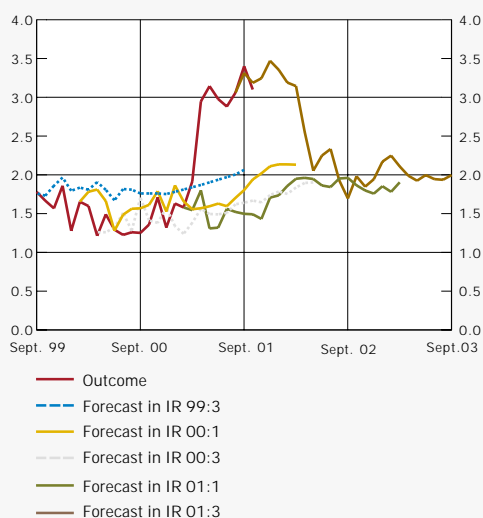


THE RELATIONSHIP BETWEEN GROWTH AND INFLATION

Figure B8. UND1X, forecasts and outcome.
Per cent



Sources: Statistics Sweden and the Riksbank.

Inflation has risen rapidly in the course of this year. The increase, which occurred mainly in the spring, had not been expected (Fig. B8). It was mainly unforeseen price increases for meat, fruit and vegetables, domestic heating oil, petrol, electricity and telecom services that lay behind inflation's high rates. In recent Inflation Reports the price rise for these goods and services has been considered to be mainly of a more transitory nature; CPI inflation should fall back towards the targeted rate as pricing returns to more normal patterns.

Prices for these goods and services are among the items that have fluctuated most historically (cf. Fig. B2 on p. 6). But even when these price increases are excluded, it is still the case that inflation moved up at a time when resources were not considered to be particularly strained. This raises questions about the picture of resources utilisation and the effect on inflation. The high inflation outcomes recently could, for example, have to do with the relationship between growth and inflation being less favourable than has been assumed in recent Inflation Reports.

The relationship between growth and inflation is an umbrella term at the Riksbank that encompasses a wide variety of conceivable connections and relationships. It is primarily two aspects of growth's impact on inflation that are considered here. The first is the picture of resource utilisation: if the Riksbank's appraisal has been on the low side, that could at least partly explain the high inflation outcomes. The other aspect is resource utilisation's effects on inflation: if the Riksbank has underestimated these effects, inflation would be higher than forecast even with a correct appraisal of resource utilisation. Finally, the question is considered of whether the high inflation outcomes recently ought to have been foreseen by the Riksbank and other observers.

THE PICTURE OF RESOURCE UTILISATION

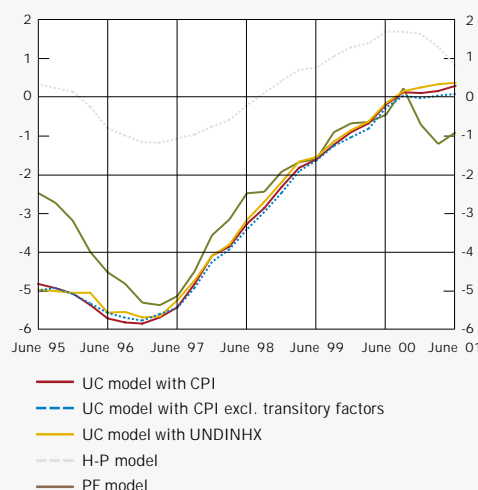
In Inflation report 1999:3 it was judged that during the forecast period resource utilisation would rise gradually and become increasingly inflationary in the course of 2000. As growth since that forecast has been lower than expected, last spring's increased inflation can hardly have been a sign of growing strains on resources. The appraisal of resource utilisation in 2000 has also been revised continuously downwards.

One approach to measuring resource utilisation uses the output gap. A problem here, however, is that the gap is not something that can be observed directly and therefore has to be estimated in one way or another. The Riksbank currently uses three methods for this (see Fig. B9; also Fig. 32 on p. 35).¹⁶ Additional information (labour market shortages, for example) is also included in the final assessment of resource utilisation.

Inflation rose last spring, as mentioned above, even excluding the price increases that were judged to be of a more transitory nature. The rise included inflation's domestic component (UNDINHX). It is conceivable that the price increases which were judged to be more transitory stemmed mainly from supply shocks and accordingly were not primarily driven by demand. In that inflation features in the estimation of the size of the output gap, including the transitory factors in the measure of inflation could give a faulty picture of the gap. It is also conceivable that resource utilisation in Sweden mainly affects inflation's domestic component. Using CPI instead of UNDINHX inflation could then give a faulty picture of resource utilisation. Output gaps estimated with inflation measured by the CPI, by UNDINHX and by the CPI excluding the price increases that are currently considered to be more transitory, are presented in Fig. B9. It will be seen that the choice of inflation measure is of little consequence for the size of the estimated output gap.

The output gap in 2000 is particularly relevant in the present context because, together with the potential growth rate, it determines whether a forecast rate of GDP growth is associated with rising or falling inflationary pressure. In the October Report, resources were judged to have been somewhat more strained in 2000 than had been allowed for earlier. The Riksbank's

Figure B9. Output gap estimated with the UC model, using three alternatives for inflation, and with the H-P and PF methods. Per cent

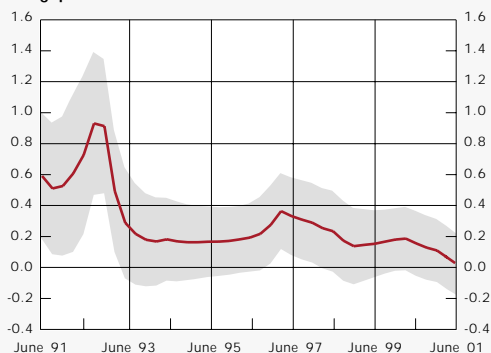


Note. The output gaps shown here are somewhat different from the picture in Fig. 32 on p. 35 because the latter are presented as four-quarter moving averages.

Source: The Riksbank.

¹⁶ One of the approaches to estimating the total output gap uses the UC model; whereas the other two – the HP filter and the PF (production function) approach – rely solely on GDP data, the UC model also takes inflation into account. For a description of this model, see Apel, M. & Jansson, P. (1999), System estimates of potential output and the NAIRU, *Empirical Economics* 24, 373–388.

Figure B10. Partial correlation between output gap and inflation.



Note. Partial correlation estimated with a rolling 40-quarter window with inflation represented by the CPI and the output gap obtained with the UC method. The shaded band indicates the 95 per cent confidence interval for the estimations.

Source: The Riksbank.

estimations of the output gap do not suggest that this was appreciably larger than was assumed after the upward adjustment.

RESOURCE UTILISATION'S EFFECTS ON INFLATION

On a number of occasions in recent years the Riksbank has made minor changes in the appraisal of resource utilisation's effects on inflation. Earlier studies have shown, for example, that the partial correlation between the output gap and inflation decreased during the 1990s. In an attempt to catch any changes more recently, the same Phillips curve as was used earlier has been estimated with a rolling window, which means that at each time-point the model is estimated with an unbroken series of preceding observations, in this case the 40 preceding quarters.¹⁷ The exercise confirmed earlier results. The partial correlation between the output gap and inflation decreased in the early 1990s and does not seem to have risen since then (Fig. B10).¹⁸

Interpretations of partial correlations should always be highly cautious. In a simple model, the relationship between the output gap and inflation is dependent *both* on resource utilisation's effects on inflation *and* on how the central bank reacts to inflation prospects.¹⁹ The Riksbank's inflation forecasts start from the technical assumption that the repo rate will be unchanged. The relevant question is then how resource utilisation affects inflation when monetary policy is unchanged. In empirical data, however, outcomes include monetary policy's stabilising influence on inflation. This means that when developments are analysed retrospectively, it looks as though the correlation has decreased.

The fall in the estimated partial correlation between inflation and the output gap in the 1990s is what one might expect after a successful implementation of inflation-targeting regime. A decreased partial correlation between resource utilisation and inflation should result from monetary policy's commitment to price stability around an inflation target.

There is nothing in Fig. B10 to suggest that the partial correlation between resource utilisation and

17 The earlier estimations are presented in *Inflation Report 1999:3*, in a box on pp. 52–55. The Phillips curve used there as well as here is written $\pi_t = \alpha + \beta_1 y_{t-4} + \beta_2 \pi_t^{exp} + (1 - \beta_2) \pi_{t-4} + \beta_3 \pi_t^{ext} + \beta_4 r_t + \varepsilon_t$, where π is inflation, y a measure of resource utilisation, π^{exp} expected inflation derived from surveys, π^{ext} external inflation, r oil price changes and ε denotes errors.

18 This conclusion is not crucially dependent on window size.

19 See e.g. Svensson, L.E.O. (1997), Optimal inflation targets, 'conservative' central banks and linear inflation targets, *American Economic Review* 87.

inflation has increased since the changeover to the inflation-targeting regime. This can be taken to imply that resource utilisation's effect on inflation has not increased, either. The result holds for different measures of both inflation and resource utilisation.

MODEL-BASED INFLATION FORECASTS

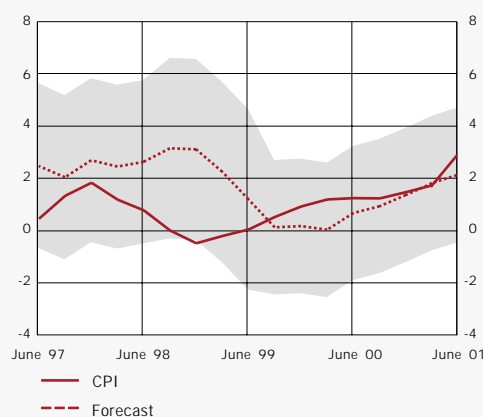
Can it be said that the Riksbank ought to have foreseen the high inflation outcomes recently? One approach to this question involves comparing various model-based forecasts with outcomes and studying whether the models catch the increased inflation. This has been done with the same Phillips curve as above. A forecast of inflation two years ahead has been obtained with each estimation in the rolling window and the results have been compared with the outcomes.

It will be seen from Figs. B11 and B12 that the models do not manage to foresee the high inflation recently. But when the transitory factors are excluded from the measure of inflation, the model's inflation forecasts are above the outcomes. So these results also suggest that this year's unexpectedly high inflation outcomes were primarily due to the transitory factors.

SUMMARY

The unexpectedly high inflation last spring has made it important to analyse whether the Riksbank's assessments of growth's impact on inflation in a wide sense were faulty. A number of approaches to this question are presented above. The conclusions from the analysis indicate, firstly, that the models yield no strong indications of the high inflation being a consequence of the Riksbank's forecasts underestimating resource utilisation. Secondly, there does not seem to be any clear indication that resource utilisation's effects on inflation have recently changed appreciably. Finally, when the transitory factors are included in the measure of inflation, recent inflation is underestimated, if anything, by simple econometric models. This supports the appraisal in the main scenario that it is above all the goods and services for which the price increases are considered to be of a transitory nature that led to the recent underestimation of inflation.

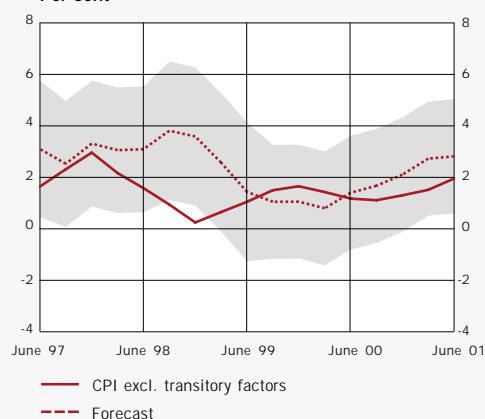
Figure B11. CPI inflation: model-based forecast and outcome.
Per cent



Note. The shaded band indicates the 95 per cent confidence interval for the forecast.

Source: The Riksbank.

Figure B12. CPI inflation excluding transitory factors: model-based forecast and outcome.
Per cent



Note. The shaded band indicates the 95 per cent confidence interval for the forecast.

Source: The Riksbank.