy as a whole. Simply put, the safety net reduces the private cost of applying more risk-filled strategies. This is a well-known phenomenon that is generally termed *moral hazard*.

Moral hazard problems can be costly for society both directly in the form of excessive risk-taking in the economy and indirectly by undermining confidence in the financial system if the safety net is abused.

To reduce moral hazard problems, it is therefore important to ensure that public supervisory authorities and regulations take account of these. In particular, the terms on which guarantees and liquidity support are provided have a big impact on regulators' ability to counteract the problems and reduce the costs incurred. Designing a public safety net for financial activities thus always involves a series of difficult balancing acts.

It is important to stress that the safety net should not be designed so that no bank will ever be allowed to fail. Such a safety net would inhibit innovation and the development of the industry. In the longer term it can only lead to a less efficient banking sector. To avoid such rigidities, it should, for example, be possible to unwind the operations of a problem bank in an orderly manner and without jeopardising the stability of the financial system.

As we have established, the public safety net has many components. These in turn involve a number of different government agencies: The Financial Supervisory Authority (financial supervision and regulation), the Riksbank (various types of liquidity support, stability research and monitoring), the National Debt Office (deposit insurance schemes, guarantees and other support measures) and the Ministry of Finance (work on financial legislation and bank support packages that have an impact on the government budget). In the following we will describe that part of the safety net for which responsibility rests with the Riksbank.

The Riksbank's tools for promoting financial stability

As mentioned in the introduction, the Riksbank has two main tasks: to conduct monetary policy and to maintain financial stability. These two tasks are closely related. Without a stable financial system, it becomes more difficult to conduct effective monetary policy. And price stability is a part of a well-functioning payment system. However, the ways in which the Riksbank approaches its two main tasks of monetary policy and financial stability normally differ somewhat from each other. It could be said that in normal circumstances the Riksbank has two different toolboxes for performing these tasks.

The first is a monetary-policy toolbox. Monetary-policy measures, such as setting the target interest rate, have a clear objective: to influence economic activity with a view to maintaining price stability. This, in turn, is a key ingredient in the Riksbank's ambition to achieve stable growth in the real economy.[7]

Secondly, there is a toolbox for promoting stability in the financial system. For this purpose the Riksbank normally uses other tools than the target rate. We can distinguish between measures that the Riksbank takes in normal circumstances to reduce the risk of serious disruptions in the financial system and tools that can be employed to manage a crisis situation that has arisen.

For preventive purposes, the Riksbank performs analyses to identify vulnerabilities and risks in the financial system; the Financial Stability Report, which is published twice a year, has now been a key part of the Riksbank's stability work for over a decade and serves as an important basis for dialogue with banks and other financial market participants. For

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7 By deciding the terms for banks' borrowing and lending in the Riksbank, the Riksbank can influence the shortest market interest rate, known as the overnight rate, so that it ends up close to the repo rate, i.e. the Riksbank's target rate. The repo rate is thus the Riksbank's target for the overnight rate. This rate, i.e. the interest rate charged on loans between banks from one day to the next, in turn affects the interest rates available to the public, and thereby activity and price trends in the economy. The monetary policy mechanism can only operate effectively when the interbank market is functioning.

a number of years, the Riksbank has also worked on improving its pre-paredness for financial crises, notably by conducting crisis management exercises and by concluding agreements on crisis management partner-ships with other government agencies, in Sweden and in neighbouring countries. The Riksbank also contributes actively to work on improving financial regulatory frameworks, in Sweden and globally. These "tools" were to a large extent developed in response to the crisis which arose in the Swedish banking system in the early 1990s. That crisis revealed sev-eral serious shortcomings, both in the banks and in the regulators' prepar-edness. At the time, there was not yet a developed culture for handling the risks created by the rapid expansion of lending that followed on the heels of the relaxation of credit regulations and pent-up borrowing needs in the 1980s. It was clear that government agencies such as the Financial Supervisory Authority, the Ministry of Finance and the Riksbank did not have a clear enough overview of the risks in the banking system to be able to predict the crisis that would occur. Nor had any of these bodies been given the task of adopting such a general perspective.

Better equipped to manage today's crisis

The conscious efforts that have been made to improve preparedness are probably one reason why the Swedish authorities have this time been better equipped to manage a crisis in the financial system than they were at the beginning of the 1990s. It is also likely that lessons from the 1990s crisis have led to certain insights and a greater awareness of the risks that exist in many financial sector participants. This in turn should have ensured that Swedish banks entered the current crisis from a better start-ing position than many banks in other parts of the world.

Despite this, it is clear that certain lessons were "forgotten" by many of the financial market players during the relatively benign period that lasted up until the present financial crisis. It could also be argued that some important legislative work, for instance on a special regulation for handling crisis-stricken banks, was pushed to the side for rather too long after the dust had settled from the 1990s banking crisis. The support bill that was rapidly introduced in October 2008 came into being only when the global financial crisis was holding the authorities by the throat. It is also clear that no authorities in any region foresaw the global scope and complexity of today's financial crisis (although the Riksbank was quick to warn about the unsustainably low credit risk premiums that existed dur-ing the period prior to the outbreak of the crisis). Previous financial crises have largely been home-grown affairs. The global extent of today's crisis

points to a need to further expand international cooperation on financial regulation, supervision and crisis management.

Hands-on tools in a financial crisis

The Riksbank, like other central banks, has long since had a range of more hands-on tools which it can employ in a financial crisis. In particular, it has various means for rapidly adding liquidity to the banking system. Central banks have – for several centuries – often had to assume the role of lender of last resort. The special nature of the current crisis has put a lot of pressure on central banks, including the Riksbank, to rapidly develop and adapt their measures to improve liquidity. We will return to this subject shortly.

When interbank markets have failed to operate normally and interest rates have to some extent been governed by a lack of confidence, this has reduced the potency of monetary policy. As a result, the Riksbank has had to use tools from both boxes during the crisis. The circumstances have required certain tools that we otherwise rarely need to use. Some tools we have had to reinvent and develop during the course of the journey. The measures taken have been aimed primarily at strengthening financial stability and at maintaining the functionality of financial markets to ensure that payment and credit systems can continue to operate. This is essential for ensuring that the economy as a whole can function.

Many of the measures taken to maintain financial stability also have indirect monetary-policy effects. Measures that help to restore confidence in markets, for instance, also help to push down interest rates and improve access to credit. This in turn increases the impact of monetary policy. Similarly, the Riksbank's interest rate cuts also help to restore financial stability by improving credit supply. In the present crisis, the Riksbank's normal monetary-policy measures and measures aimed at strengthening financial stability have thus complemented each other in a mutually reinforcing manner.

To gain some understanding of what we are doing today, we can look at the banks' lending rate, i.e. the rate charged to households and businesses. Simply put, it could be described as the Riksbank's target interest rate plus a premium. The size of the premium depends on the bank's demand for compensation for credit risks and liquidity risks, differences in maturities and the bank's capital adequacy requirements for the lending as well as other factors. What we are now doing is adjusting the *first* term, i.e. the target rate, while at the same time attempting to influence the *second* term, i.e. the risk premiums that have occasionally been reflected in wide credit spreads because of fears about financial stability.

The actions taken by the Riksbank and other central banks should be seen as complements to a whole range of other government initiatives, such as loan guarantees, capital injections and the purchase of under-performing assets, which have been implemented around the world. As mentioned, one of the purposes of this article is simply to describe the concrete measures that the Riksbank has taken during various phases of the crisis. Because of the, in this sense, narrow focus of the article on the measures taken by the Riksbank, many other government initiatives that may be significant per se are not dealt with here.[8],[9] Nor do we address the more fundamental causes of the crisis.[10] Before we take a more detailed look at the measures that the Riksbank has taken in response to the crisis, however, it may be a good idea to take an overall look at the course of events from a global perspective.

The current crisis: origins in the US home loans market

The first manifestations of the crisis appeared in the United States. In fact, the problems in the US mortgage market surfaced already in 2005 when US interest rates started to rise. As a result, many borrowers in the "sub-prime" segment, i.e. that portion of the mortgage market that is aimed at borrowers with poor credit histories, faced difficulties meeting their payment obligations. In 2007, these problems led to a gradual increase in the number of defaults among mortgage institutions operating in the subprime market. The subprime market was heading inexorably towards collapse.

For a long time, it was hoped that the problems would be limited to the subprime segment. But soon a number of events occurred which would dash those hopes. It began on June 7, 2007 when Bear Stearns & Co, a major investment bank, informed its investors that two of its hedge funds had sustained large losses on assets tied to subprime loans. Shortly thereafter the funds collapsed. On June 20, the investment bank Merrill Lynch took over assets worth $800 billion from Bear Stearns' funds.

In early July, Moody's cut its credit ratings on a whole range of securities with subprime content. Concerns about the quality of subprime loans mounted, and trading in a number of related credit risk instruments

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[8] Other government initiatives are discussed in the article "Global recession and financial stability", *Financial Stability Report* 2009:1 (Sveriges Riksbank).

[9] See also Sellin, P., 2009, "The central banks' extraordinary measures during the financial crisis", *Economic Commentaries*, 2009:9 (Sveriges Riksbank).

[10] See Ingves S. & J. Molin, 2009. "The Monetary Policy Landscape in a Financial Crisis", *The Economic Review*, 2009:2 (Sveriges Riksbank) for a discussion of more fundamental causes behind the current crisis, such as the global imbalances that were built up over a long period of time, failings in the risk behaviour of financial market participants and certain loopholes in financial regulations.

fell dramatically. Spreads between the prices quoted in the market and those arrived at using specially designed valuation models widened significantly. In many cases no prices at all were quoted in the market. This meant that the crisis was starting to have major international ramifications. Many banks in all corners of the world found it hard to renew their short-term loans in the market, and struggled to fund their operations. Swedish banks still remained relatively unscathed, however. Although they, too, now found it more difficult and expensive to obtain funding in the market than previously, their problems were not as great as those faced by many other banks around the world. Their strong balance sheets and earnings and their lack of significant exposures to instruments with suspected subprime content placed them on relatively stable ground.

The problems spread to Europe

In late July 2007, the German bank IKB announced that it had incurred big losses on its large exposures to the subprime market. A few weeks later, another German bank, Sachsen Landesbank, was hit.

At the beginning of August 2007, the shortest interbank rates shot up. The reason was that many banks with excess liquidity chose to deposit their money safely with the central bank rather than lend it out in the interbank market. On August 9, the French bank BNP Paribas temporarily closed three of its funds due to "the total lack of liquidity in the market". The same day, the European Central Bank (ECB) responded by offering loans to the banks at its official lending rate of four percent, i.e. with no extra premium. This increased liquidity in the European banking system by $95 billion.

The following day, a number of central banks, including the Bank of Japan, Bank of Canada, ECB and the Federal Reserve, implemented the biggest internationally-coordinated liquidity operation since the 2001 terrorist attacks. The Riksbank did not participate in the operation, as the liquidity situation for the Swedish banks at this time was not as difficult.

On 13 September 2007, the UK mortgage lender Northern rock announced that it faced acute funding problems and turned to the Bank of England with a request for emergency credit. In a very short space of time, Northern Rock, which had to a large degree funded its operations in the commercial paper and interbank markets, found itself facing a crisis of liquidity. When the bank's problems became known, depositors rushed to withdraw their savings and the share price plummeted. In response, the UK authorities announced further guarantees and raised the deposit guarantee.

In October and November, several large international banks announced that they had incurred significant impairment losses on their exposures to the subprime sector.

The crisis escalates

In the winter of 2007/08, the problems affecting subprime-related assets continued amid weak trading in the market for these assets. Serious concerns also arose about the monolines, a type of credit insurers specialising in bond insurance.

On 18 February 2008, after a series of failed negotiations with private investors on a takeover of the bank, Northern Rock passed into the ownership of the UK government.

In March 2008, rumours arose that Bear Stearns faced a liquidity squeeze. As a result, investors no longer wanted to lend money to the bank, creating an acute shortage of short-term funding for Bear Stearns. On March 14, the Federal Reserve issued a loan against collateral with the aim of stabilising the situation in Bear Stearns. The news led to a halving of the share price and prompted downgrades from the rating agencies. On March 16, the investment bank J.P. Morgan announced that it planned to buy Bear Stearns with help from the Federal Reserve. Following renegotiations of the offer over the Easter weekend, Bear Stearns' assets were transferred to a separate company set up by the Federal Reserve, in which J.P. Morgan assumed the risk for the first billion dollars of any loss. Under the agreement, the Federal Reserve guaranteed the rest, $29 billion.

On 11 July 2008 IndyMac Bank, a subsidiary of Independent National Mortgage Corporation, was placed in administration by the US Federal Deposit Insurance Corporation (FDIC).

The crisis reached a crescendo at one o'clock in the night before Monday, 15 September 2008 when Lehman Brothers Holdings announced that it intended to apply for Chapter 11 bankruptcy protection. The bankruptcy filing, coming from a major investment bank, sent shockwaves across the already hard-pressed financial markets, triggering a period of extreme volatility. Some commentators characterised this period as "the perfect storm". In this situation liquidity in a number of the banks' key short-term funding markets seized up, and the Swedish banks were drawn into the crisis in a serious way. The authorities now intensified their activities aimed at mitigating the impact on financial markets and the economy at large.

The Riksbank intervenes

The Riksbank raised its preparedness already in the summer of 2007 when the first signs of problems in international financial markets appeared. When the ECB increased the supply of liquidity in the interbank market in early August 2007, the Riksbank responded by expanding the range of data that banks are required to provide and stepped up its monitoring of the liquidity situation in the market. Shortly before Lehman Brothers' bankruptcy filing the central banks also intensified their collaboration on transactions in CLS, the international system for foreign exchange transactions.

However, after Lehman Brothers filed for bankruptcy on September 15 the situation in financial markets took a significant turn for the worse. At this time, the Riksbank was monitoring the liquidity situation in the banking system virtually on an hour-by-hour basis. In the ensuing period, the Riksbank took measures in various phases that were designed to strengthen the functionality of the financial market and the stability of the financial system in general. These measures fall broadly into three main categories: *general measures to improve liquidity, liquidity support to individual institutions* and *loan facilities for neighbouring countries.*

General liquidity measures alleviate the situation in the interbank market

The Riksbank's counterparties have long been able to obtain overnight credit in Swedish kronor in the RIX payment system against certain types of pre-approved collateral at the repo rate plus a premium of 0.75 percentage points. There is also a corresponding facility enabling banks to deposit money overnight in RIX accounts paying the repo rate minus 0.75 percentage points.[11] As the Swedish interbank market, unlike those of many other countries, actually continued to function for the very shortest maturities, it has so far not proved necessary to use this facility. On the other hand, Swedish banks have found it hard to borrow at longer maturities since the autumn of 2008. This, in turn, has created a certain slack that is also reflected at the short end of the money market, putting pressure on short-term rates.

To make it easier for the banks to obtain short-term funding and trade in the interbank market, the Riksbank has on a number of occasions during the crisis created new and supplementary loan facilities. As a

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[11] In July 2009, this interest rate corridor, as it is known, was reduced from plus/minus 0.75 percentage points to plus/minus 0.5 percentage points. With the repo rate currently standing at 0.25 per cent, this means that a bank which deposits money overnight in RIX will receive a negative interest rate.

preventive measure, these facilities have since been made available on a more regular basis in order to reduce the risk of even more serious problems arising in the banking system. However, the subsequent course of events has made it necessary to modify some of the terms for the facilities. The Riksbank's general measures aimed at improving liquidity in the banking system can be divided into the following categories:

- a facility to borrow Swedish kronor at longer maturities than normal (3, 6 and 12 months)
- a facility for short-term loans in foreign currency (US dollars)
- an expansion of the list of types of collateral that are accepted in RIX
- an expansion of the group of counterparties that can borrow from the Riksbank

In connection with Lehman Brothers' bankruptcy filing, the liquidity of mortgage bonds plummeted around the world. This made it difficult for banks to trade their mortgage paper. On 18 September 2008, the Swedish National Debt Office announced that it had decided, after consulting the Riksbank, to issue a large volume of short-term treasury bills. The money raised through the extra auctions was lent in the form of reverse repos backed by mortgage paper.

On September 22, the Riksbank decided, for the same reason, to raise the permissible share of covered bonds from related institutions that banks could use as collateral for loans in the Riksbank's payment system, RIX. The share was raised from 25 per cent to 75 per cent. The expanded loan facility in RIX improved the banks' liquidity situation. A few weeks later, on October 8, the restriction on the share of covered bonds from related institutions was removed completely. This brought the Riksbank's rules more in line with those of other central banks. At the same time, the Riksbank also decided to lower its minimum credit rating requirement for securities with longer maturities that are posted as collateral.

Lehman Brothers' bankruptcy filing also led to a run on a number of large US money market funds. As these funds had accounted for a majority of US dollar loans to European banks, the upshot was an acute global shortage of US dollars. On September 24, the Riksbank announced that it together with several other central banks had instituted temporary, reciprocal currency arrangements (swap facilities) with the Federal Reserve for the purpose of managing the stressed situation in the markets for short-term dollar borrowing. On September 29, the Riksbank also announced a new US dollar loan facility.

On October 2, the Riksbank opened a new Swedish kronor loan facility. The purpose was to improve access to credit at longer maturities.

An initial auction of SEK 60 billion for secured three-month loans was planned for October 6. However, the same day the Riksbank stated that it had decided to increase the amount to SEK 100 billion. The auction was oversubscribed. On October 8, a further auction for SEK 100 billion at maturities of six months was announced.

The introduction of these new loan facilities marked the start of a long series of frequently-recurring auctions during the autumn, spring and summer. In these auctions the Riksbank has offered its counterparties loans in kronor as well as dollars. On October 24, to improve predictability, the Riksbank announced a programme of auctions for three-month Swedish kronor loans at approximately two-week intervals starting on November 10. At the same time it was announced that the exact terms for each auction would be published at least two days before the auction date and that the amounts would be fixed based on market conditions and the outcome of previous auctions.

On October 29, the Riksbank introduced one further credit facility in which banks could post commercial paper with maturities of up to one year as collateral. The purpose of the new credit facility was to improve the supply of credit to non-financial enterprises. The first of the credits under this new facility, SEK 40 billion in three-month loans, was offered in an auction on November 5, but only SEK 4.5 billion was taken up by the banks. This facility, too, was offered at two-week intervals. However, the banks have not made extensive use of these facilities.

In May 2009, the Riksbank also started offering twelve-month loans in Swedish kronor against collateral.

Since the autumn of 2008 and until today (September 1, 2009), the Riksbank has offered secured loans (including commercial paper) with various maturities worth a total of SEK 2,440 billion through auctions. Of this, about 30 per cent, or SEK 735 billion, has been taken up by the banks. Although the banks have not made full use of their opportunities to borrow from the Riksbank, it is highly likely that the awareness that such opportunities exist has help to alleviate the situation in the interbank market.

GREATER INTEREST IN DOLLAR LOANS

On the other hand, the banks showed very strong interest in the dollar loans. Why this was so was difficult to say, as we did not know how large a portion of the loans the banks have used to actually pay down dollar debts and how large a portion has been swapped for Swedish kronor. Recently, interest in the dollar auctions has cooled, however. In these auctions the Riksbank has offered some USD 130 billion, of which about 75

per cent has been taken up by the banks. To enable lending in US dollars, the Riksbank has used its swap agreements with the Federal Reserve, under which Swedish kronor are exchanged for dollars, as well as parts of its foreign exchange reserves.

In late May 2009, the Executive Board of the Riksbank decided to strengthen its foreign currency reserve by borrowing the equivalent of SEK 100 billion. This was considered necessary partly because the Riksbank had lent a part of its foreign exchange reserves to Swedish banks, and partly because it had increased its commitments to other central banks and international organisations. The Executive Board deemed it important that the Riksbank should remain prepared to provide the Swedish banks with the foreign currency liquidity they required.

At present (1 September 2009) the Riksbank has outstanding loans to the banks of about SEK 300 billion and about USD 8 billion.

LENDING TERMS NEED TO BE ADJUSTED

In the intervening period various changes have been made to the terms for the various loan facilities. Originally, the Swedish kronor loans were offered at fixed interest rates (the repo rate plus a premium). However, on 13 February 2009 the Riksbank stated that it intended to offer variable-rate loans in order to ensure that speculation about future interest rate cuts would not lead the banks to wait for too long before deciding to borrow. When the repo rate was set at an unprecedentedly low 0.25 per cent on 2 July 2009 the Riksbank once again offered to lend money at essentially fixed interest rates. This time it offered SEK 100 billion in one-year loans. The minimum interest rate was set at the repo rate plus a premium of at least 0.15 percentage points.[12] The loan had an expressly monetary-policy purpose.

To attract the excess liquidity that temporarily arises in the banking system due to the expansion of its loan facilities, the Riksbank has also on a number of occasions, starting on 14 October 2008, issued Riksbank certificates with maturities of one week. These have served as a complement to the Riksbank's existing fine-tuning operations. However, the banks have to a large extent chosen to invest their excess, at lower interest rates, in liquid deposit accounts with the Riksbank, i.e. in the fine-tuning facilities.

On 3 April 2009, the number of counterparties able to access the Riksbank's temporary credit facilities was expanded. This was achieved by

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12   Bidding in the auctions covers volumes as well as interest rate terms. The auction was oversubscribed and the outcome resulted in a final premium of 0.20 percentage points.

giving other financial institutions than the Riksbank's ordinary counterparties the opportunity to become "limited counterparties".

As the reader will be aware, the repo rate itself has been adjusted several times during the period. Although this is primarily a monetary-policy measure aimed at influencing economic activity and maintaining price stability, the measure has also indirectly helped to improve the functioning of the financial market. This is an example of how monetary-policy measures and measures to improve financial stability have complemented each other in the crisis.

The Riksbank's balance sheet has trebled

As a result of the measures described above, the Riksbank expanded its lending to banks by over SEK 450 billion in the second half of 2008. The increased lending expanded the Riksbank's balance sheet from about SEK 200 billion to about SEK 700 billion in the second half of 2008, i.e. by more than three times. To get a better idea of what all this lending meant for the Riksbank, it may be interesting to look at the bank's balance sheet before and after the Lehman Brothers bankruptcy. The Appendix shows the Riksbank's balance sheet at 30 June 2008 (Table 1) and at 31 December 2008 (Table 2).

Comparing the two balance sheets, we see that the bank's lending in Swedish kronor increased by about SEK 260 billion during the period. On the liability side this was reflected in an increase in the Riksbank's fine-tuning facility, where banks can invest their excess liquidity overnight, and in the increase in one-week Riksbank certificates. The banks thus increased their reserves at the Riksbank.

The Riksbank also issued US dollar loans worth almost SEK 200 billion. As mentioned, these loans were funded using the bank's foreign exchange reserves and through a swap agreement with the Federal Reserve. The apparent increase in the foreign exchange reserve during the period is mainly due to foreign exchange reserves.

The "Other" item on the liability side includes the Riksbank's earnings and valuation accounts. The increase in this item is primarily due to exchange rate effects but also to the fact that the Riksbank made a certain profit from the transactions.

The balance sheets of other central banks also expanded sharply as a result of increased lending during this period (see figure 5 in the Appendix).

Liquidity support to individual institutions as a means of alleviating concerns

Chapter 6, Section 8 of the Sveriges Riksbank Act gives the Riksbank the opportunity to offer credit or guarantees to banks on special terms for the purpose of providing liquidity support. Such targeted liquidity support can be employed, for instance, when problems in one institution risk causing knock-on effects on other parts of the financial system.

In autumn 2008, financial markets were in turmoil. In the volatile situation that existed it was deemed that even if a small number of institutions were allowed to fail the risk of widespread contagion would be significant. Because of this, two institutions, Kaupthing Bank Sverige and Carnegie Investment Bank, which under normal circumstances would have been unlikely to qualify, were given emergency liquidity support from the Riksbank. It eventually proved possible to sell the two problem banks to private investors, and the liquidity support incurred no losses for the State.

KAUPTHING BANK SVERIGE

The Icelandic banking sector had been under heavy pressure from an early stage of the crisis. In the autumn, conditions in the Icelandic banking sector deteriorated significantly, and in October 2008 Kaupthing Bank Sverige (AB) (KBS), a Swedish subsidiary of Kaupthing Bank of Iceland, was struggling to meet its payment obligations. On 8 October 2008, the Riksbank therefore decided to provide emergency liquidity support to KBS in the form of a five billion kronor credit line. The loan was provided against collateral on a provisional basis. Under the agreement, the loan could be used to pay depositors with accounts at Kaupthing's Swedish branch (Kaupthing Edge) as well as depositors and other creditors in Kaupthing's Swedish subsidiary, KBS. In connection with the provision of the credit facility, the Riksbank and the Swedish Financial Supervisory Authority both made the assessment that KBS was solid. The day before, the Icelandic central bank had also provided a €500 million liquidity support facility to KBS' Icelandic parent.

In a press release the Riksbank explained its reasons for the decision: "In the situation that has arisen there is an imminent risk that the bank will face liquidity problems. To maintain financial stability in Sweden and ensure the functionality of financial markets, the Riksbank has therefore decided to provide liquidity support to Kaupthing Bank Sverige AB. The Riksbank is prepared to provide the liquidity that is required."

On 27 March 2009, Ålandsbanken bought Kaupthing Bank Sverige AB. As a result, all of the liquidity support provided was paid back to the Riksbank.

CARNEGIE INVESTMENT BANK

A few weeks after KBS had received liquidity support, Carnegie Investment Bank AB (Carnegie) also faced liquidity problems. Carnegie operated mainly in the areas of stockbrokerage, equity research, equity trading, asset management and M&A advisory services, and was a major player in the Nordic securities markets. The key reason behind Carnegie's liquidity problems was the increasing demand for collateral in the wake of the financial crisis.

On 27 October 2008, the Riksbank decided to provide a one billion kronor emergency liquidity support facility to Carnegie Investment Bank AB. The following day the credit limit was increased to five billion kronor. The action was taken preventively as a means of enabling Carnegie to release its own liquidity should the need arise.

The decision to provide liquidity support was taken to reduce the risk of a serious disruption in the financial system in view of the turbulent conditions that prevailed at the time. The Riksbank and the Financial Supervisory Authority both took the view that Carnegie was solid but that the ongoing financial crisis had created liquidity problems for the bank. The loan was provided against collateral on a provisional basis.

However, the Financial Supervisory Authority had pointed to serious failures in Carnegie's risk management. The problems affecting Carnegie's management and ownership structure also ran deep. On November 10, after the expiry of the period of grace that the bank's board of directors had been given to rectify the situation, the Financial Supervisory Authority revoked Carnegie's license to conduct banking operations. Simultaneously, the National Debt Office granted Carnegie a loan of up to five billion kronor to replace the emergency liquidity support facility previously granted by the Riksbank. This was done after the National Debt Office and the Riksbank had agreed that the former would take over the Riksbank's loan to Carnegie. Based on the bank support legislation that had recently been introduced, which assigned a special role to the National Debt Office in the provision of government support, it was deemed appropriate that the National Debt Office should assume responsibility for the support to Carnegie. In connection with this, the National Debt Office also assumed ownership of Carnegie Investment Bank AB, which thus recovered its banking license.

On 11 February 2009, the National Debt Office sold Carnegie Investment Bank and its subsidiary, Max Matthiessen Holding AB, to Altor Fund III and Bure Equity AB.

Swap agreement to alleviate the situation in Sweden's neighbours

The four largest Swedish banking groups have total assets of SEK 11,500 billion and a combined loan portfolio of about SEK 7,100 billion (second quarter of 2009). By comparison, Sweden's gross national product (GDP) in 2008 was about SEK 3,160 billion. About half of the banking groups' loan portfolios refer to foreign loans, mainly to borrowers in the other Nordic countries. About six per cent of the total volume, roughly SEK 440 billion, refers to the three Baltic countries – Estonia, Latvia and Lithuania. The Swedish banks' market shares are 82 per cent in Estonia, 55 per cent in Latvia and 63 per cent in Lithuania (second quarter of 2009).

The Baltic countries have been among those hardest hit by the current crisis, suffering precipitous falls in GDP and employment. In the second quarter of 2008, about half of the Swedish banking groups' credit losses stemmed from the Baltic countries. Because of the Swedish banks' not insignificant exposure to credit risk in the region, the continued economic performance of the Baltic countries impinges on the stability of the Swedish financial system.

To counteract any fallout in the Swedish financial system, the Riksbank has entered into swap agreements with the central banks in two of our Baltic neighbours. The swap agreement that the Riksbank, together with Danmarks Nationalbank, concluded with the central bank of Latvia, Latvijas Banka, on 16 December 2008 is one such agreement. It allows the Latvian central bank to borrow up to €500 million in exchange for Latvian lats. The Riksbank's share of the loan is about €375 million. On 27 February 2009, the Riksbank also signed a swap agreement with the central bank of Estonia allowing it to borrow up to ten billion Swedish kronor in exchange for Estonian kroons. The agreements are designed to provide short-term funding as a means of maintaining macroeconomic and financial stability in the two countries.[13]

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[13] Earlier, on 16 May 2008, the Riksbank had together with the central banks of Norway and Denmark concluded a swap agreement with the central bank of Iceland, Seðlabanki Íslands, allowing it to exchange Icelandic krónur for euro. The Riksbank's swap agreement with Seðlabanki Íslands had a limit of €500 million. It could be argued, however, that this agreement had a somewhat different character than the agreements concluded with Estonia and Latvia, as the situation in Iceland was not as significant for the stability of the Swedish financial system.

The central banks' actions have been effective but the situation has yet to normalise

The most acute phase of the liquidity crisis now appears to be over and conditions in the global interbank markets have eased somewhat, with banks resuming some of their lending to each other. However, this is largely due to the fact that central banks have stated that they are willing to continue lending to the banks to the extent required.

Another difference is that the rates at which banks lend to each other have fallen sharply. Figures 2-4 in the Appendix shows Ted[14] and Basis[15] spreads for the United States, the euro area and Sweden. Both spreads have fallen to roughly the levels that prevailed before the collapse of Lehman Brothers in September 2008 and are currently (1 September 2009) about 30 basis points in the US and 40 basis points in the euro area and Sweden. Although the levels are well below the spikes of autumn 2008, they are still high compared with the period before the outbreak of the crisis in 2007. A strong contributing factor behind the fall in interbank rates is that central banks worldwide have cut their policy rates to very low levels. Since December 2008, the Riksbank has lowered its repo rate from 3.75 per cent to 0.25 per cent.

For maturities over one month the money market is still operating less well than normal. Many banks are still choosing to hold excess liquidity on their own balance sheets. This means that transactions involving longer maturities are small and irregular. Banks and investors around the world are thus still reluctant to lend, and the funding problems that arose in 2008 are still present in many places. This confirms the impression that it is the actions taken by central banks that are keeping the interbank markets afloat. As long as concerns about actual counterparty risk persist central banks will remain the most important source of funding.

The liquidity in Swedish kronor and US dollars that the Riksbank has provided since 2008 through its recurring auctions has helped to ease conditions in the Swedish interbank market somewhat. Yet this is true mainly of short maturities, where turnover is satisfactory, though still below the levels existing before the crisis hit Sweden in earnest in September 2008. Although the auctions have not been fully subscribed, they provide security in the sense that the participants know that liquidity is available if it is required.

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[14] Ted spread = the difference between the interest rates on three-month interbank loans and treasury bills with the same maturity.

[15] The difference between the three-month interbank rate and the expected policy rate.

The measures are still needed

The Riksbank, like other central banks, has taken a range of measures to improve liquidity in the interbank markets and restore stability to the financial system. The special nature of the crisis has put central banks under a lot of pressure to develop and adjust these measures in a short space of time. The wide variety of measures testifies to the shifting requirements created by various phases of the crisis.

The situation has not yet fully normalised, and the measures taken by the Riksbank and other government agencies are still needed to ensure that the markets are able to operate.

Since the most acute phase of the crisis, the demand for liquidity from the central banks has fallen in many places. This does not mean that the facilities no longer have a role to play. The fact that central banks the world over, including the Riksbank, have declared themselves willing to lend to banks to the extent required is a key reason why the banks now dare to lend to each other to some extent.

The situation in the Baltic countries still hangs as a cloud over the stability of the Swedish financial system, although the Swedish banks are currently deemed to be able to withstand a large amount of stress. If the situation were to take a dramatic turn for the worse the Riksbank is prepared to take the necessary measures.

Appendix

TABLE 1. THE RIKSBANK'S BALANCE SHEET AT 30 JUNE 2008 (SEK BILLION)

Assets		Liabilities	
Gold	26	Banknotes and coins	108
FX reserve	158	Fine-tuning	0
USD lending	0	Riksbank certificates	0
SEK lending	4	Liabilities to Fed	0
Other	4	Equity	59
		Other	25
TOTAL	192	TOTAL	192

TABLE 2. THE RIKSBANK'S BALANCE SHEET AT 31 DECEMBER 2008 (SEK BILLION)

Assets		Liabilities	
Gold	30	Banknotes and coins	112
FX reserve	200	Fine-tuning	207
USD lending	196	Riksbank certificates	49
SEK lending	262	Liabilities to Fed	189
Other	7	Equity	59
		Other	84
TOTAL	700	TOTAL	700

Figure 1. Credit spreads* on US corporate bonds (basis points)
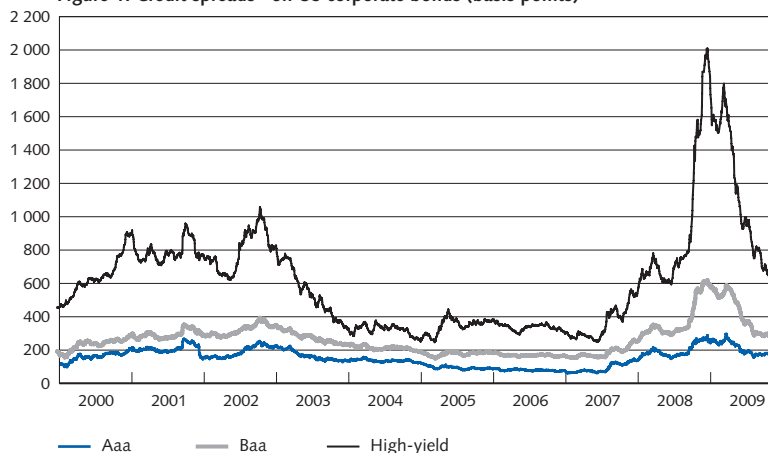
*The difference in yields between corporate bonds and government bonds.
Source: Reuters Ecowin

Figures 2–4. The *Ted spread* **(the three-month interbank rate less the interest rate on a three-month treasury bill) and** *Basis spread* **(the three-month interbank rate less the expected O/N rate for the same period)** (basis points)

Figure 2. USA

Ted-spread, USD — Basis spread, USD

Figure 3. Euro area

Ted-spread, EUR — Basis spread, EUR

Figure 4. Sweden

Ted-spread, SEK — Basis spread, SEK
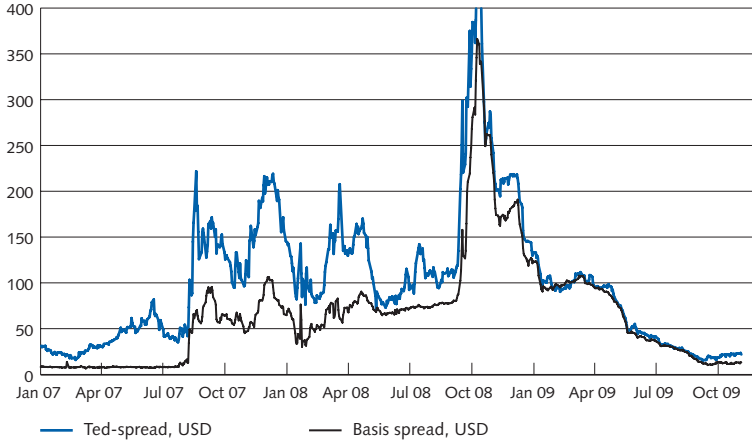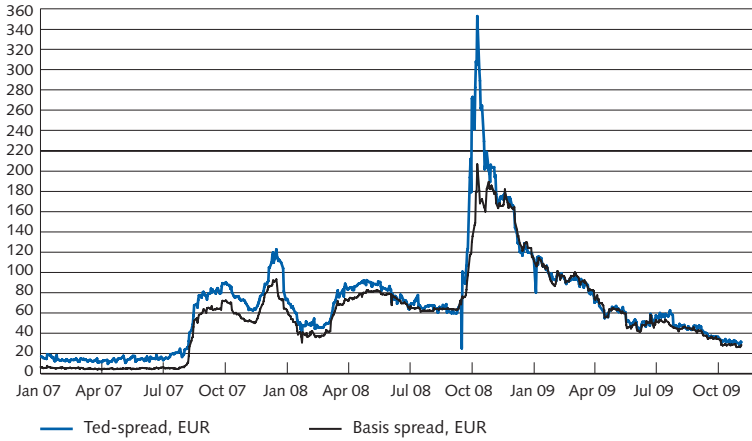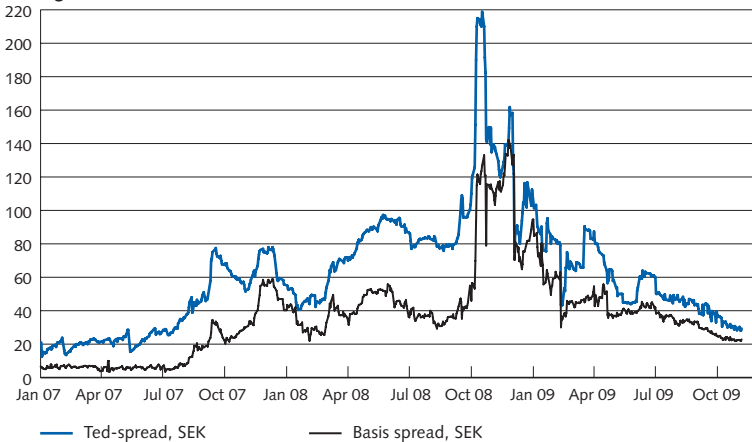
Figure 5. Central bank balance sheets, (percentage of GDP)
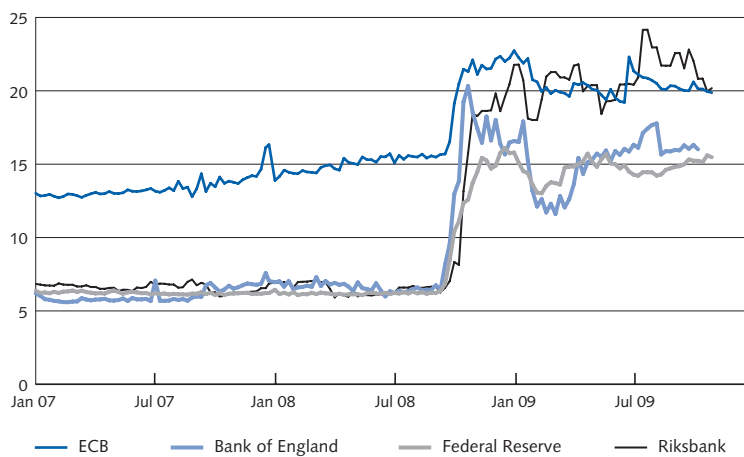
Sources: Bureau of Economic Analysis, Eurostat, Office for National Statistics, Statistics Sweden and the respective central banks.

Peter Englund, Professor, Stockholm School of Economics, comments on
the paper by Johan Molin:

How has the Riksbank managed the financial crisis?

A central bank's most basic task is to guarantee the stability of the finan-
cial system. Traditionally, financial stability has primarily been associated
with the payment system. By making it possible for solvent banks to bor-
row funds at the Riksbank, temporary shortages of liquidity in individual
banks can be prevented from affecting the ability of these banks (and,
ultimately, the entire banking system) to execute payments. Normally,
the banks primarily manage their liquidity through mutual transactions on
the interbank market. In this way, temporary surpluses and deficits can be
evened out between different banks, while deficits in the banking system
as a whole are eliminated by the raising of loans at the Riksbank. As such
loans are normally more expensive than borrowing on the interbank mar-
ket, the banks only turn to the Riksbank when all other options have been
exhausted: the Riksbank is a "lender of last resort".

This traditional view of financial stability has now been widened in
the direction Johan Molin discusses in the introductory part of his art-
icle. This is an issue not only of guaranteeing the payment system in the
narrow sense, but also of the financial system's ability to manage risks
and channel resources from savers to investors. The explosion of risk
premiums and the drainage of liquidity occurring across all markets in
September 2008 indicated that financial stability, in this sense, was under
serious threat. It rapidly became much more expensive or, in certain cases,
impossible for companies to obtain funding on the securities markets,
while, not least importantly, the banks themselves were affected by the
same problems as normal companies. This increased distrust of the system
as a whole also led the banks to be less and less inclined to lend money to
each other, particularly for longer periods of time. It rapidly became much
harder to raise loans, even for Swedish banks – which were initially well
capitalised and were not reporting any major loan losses. Interbank bor-
rowing, to the extent that it was possible at all, underwent a shift towards
shorter and shorter maturities. The central stability problem in the bank-
ing system – that long-term lending was funded by short-term borrowing
– became accentuated.

Under these circumstances, the provision of overnight loans by cen-
tral banks was not sufficient to secure the banks' acute liquidity require-

ments. The main factor lacking was access to funding over the slightly longer term. Across the world, measures were adopted that would turn the central banks into "lenders of first resort". While, under normal circumstances, banks' borrowing from central banks is entirely marginal, the Swedish banks' loans at the Riksbank amounted to approximately SEK 450 billion by the end of 2008, an amount equivalent to approximately one-quarter of their borrowing from the public. These loans had maturities of up to twelve months, longer than those normally granted by the Riksbank. Nevertheless, the effect was a significant reduction of the banks' funding. During the period from 2004 until the end of the first six-month period of 2008, half of the Swedish banks' borrowing had been long-term, with maturities exceeding one year, but, during the last six months of 2008 and the first six months of 2009, this only amounted to 15 per cent.[1] In practice, Riksbank loans with maturities of a few months came to replace borrowings of several years on the market. Interestingly enough, at the same time, almost half of this amount was returned to the Riksbank in the form of overnight deposits (the 'fine-tuning' item). Instead of relying on a poorly-functioning interbank market, the banks have built up large liquidity reserves in accounts at the Riksbank, funded by borrowing there.

Johan Molin's article presents the various measures implemented by the Riksbank, and the background to them, in a clear and instructive manner. However, he is cautious when it comes to assessing their effectiveness. There can certainly be no doubt that stability was seriously threatened and that the measures package as a whole – together with equivalent measures in other countries – contributed towards the restoration of an adequately functioning financial system. It is harder to assess whether these measures were correctly balanced. Were they the right kind of measures? Was their scope appropriate? Which criteria should be used to measure success when making such an assessment?

On the whole, the Riksbank's measures have not been directed towards individual institutions but towards supporting declining loan markets and offering borrowing from the Riksbank as a substitute for non-functioning markets. This primarily means the interbank market, above all for somewhat longer maturities, but it also applies to markets with more direct links to households and companies, such as the markets for mortgage and corporate bonds. In all of these markets, interest rate margins had skyrocketed in comparison with safe government securities.

However, apart from the various forms of general liquidity support, the Riksbank has also provided directed loans ('emergency liquidity

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[1] According to information from Blomberg (2009).

assistance') to save two individual banks, Kaupthing Bank Sverige AB and Carnegie Investment Bank AB. In a crisis situation, financial stability tends to become equivalent to stability for the more important financial institutions. Very major banks are normally considered to have such great significance for the financial system that it seems impossible to gain an overview of the consequences of their failure. Regardless of the formal rules and regulations, they are "too big to fail". When a crisis is general, increasing numbers of banks tend to be placed in this category. There are several reasons for this. Firstly, in times of crisis, major banks are more vulnerable than normal to direct losses as a consequence of counterparty risks etc. Under such circumstances, even the insolvency of a minor bank can shake the entire system. Secondly, information becomes harder to interpret. Consequently, even the insolvency of a minor bank gives out signals which, fairly or unfairly, can be interpreted as indicating general problems also affecting other, larger banks. Thirdly, liquidity on the inter-bank market can be impacted negatively even by the failure of minor banks. It is difficult for outsiders to assess the effects the bankruptcy of Kaupthing or Carnegie would have had, and it is certainly understandable that the Riksbank was unwilling to test this in practice by simply letting them go under. However, at the same time, it must be pointed out that the provision of loans to these banks signalled that many banks are systemically important during a crisis.

Comparisons with other countries form a natural starting point for an assessment. An initial observation is that, taken in proportion, the Swedish measures seem unusually comprehensive, at least measured on the basis of the Riksbank's balance sheet. As can be seen in Figure 5 in the article, before the crisis, central bank balance sheets were equivalent to approximately 6 per cent of GDP in Sweden, the United States and the United Kingdom, while, by the spring of 2009, this figure had increased to 22 per cent in Sweden, compared with 13 and 12 per cent in the United States and United Kingdom respectively. Without knowing exactly what is behind these different figures, it still seems remarkable that the reaction – measured in this manner – should have been so much stronger in a small country far from the epicentre of the crisis than in the two countries where the whole matter began.

Another important difference from the rest of the world is that the Swedish measures have essentially been directed towards the banks, consisting of new loan facilities for them. The banks have thus been offered loans with longer maturities and against a greater range of collateral than normal, as well as loans in foreign currency. Furthermore, the Riksbank has expanded the group of financial institutions allowed to borrow to embrace those who are not counterparties in the payment system RIX.

On the other hand, the Riksbank has not conducted any direct operations on exposed financial markets – such as the markets for mortgage bonds – in a manner similar to those undertaken by their equivalents in several other countries. These markets have only been indirectly supported through the acceptance of such bonds as collateral for borrowing from the Riksbank. The intention has been to stimulate the banks to invest in commercial paper and similar instruments for subsequent use as collateral for borrowing from the Riksbank.

How can we assess whether the Riksbank's measures have been correctly balanced? We must first ask how far the Riksbank's responsibility for financial stability stretches. The inclusion of the payment system is uncontroversial. However, it is less obvious that various securities markets, for example the market for mortgage bonds, are also included. Are there markets that are "too important to fail"? Three lines of argument can be taken here (and they are not necessarily mutually exclusive). Firstly, if high interest rate margins and insufficient liquidity in various markets are due to stability problems in the banking sector – and these problems are of such an order as to threaten the stability of the payment system – it may then be justifiable to take direct action to restore the normal functioning of these problem markets while waiting for the banking system to stabilise. Secondly, if the problems in the banking system are due to problems on another market, it may be justifiable to take direct action on this market. This has evidently been applicable in the United States during the current crisis, but hardly in Sweden. Thirdly, if problems on certain markets are impacting the efficiency of monetary policy – for example, by severing the link connecting the policy rate with mortgage rates and other market interest rates – the precision of monetary policy can be heightened by an improvement of the functioning of the markets in question. As I see it, it is primarily the first and, to a certain degree, the third arguments that are of significance to Swedish policy. The fact that the crisis in the United States originated in the market for mortgage securities of various kinds explains the direct action taken by that country's government on these markets, alongside measures aimed directly at the banking system. The difference between Sweden and the United States and United Kingdom in this regard can thereby reasonably be explained by differences in the mechanisms of the crisis.

How can we tell whether the measures have been successful? On a superficial level, this question has a simple answer. As we can see, the banking system has survived and the payment system does not appear to be threatened. The banks appear to be solid and attractive enough to investors to bring in new capital in the form of new investments. All markets are also functioning better than they were a year ago. Interest rate

margins have fallen and liquidity has improved. The interbank markets are also functioning slightly better. However, the Ted spread, a measurement of the interest rate margin between interbank loans and treasury bills, remains at a relatively high level in Sweden, unlike in the United States. The Riksbank's measures seem to have been effective, even if they have not been enough to fully restore the banks' confidence in one another. One explanation for this is that the risk of major loan losses in the Baltic remains, and may even have increased.

Another indicator is lending by the banks. In addition to payment services, providing households and trade and industry with credit is, of course, one of the banks' main tasks. How well they are coping with this task is not easy to assess. Lending to households has continued to increase, albeit at a slightly lower rate than previously, while corporate lending started to decrease during the spring of 2009. However, whether this has been driven by a diminished supply from the banks or by declining demand is difficult to assess. A study conducted within the Riksbank (Ekici et al., 2009) draws the conclusion that "at present, there is nothing to indicate that Swedish companies and households are facing a serious credit restriction".

All in all, the Riksbank's measures – in combination with other government measures – have thereby contributed to the revitalisation of the Swedish banking system's capacity to fulfil its fundamental tasks. The policy has thus clearly demonstrated its advantages. But what are its costs? An answer to this question may initially be attempted from a public finance perspective. The Riksbank has lent large amounts against collateral which has evidently been deemed to be doubtful by the banks, and for an interest rate below the applicable market rate. In addition, half of this loaned amount has been returned as deposits with a favourable interest rate margin for the Riksbank. Calculated in this manner, the policy will probably not have any costs ex post. Unless a new banking crisis is lurking around the corner, the effect on the Riksbank's profit and loss account will, in all certainty, be positive. But this is, of course, an excessively simplistic view of the matter.

The real cost will instead be found in the signals sent to our banks by these crisis management measures. As we know, one of the main causes of the crisis was that the banks took excessive risks. Not least, they increasingly relied upon obtaining funding on a liquid and efficient short-term loan market. As this market has dried up, the banks' capital base has been insufficient to guarantee their stability. Now, at the same time as the Riksbank is instead stepping in to offer equivalent loans, the banks are being told that they will not need to attach such great significance to the liquidity risks on the short-term loan market in the future

either. This acute crisis management cannot be regarded in isolation but actually forms part of a system. If the Riksbank considers its task, in times of crisis, to consist of offering not only overnight loans but also loans for considerably longer maturities, it will simultaneously be inviting the banks to continue to ignore the liquidity risks inherent in short-term borrowing. Such a scenario would reinforce the need to regulate the banks' funding in another manner.

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■ Articles in earlier issues

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