

Inflation Forecast Targeting: the Swedish Experience

Claes Berg¹
Sveriges Riksbank

Abstract

In this paper key points in the development of the present Swedish inflation-targeting strategy are analysed. Since the implementation of the inflation target strategy began in 1993, three different phases are distinguished: the establishment of the inflation target, the communication of explicit inflation forecasts, and, finally, the introduction of distribution forecast targeting. In practice, distribution forecast targeting involves presenting a main scenario for future inflation, and assessments of both the degree of uncertainty in the forecast and the magnitude of the upside and downside risks in the main scenario in quarterly inflation reports. While inflation targeting in Sweden has been successful in reducing both inflation and private sector inflation expectations, aggregate demand as well as supply shocks and temporary factors have also exerted a downward influence on inflation in the 1990s. It is therefore premature to distinguish any improvements in the inflation-output trade-off. It is likely, however, that the increased credibility of the inflation target has resulted in both a lower average inflation level and lower inflation variability.

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1. Introduction

In the long run, the inflation rate is the most important macroeconomic variable that monetary policy can affect. During recent years a broad consensus therefore has been established that price stability should be the overriding goal for monetary policy. When monetary policy is used to address short-run stabilization objectives, the long-run objective of price stability should not be compromised. Monetary policy therefore needs a nominal anchor. An inflation target can serve as such a nominal anchor, aiming at coordinating inflation expectations. As a nominal anchor an inflation target will also provide a commitment mechanism and will increase the accountability of the monetary policy authority. The inflation target communicates to the public the inflation rate the central bank is aiming at in the future. It will thus serve as a reference point against which the central bank can be judged.² The purpose of this paper is to illuminate and discuss the experience of implementing the Swedish inflation target since 1993.

A nominal anchor can be used to avoid both inflation and deflation. In 1931, Sweden became the first country to make the stabilization of the domestic price level the official goal of its monetary policy, actually the only country that so far has adopted such an explicit *price-level* target.³ The Swedish experience of the 1930s anticipated much of present discussion of monetary policy for central banks with price stability as the primary objective. The Swedish policymakers took aboard the idea, discussed above, that an institutional commitment to price stability could act as a coordinating device and anchor expectations. An important lesson from the early Swedish experience is that a price stability target can be used to raise inflation expectations when there are widespread fears of deflation.

After the Swedish experiment with a price level target in the 1930s, which was abolished due to increased emphasis on economic policy activism and price regulations imposed during World War II, monetary policy was conducted with a fixed exchange rate as nominal anchor. Sweden participated in the Bretton Woods system until 1973, then the krona adhered to various fixed exchange rate arrangements. The krona was unilaterally pegged to the ECU from May 1991 until the fixed exchange rate regime finally collapsed in November 1992, after several months of speculative attacks.

During the last decades of the fixed exchange rate regime rising wages accompanied by accommodating macroeconomic and exchange rate policies contributed to high inflation. Inflation in Sweden in the 1970s and 1980s was higher than our trading partners. Devaluations

² Bernanke et al (1999)

³ Berg and Jonung (1999)

of the krona were used to compensate for this 5 times between 1976 – 1982. In the late 1980s the Swedish economy became overheated. Given the fixed exchange rate regime, monetary policy was tied to the mast. At the same time loose fiscal policy, deregulation of the financial markets and a tax system that encouraged debt-financed consumption spurred aggregate demand and increased asset prices.

The economic boom in the late 1980s was followed by a depression in the early 1990s. The combination of disinflation and an international downturn, a reformed tax system which encourages net savings, abolished investment allowances and falling asset prices contributed to the deep recession. CPI inflation fell from 10 per cent in 1990 to 2 per cent in 1992. As a result after-tax real interest rates rose rapidly. Following the downturn in the economy the budget deficit increased rapidly. Moreover, after the collapse of asset prices large parts of the Swedish banking system experienced a deep crisis. In the meantime the overvalued krona led to devaluation expectations. The immediate effect of the decision to allow the krona to float in November 1992 was a depreciation of about 10 per cent in the effective exchange rate (TCW).

On the 14 January 1993 the Governing Board of the Riksbank decided to adopt an explicit inflation target and specified that, from 1995 onwards, the rate of CPI inflation would be limited to 2 per cent a year with a tolerance interval of ± 1 percentage point.⁴

Since the announcement of the target in January 1993, the annual increase in the CPI has averaged 1.9 per cent. Since the target became operative at the beginning of 1995, the average annual increase has been 1.1 per cent.

The experience of the first years of inflation targeting in connection with the latest amendments to the Riksbank Act (1988:1385), which came into force the 1st of January 1999 and prescribe an explicit objective for monetary policy, gave reasons to clarify the formulation of monetary policy as well as the implementation of the Riksbank's inflation target and to propose forms for appraising the Riksbank's actions.⁵

Section 2 considers the definition of price stability: inflation target vs price level target, the appropriate target level and the appropriate target variable. Section 3 discusses maintaining price stability. The role of the inflation forecast and the way to deal with forecast uncertainty

⁴ According to the central bank act that was effective until 1998, the Governing Board, appointed by the Riksdag, was responsible for monetary policy. According to the new central bank act, the responsibility for monetary policy has been transferred to a new body, an Executive Board, with six full-time members. See section 4.

⁵ See Heikensten (1999).

and transitory effects are analyzed. The respective roles of the Staff and the Executive Board in the decision making process are discussed. Section 4 presents the new central bank act and its requirements on accountability and the role of the tolerance interval. Section 5 gives an overview of the implementation of monetary policy since 1993 and describes the development from implicit inflation forecast targeting (1993-1995) to explicit inflation forecasting (1996-1997) and finally distribution forecast targeting (1998 and onwards).⁶ Section 6 discusses some preliminary results regarding the effect of inflation targeting on the economy. Section 7 concludes.

2. Defining price stability

2.1 Introduction

The fundamental reason why long-term price stability is desirable is that inflation is detrimental economically and socially.⁷ Price stability facilitates the role of the payment system, reduces uncertainty in firms and households investment decisions and prevents arbitrary redistribution of income and wealth. The central bank is in a unique position to pursue the objective of price stability in that it has the exclusive right to create assets, mainly notes and coins, that can be used for final payments. To a limited extent, moreover, the central bank can contribute to the stabilisation of real economic activity.

Price stability is accordingly an appropriate objective for monetary policy. Because inflation reacts to monetary measures with a considerable lag, however, the central bank can only control inflation indirectly. To assist its pursuit of the ultimate objective, the central bank can therefore have an intermediate target that lacks intrinsic value but correlates strongly with the ultimate objective. The intermediate target is more controllable and often easier to observe than the ultimate objective. One example of an intermediate target is a fixed exchange rate. Experiences from the 1970s and '80s in Sweden and several other countries show, however, that a fixed exchange rate does not guarantee price stability.

Intermediate targeting of different monetary aggregates, together with a flexible exchange rate, has been used in Germany and Switzerland, for instance. For this to function properly, the money stock need to be highly correlated with prices not only in the long run (which is the

⁶ The term “distribution forecast targeting”, was introduced in Svensson (1999f), which gives a theoretical and coherent foundation of monetary policy with price stability as the primary objective.

⁷ A more detailed review of inflation's negative effects lies outside the scope of this memorandum; the reader is referred, for example, to Fischer (1994)

case) but also in the short and medium run (which is usually not the case). Particularly in countries with a highly developed financial sector correlation is usually low. In keeping with the multi-indicator approach that is used in countries with an explicit inflation target, it can be said that the money supply is an acceptable intermediate target only if it contains all the relevant information for forecasting inflation, that is, if the money stock is the only predictor of future inflation. In that case, monetary control becomes a special instance of targeting inflation.⁸

Another reason for preferring an explicit inflation target to an intermediate monetary target is that the significance of an expected change in the general price level appears to be considerably more comprehensible to the public than the growth rate for specific monetary aggregates. This probably applies in particular when a low-inflation regime is being established.⁹

⁸ See Svensson (1999a), (1999c), (1999e).

⁹ It should be noted that in practice, the differences between inflation targeting and monetary targeting should not be exaggerated. In Germany, for example, the monetary target was derived from the quantity equation so that it was consistent with a targeted rate for annual inflation, given predicted real income and conceivable changes in the velocity of money. Since 1986, the targeted rate of inflation has been 2 per cent. The monetary policy strategy was modified by the Bundesbank in December 1996; the medium-term price rise underlying the estimate of the money supply range was set to 1.5–2 per cent during 1997 and 1998. There have been frequent deviations from the monetary target and they have been explained in terms that suggest that the targeted rate of inflation has precedence, with the money supply being treated as one of several indicators of price tendencies, that was, the strategy in practice was not very different from inflation targeting.

2.2 Inflation target vs price level target

One of the matters being discussed in the monetary policy literature is whether monetary policy should have an inflation target rather than a target for the price *level*.¹⁰ Even if an inflation target does lead to a stable rate of inflation, that is not the same as a stable price level. However, a price level target can also be formulated to allow some inflation if this is considered desirable.

With a price level target the longer-term variance, and hence uncertainty, about prices is smaller, but this may come at the cost of increased short term variability of inflation. According to many observers, the chief disadvantage of a price level target is that the monetary authority is attempting to deflate the economy half the time, thus creating more uncertainty about short-term inflation rates than with an inflation target.¹¹ Via nominal rigidities, the higher inflation variability would result in higher output variability. This view has recently been challenged. In more elaborated models, with more realistic dynamics, the relative variability of inflation in the two regimes becomes an open issue. In a model with persistence in output due to price-stickiness, for instance, price level targeting results in lower short-run inflation variability than inflation targeting, without output variability becoming higher.¹²

Therefore the relative benefits of price-level targeting and inflation targeting are not settled. More knowledge and experience of low inflation regimes is needed before a well-founded conclusion can be drawn regarding possible advantages of a price-level target in relation to present day inflation targeting frameworks.

2.3 Why 2 per cent?

In January 1993 the Riksbank specified that the objective of monetary policy is to limit the annual increase in the consumer price index in 1995 and onwards to 2 per cent, with a degree of tolerance of ± 1 per cent. This objective corresponded to the so called underlying rate of inflation when the target was announced. In 1993 as well as in 1994, monetary policy aimed at preventing the inflationary impulse which was deemed unavoidable, due to the large

¹⁰ See Svensson (1999f) for an overview.

¹¹ Fischer (1994).

¹² Under inflation targeting, according to the model by Svensson (1999e), the decision rule is a linear feed-back rule for inflation on the output gap and the variance of inflation is proportional to the variance of the output gap. Under price level targeting, the decision rule is a linear feed-back rule for the price level on the output gap. Then inflation is a linear function of the first difference of the output gap and the variance of inflation is proportional to the variance of the first difference of the output gap. See also Svensson (1999f).

depreciation of the krona and changes in indirect taxes, from causing a persistent increase in inflation, that is, an increase in the underlying rate of inflation.

The Governing Board noted in its announcement that the underlying rate of inflation had fallen substantially during the last few years to a level of about 2 per cent. Sweden had accordingly achieved a rate of price increases that represented a low West European level. The Board regarded the formulation of the inflation target as a way of safeguarding what had been achieved in the fight against inflation.

There is no clear evidence that the optimal level for an inflation target is exactly 2 per cent. There are grounds, however, for not having a too low inflation target. For one thing, there are indications that in many countries the CPI tends to overestimate inflation, e.g. the measurement bias. For another, an excessively low inflation target may cause problems if, as is often the case, nominal wages display downward rigidity. In the absence of any inflation, adjustments to shocks then occur to an unnecessarily large degree via labour shedding because that is the only way of cutting the total wage bill.¹³ A final argument in favour of a positive inflation target is the fact that nominal interest rates are non-negative.¹⁴

Sweden is a member of the European Union since 1995. The primary policy objective of the new European Central Bank (ECB), which assumed responsibility for monetary policy in the euro area from the beginning of 1999, is the maintenance of price stability. Until further notice Sweden has chosen not to join the euro area. The difference between the target formulations of the ECB, with its implicit price norm of 1.5 per cent, and the Riksbank target of 2 per cent is probably small in practice and it has not led to a revision of the level of the Swedish inflation target.¹⁵

¹³ Two percent is the borderline in Akerlof, Dickens and Perry (1996), who study the effects of downward rigidity of nominal wages.

¹⁴ One percent is the borderline in Orphanides and Wieland (1998), who examine the consequences of non-negative nominal interest rates.

¹⁵ The quantitative definition of the price stability objective that the ECB Governing Council has adopted is: "price stability shall be defined as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2 per cent" This presumably means that an annual rate of increase between 0 and 2 per cent complies with the ECB's price stability definition. The reference value for M3 growth, which has been set at 4.5 per cent for 1999, is based on medium-term assumptions of an annual real GDP growth trend of 2-2.5 per cent and an annual decline in M3's velocity of circulation of 0.5-1 per cent. Derived from the quantity equation, this gives an implied inflation target between 1 and 2 per cent. On this basis, calculations give a price norm for of 1.5 per cent See Angeloni, Gaspar and Tristani (1999).

2.4 Target variable

The Swedish inflation target is expressed as the change in the official consumer price index. The CPI is meant to measure the price changes for total private consumption in the domestic market. The advantages of the CPI are well understood: it is widely used and recognized as a measure of inflation among economic agents and the general public, published monthly with a short time lag, and rarely subject to revision. Using the CPI eases communication with the general public and politicians and has educational value.¹⁶

A drawback, when using headline CPI as a target variable for monetary policy, is that it contains prices that are outside the control of the Riksbank (indirect taxes and subsidies) and prices that have perverse effects on monetary policy (mortgage interest costs). Another potential problem with the use of a conventional price index is that transitory price movements in the market prices of particular goods may mask a different development of the general price level. There are commodities that historically have given rise to such one-off effects on the price level, for example oil products, food products etc. The current role of a measure of underlying inflation, UNDI_X, in the conduct of monetary policy and the issue of how to deal with transitory effects will be discussed in section 3.3 below.

When proposals have been presented by the CPI Inquiry appointed by the Swedish government, which is scheduled to be published in the middle of 1999, there may be occasion, to consider which index of inflation should guide policy. One alternative to the CPI could be the HICP, which is being constructed under EU auspices. There may also be cause for a future assessment of monetary policy's formulation and target in the light of the move to Stage Three of EMU and the monetary policy of the European Central Bank.

¹⁶ The Swedish CPI has a long and fairly distinguished history. It is available monthly since 1954, when a major revision of the then existing index was conducted. The calculation methods and sampling procedures are subject to rolling revisions and new goods are introduced continuously. Errors may occur in that full allowance is not made for new retail establishments, new products and changes in the quality of certain items. In a more qualitative assessment, Statistics Sweden has found that the Swedish CPI may both overestimate and underestimate inflation.

3. Maintaining price stability

3.1 The inflation forecast¹⁷

The considerable lag before monetary measures affect inflation means that policy has to be forward-looking. Forecasts of central macro variables, inflation in particular, therefore play an important part. In practice, the part played by the Riksbank's inflation forecast is so vital that it resembles an intermediate target.

The principles for monetary policy decisions can be formulated as a simple rule of thumb: if the inflation forecast, based on an unchanged repo rate, is in line with the target at the suitable horizon, then the monetary stance is appropriate; if the forecast is above (below) the inflation target, then the monetary stance is too expansionary (restrictive) and the repo rate should be raised (lowered) immediately or in the near future. As this rule of thumb refers to an inflation forecast with the instrumental rate unchanged, it is natural for the Riksbank to present its forecasts accordingly.

Attempts to fulfil the inflation target in the short run may prove difficult and require sharp interest rate adjustments and abrupt shifts in the monetary stance. There are several grounds for preferring a longer horizon and a gradual adjustment of the monetary stance. Very pronounced changes in interest rates and the monetary stance are liable to generate instability in real variables such as output, employment and the real exchange rate. With a longer horizon and a gradual policy realignment, the inflation target can be fulfilled along with some stabilisation of these real variables.

3.2 Dealing with forecast uncertainty¹⁸

The main scenario

In order to construct the inflation forecast econometric models are used. There is also a rule for additional extra-model information and judgemental adjustment, given the uncertainty about modeling the transmission mechanism.

A main scenario and several alternative scenarios are presented by the staff to the Executive Board.

¹⁷ For a more technical presentation see Svensson (1999b).

¹⁸ This section is based on Blix and Sellin (1999).

The forecasting round at the Riksbank culminates in a main scenario that is published in the Inflation Report¹⁹. It should be stressed that the main scenario is viewed as the most likely outcome under the assumption that the repo rate is held constant over the forecast horizon. The assumption of an unchanged repo rate is made primarily for pedagogic reasons in order to show whether or not the repo rate needs to be changed to bring inflation in line with the target. One consequence of this assumption is that the Riksbank's forecast is not directly comparable to other forecasts that typically assume some response from monetary policy.

The statistical measure that best corresponds to the forecast in the main scenario is the mode, since it is the most likely outcome in the distribution (or rather the value that corresponds to the the maximum of the density function). For a symmetric probability distribution the usual measures for the distribution's centre - the mean, the mode and the median - coincide, but this is not the case for other distributions. For the distribution that the Riksbank uses when measuring inflation uncertainty (the two-piece normal), the measures *may* coincide, but they need not.

However, monetary policy is not only guided by the most likely outcome, e.g. the main scenario, based on an unchanged repo rate over the forecast horizon. An assessment of the risk spectrum is also important, and in practice the mean forecast of future inflation is therefore taken into consideration, when deciding on the appropriate monetary policy stance.²⁰ In recent Inflation Reports, confidence intervals for the forecasts have been published. The executive board may take the properties of the whole distribution into account when setting the repo rate. This implies that monetary policy can be described as being guided by "distribution forecast" targeting.²¹

Uncertainty and risk

As indicated above, the assessment in the main scenario is the path of future inflation that is deemed to be most likely over the forecast horizon. It is based on assessments of the factors that are deemed to be important for how inflation will develop, such as total demand and supply in the economy, import prices and wages. Such assessments are of course associated with uncertainty. At any given time there can be more or less uncertainty compared to the

¹⁹ See for example the Inflation Report 1998:4 for a discussion of the framework for the forecast.

²⁰ By focusing on the mean forecast, the use of econometric models is facilitated, as such models normally produce forecasts of the mean.

²¹ Svensson (1999f) shows that nonlinearity and model uncertainty both imply that certainty-equivalence does not apply. Then it is not optimal to use conditional mean forecasts as intermediate variables. Therefore he suggests the use of conditional probability distributions of the target variables instead of means only. In practice, this form of distribution targeting is implemented in an elementary way, as the Riksbank staff constructs paths for inflation and the output gap, given various interest rate paths, which are presented to the Executive Board.

historical average (as measured by standard deviations) for a certain factor. This should be reflected in the inflation-forecast distribution: the more important a component is for inflation, the larger should be its influence on total inflation uncertainty.

Apart from allowing for more or less uncertainty in a given factor, there might also be reasons to believe that the probability of outcomes above the main scenario is larger than the probability of outcomes below. This would then constitute an "upward" risk in the forecast. Correspondingly, there would be a downward risk if the probability of outcomes below the main scenario is judged to be larger than the probability of outcomes above the main scenario. In other words, it is possible for the risks to be asymmetrically distributed around the main scenario. Such an asymmetry in a component that influences inflation should result in an asymmetry in the inflation forecast distribution. Just as with the uncertainty discussed above, the asymmetric risk should be given more weight for the asymmetry in the inflation-forecast distribution the more important the variable is for future inflation. As measure of asymmetry - or skewness - the Riksbank uses the difference between the mode and the mean.²²

How are these assessments made in the forecasting round? The economists at the Economics Department of the Riksbank make forecasts one and two years ahead for the factors that they are responsible for. For each assessment and forecast horizon they make a subjective judgement whether the uncertainty is the same, larger or smaller than the average historical uncertainty. A subjective assessment that departs from the historical has to be accompanied by a clear explanation - for example in the form of some indicator - that justifies it. Likewise if the risks around the main scenario are deemed to be asymmetric, this also has to be motivated.

What makes the various assessments by the different economists consistent with each other? All the economists involved in the forecasting round meet to discuss and adjust their assessments to ensure consistency. The motivations for the risk and uncertainty that accompanies the assessments form a basis for discussions about the overall picture of risk and uncertainty. The quantitative assessments and the motivations given for them ensure that the discussions are focused and constructive.

²² The difference between the mean and the mode is proportional to the usual statistical measure of skewness, the third central moment. For details, see Blix and Sellin (1998).

The inflation forecast distribution

When there is a forecast in the main scenario as well as an assessment of uncertainty and risk for each factor deemed to be important for inflation. This information must be weighed together in some way to determine what it implies for the inflation-forecast distribution. This section describes how such a weighing is done and its underlying rationale.

A summary description of the forecast for a certain factor as well as the uncertainty and (a)symmetric risk associated with it can be made with a probability distribution function (p.d.f.) that allows for skewness. An example of such a distribution is the two-piece normal.²³ The Riksbank uses the subjective assessments of risk and uncertainty to "increase or decrease" the two measures of standard deviations in the two-piece normal distribution.

Once the p.d.f.'s for the various factors have been adjusted to reflect the subjective risk and uncertainty assessments, the key step in the method is - as indicated above - how the information can be translated to an inflation forecast distribution. For this purpose, it is assumed that the skewness in the inflation distribution is the sum of the skewness from each factor weighed by its importance for future inflation. Note that with this assumption an assessment of the risk and uncertainty in the inflation forecast per se is not needed, since these are derived endogenously from the factors that are deemed to affect inflation. In other words, a method was developed that connects uncertainty and risk assessments in macro variables to the inflation-forecast distribution.²⁴

The inflation forecasts from the main scenario that are published in the Inflation Reports (since 1998:2) are presented with surrounding uncertainty bands that are derived using the inflation forecast distributions discussed here. The bands are constructed such that the probability of outcomes below the lower band and outcomes above the upper band are equal. A 5 percent chance of being below and 5 percent chance of being above, for example, define the 90 percent interval.²⁵

²³ The name stems from the feature of the distribution that it is made up of two Gaussian distributions that are combined together with (possibly) different standard deviations. For further details, see Blix and Sellin (1998).

²⁴ Where do the weights come from? For our purposes the important issue is that they should reflect the macro variables' importance for future inflation. The weights used at the Riksbank are derived by shocking each respective factor in isolation and calculating its impact on inflation one and two years ahead.

²⁵ Wallis (1999) criticizes Bank of England for not having equal tail probabilities. See also the Economist (1999). It should be stressed that the Riksbank's uncertainty bands have equal tail probabilities.

The respective role of the staff and the Executive Board in the decision making process

The uncertainty analysis is based on two types of assessments for each factor that is deemed to affect inflation. First, an assessment is made whether the uncertainty in the forecast is larger or smaller than the uncertainty that historically has been associated with the factor. Second, an assessment is made if the probability of outcomes above the main scenario is deemed to be larger than the probability of outcomes below (i.e. the possibility of asymmetric risk). For each factor these assessments are then summarised in a two-piece normal distribution. The resulting distributions are then weighed together to an inflation-forecast distribution with weights that reflect each factors relative importance for future inflation.

The work with these assessments is initiated at the Economics Department concurrently with the main scenario. It seems natural that the forecasters of a certain factor also makes an uncertainty and risk assessment for the factor. But in order to make the assessments consistent with one another, all economists involved in the forecast meet to discuss and potentially adjust their assessments so that the overall risks are congruent.

The Executive Board takes a preliminary main scenario and the picture of risk from the Economics Department's analysis as starting point for its assessment at an early stage of the process.²⁶ The initial assessment from the Economics Department thereby provides a concrete basis for the executive board's discussion. The Executive Board's conclusions may imply that the main scenario and the distribution for the inflation forecast are revised. This final assessment is presented in the Riksbank's Inflation Report, enabling the Riksbank to pedagogically communicate its view on uncertainty and (a)symmetric risk for the inflation forecast in the main scenario.

3.3 Dealing with transitory effects

There is a limit to the ability of monetary measures immediately to counter price movements arising from some kind of shock, for instance changes in the exchange rate, indirect taxes and subsidies, raw materials prices, etc. Given a credible monetary policy, moreover, countering the direct effects of shocks in full is not necessarily desirable if their impact on inflation is only transitory. Such countermeasures might destabilise real economic activity. It is important, on the other hand, to try to counter - and thus to obtain information about - shocks that affect prices more permanently, and hence influence inflation expectations.

²⁶ As the present management structure has been in place for a short period of time, the interaction between the Executive Board and the staff is still developing. See section 4 below.

The problem of temporary influences can be managed in different ways. One possibility is to specify in advance which deviations from the CPI are acceptable. This is the method used in New Zealand.²⁷ A closely related alternative is to use a measure of the underlying inflation as the target. Another possibility is to supplement the CPI by one or several measures of the underlying inflation. In Canada the objective is expressed in terms of the CPI whereas a measure of the underlying inflation -which describes the process of inflation better - is the operative target.²⁸ A "softer" variety on the same theme is to clarify how the practical policy is influenced by various measures of the underlying inflation, since it can often give a clearer picture of the process of inflation.

When the Swedish inflation target was clarified in 1999 it was modified in two respects. The first respect concerns situations when CPI inflation in the relevant time perspective is being affected by specific factors that are judged to have no substantial permanent impact on inflation or the inflation process. A repo rate adjustment, up or down, affects house mortgage interest expenditure, which is a sizeable component of the CPI. This is evidently not an effect on the CPI that the Riksbank ought to counter. Monetary policy effects of indirect taxes and subsidies can be analysed in a similar way.²⁹ Although supply shocks are more difficult to analyze, they also deserve special mention. Price movements for petroleum and other imported goods, for example, that are judged to have only transitory effects on domestic inflation ought not to elicit monetary policy countermeasures. When policy is formulated in these situations, there may be grounds for explaining *in advance* that a deviation from the CPI target is warranted.³⁰

²⁷ In New Zealand the price stability target is defined in terms of the All Groups Consumers Price Index excluding Credit Services (CPIX). There is a range of events that can have a significant temporary impact on inflation as measured by the CPIX, and mask the underlying trend in prices which is the proper focus of monetary policy. These events may even lead to inflation outcomes outside the target range, 0 to 3 per cent. Such disturbances include, for example, shifts in the aggregate price level as a result of exceptional movements in the prices of commodities traded in world markets, changes in indirect taxes, significant government policy changes that directly affect prices, or a natural disaster affecting a major part of the economy. When disturbances of this kind arise, the Central Bank should react in a manner which prevents general inflationary pressures emerging.

²⁸ The main operational target variable is a measure of underlying inflation defined as excluding indirect taxes as well as prices for food and energy, which normally display high volatility. It is underscored, however, that a distinction has to be made between the short-run volatility in prices for these goods and the longer trend, which should be allowed for in the operational definition of inflation. In principle, therefore, the operational definition should be adjusted so that allowance is made for any long-term difference between the development of prices for food and energy on the one hand and the other CPI items on the other.

²⁹ It should be noted, however, that even taxes and charges contain important information about the inflation process. Political decisions affect administered prices, e.g. for medical care; increased fees or indirect taxes may be a sign of growing pressure from public sector costs.

³⁰ It should be underscored that the question of what constitutes a transitory effect is *complex*. This is particularly evident in the case of supply shocks. To what extent do import price movements, for example, reflect transitory factors rather than international competition's more long-term consequences? This suggests that supply shocks may need to be analysed particularly closely and cited selectively as an argument for departing from the CPI target.

In the inflation report published in June 1999, changes in indirect taxes, subsidies and house mortgage interest expenditure were judged to have no permanent effect on inflation. They were therefore disregarded in the formulation of monetary policy. In practice, monetary policy is currently based on an assessment of underlying inflation as measured by UNDI_X.

Target horizon

The second respect which required a clarification in the formulation of the inflation target is when inflation for some reason has deviated markedly from the target. This raises the question of how quickly inflation should be returned to the target rate of 2 per cent. With an inflation target strategy, it is the Riksbank's duty to construct monetary policy so that forecasted inflation at an appropriate horizon is in line with the inflation target. This *target horizon* is a forward-looking concept for how far ahead monetary policy is calibrated to fulfil the inflation target. The choice of target horizon is very contingent on the lag with which monetary policy affects inflation and the length of this lag is generally difficult to specify. Experience in Sweden as well as international studies suggest that the lag before monetary policy elicits its main effect is 1-2 years³¹

This horizon for the main effect of monetary policy implies that policy is guided by inflation forecasts 5-8 quarters ahead. The target horizon, however, is not necessarily the same as the horizon for the main effect of monetary policy. The target horizon for meeting the inflation target *normally* is 5-8 quarters ahead. However, in the event of a sizeable deviation from target, there are always grounds for weighing the ambition to achieve a rapid return to target against its consequences for the real economy.³²

There should therefore be scope for adjusting the target horizon in the event of a sizeable shock. If the normal target horizon is considered to be insufficient for returning inflation to the target, the Riksbank should make this clear. The reasons for the delay and the new target horizon will be specified in advance in a statement or an inflation report. But the size of the necessary interest rate adjustment and the period over which it should be implemented are matters that should have to be decided from case to case. A mechanical approach that invariably attempts to bring inflation back to the targeted level within the next one to two years could lead in certain cases to unduly large and undesirable fluctuations in economic activity. The Riksbank's discretion in this respect is partly dependent on economic policy's

³¹ For references, see Bernanke and Gertler (1995) and Gerlach and Smets (1994).

³² See Heikensten and Vredin (1998) for a discussion of flexible inflation targeting.

credibility; strong confidence in monetary policy's commitment to long-term price stability, together with a credible economic policy in other respects, can enlarge the scope for flexibility in the policy's short-run formulation.

Under normal circumstances the target horizon is moved ahead one quarter in connection with the publication of each new inflation report containing a new inflation forecast.

4. Accountability

The inflation target is very helpful in communicating monetary policy intentions to the public and to impose accountability and discipline on the central bank. The adoption of the Swedish inflation target, the need to establish its credibility and the aim of being transparent has contributed to a more open Riksbank.

An inflation targeting central bank's accountability can be assured in several ways: first, by comparing inflation outcomes with the target; and second by the central bank's reports which aim at providing the public with convincing rationals for the policy choices it makes; and third by presenting the central banks's own inflation forecast (based on unchanged monetary policy) the public can make its own assessment of the appropriate stance of monetary policy.

As monetary policy cannot control future inflation perfectly, deviations from target will occur. Transparency regarding the central bank's assessments will also make it possible to evaluate whether these deviations are acceptable or if they are the consequence of severe mistakes made by the central bank.

4.1 The new central bank act

The amendments to the Riksbank act which came into force 1 January 1999 were designed to give the Swedish central bank greater independence from political influence, establish a primary objective for monetary policy (price stability) with a legal backing and ensure accountability on the part of the Riksbank for achievement of its policy objective.^{33 34}

³³ With regard to exchange rate policy, the Government will have the authority to decide, after consultation with the Riksbank, on the choice of exchange rate regime. The Riksbank will have responsibility for the implementation of the exchange rate regime adopted by the Government. This means, for example, that the Riksbank will decide on the central rate and the band width in a fixed exchange rate system and on the practical application of policies in a floating rate system.

³⁴ The first step towards making the Riksbank more independent was taken already in 1988. For a discussion of the Swedish debate, see Heikensten and Vredin (1998).

The management structure of the Riksbank was changed. Under the previous system, the Governing Board, which is appointed by the Riksdag, had responsibility for operational matters in monetary and exchange rate policies. Although this system had worked well in the past, it was in violation of the requirement of central bank independence formulated in the Maastricht Treaty. The responsibility for monetary and exchange rate policies was instead transferred to a new body, an Executive Board. The Executive Board has six full-time members of which one is chairman and Governor of the Riksbank.³⁵ Their term of office is six years and they will be up for election on a rolling basis. The Governing Board retains general, supervisory functions and appoints the members of the Executive Board.³⁶

Proposals aiming to ensure transparency and Riksbank accountability were also laid down in law. The Riksbank is required to make a written report on monetary policy to the Parliamentary Standing Committee on Finance at least twice a year (Riksbank Act, Ch. 6, Art. 4). The Riksbank considers that these reports should coincide with its Governor's appearance before the Standing Committee. After the legislation went into force the Riksbank has clarified the role of the tolerance bands in this context. It also started the publication of the minutes of the Executive Boards monetary policy meeting, with a publication lag of 6-8 weeks. This publication lag will be reduced to around 1 month during the second half of 1999.

4.2 The role of the tolerance interval

As monetary policy cannot control future inflation exactly, inflation will fluctuate around the targeted rate. There are several grounds for a tolerance interval. A tolerance interval may be useful in the assessment of monetary policy by the body to which the central bank is accountable. It can also be seen as a way for the Riksbank to explain that it is not capable of keeping inflation exactly on target. The width of the tolerance interval can also be regarded as an indicator of inflation's presumed variability. In other words, the degree of tolerance can be interpreted as a confidence interval in the statistical sense, implying that inflation may lie outside the interval for a certain percentage of time.

³⁵ Also having Constitutional status is a provision to the effect that no public authority will be allowed to issue instructions to the Riksbank in matters relating to monetary policy. A corresponding provision is included in the Riksbank Act. No member of the Executive Board is allowed to seek or accept instructions in monetary policy matters.

³⁶ It is not possible to separate a member of the Executive Board from his position unless he no longer fulfills the conditions required for the performance of his duties or if he has been guilty of serious misconduct.

Two measures have been taken recently aiming at clarifying the role of the tolerance band. First, after the new central bank legislation went into force 1 January 1999, the assessment of monetary policy by the Riksdag has been clarified. Certain routines has been prescribed when inflation moves outside the tolerance interval. In connection with the Governors first appearance before the Riksdag each year the Riksbank intends to account for results of its policy. The material that is presented should include a comparison between the 2 per cent target for CPI inflation and the outcome. The above-mentioned clarifications are crucial here as they make it easier to determine whether deviations from the target are attributable to earlier decisions rather than to other factors, for example forecasting errors. The outcome for inflation is to be presented both as consecutive 12-month CPI inflation rates and as a moving average of 12-month inflation rates.

In this context the tolerance interval will have an operational function. The Riksbank has announced that whenever CPI inflation is outside the tolerance interval, it will present an explanation of the reasons.³⁷ These explanations will serve, for instance, to highlight the transitory effects that are judged to have been acting and which the Riksbank took into account in the formulation of monetary policy. In this context, moreover, the Riksbank can show how target fulfilment has been affected by the rate at which inflation has been brought back to the target after a shock. Explanations of this kind can provide the Riksbank's principal with a foundation for appraising the Riksbank's forecasting ability and conduct of monetary policy.

Second, in order to specify the statistical uncertainties in the inflation forecasts, the Inflation Report, since mid-1998, includes a table showing the probabilities of inflation of being inside the tolerance interval inflation twelve and twentyfour months ahead, assuming unchanged monetary policy stance. In March 1999, for example, the probability of the twelve month CPI inflation being inside the tolerance band in March 2001 was calculated at 50 per cent , while there was a 41 per cent probability of inflation being below 1 per cent and a 9 per cent probability of inflation being above 3 per cent. It should be noted that the assumption of unchanged interest rates results in a wider confidence interval than if an endogenous response of monetary policy is assumed.

Since the inflation target came into force at the beginning of 1995, the annual increase in consumer prices has averaged 1.1 per cent. This average outcome is below the targeted figure but inside the tolerance interval. In the same period the average underlying rate of inflation

³⁷ This clarification has been inspired by the rule requiring the Bank of England, as soon as inflation is outside a tolerance interval, to write an open letter explaining why inflation is not on target. It was suggested by Heikensten and Vredin (1998).

has been somewhat higher: 1.7 per cent in terms of UNDI_X and 2.3 per cent in terms of UNDI_{NHX}, see figure 3. This shows that during these four years, transitory downward effects on inflation have been stronger on the whole than the upward effects. Since 1995, both the 12-month figure for CPI inflation and the moving 12-month average for CPI-inflation has been outside the target range during two periods. This was largely because falling interest rates and house mortgage costs had a downward effect on CPI. Transitory effects from altered indirect taxes and subsidies pulled in the same direction.

Are there grounds for widening the Swedish tolerance interval, which is currently ± 1 percentage point?³⁸ Widening the target range increases the likelihood of meeting the target but may also lead to the central bank being perceived as attaching somewhat greater importance than before to the stabilisation of the real economy or considers that uncertainty about the transmission mechanism for monetary policy has grown. A wider tolerance interval can be taken to imply that fighting inflation has somewhat less priority than with a narrow interval.

4.3 The publication of minutes

Evaluation of monetary policy decisions requires knowledge about the analysis and discussion preceding the decisions. One way to facilitate effective monitoring of the central bank is to publish the minutes of the decision making body. The Executive Board of the Riksbank has decided to hold monetary policy meetings 8-10 times a year and the minutes are published with a time lag of around 6 weeks.

Moreover, a brief account of the grounds for decisions are presented in a communiqué on the day after the meeting.

There may be situations in which members of the Executive Board reach divergent conclusions. That will necessitate a more formal voting procedure. The outcome will be recorded in the minutes. No mention of a vote indicates that the Board agreed unanimously; otherwise, members with dissenting opinions will be named.

The first minutes from a monetary policy meeting (the meeting on February 12th) was published on April 6th.³⁹ The outline of the minutes is similar to the structure of the inflation report. The first section covers international activity, interest rates and exchange rates, monetary aggregates, demand and supply, prices, transitory factors and inflation expectations.

³⁸ In New Zealand, the policy target was changed from 0-2 to 0-3 per cent in December 1996.

³⁹ See Sveriges Riksbank's Web page: www.riksbank.se/eng/

The second section gives the Executive Board's assessment of inflation prospects in the main scenario and the risk spectrum for the formation of monetary policy. The third section presents the discussion and assessment of the monetary policy situation. The decision is finally presented in the fourth section.

5. The Implementation of Monetary Policy in Sweden since 1993

5.1 Introduction

The implementation and communication of monetary policy since 1993 can be divided into three phases. In the first phase, 1993-1995, the inflation target strategy was announced and established. During the first two years of this period the objective was to prevent the underlying rate of inflation to increase. The publication of a report "Inflation and inflation expectations in Sweden" began. During this phase bond investors long term (five year) inflation expectations fell from above 4 per cent to 3 per cent, that is to the upper bound of the tolerance interval, see figure 14. At the end of this phase the credibility of fiscal consolidation increased. In the second phase, 1996-1997, inflation-forecast targeting was introduced. The Riksbank's own inflation forecasts were given more weight in communication of monetary policy. Forecasts for future inflation were gradually introduced in the reports which changed name to "Inflation report". During this phase bond investors' inflation expectations five years ahead fell from 3 per cent to around 2 per cent, implying that the inflation target gained credibility. In the third phase, 1998-, "distribution forecast" targeting was introduced and explicit paths for future inflation were published, surrounded by uncertainty intervals. Uncertainty bands around the inflation serve to illustrate that the inflation forecast is inherently uncertain. Long term inflation expectations during this period were slightly below 2 per cent, signalling the credibility of the inflation target strategy.

5.2 Establishing the inflation target strategy and implicit inflation forecasting

The move to a flexible exchange rate in November 1992 did not entail any change in the principal objective of monetary policy, price stability. This was made clear by the Riksbank when announcing the inflation target in January 1993.

Since monetary policy measures show their full effect on the economic activity and price developments only after a year or two, monetary policies must be far sighten in their direction. The Riksbank started to employ a number of indicators of economic activity and anticipated future inflation. The publication "Monetary Policy Indicators" in June 1993 summarized the work during the first six months of inflation targeting. The first publication of a report

providing an account of the Riksbank's analysis of current inflationary pressure and inflation expectations occurred on October 1993.

After the depreciation of the krona in November 1992, the Riksbank initiated a cautious reduction of the instrumental rate. There was little inflationary pressure and the economy was in a deep recession, but fiscal policy resulted in large deficits. With the weak exchange rate, high export growth generated an economic recovery, while domestic demand remained low. Besides the krona's depreciation, Sweden's competitive position was improved by decreased employers' contributions and gains in industrial productivity that exceeded the rate in the rest of the world. The Riksbank lowered the instrumental rate from November 1992 to June 1994 by more than 5½ percentage points, to 6.92 per cent, see figure 13. This was done mostly in small steps; as the Riksbank considered that, with the new framework, that excessively large steps might cause inflation expectations to rise or lead to the market misunderstanding the Riksbank's intentions. The problems in this period were the steep depreciation of the krona (25 per cent up to the end of 1994) and major uncertainty about future fiscal policy. The central government financial deficit for 1993 was 15.2 per cent of GDP and the ability of the Government and Parliament to reduce the deficit was widely doubted. In 1993 CPI inflation was around 5 per cent and the measure of underlying inflation around 2-3 per cent, while in 1994 both the CPI and the underlying measures showed rates around 1 per cent. It can thus be said that the monetary policy objective of preventing underlying inflation from moving up during 1993 and 1994 was fulfilled.

Inflationary pressure grew during the spring and summer of 1994. Capacity utilisation moved up 3 percentage points to 88 percent, according to Statistics Sweden. During the year the output gap as then measured by the Riksbank began to close. This was accompanied by rising inflation expectations; during the summer, surveys of inflation expectations among money market agents showed an increase of 0.8 per cent to a level above the inflation target's tolerance interval. All this prompted the Riksbank to start raising the repo rate in August 1994; a series of increases, totalling 2 percentage points, brought the rate up to 8.91 per cent in the summer of 1995. The Riksbank was forward-looking and based its monetary policy on inflation forecasts. In August 1994, the internal inflation forecast for the annual increase of CPI inflation in 1995 was 3.8 per cent, given a constant weak exchange rate. In order to bring inflation down to 3 per cent an appreciation of the krona of around 2-4 per cent per quarter was deemed necessary.

However, during this period the Riksbank did not publish inflation forecasts. In the reports "Inflation and Inflation Expectations in Sweden", published three times a year, monetary policy adjustments were motivated in a more general way. In October 1994 for example, the

Riksbank stated that monetary policy indicators showed that the inflation target would be threatened. It was pointed out that firms and investors inflation expectations were not in line with the target and that inflation forecasts by outside observers indicated that they did not expect the inflation target to be met.

5.3 Explicit Inflation Forecast Targeting

CPI inflation in 1995 turned out to be just under 3 per cent and estimates of the underlying rates were about 2 per cent. The difference mainly reflected the tax changes but also had to do with increased house mortgage interest costs. The repo rate increases, however, were of little consequence for mortgage interest costs, which largely rose in connection with the upward shift in bond rates.

The exchange rate's negative trend was broken in the summer of 1995; this reflected increased confidence in the consolidation of government finance (mainly in connection with a growing awareness about the scale of the consolidation measures), the improvement in the budget outcome and an end to the unrest in international markets during the winter and spring. The presentation of Sweden's convergence programme to the EU in June 1995 contributed to the reappraisal of government finance. This was accompanied by some fall in inflation expectations, though these were still above the 2 per cent inflation target.

Slackening economic activity in central Europe led to a slowdown in Sweden in the second half of 1995. Partly for this reason, the Riksbank successively adjusted the inflation forecast down. The Riksbank saw a possibility of lowering the repo rate in January 1996. The internal main scenario conditional inflation forecast for 1996 and 1997 was somewhat above 2 per cent in terms of headline CPI. Indirect taxes were assumed to contribute around 0.2-0.4 percentage points to the annual increase in CPI. However, this internal forecast was based on a growth assumption on the high side for 1996 (around 2 per cent) and it was more and more clear that the domestic and international demand was becoming weaker than expected. Therefore the internal discussion focused on the probabilities for alternative growth and inflation scenarios, giving more weight to a scenario in which the economy would grow at less than its potential rate in 1996. Increased confidence in economic policy during 1996 was evident from an appreciation of the krona and falling market interest rates.

By December 1996 the repo rate had been lowered from 8.91 to 4.1 per cent. The monetary policy easing was motivated in the reports. The report changed name to "Inflation Report" in March 1996. From March 1996 and onwards the Riksbank publishes four "Inflation Reports" per year. Inflation forecasts were gradually introduced in the reports. In the report

published in December 1996, for example, inflation was expected to average just under 1.5 per cent in 1997, followed by about 2 per cent in 1998.

CPI inflation decreased sharply up to November 1996, reaching a low of -0.1 per cent. The average rate for 1996, 0.8 per cent, was below the inflation target's tolerance interval. The extremely low rate of CPI inflation largely had to do with transitory effects. With the stronger exchange rate, prices for goods that are mainly imported were virtually unchanged during the year. The falling market interest rates, together with the Riksbank's repo rate cuts, led to greatly reduced house mortgage rates. During 1996, mortgage interest costs fell 12 per cent; as this item makes up 9 per cent of the CPI, its negative contribution to inflation amounted to more than 1 percentage point. From mid 1996 to mid 1997 the rates for underlying inflation were around 1 per cent.

Inflation turned upwards again during the autumn of 1997. A marked economic recovery was evident in more and more sectors. In December, CPI inflation had moved up to 1.9 per cent, while the indicators of underlying inflation pointed to between 2.0–2.5 per cent. A large part of the increase in CPI inflation had come from increased indirect taxes and rent increases, while the overall rate had been held back by lower mortgage interest costs.

Considering that activity was becoming stronger and the monetary stance still was expansionary, inflation was expected to rise in the years ahead. In the Inflation Report published in December 1997, graphs showing forecasts for future inflation and uncertainty margins were published for the first time. CPI-inflation by the end of 1999 was expected to be around 2.5 per cent, while the underlying rate of inflation (UND1) was expected to be above 2.5 per cent. Two risk scenarios were presented. One risk scenario was that the economic crisis in Asia together with its repercussions on stock exchanges around the world, had an impact on economic activity and inflation that would be more extensive than envisaged in the main scenario. Another risk scenario showed a more marked acceleration of inflation, due to weaker productivity growth and higher wage increases than in the main scenario. However, no specific assessments of the probability of inflation being lower or higher than in the main scenario was published. It was only said that all in all there seemed to be a roughly equal risk of either of these two alternative scenarios materialising. It was concluded that monetary policy had to be given a less expansionary stance. The repo rate was increased by 0.25 percentage points to 4.35 per cent. The report was published when wage negotiations were held in Sweden and it was felt important to stick to the inflation target regime in a credible way.

5.4 Distribution forecast targeting

The rate of inflation tended to rise at the end of 1997 but the 12-month change in the CPI then slackened from 1.9 per cent in December to 1.3 per cent in January 1998. Underlying inflation, measured as UND1, was 1.5 per cent in January, which was more subdued than foreseen in the December report.

Some downward adjustment of future growth was made in the March 1998 report because it was considered that effects of the Asian crisis would be somewhat greater and more prolonged than the Riksbank had counted on earlier. In the June report this picture was confirmed. Prices were more subdued than the Riksbank had expected, partly because international prices for oil and other raw materials went on falling. Moreover, with lower wage settlements than expected and somewhat higher predicted productivity, the development of unit labour costs was assumed to be more subdued than envisaged earlier.

In the June report a construction of the uncertainty interval, based on the two-piece normal distribution, was introduced, showing the perceived probability of inflation being inside a particular interval in some future period. Combining the assessments of uncertainties indicated that the probability of inflation being lower than in the main scenario was somewhat greater than the probability of it exceeding that rate. The overall inflation assessment accordingly pointed to a rate of inflation that was somewhat lower than in the main scenario. This was reflected in the uncertainty interval, which instead of being symmetric around projected inflation, was somewhat broader on the downside, see figure 8. It was concluded that the monetary conditions could be moved in a somewhat more stimulatory direction. The repo rate was cut by 0.25 percentage points to 4.1 per cent.

In the September 1998 Report the main scenario presupposed that the weakening of the krona by almost 4 per cent since the June report was temporary and mainly a consequence of short term market reactions generated by the stock-exchange unrest.

There were still considerable downside risks in the international picture, above all in the form of a weaker than expected outcome in Japan and the United States. But there were also upside risks in the form of a permanently weakened Swedish exchange rate and the strong upward trend in Sweden's economy. All in all, the downside and upside risks were judged to be equally large. The equal magnitude of the upside and downside risks was represented by the uncertainty interval being symmetric around the main inflation forecast. The uncertainty in the inflation assessment was appreciably greater than usual on account of the financial market

unrest and the consequences it and other factors may have had for international economic developments. The greater uncertainty in the inflation assessment was reflected in a broader uncertainty interval compared with the June report, see figure 8. It was also reflected in the monetary policy conclusion not to change interest rates at the publication of the September Report.

In October 1998 the international turbulence in financial markets became more pronounced. The unrest had been accentuated by the near failure of LTCM in September and the earlier suspension of debt payments in Russia. The financial turbulence contributed to a rapid depreciation of the krona, to its lowest level in three years. This was markedly different from the path that had been assumed for the krona in September's main scenario. The abrupt fall also seemed to be unmotivated in relation to economic fundamentals, with good growth, low inflation and a growing surplus on public finances.

In November, before the next Inflation Report was published, new information since the September report indicated that two years hence, inflation would still be below the 2 per cent target. The real economic consequences of the global financial crisis were judged to be greater than expected earlier. There were ground for a downward revision of growth and inflation forecasts for the OECD area. The consequences of this for growth and inflation in Sweden were judged to counter the stimulatory effect of the krona's depreciation. The krona was still assumed to strengthen over the longer term. Therefore, the repo rate was cut twice by 0.25 percentage points in November, lowering it from 4.10 to 3.60 per cent.

The rate of inflation, measured as the 12-month change in the CPI, had decreased more or less continuously in 1998; the rate in October was -0.4 per cent. The decline during 1998 had been more marked than was foreseen in the Inflation Reports published during the year. The downward movement was essentially a consequence of falling prices for energy-related products and lower housing costs. Underlying inflation, measured as the 12-month change in the UNDI_X, decreased to 0.7 per cent in October. The decline had been unexpectedly marked, due to price reductions for imported consumer goods had been larger than assumed.

In the December 1998 Report growth prospects in Sweden seemed to be somewhat poorer than at the time of the September Report. In the main scenario the krona was assumed to remain at a fairly weak level initially, on account of the market unrest, and then become stronger. CPI inflation and underlying inflation was judged to be below target. The downward revision of the CPI was more marked than for underlying inflation, mainly on account of changes in transitory effects. All in all the balance of risks in the inflation assessment seemed to be somewhat on the downside, as was evident from the probability distribution published in

the Report, see figure 8. This picture differed from the assessment in the September Report in that the balance of risks at the time was judged to be symmetrical. However, the financial unrest had tended to subside since September and the general uncertainty in the inflation assessment had decreased since the September Report. Therefore the uncertainty interval was narrower in the December Report. It was concluded that there was room for a monetary policy easing. The repo rate was cut by 0.20 percentage points to 3.40 per cent in mid-December. It was also announced that no further cuts would take place until the new Executive Board was in place.

In February 1999, immediate inflationary pressure in Sweden once again had proved to be somewhat lower, compared with the Riksbank's most recent inflation assessment in December 1998. International economic activity and inflationary pressure had also been dampened, which meant that in the coming two years economic activity and inflation in Sweden probably would be somewhat weaker than expected in the main scenario in the December Report.

CPI inflation one to two years ahead was judged to be below the Riksbank's 2 per cent target. This was partly a consequence of transitory factors that were not considered to have a more permanent effect on either inflation or the inflation process and therefore do not influence the formulation of monetary policy. However, even when these transitory factors were excluded, it was foreseen that inflation one to two years ahead would be below the 2 per cent target.

At its meeting on Thursday, February 11th, the newly elected Executive Board of the Riksbank decided to lower the repo rate 0.25 percentage points, from 3.40 to 3.15 per cent.

In the March 1999 Inflation Report, it was noted that the consumer price tendency since the December report had been weaker than expected. In February 1999 the 12-month change in the CPI was -0.2 per cent. A price fall for petroleum-related products that exceeded expectations contributed to this. Moreover, since the beginning of December the lowering of repo rates, had had a downward effect on household interest expenditure. The international slowdown was expected to affect Swedish growth to some extent in 1999, but a successive increase was foreseen in domestic demand, partly in view of comparatively low interest rates. In the main scenario, CPI inflation was judged to be below the 2 per cent target in March 2001.

The risk of the international economic trend being weaker than in the main scenario was discussed in March 1999. Currency options prices showed that the market seemed to believe

that a depreciation of the krona against German mark (and hence the euro) was more probable than an appreciation. In terms of traditional indicators of competitiveness, however, the krona was still undervalued. Under these circumstances, the probabilities of the krona's path being weaker or stronger than in the main scenario were judged to be equal.

All in all, the inflation assessment carried a downside risk stemming from the risk of weaker international activity than in the main scenario. The downside risk for inflation was accordingly somewhat larger than the upside risk. The larger downside risk was represented by the uncertainty interval being somewhat broader below the forecast path than above it, see figure 9. In that downside risks predominated, the mean assessments of inflation in March 2000 and March 2001 were 0.1 and almost 0.2 percentage points, respectively, below the main scenario's forecast, approximately the same as in the December Report. The width of the uncertainty interval was approximately the same as in the December Report.

The Report concluded, that after adjustments for transitory effects from indirect taxes, subsidies and interest rates, the rate of inflation twelve to twenty-four months ahead would be somewhat below the Riksbank's target. In relation to the uncertainty associated with such assessments, however, the deviation from target was not considered sizeable. At the same time, the risk of inflation being somewhat lower than in the main scenario was judged to be greater than the risk of a higher rate.

On the basis of this conclusion, the Executive Board, decided to lower the repo rate by 0.25 percentage points to 2.90 per cent.

6. What effect does inflation targeting have on the economy?

In this section some preliminary results regarding the effect of inflation targeting on the real economy are discussed. Has the adoption of the inflation targeting framework affected inflation, growth and the inflation-output trade-off? Did the adoption of inflation targeting alter the private sector's inflation expectations? Did the pass-through of exchange rate movements to CPI inflation change after the introduction of the inflation target? Some of these questions are difficult to answer, since Sweden has not been through a complete business cycle since adoption of the inflation target.

Inflation-output trade off and household inflation expectations

Annual average GDP-growth between 1970-1992 was 1.7 per cent in Sweden, while it was 2.9 per cent in the OECD area during the same period. After the deep economic crisis in Sweden in the early 1990s, a favourable export and investment trend laid the foundation for a stable recovery. Private consumption has also increasingly contributed to growth. Since the middle of 1993, annual growth has averaged 2.4 per cent, while average growth in the OECD-area during the same period was around 2.5 per cent. Thus, the growth rate in recent years has been more in line with the rest of the world after a long period with lower average growth in Sweden.

Inflation in Sweden since 1992 has been low, accompanied by declining inflation expectations and rising credibility in monetary policy. Moreover, the sharp fall in households' inflation expectations is a clear sign of increased credibility for the inflation target. In the 1980s these expectations of inflation in the coming twelve months averaged 6.5 per cent, while average inflation expectations since the beginning of 1992 have been slightly below 2 per cent. The clear break in households' inflation expectations in 1992 can be interpreted as an initial sign of a downward shift in the inflation process.⁴⁰ Figure 15 also shows that households have been quite successful in forecasting future inflation. In particular, households in Sweden appear to have foreseen the disinflation in the early 1990s surprisingly well. The adoption of the inflation target, however, involves a process of learning for all actors in the economy which means that there is some time lag before long-term inflation expectations move down, as is evident from bond investors' inflation expectations, in figure 14.⁴¹

Using Phillips type equations, it is possible to analyze whether the inflation process has changed since the introduction of the inflation target. The inflation process is affected by inflation expectations, the trade-off between the output gap (or unemployment) and inflation, and transitory or supply effects. A more permanent change in the inflation process may arise because of institutional changes and affect the way in which inflation expectations are generated as well as the trade-off between the supply and demand situation and the rate of inflation. In a Riksbank study it was found that when demand was represented by indicators of an output gap, inflation tended to be overpredicted for the years after the introduction of the inflation target in 1993.⁴² Thus, the inflation-output trade-off seems to have improved in Sweden. However, when demand was represented instead by unemployment, the Phillips curve relationship no longer overestimated inflation, in the period after 1993. In another Riksbank study the analysis starts from the following decomposition of registered inflation:

⁴⁰ In the 1991 Budget Statement, the Government declared that a policy for a fair distribution and full employment must give the fight against inflation precedence over other ambitions and demands.

⁴¹ The downward shift in Swedish inflation is explicitly modelled in Blix (1999) with two discrete regimes, a high and a low inflation state. The probability of switching between the regimes is estimated and discussed.

⁴² See Berg and Lundkvist (1997).

$$\pi_t = \pi_t^{LS} + \pi_t^E + \pi_t^T, \quad (1)$$

where π_t is the measured inflation rate, π_t^{LS} long-run inflation, π_t^E the component of inflation generated by cyclical fluctuations in the economy (often regarded in turn as an indicator of variations in aggregate demand), and π_t^T the component of inflation generated by various types of transitory effects and supply shocks, for example changes in indirect taxes, subsidies and oil prices.⁴³ Restrictions on the models for the individual components (π_t^{LS} , π_t^E och π_t^T) are such that it can be demonstrated that in long-term equilibrium measured inflation and long-run inflation are identical. From these restrictions it also follows that only *deviations* from π_t^{LS} covary with cyclical real economic fluctuations, which with reference to Phillips-curve theory means that π_t^{LS} should represent *expected inflation*.

The picture of the inflation process conveyed by the model agrees in important respects with other analytical approaches (used by the Riksbank as well as other observers) and with the overall picture outlined in recent Inflation Reports. The most notable finding is perhaps, as shown in Fig. 16, the marked decline of expected inflation in the 1990s.⁴⁴

Another conclusion from Fig. 16 is that the level of demand has had an appreciable downward effect on inflation almost continuously in the 1990s but that even supply effects and transitory factors of various types have exerted an appreciable downward influence.⁴⁵ This picture of inflation's path can be said to indicate that monetary policy in the 1990s has been rather successful in bringing expected inflation down to a more favourable level but that overall measured inflation has also been lower as a result of a weak demand trend and various more transitory factors. Given the chosen specification, in 1998 Q4 the contribution from the latter type of effects was as much as – 1.6 per cent (-2.1 per cent including the contribution from supply shocks).⁴⁶

⁴³ A discussion of the model was presented in a box on pp. 35-37 in *Inflation Report 1999:1*. The approach is described in Apel, M & Jansson, P. (1999), *A Parametric Approach for Estimating Core Inflation and Interpreting the Inflation Process*, Sveriges Riksbank Working Paper No. 80

⁴⁴ Note that expected inflation in the model is somewhat higher than the expected rate derived from survey data, at least in the latter part of the study period. It is not surprising, however, that different methods do not yield identical results for inflation expectations. Moreover, when allowance is made for the purely statistical nature of certain differences, the discrepancies are less dramatic.

⁴⁵ In the specification used here, the origins of transitory effects are changes in the short-term nominal interest rate, the nominal oil price, nominal import prices and indirect taxes; supply shocks are approximated with changes in the real oil price and productivity.

⁴⁶ As the decomposition in (1) is also affected by a constant, the contributions from the various components do not sum exactly to the rate of measured inflation. Moreover, the aggregate contribution from the components includes indirect as well as direct effects on inflation.

The dominance of falling expected inflation in the 1990s makes it difficult to analyse the partial relationship between demand and inflation. There is as of today no strong indication of a significant change in this relationship. While the reduction of expected inflation does indicate that the average *level* of measured inflation will be lower in the future, it is not certain that inflation's *cyclical fluctuation* have decreased. It is conceivable, however, that the development of inflation expectations also plays some part in inflation's short-run fluctuations, in which case the result could be a lower average *level* as well as lower *variability* even though the direct relationship between demand and inflation has not changed.^{47 48}

The exchange rate

The Riksbank's view on the exchange rate has altered in some respects since 1992. Gradually more emphasis has been placed on the krona's forecast path, while occasional fluctuations have been played down.⁴⁹

When the flexible exchange rate regime was introduced, the krona depreciated markedly; in the first six months it weakened about 20 per cent. A major factor behind the krona's initial depreciation was no doubt uncertainty about the Swedish economy and economic policy. In the first years with a flexible exchange rate the path of the krona was not strongly related to current inflation or demand. A simple regression analysis shows that the confidence of market agents in Swedish economic policy - measured as the long-term interest rate differential against Germany, see figure 12 - can explain almost a third of the nominal exchange rate's variability since 1992. In the period from 1994 to 1996 the swings in credibility, measured in this way, actually explain almost two-thirds of the exchange rate movements.

In the period thereafter, the exchange rate has been comparatively stable, except during the widespread turbulence in connection with the international financial crisis in the autumn of 1998. But even with relatively strong government finances and low inflation, a flexible

⁴⁷ See Apel and Jansson (1998).

⁴⁸ A general result in the recent study on by Bernanke, Laubach, Mishkin and Posen (1999), is that inflation targeting appears to have been successful in reducing both inflation and private sector inflation expectations in four inflation targeting countries. They also find evidence in favour of an improved inflation-output trade-off in Sweden since the introduction of the inflation target. Bernanke et al find that the sacrifice ratio in Sweden is lower than in Canada, New Zealand and United Kingdom during the disinflation process. This result, however, may partly be a consequence of the method they use to calculate the output gap. In their VAR model, lower than expected inflation rates in Canada, New Zealand and United Kingdom, but not in Sweden, are accompanied by substantial shortfalls of GDP over the two years following target adoption of the target. Thereafter, GDP growth rates in all four countries exceed the projections, while inflation and short-term interest rates remain at levels below the forecasted levels.

⁴⁹ See "Monetary Policy and the exchange rate", speech held by Lars Heikensten, april 1999

exchange rate does seem to entail exchange rate fluctuations that are greater than was believed when the krona fell in the autumn of 1992. This experience is shared with other inflation targeting countries, like UK and Canada, and may not be related to credibility problems regarding economic policy in Sweden, as is evident from bond market developments. Although the long-term interest rate differential with Germany increased somewhat during the financial turmoil in 1998, it stayed on a very low level (below one percentage point) compared to the levels in the beginning of the floating exchange regime.

The exchange rate normally affects inflation through import prices as well as via foreign trade and resource utilization. The relationship is complicated, however, in that the average pass-through from exchange rate movements to import prices seems to be incomplete. In the short run and in particular if the exchange rate movement is judged to be temporary, this is a consequence of price rigidities and other adjustment costs. In the longer run the pass-through is also dependent on other market conditions.

Since the introduction of the inflation target, the pass through of exchange rate movements to CPI inflation seems to have weakened. One important explanation probably is that the move to a flexible exchange rate has altered pricing behaviour. When the krona was devalued during the last decades of the fixed exchange rate regime, the new exchange rate was perceived as permanent and prices were set in relation to its weaker level. Since 1992, depreciations of the krona have probably been perceived as temporary and therefore resulted in more limited price adjustments. Another factor may be downward price pressure from increased international competition. It is reasonable to suppose that increased competition has the primary effect of depressing inflation temporarily. It is a matter of a one-off effect - albeit a protracted one - on the *price level*, in that firms are obliged to adjust prices downwards as long as competition is intense. In an inflationary environment this shows up as lower inflation.

7. Conclusions

In this paper key points in the design of the present Swedish inflation-targeting strategy have been described and analyzed. According to the central bank act, the primary objective of monetary policy is price stability. A numerical target value of 2 per cent for inflation, with a tolerance band of ± 1 percentage points, serves as an operational target for monetary policy and as a nominal anchor for inflation expectations.

The target horizon for meeting the inflation target normally is 5-8 quarters ahead. However, in the event of a sizeable deviation from target, there may be scope for adjusting the target

horizon, allowing for stabilization of real variables. The publication of inflation forecasts in the Riksbank's Inflation Report for both headline CPI and underlying inflation as well as uncertainty assessments are used to motivate monetary policy decisions. The publication of the forecast is thereby an important feature of the Riksbank's accountability to the public and to parliament on achieving the inflation target. When inflation is outside the tolerance band, the Riksbank has to present the reasons for this and show how inflation can be brought in line with the target.

Since the implementation of the inflation target strategy began in 1993, three different phases have been distinguished: the establishment of the inflation target, the communication of explicit inflation forecasts, and, finally, the introduction of distribution forecast targeting.

In practice, distribution forecast targeting involves presenting a main scenario for future inflation, and assessments of both the degree of uncertainty in the forecast and the magnitude of the upside and downside risks to the main scenario. The probabilities of inflation twelve and twenty-four month ahead being inside certain intervals are published in the inflation report. When the Executive Board sets the interest rate (the repo rate), both the main scenario, that is the mode of the forecast, and the risk spectrum surrounding the main scenario, are taken into account.

While inflation targeting in Sweden has been successful in reducing both inflation and private sector inflation expectations, aggregate demand as well as supply shocks and temporary factors have also exerted a downward influence on inflation in the 1990s. It is therefore premature to distinguish any improvements in the inflation-output trade-off, after the announcement of the inflation target in 1993. It is likely, however, that the increased credibility of the inflation target has resulted in both a lower average inflation level and lower inflation variability, even if the direct relationship between output and inflation is unchanged.

References

- Akerlof, George A., William T. Dickens and George L. Perry (1996), "The Macroeconomics of Low Inflation," *Brookings Papers on Economic Activity* 1:1996, 1-76.
- Andersson, Krister and Claes Berg (1995), The inflation target in Sweden, in Haldane, A.G. (ed.), *Targeting Inflation*, Bank of England, pp. 207-223.
- Angeloni, Ignazio, Vitor Gaspar and Oreste Tristani (1999), "The Monetary Policy Strategy of the ECB," Working Paper, ECB.
- Apel, Mikael and Per Jansson (1998), "System estimates of potential output and the NAIRU", (Forthcoming) *Empirical Economics*.
- Berg, Claes and Peter Lundkvist (1997), "Has the inflation process changed?", *Sveriges Riksbank Quarterly Review* 2, pp. 5-23.
- Berg, Claes and Richard Gröttheim (1997). "Monetary Policy in Sweden Since 1992". Bank for International Settlements, Policy Papers No. 2.
- Berg, Claes, and Lars Jonung (1999), "Pioneering Price Level Targeting: The Swedish Experience 1931-1937," *Journal of Monetary Economics*, 43:525-551.
- Bernanke, Ben and Michael Woodford (1997). "Inflation Forecasts and Monetary Policy". *Journal of Money, Credit, and Banking* 29(4):653-84
- Bernanke, Ben, Thomas Laubach, Frederic S. Mishkin, and Adam S. Posen (1999), *Inflation Targeting: Lessons from the International Experience*, Princeton University Press.
- Bernanke, Ben and M. Gertler (1995), "Inside the black box: the credit channel of monetary policy transmission", *Journal of Economic Perspectives* 9, Fall, pp. 7-48.
- Bernanke, Ben S., and Ilian Mihov (1997), "What Does the Bundesbank Target?" *European Economic Review* 41, 1025-1054.
- Blix, Mårten, and Peter Sellin (1999), "Inflation Forecast with Uncertainty Bands", Forthcoming, *Quarterly Review*, *Sveriges Riksbank*.

Blix, Mårten, and Peter Sellin (1998), "Uncertainty Bands for Inflation Forecasts," Sveriges Riksbank, Working Paper Series, No. 65.

Bäckström, Urban (1998) "Five years with the Price Stability Target", *Quarterly Review*, 1998:1, 31-45, *Sveriges Riksbank*.

The Economist, March 27th, 1999

European Central Bank (1998a), "A Stability-Oriented Monetary Policy Strategy for the ESCB," Press Release, October 13, <http://www.ecb.int>.

European Central Bank (1998b), "The Quantitative Reference Value for Monetary Growth," Press Release, December 1, 1998 <http://www.ecb.int>.

Gerlach, S. and F. Smets (1994), "The Monetary Transmission Mechanism: Evidence from the G-7 Countries", Bank for International Settlements.

Fischer, Stanley (1994), Modern Central Banking, in Capie et al., "The Future of Central Banking", Cambridge University Press.

Heikensten, Lars (1999), "The Riksbank's Inflation Target – Clarification and Evaluation", *Quarterly Review*, 1999:1, 5-17, *Sveriges Riksbank*.

Heikensten, Lars (April 1999), speech, "Monetary Policy and the Exchange Rate", *Sveriges Riksbank*.

Heikensten, Lars and Anders Vredin (1998), "Inflation Targeting and Swedish Monetary Policy – Experience and Problems", *Quarterly Review*, 1998:4, 5-33, *Sveriges Riksbank*.

Jacobson, Tord, Per Jansson, Anders Vredin and Anders Warne (1998), "A VAR model for monetary policy analysis in a small open economy", Unpublished working paper, Sveriges Riksbank.

Orphanides, Athanasios, and Volker Wieland (1998), "Price Stability and Monetary Policy Effectiveness when Nominal Interest Rates Are Bounded at Zero," Working Paper, Federal Reserve Board.

Svensson, Lars E.O. (1995), "The Swedish Experience of an Inflation Target." In Leonardo Leiderman and Lars E.O. Svensson, eds., *Inflation Target.* London: Centre for Economic Policy Research.

Svensson, Lars E.O. (1997), "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets," *European Economic Review* 41, 1111-1146.

Svensson, Lars E.O. (1999a), "Inflation Targeting as a Monetary Policy Rule," *Journal of Monetary Economics*, forthcoming.

Svensson, Lars E.O. (1999b), "Inflation Targeting: Some Extensions," *Scandinavian Journal of Economics*, forthcoming.

Svensson, Lars E.O. (1999c), "Monetary Policy Issues for the Eurosystem," *Carnegie-Rochester Conference Series on Public Policy*, forthcoming.

Svensson, Lars E.O. (1999d), "Open-Economy Inflation Targeting," *Journal of International Economics*, forthcoming.

Svensson, Lars E.O. (1999e), "Price Level Targeting vs. Inflation Targeting," *Journal of Money, Credit and Banking*, forthcoming.

Svensson, Lars E.O. (1999f), "Price Stability as a Target for Monetary Policy: Defining and Maintaining Price Stability", Working Paper

Wallis, Kenneth (1999), "Asymmetric Density Forecasts of Inflation and the Bank of England's Fan Chart", *National Institute Economic Review*, January 1999, 106-112

Sveriges Riksbank. 1992-94a. *Quarterly Review*, various issues.

Sveriges Riksbank (1999), "The Riksbank's Inflation Target – Clarification and Appraisal", MEMORANDUM, 1999-02-04