

Recent inflation outcomes and forecasts

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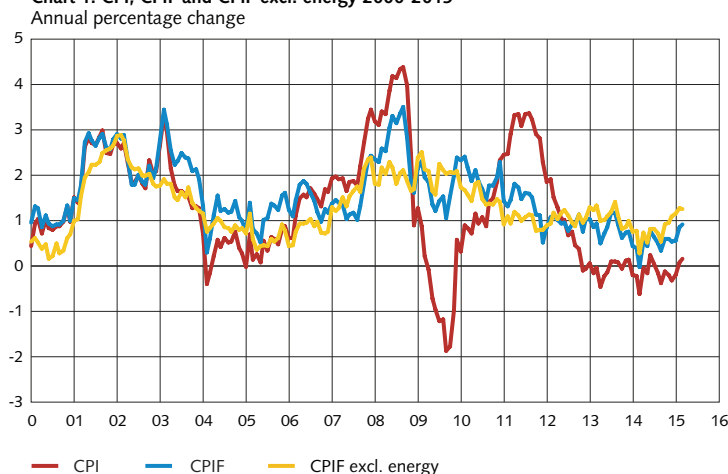
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Introduction

Because monetary policy affects the economy with somewhat of a lag, forecasts play an important role in the monetary policy decision-making process. In order to be able to make good decisions, the Riksbank must have access to fast, reliable information about current economic conditions. Not least, information regarding the direction of inflation in the immediate future is needed. This commentary looks at the accuracy of the Riksbank's inflation forecasts in the short term, i.e. one to three months ahead. The Riksbank's report "Account of monetary policy" contains assessments of longer-term forecasts.²

Inflation has been low since 2011, but dropped to even lower levels in 2013 and 2014 (see chart 1.) The Riksbank's forecasts have been inaccurate on several occasions during that period. The forecasting error has also been unexpectedly large, despite the Riksbank having used the same forecasting methodology as before. Other forecasters have also made similar forecasting errors.

Chart 1. CPI, CPIX and CPIX excl. energy 2000-2015



Note. CPIX is the CPI with a fixed mortgage rate.
Sources: Statistics Sweden and the Riksbank

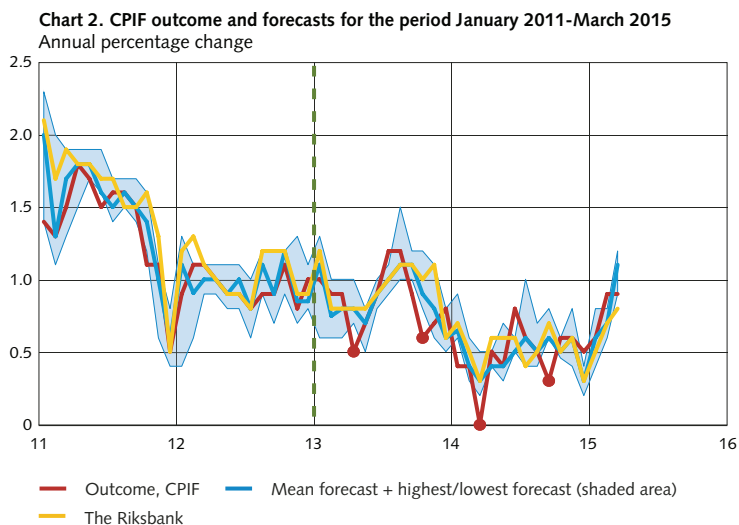
The red line in chart 2 shows the outcome of the annual percentage change in the consumer price index with a fixed interest rate (CPIX). The yellow line shows the Riksbank's forecasts and the blue line shows a mean of the projections of other forecasters. Also in the chart, the difference between the lowest and highest forecast

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2. The latest assessment for the period 2007-2014 shows that the Riksbank's longer-term forecasts have been comparatively good for CPIX inflation, GDP growth and unemployment. However, accuracy is not as good as that of other forecasters for CPI inflation and the repo rate. The evaluations show however that the differences between the forecasting ability of various forecasters are slight.

In this Economic Commentary, short-term inflation forecasts are compared. Both the Riksbank and other forecasters have overestimated inflation on several occasions during the period 2013-2015. This suggests that the low inflation has been difficult to predict. According to the evaluation, the Riksbank's short-term forecasts have been more or less as accurate as those of other forecasters, despite the Riksbank in many instances having had less information at its disposal. A review of the statistics shows that it is a case of an extensive drop in inflation. Several outcomes have also been extreme in a historical perspective.

out of the other forecasters is marked in blue.³ In the chart, it can be seen that few inflation outcomes ended up outside of the shaded area in 2011-2012 (to the left of the vertical dashed green line). In 2013-2014, more forecasts ended up outside the area. It would appear that the development has been more difficult to predict since 2013.



Sources: Bloomberg, Statistics Sweden and the Riksbank

The Riksbank's methodology for short-term inflation forecasting

The Riksbank uses both models and judgements for forecasting inflation in the short term. Pure judgements may for example be needed to estimate effects of amended taxes, rent negotiations, changes to weights or fluctuations in the prices of electricity and oil. Models are needed to capture and forecast more regularly recurring price fluctuations.

An example of a model used for forecasting a few months ahead is the "component model". In that model, various subindexes or components of CPI are modelled separately, using simple time series models. Then, forecasts are established for the various subindexes. Addressing CPI components individually in this manner may facilitate the inclusion of specific information, such as commodity prices in food when food prices in CPI are modelled, or exchange rate fluctuations when commodity prices are modelled. The various subindexes have different weights in CPI. These weights can be used when the forecasts are then weighed together into various aggregates such as CPI, CPIF or CPIF excluding energy (CPIFxe).

A comparison of short-term forecasts in the past two years

In this evaluation, the Riksbank's forecasts according to the most recently published assessment are used. Because the Riksbank does not release new forecasts each month, often one or sometimes two CPI outcomes may already have been published when the Riksbank's forecasts are compared with a new CPI outcome. This evaluation includes the Riksbank's forecasts for horizons of one to three months ahead.⁴ These mixed horizons are compared with the projections of other forecasters, which are often made a day or so before a new CPI outcome is published.⁵ In their case, it is thus a matter of forecasts with a one-month horizon. Hence, in most cases, the figures

3. In the calculation of the mean, as well as the highest and lowest forecasts, the Riksbank's forecasts are not included.

4. During the period analysed, thirteen of the Riksbank's forecasts have a one-month horizon, and eleven have a two-month horizon. Three of the Riksbank's forecasts have a three-month horizon.

5. Source: Bloomberg.

from other forecasters are based on more information than those of the Riksbank.⁶ The Riksbank's CPIF inflation forecasts between January 2013 and March 2015 are compared with forecasts from sixteen other forecasters for the same period. That period thus includes the rapid drop in inflation.

There are different ways of evaluating forecasts. One of the simplest methods is to calculate the average forecasting error, sometimes known as "bias". That measure shows whether the forecast has on average been above or below the outcomes and thus captures the degree of systematics in the forecasting errors.⁷ RMSE (Root Mean Squared Error) summarises the spread, standard deviation, and bias for forecasting errors. The lower the RMSE, the better the forecasting ability. A forecast that is always accurate has RMSE equal to zero. In table 1 below, the forecasting ability of the various entities is evaluated, both with RMSE and with bias.

Table 1. Forecast evaluation for CPIF inflation from January 2013 to March 2015
Forecasts with horizons of one to three months for the Riksbank

		BIAS	RMSE	NUMBER OF FORECASTS
1	Societe Generale	0.00	0.15	9
2	Morgan Stanley & Co,	0.08	0.17	18
3	Nordea Markets	0.01	0.17	26
4	Skandinaviska Enskilda Banken	0.00	0.18	24
5	Credit Suisse	-0.07	0.18	10
6	Swedbank	-0.03	0.18	26
7	Citi	-0.02	0.19	17
8	Svenska Handelsbanken	0.01	0.19	26
9	Danske Bank	-0.02	0.20	24
10	Barclays Capital Group	0.03	0.20	16
11	Nykredit Markets	-0.03	0.20	15
12	Riksbank	0.04	0.21	27
13	4Cast Limited	0.05	0.23	26
14	Informa Global Markets	0.01	0.23	14
15	DnB NOR	0.01	0.25	18
16	BNP Paribas	0.20	0.30	20
17	UBS Warburg	0.16	0.31	7

Sources: Bloomberg and the Riksbank

In the table, the forecasters are ranked according to RMSE. Societe Generale has had the most accurate CPIF forecasts, but was only included in nine out of the 27 studied forecast months. Out of those that issued forecasts for most months in the sample, the major Swedish banks fare very well indeed in the ranking. Compared with them, the Riksbank has a higher RMSE. Remember, though, that the Riksbank's forecasts have a longer forecast horizon than others in many cases.^{8,9} An average RMSE of the various forecasters excluding the Riksbank amounts to 0.21.^{10,11} Otherwise, it can be ascertained that the Riksbank has on average forecast somewhat too high inflation in the short term during the period, so the Riksbank's bias is positive.

6. An average forecast from a number of forecasters should thus, in most cases, be more accurate than the Riksbank's most recent published forecast. Also in cases when the Riksbank's forecast refers to inflation one month ahead, other forecasters have a certain information advantage because their forecasts are often made just a few days before the CPI outcome. Sometimes, the amount of information possessed about developments over the past few days in e.g. fuel prices, electricity prices and exchange rates can be crucial.

7. When working out the average forecasting error, positive and negative forecasting errors offset each other.

8. If the forecasts of the National Institute of Economic Research are evaluated in the same way, RMSE of 0.27 is obtained for the period in question. However, their sample includes nine forecasts with a two-month horizon, and as many as seven forecasts with a three-month horizon. For two out of the 27 studied months, forecasts with a four-month horizon are used.

9. See a discussion about various forecasting horizons in "Forecasters' ability – what do we usually assess and what would we like to assess?" by Michael K. Andersson and Ted Aranki, *Economic Review*, No. 3, 2009.

10. If in an initial step an average forecast is instead calculated based on all forecasters except the Riksbank, and an RMSE is then calculated for that forecast, a number of 0.18 is obtained.

11. RMSE for the Riksbank's forecasts with only a one-month horizon amounts to 0.22 for the period 2013-2015. The same applies to forecasts with a two-month horizon. The equivalent figures for the period 2011-2012 are 0.29 for forecasts one month ahead, and 0.19 for forecasts with a two-month horizon.

In table 2, the forecasting ability of the various entities is again evaluated, but this time only for forecasts with a one-month horizon for the Riksbank. Comparability is then better while at the same time there are fewer forecasts. The ranking turns out more or less the same as in table 1, although the Riksbank climbs a few notches. An average of the various forecasters' RMSE excluding that of the Riksbank then amounts to 0.24. Here too, it can be seen that the Riksbank has forecasted somewhat too high inflation on average.

Table 2. Forecast evaluation for CPIF inflation from January 2013 to March 2015

Forecasts with a one-month horizon for the Riksbank

		BIAS	RMSE	NUMBER OF FORECASTS
1	Societe Generale	0.05	0.16	4
2	Nordea Markets	0.00	0.18	13
3	Skandinaviska Enskilda Banken	0.00	0.20	12
4	Swedbank	-0.01	0.20	12
5	Morgan Stanley & Co,	0.10	0.20	9
6	Credit Suisse	-0.10	0.21	6
7	Citi	-0.01	0.22	10
8	Riksbank	0.05	0.22	13
9	Barclays Capital Group	0.08	0.22	8
10	Svenska Handelsbanken	0.01	0.22	13
11	Danske Bank	-0.04	0.24	11
12	Nykredit Markets	-0.10	0.24	6
13	DnB NOR	0.03	0.26	9
14	Informa Global Markets	0.04	0.27	8
15	4Cast Limited	0.08	0.27	12
16	BNP Paribas	0.28	0.35	9
17	UBS Warburg	0.28	0.39	4

Sources: Bloomberg and the Riksbank

Unusually difficult to predict inflation in recent years

Chart 2 clearly shows that forecasters, at least on four occasions, have made unusually large forecasting errors since January 2013 – in April and October 2013 and in March and September 2014.^{12, 13} Below is a more detailed review of the forecasting errors in those months.

In the analysis, forecasts and outcomes for various subindexes in CPI are compared. Forecasts for various components are not usually published by the Riksbank.¹⁴

April 2013: Declining price increase rates for both goods and services

The CPI outcome for April 2013 was published on 24 May. The Riksbank's CPIF inflation forecast, which was published in the Monetary Policy Update on 17 April, was 0.8 per cent, which was equal to the average forecast of other forecasters. However, the outcome was 0.5 per cent. Also for CPI inflation, the Riksbank's forecasting error was almost 0.3 percentage points. Food prices and mortgage costs came in higher than expected. At the same time, energy prices and the prices of goods and services were lower than expected. Chart 3 shows how much of the forecasting error for CPI inflation might be attributable to the forecasting errors for the various subindexes. The development of service prices was the most unexpected. It can also be seen that food prices had a counteracting effect, with an outcome that was higher than the forecast.

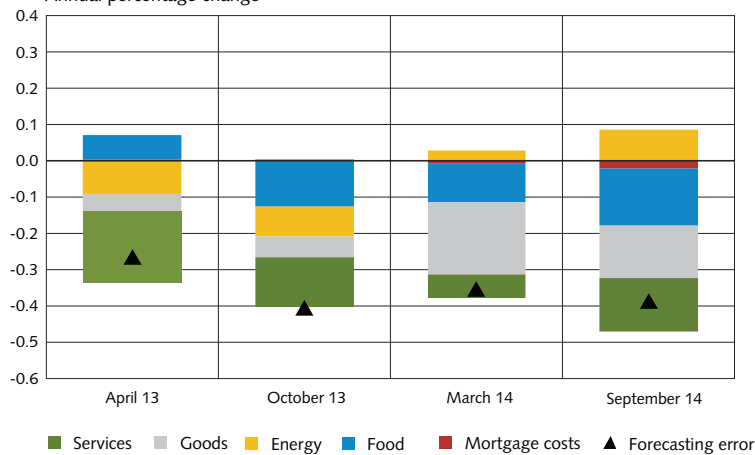
12. See the large red dots in the chart.

13. There was also a substantial forecasting error in January 2014. However, it is much more common for forecasts to be wrong in that particular month. Various changes to weights, and other factors, make it particularly difficult to forecast price changes between December and January.

14. Besides judgements, the Riksbank usually uses the components model to establish short-term forecasts for various subindexes.



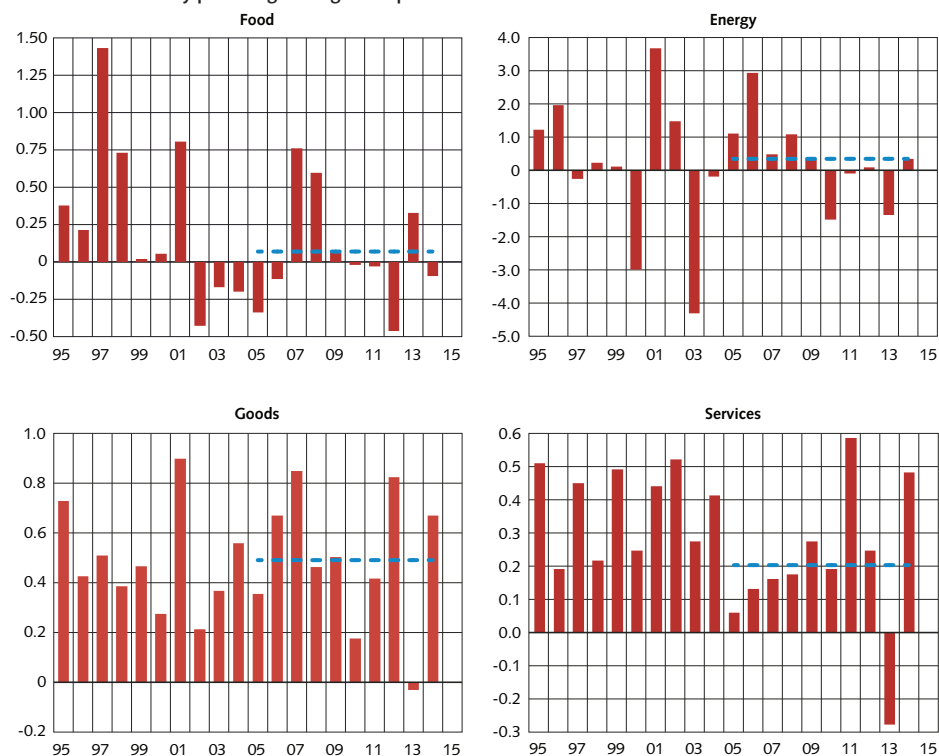
Chart 3. Subindex contribution to forecasting error for CPI inflation
Annual percentage change



Sources: Statistics Sweden and the Riksbank

In order to analyse the outcomes for the various components in more detail, chart 4 shows the monthly percentage changes for April from 1995 to 2014 for all subaggregates apart from mortgage costs. Studying data in this way can be particularly informative if the time series have a clear seasonal variation. The red bars thus show the percentage changes between March and April for each year between 1995 and 2014. The chart also shows the average monthly change for April since 2005 as a dotted line. The last-but-one bar in each chart shows the outcomes for April 2013. It can be noted that the monthly change for prices of both goods and services is the lowest measured since 1995. Prices of goods have on average increased by close to 0.5 per cent, while prices of services have risen by 0.2 per cent on average. In April 2013, however, the prices of both goods and services dropped. Out of the prices of goods, the price increase rate for clothing and household articles was unusually low. Out of services, foreign travel prices in particular rose unusually slowly. The price increase rate of domestic travel was also unusually low. The same applies for lotteries, pools and games.

Chart 4. Monthly percentage changes in April 1995-2014^{15, 16}



Sources: Statistics Sweden and the Riksbank

October 2013: Falling prices on food

The outcome for the annual percentage change in CPI in October 2013 was -0.1 per cent, while the Riksbank's forecast was 0.3 per cent. The forecasting error was thus -0.4 percentage points. In the forecast, published in the Monetary Policy Report on 28 October, the Riksbank had access to CPI information for September. When the forecast was published, the Riksbank also had access to the majority of all relevant monthly information for October, such as for interest rate and fuel price developments. Yet, the forecasting error was substantial and also somewhat greater than the average forecasting error for other forecasters.¹⁷ The prices of all subgroups, apart from mortgage costs, came in lower than expected.

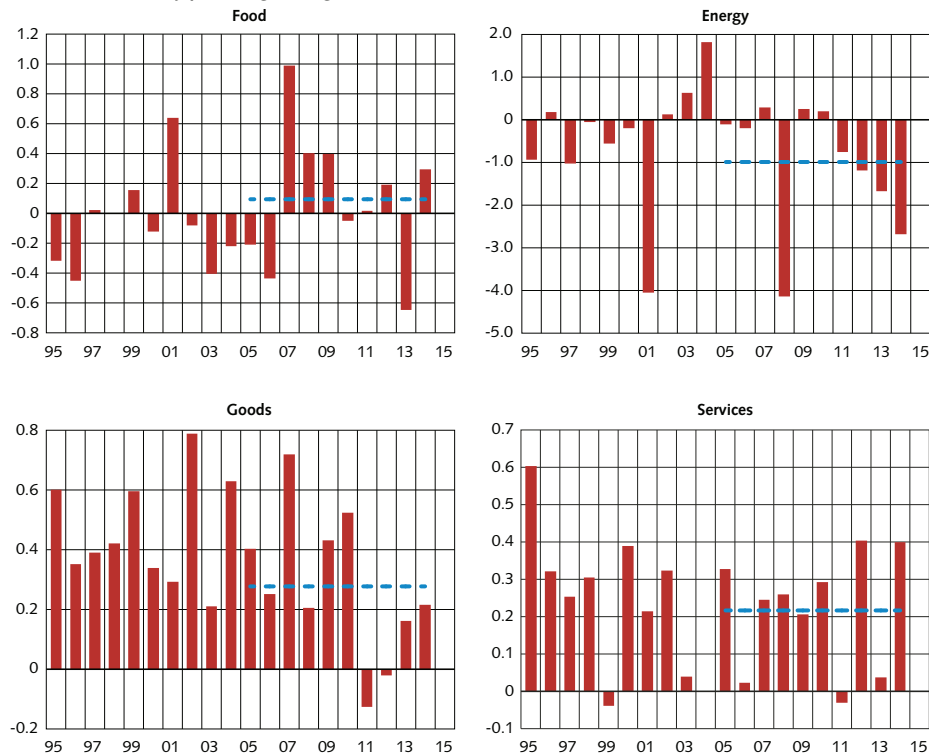
In chart 5, monthly changes for October for the four CPI subgroups are shown. The last-but-one bars in the charts show the outcomes for 2013. The monthly changes for both goods and services were very low, and the monthly change for food was the lowest measured since 1995. Within the food aggregate, meat products, fish and canned fish as well as fruit and vegetables had unusually low price increase rates that month. In terms of energy, only the prices of oil-related products increased more slowly than expected. Out of goods, footwear, household articles and automotive had lower price increase rates than normal. Out of services, foreign travel prices once more rose unusually slowly.

15. Food has a 17 per cent weighting in CPI, energy 9 per cent, goods 24 per cent and services 44 per cent.

16. The dotted lines shows a mean for the period 2005 to 2015.

17. In chart 2, it can be seen that the Riksbank made a greater error than the average of other forecasters (the yellow line is much higher than the blue one). The main reason for this is that the average fuel price for September 2013 was wrongly calculated by the Riksbank. The error caused the CPIF forecast to be at too high a level for October and November 2013. In table 2, this error causes RMSE for the Riksbank to increase by just over one hundredth from 0.21 to 0.22.

Chart 5. Monthly percentage changes in October 1995-2014



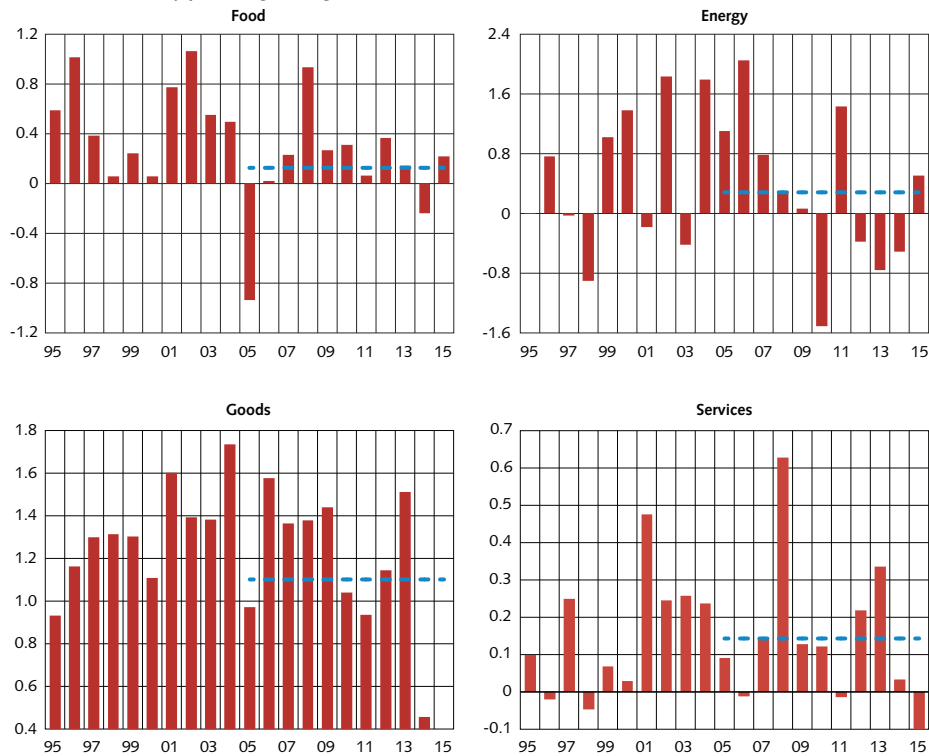
Sources: Statistics Sweden and the Riksbank

March 2014: Historically low price increase rate for goods

In March 2014 the CPI inflation outcome was -0.6 per cent, while the forecast was -0.3 per cent. The forecasting error was thus -0.3 percentage points. The forecast had been published in the monetary policy update on 9 April and the Riksbank then had access to the CPI outcome for February and indicator information for March. The March outcome was published two days later, on 11 April. So, despite access to a lot of information for March, the forecasting error was substantial. The same also applied to other forecasters. All subgroups apart from energy had unusually low price increases. The main reason for the too-high forecast was that goods prices did not rise as expected (see the third bar in chart 3).

In chart 6, the monthly percentage changes for March from 1995 to 2015 are shown. The last-but-one bar in the charts shows the outcome for 2014. There, the monthly change for the prices of both food and services is low, but not record-low. For goods prices, the monthly change was at the time the lowest measured since 1995 (in March 2015 it was even lower). The price increase rate for flour, grain and bread, as well as meat products, was unusually low. For fuel and energy, it was instead unusually high. For goods, the price increase rate for clothing, toys, games and hobby articles was unusually low and examples of services that had a lower price increase rate than usual included foreign travel as well as lotteries, pools and games.

Chart 6. Monthly percentage changes in March 1995-2014



Sources: Statistics Sweden and the Riksbank

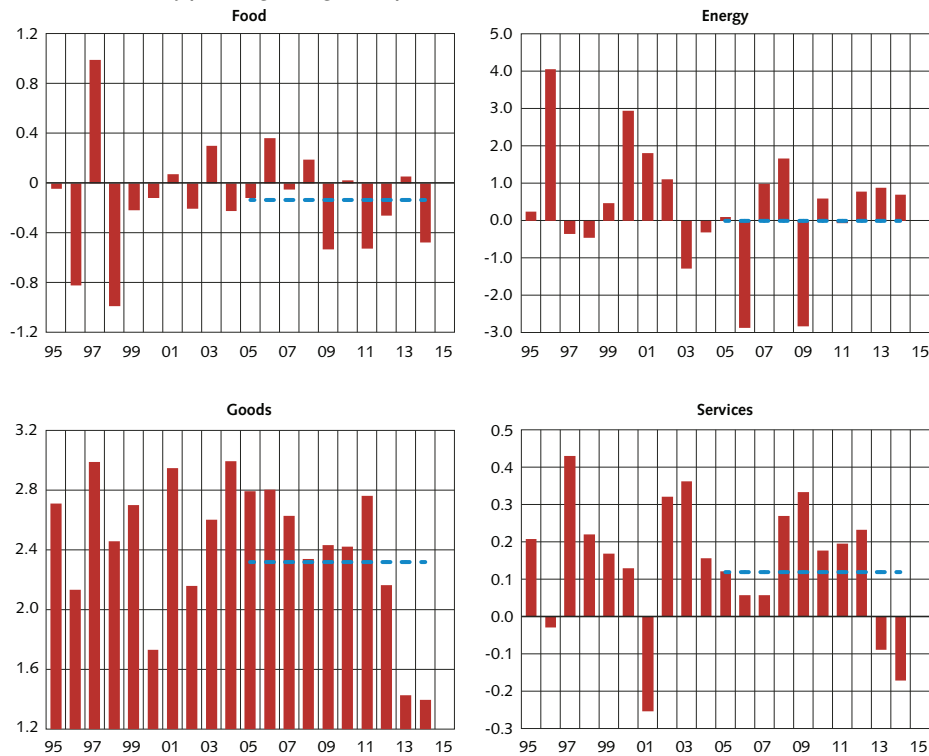
September 2014: Low price increase rates or declining prices for food, goods and services

In the Riksbank's forecast for September 2014, prices were expected to be unchanged compared with the same month of the prior year. However, prices dropped and the outcome and forecasting error were instead close to -0.4 percentage points. The forecast was published on 4 September and at the time the Riksbank had CPI information through July. The outcome for September was published on 14 October. When the forecast was published, the Riksbank did not have access to any short-term information for September. All subgroups apart from energy had unexpectedly low price increase rates once more (see the fourth bar in chart 3).

Chart 7 shows the final monthly percentage changes for September. The last bar refers to September 2014. It can be noted that the monthly change for both food and services is among the lowest measured since 1995, while the monthly change for goods is the very lowest for the same period.¹⁸

18. The price increase rates for flour, grains and bread and well as coffee, tea and cocoa were unusually low. At the same time, the prices of both electricity and oil-related products came in higher than expected. Out of the prices of goods, the price increase rate for e.g. clothing, household textiles and household appliances was unusually low. Out of the services prices that had a lower price increase rate than usual, domestic and foreign travel as well as dental fees can be mentioned.

Chart 7. Monthly percentage changes in September 1995-2014



Sources: Statistics Sweden and the Riksbank

Summary

Both the Riksbank and other forecasters have overestimated inflation on several occasions over the past two-year period. An evaluation for the period January 2013 to March 2015 shows that the Riksbank's short-term forecasts have been more or less as accurate as those of most other forecasters, despite the Riksbank having established its forecasts with less information at its disposal in many cases. A review of some instances with particularly large forecasting errors shows that the outcomes have been low for many CPI subgroups. It is thus a case of an extensive drop in inflation. Many outcomes have been the lowest measured since 1995, and it is difficult to believe that standardised models could capture such wide deviations from normal patterns.