Economic Commentary

Cruising to victory or a dead heat? Central Bank Championships in forecasting ability 2021 and 2022

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SVERIGES RIKSBANK

Central Bank Championships in forecasting ability 2021 and 2022

After many years of low inflation, consumer prices rose rapidly in 2021 and 2022. Inflation targets and central banks' forecasting ability were tested to an extent that has not occurred since the targets were introduced. Neither the central banks nor other forecasters anticipated the rapid upturn in inflation, and consequently inflation forecasts showed large forecasting errors, which led to harsh criticism.

In this Commentary, we compare the Riksbank's forecasts for CPIF inflation, which is the Riksbank's target variable, with nine other central banks' forecasts for their own target variables in 2021 and 2022. In addition to the Riksbank, the analysis includes the central banks of Australia, Canada, the Czech Republic, the euro area, New Zealand, Norway, Poland, United Kingdom and the United States. The question we ask is whether the forecasting errors differ greatly between different central banks under these very challenging circumstances, and how the Riksbank fares in such a comparison.

We show that the ten central banks that we study have been largely equally good, or equally bad, at forecasting their inflation target variables in 2021 and 2022, when we take into account the fact that inflation varies in different ways from one country to the next.

Different approaches yield slightly different results and the study should not be interpreted as an overall assessment by the Riksbank of either its own forecasting ability or that of other central banks.[1]

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Inflation rose rapidly

After many years of low inflation, consumer prices rose rapidly in 2021 and 2022 and inflation reached the highest levels in over 30 years. The inflation target, like the

Riksbank's the forecasting ability, was tested to an extent not seen since the intro-
duction of the target. Many countries experienced similar developments (see Figure
1).[3] Central banks did not anticipate that inflation would rise so quickly and inflation
forecasts consequently showed large forecasting errors. The ability of central banks to
forecast inflation has therefore been severely criticised. [4]

Figure 1. Inflation in Sweden and nine other countries or currency areas
Annual percentage change
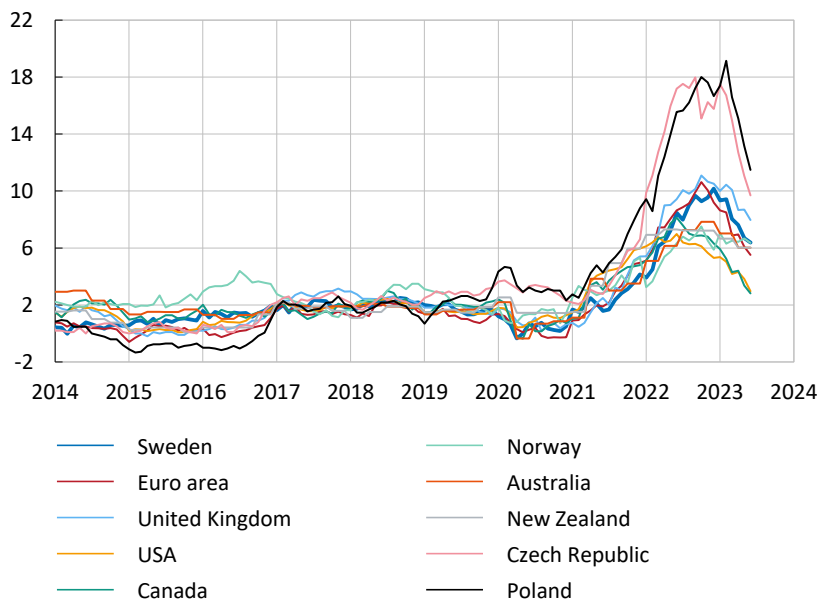
Note. Refers to the CPIF (consumer price index with a fixed interest rate) for Sweden, the HICP
(harmonised index of consumer prices) for the euro area, the PCE (personal consumption
expenditures price index) for the United States and the CPI (consumer price index) for other
countries.

Sources: Statistics Sweden, Eurostat, U.K. Office for National Statistics, US Bureau of Labour
Statistics, Statistics Canada, Statistics Norway, Australian Bureau of Statistics, Statistics New
Zealand, Český statistický úřad and Główny Urząd Statystyczny.

At the end of 2022, the Centre for Monetary Policy and Financial Stability (CeMoF) at
Stockholm University was commissioned by the Riksdag Committee on Finance to
review monetary policy in Sweden in 2022. The evaluation (Hassler, Krusell and Seim,
2023) argues that the Riksbank should have increased its preparedness when inflation
started to rise in December 2020 in the United States and when the Bank of England
started to raise its policy rate in December 2021.[5]

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[3] The rise in inflation was preceded by an unusual combination of events affecting economies around the
world: first, the pandemic, which led to severe supply disruptions and pent-up consumer demand, large
fiscal and monetary stimulus, and then the war in Ukraine, which led to large increases in energy and food
prices, among other things.

[4] See for example Bordo and Levy (2022), House of Representatives (2022), Levy (2023), Australian
Government (2023) and House of Commons (2023). An exception is Holm and Martinsen (2023) who
praised Norges Bank for its inflation management. Their assessment was that the decisions were generally
well balanced and timely.

[5] See page 7 of Hassler, Krusell and Seim (2023).

In this Commentary, we take up the evaluation's observations and proposal to compare the development of inflation in Sweden with that of the rest of the world and we examine how good, or bad, ten different central banks including the Riksbank were at forecasting their target variables when the development of inflation was completely different from that of previous decades.[6] The question we ask is whether the forecasting errors differ greatly between central banks under these very challenging circumstances and how well the Riksbank fares in such a comparison.[7].

Large forecasting errors across the board

Figure 2 shows how the Riksbank's CPIF forecasts were updated between 2020 and 2023, and the outcomes for CPIF inflation until the second quarter of 2023. The blue dashed line shows annual averages for 2021 and 2022 for the outcomes and the grey dashed line shows the average of the corresponding forecasts. It is clear that the forecasting errors were large in both years, but especially in 2022. The average of the Riksbank's 2020–2022 full-year forecasts for CPIF inflation in 2021 and 2022 was 1.6 and 3.2 per cent respectively (grey dashed line).[8] The outcome for CPIF inflation in 2021 and 2022 was 2.4 and 7.7 per cent respectively, which means that the average forecasting errors were around 0.8 percentage points for 2021 and 4.5 percentage points for 2022.

A common way to summarise and evaluate the accuracy of forecasts is to calculate the average of the absolute value of all forecasting errors made in a given period. In Figure 3, we show a very similar measure, the root mean square error (RMSE), to summarise the forecasting errors for the ten central banks we study.[9] This measure can be interpreted in much the same way as the average forecasting error, but gives more weight to large forecasting errors and less weight to small ones.[10]

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[6] We study how well the central banks forecast their target variables, as this makes the forecasts comparable insofar as it is these variables that the central banks are asked, or have themselves chosen, to stabilise.

[7] The different target variables are affected to different degrees by, for example, energy prices and interest expenditure. However, the comparison partially takes this fact into account, as we normalise the forecasting errors by how much the target variables have varied during the period under evaluation. Central banks make their forecasts under different conditions. However, we refrain from fully considering these differences here, leaving it for further studies. For example, we disregard the fact that central banks have chosen to condition their forecasts on different assumptions for interest rates, exchange rates, oil prices and so on. Another aspect that we do not consider is that central banks make different numbers of forecasts per year. The appendix, which shows the inflation forecasts of all ten central banks, shows this clearly. It can also be noted that some central banks worked with scenarios and not forecasts in 2020. For example, the Reserve Bank of New Zealand published three different scenarios between March 2020 and January 2021. We also disregard this in our Commentary.
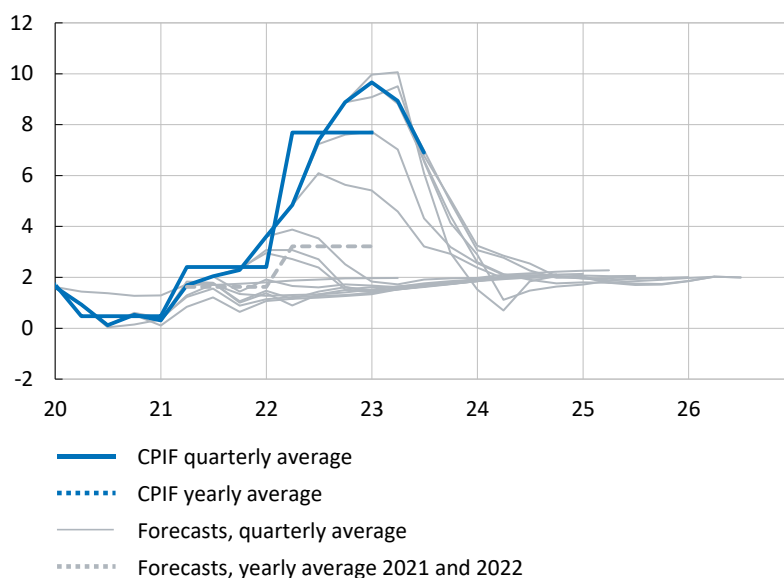
[8] The Riksbank published forecasts for 2021 between October 2018 and November 2021. Forecasts for 2022 were made between November 2019 and November 2022.

[9] Both the absolute value and the square of a number remove the sign of the number. This means that both positive and negative forecasting errors can be summarised and compared. The absolute value does this directly by giving a number the positive value regardless of whether it is negative while the square does this indirectly as the square of a negative number is always positive.

[10] Note that the RMSE represents a particular type of (quadratic) loss function that may be natural for a central bank. Indeed, large forecast deviations are considered relatively more serious than small forecasting errors with such a loss function. Different functions can lead to different results.

Figure 2. CPIF, the Riksbank's forecasts and outcomes

Annual percentage change

- CPIF quarterly average
- .... CPIF yearly average
- Forecasts, quarterly average
- .... Forecasts, yearly average 2021 and 2022

Note. Blue solid lines show quarterly averages for CPIF and grey solid lines show quarterly averages of the Riksbank's CPIF forecasts at the respective forecast times. The blue dashed line shows the annual average for CPIF and the grey dashed line shows the annual average for the Riksbank's CPIF forecasts in 2021 and 2022.
Sources: Statistics Sweden and the Riksbank.

If we start with the Riksbank's forecasting errors, we can see that the forecasting errors for 2021 and 2022 are substantial compared with the decade before the pandemic. The average forecasting error for the Riksbank's forecasts for the years 2011–2020 made in the same year and the year before was 0.3 percentage points.[11]

If we then compare with other central banks, we can first note that all central banks' forecasting errors were significantly larger for 2022 than for 2021. It is also clear that the spread of root mean squared errors across central banks increased in 2022. Norges Bank and the Bank of Canada have average mean squared errors of only 3.5 percentage points, while the Polish and Czech central banks' corresponding errors are close to 10 percentage points.

Furthermore, it can be observed that forecasting errors were larger in those countries where inflation became higher and began to fall later. For example, inflation in Sweden, the United Kingdom and the euro area rose more than in many other countries. At the same time, forecasting errors were also larger in these three countries/regions. Norges Bank appears to have done relatively well with its inflation forecasts for both 2021 and 2022 and comes out the overall winner, if this measure alone were to be the deciding factor.

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[11] Table 2 in *Evaluation of the Riksbank's forecasts 2021*, Riksbank Study, Sveriges Riksbank.

Figure 3. Root mean square error of forecasts in 2020, 2021 and 2022 for inflation in 2021 and 2022 respectively

Percentage points
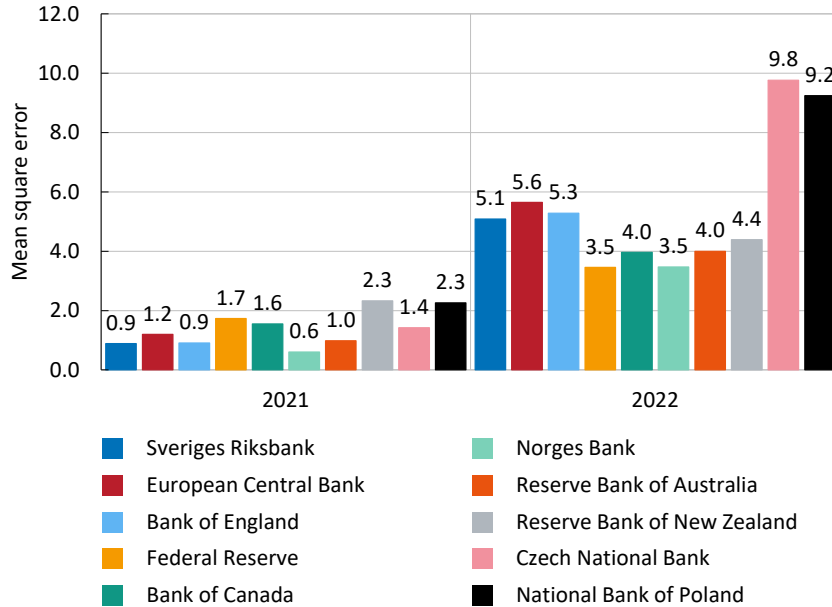
Note. The forecasting errors relate to forecasts made between 2020 and 2022 for average inflation in 2021 and 2022 for each country's inflation target variable. These are the CPIF for the Riksbank, HICP for the European Central Bank, PCE for the Federal Reserve, and CPI for other central banks.

Sources: The respective central banks and the Riksbank.

However, Figure 3 does not take into account the fact that the different countries might have been subjected to varying degrees of disruptions and shocks during 2021 and 2022. Moreover, the impact of the disruptions on the economy may have differed across countries. We also do not take into account that the variation in different measures of inflation may be different. When comparing forecasting errors between different data series, it is common to normalise, or standardise, the error. One way is to normalise the root mean square errors with some kind of measure of variability for the outcome variable.[12]

Figure 4 normalises the average forecasting errors by the range of variation (the difference between the highest and lowest outcomes) of inflation between the first quarter of 2013 and the last quarter of 2022. Large forecasting errors will then be weighted down if inflation has varied relatively more (as in Poland and the Czech Republic). The idea is that it is relatively harder to forecast a variable that varies a lot than one that varies relatively little. Different choices of time periods for the inflation

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[12] A normalised forecasting error gives an idea of the size of the error relative to the actual outcome, or the variation in the outcome. It helps to put the error into perspective and makes it possible to compare forecasting errors across different scales or between different data series. If a forecasting error is 4 percentage points and the variation in the outcome is 4 percentage points, the normalised forecast error is 4/4 = 1. If instead the forecasting error is 8 and the variation in the outcome is 16 percentage points, the normalised forecast error is 8/16 = 0.5. A large absolute forecasting error can thus become a relatively small forecasting error if one takes into account that outcomes vary to different degrees.

outcomes and different measures of variability (e.g. variance or standard deviation) that we have chosen to normalise with give the same qualitative results, as long as the outcomes for 2021 and 2022 are included in the normalisation.

Figure 4. Normalised root mean squared errors for forecasts in 2020, 2021 and 2022 for inflation in 2021 and 2022 respectively
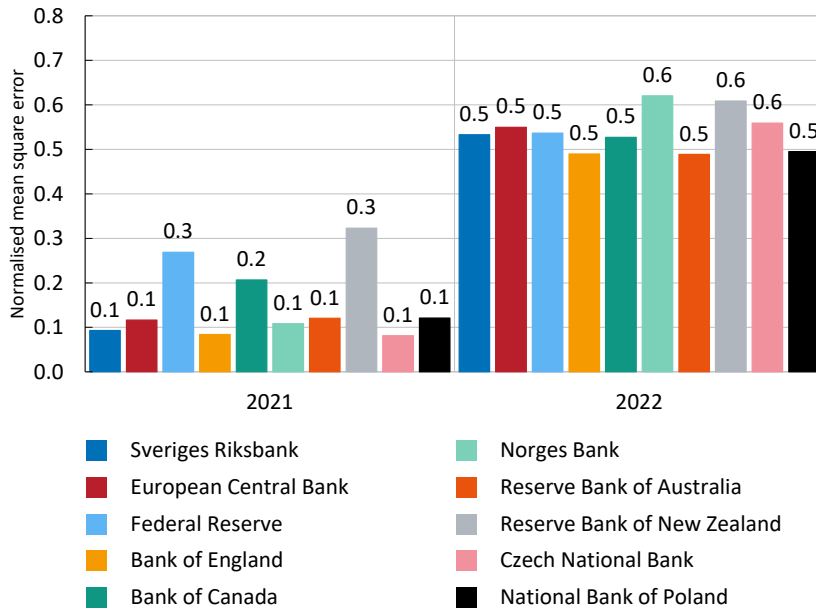
Note. See Figure 3. The mean squared errors are divided by the range (the difference between the highest and lowest outcomes) of inflation between 2013 and 2022. The range of variation in each country in ascending order is (in quarterly average inflation) Norway: 5.6, USA: 6.4 (vintage: 2023-07-30), New Zealand: 7.2, Canada: 7.5, Australia: 8.2, Sweden 9.5, euro area: 10.3, United Kingdom: 10.8, Czech Republic: 17.5, and Poland: 18.7. Excluding four forecast events in 2020 and 2021 when the RBNZ used scenarios instead of forecasts, the normalised mean squared errors are 0.2 for 2021 and 0.5 for 2022.

Sources: The respective central banks and the Riksbank.

Of course, the fact that inflation has risen more in some countries may also be due to the monetary policy conducted. Adjusting for the variation in inflation means that we not only adjust for different shocks but also for different monetary policies. Thus, we may be putting central banks that were not as successful in stabilising inflation in a better position.[13]. If standardisation is not considered relevant in this context, we refer to the results in Figure 3.

Figure 4 is the central figure in our analysis. Interestingly, it shows that the central banks have been broadly as good, or as bad, at forecasting their respective inflation target variables. If anything, the Federal Reserve and the Reserve Bank of New Zealand made slightly poorer forecasts for inflation in 2021 than other central banks.

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[13] The relationship between how much inflation rose in the countries we study and when central banks actually started tightening monetary policy and raising policy rates is positive (if one excludes Poland and the Czech Republic). Inflation rose more in countries that raised their policy rates later than in those that raised them earlier.

Otherwise, the forecasting errors are strikingly, and perhaps even surprisingly, similar.[14]

When did the central banks start adjusting their inflation forecasts for 2022 upwards?

Figure 5 shows the Riksbank's and other central banks' forecasting errors (outcome minus forecast) for each country's inflation target variable for 2022. Here we can see when the Riksbank adjusted its forecasts compared to other central banks. In other words, the figure shows when the largest forecasting errors were made. Figure 6 shows the corresponding forecasting errors standardised by the range of variation in the same way as in Figure 4 above. As the forecasting errors for the Czech Republic and Poland were relatively large, we have excluded them in Figure 5 to make it easier to study the Riksbank's forecasting errors.

Figure 5. The Riksbank's and other central banks' forecasting errors (outcome minus forecast) for each country's inflation target variable for 2022

Percentage points
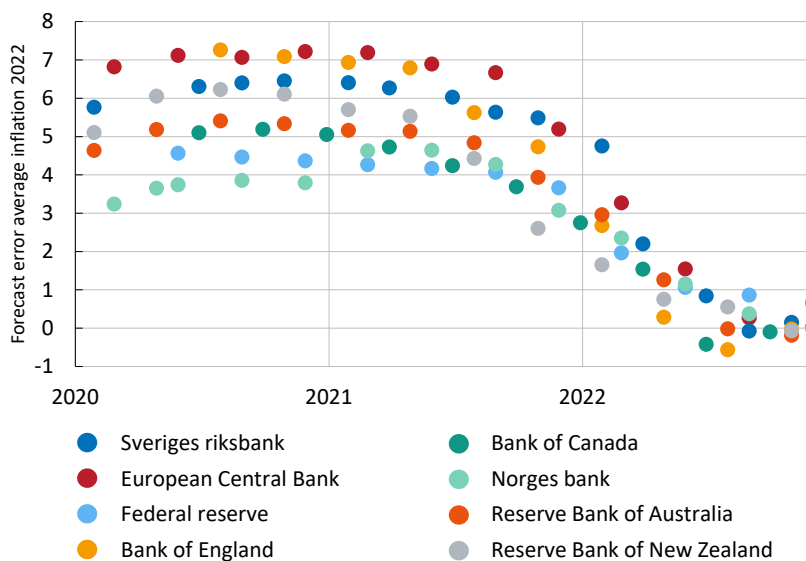
Note Due to their size, the forecast errors for the Czech Republic and Poland have been excluded from the diagram to facilitate studying the Riksbank's forecast errors.
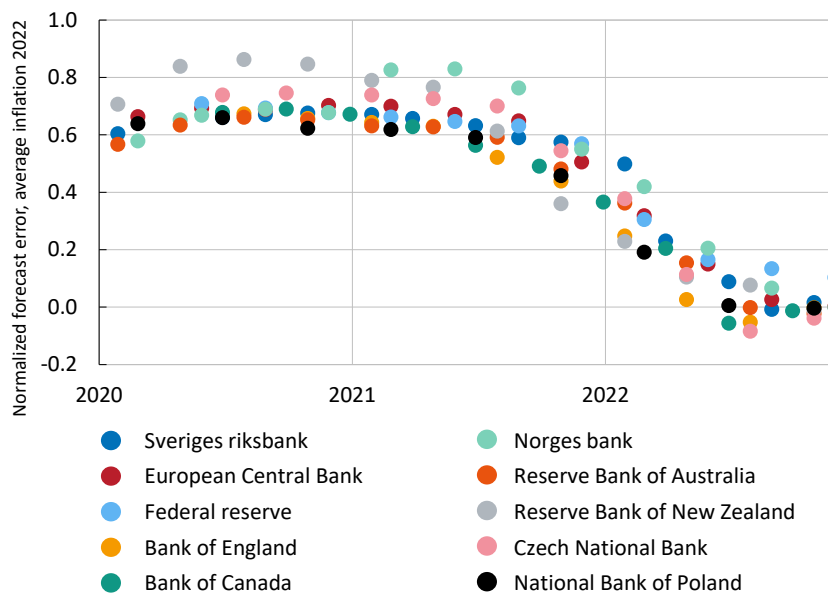
Sources: The respective central banks and the Riksbank.

The range of variation in forecasting errors for 2022 confirms the conclusions from Figures 3 and 4. Figure 5 shows that the forecasting errors of the Riksbank, the European Central Bank and the Bank of England are generally higher than those of other central banks (if Poland and the Czech Republic are excluded). This is the same picture

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[14] Mean squared errors for projections made in 2021 and 2022 instead of 2020. 2021 and 2022 are consistent with those shown in Figures 3 and 4.

as painted in Figure 3. At the beginning of 2022, the forecasts for all central banks are adjusted upwards and the forecasting errors are noticeably reduced. The fact that inflation was about to really take off was thus not clear to any of the central banks we are studying until the end of 2021 or early in 2022. We note that the Reserve Bank of New Zealand's (RBNZ) forecasting errors in 2020 were in line with those of the Riksbank. In 2021 and 2022, the forecasting errors for the RBNZ clearly decreased. In November 2021, the RBNZ revised its forecast for inflation in 2022 upwards by almost two percentage points compared with the August forecast. However, inflation had also risen sharply between the second and third quarters. Both the consumer price index (CPI) and the CPI excluding certain foods and energy rose by 1.5 percentage points between the quarters. The situation was different in Sweden. CPIF inflation rose by only 0.25 percentage points and the CPIF excluding energy fell by 0.1 percentage points between the second and third quarters of 2021. Inflation thus rose earlier in New Zealand than in Sweden, which is a possible explanation for the RBNZ raising its forecasts earlier than the Riksbank.

Figure 6. The Riksbank's and other central banks' normalised forecasting errors (outcome minus forecast) for each country's inflation target variable for 2022

Note. The forecasting errors are divided by the range of variation (the difference between the largest and smallest outcomes) in inflation between 2013 and 2022.

Sources: The respective central banks and the Riksbank.

However, it can be noted that the forecasting errors for inflation in 2022 made by the Riksbank in November 2021 and February 2022 are generally at the upper end of central bank forecasting errors. In other words, the Riksbank forecast lower inflation in relation to the outcome for 2022 than other central banks did. This is true even if

one takes into account that the range of variation in the CPIF is relatively high (see Figure 6).[15]

The conclusion in Hassler, Krusell and Seim (2023), that the Riksbank should have increased its preparedness when inflation in the United States began to rise in December 2020 and when the Bank of England began to raise its policy rate in December 2021, is thus a relevant criticism if one looks only at these two forecast dates. If the Riksbank had taken into account the rapid rise in inflation in other countries and allowed it to affect the CPIF forecast in that direction at the end of 2021 and the beginning of 2022, the forecasting error for these two forecast dates would probably have been lower.

Overall, however, the Riksbank's forecasts do not appear to be worse than those of other central banks. So, overall, we see a dead heat with no clear winner in the 2022 forecasts – taking into account that inflation varied widely across countries between 2013 and 2022. Nevertheless, one can agree that the forecasts could have been better on some occasions, if the Riksbank had taken greater account of inflation developments abroad and of other central banks' inflation forecasts, which was also noted in the Riksbank's Account of monetary policy 2022.[16]

Summary – in principle, a dead heat between the central banks

It is difficult to make forecasts when conditions change drastically. This becomes clear when we study the forecasts of ten central banks for inflation in 2021 and 2022. We observe large forecasting errors across the board – especially for 2022. Neither the central banks nor other forecasters predicted how quickly inflation would rise and inflation forecasts accordingly showed major forecasting errors.

Simple measures that summarise forecasting errors show that the Riksbank's forecasting ability for 2021 was good, but that it was not the best for 2022 – but also not the worst. Inflation rose relatively late in Sweden and the Riksbank did not adjust its forecasts sufficiently in late 2021 and the beginning of 2022. The forecasting errors for inflation in 2022 were therefore relatively large during this period. The conclusion in Hassler, Krusell and Seim (2023) that the Riksbank should have raised its preparedness when inflation began to rise abroad, is thus a relevant criticism if one only looks at these two forecast dates.

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[15] The inflation forecast was analysed in detail in the February 2022 Monetary Policy Report. The minutes of the Executive Board meeting noted that inflation had risen rapidly over the past year worldwide. The Board members emphasised that this was largely due to a surprisingly rapid rise in energy prices. They also emphasised that there was considerable disparity between different countries regarding measures of inflation that exclude energy prices. Compared with the United States, for example, where even inflation excluding energy had risen substantially, it was pointed out that Swedish inflationary pressures were still moderate. Several members pointed out that different measures of underlying inflation in Sweden were unusually volatile, and therefore gave no clear picture of the longer-term trend in price growth. The members noted that until the end of February 2022 there did not appear to be a broad pick-up in inflationary pressures.

[16] See *Account of monetary policy 2022*, Sveriges Riksbank, 2023.

The simple measures that summarise forecasting errors compare inflation target variables that have different characteristics. For example, some countries are more dependent on electrical heating, while others may be more sensitive to supply disruptions. Other countries have closer ties to Ukraine and thus may have been more directly affected by the war. One way to account for these different conditions is to standardise the forecasting errors. When we do so, it turns out that the "forecast competition" is basically a draw.

Finally, it should be noted that what we study is the average of the inflation forecasts for 2021 and 2022. It may be the case that an evaluation of forecasts for individual quarters or certain forecast periods would differ from the results presented in this Commentary. Different approaches may also yield slightly different results, and the study should therefore not be interpreted as the Riksbank's overall assessment, or evaluation, of either its own forecasting ability or that of other central banks.

References

Australian Government (2023), "An RBA fit for the future", The Australian Government Review of the Reserve Bank of Australia Report.

Bordo, Michael and Mickey Levy (2022) "The Fed's Monetary Policy Exit Once Again behind the Curve", in *How Monetary Policy Got Behind the Curve and How to Get It Back*, Michael D. Bordo, John H. Cochrane and John B. Taylor (eds.), Hoover Institution Press.

Hassler, John, Per Krusell and Anna Seim (2023), "Evaluation of monetary policy 2022", Report from the Riksdag 2022/23:RFR5, Stockholm.

Holm, Martin Blomhoff and Kjetil Martinsen (2023), "Norges Bank Watch 2023 – An independent evaluation of monetary policy in Norway", Centre for Monetary Economics, BI Norwegian Business School.

House of Commons (2023), Treasury Committee Oral evidence: Bank of England Monetary Policy Reports, HC 143, Tuesday 23 May 2023.

House of Representatives (2022), Serial No. 117–72 (House Hearing) – Monetary Policy and the State of the Economy, Committee on Financial Services, 2 March 2022.

Levy, Mickey (2023), "The Fed: Bad Forecasts and Misguided Monetary Policy", Hoover Monetary Policy Conference, Hoover Institution, Stanford University, 12 May 2023.

Reserve Bank of New Zealand (2022), "In Retrospect: Monetary Policy in New Zealand 2017–22".

Riksbank (2021) "Evaluation of the Riksbank's forecasts," Riksbank Studies, No. 1, 2021, 24 March.

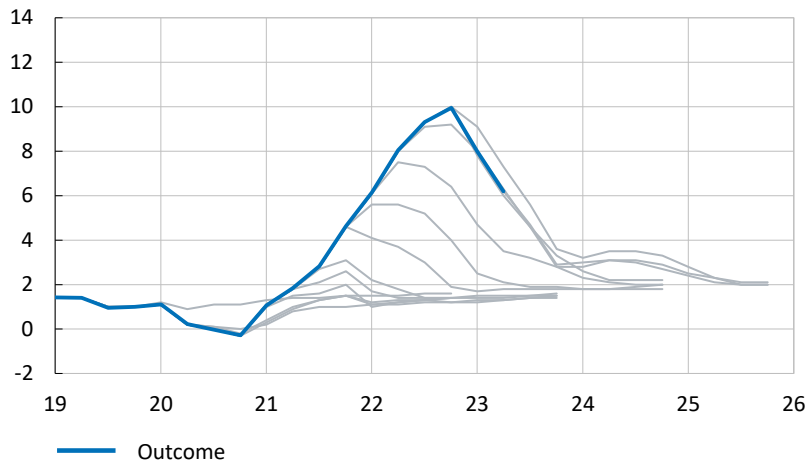Riksbank (2023), "An account of monetary policy 2022".

APPENDIX – Inflation forecasts and outcomes

Figure 7. Australia. CPI, outcomes and Reserve Bank of Australia's forecasts
Annual percentage change
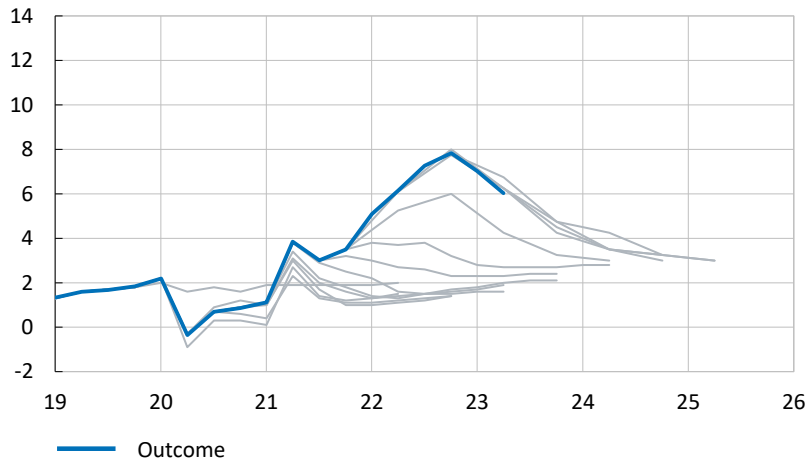
Source: Reserve Bank of Australia

Figure 8. Euro area. HCPI, outcomes and European Central Bank forecasts
Annual percentage change

Note. The forecasts we evaluate are those prepared by European Central Bank staff (March and September forecasts) and by Eurosystem staff (June and December forecasts).

Source: European Central Bank

Figure 9. Canada. CPI, outcomes and Bank of Canada linearly interpolated forecasts
Annual percentage change
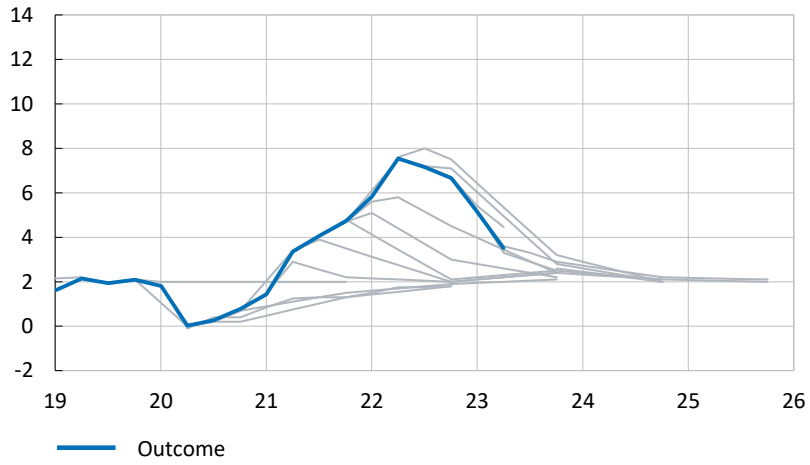
Note. The Bank of Canada publishes quarterly forecasts for the current year (depending on when the forecast is made during the year) and for the fourth quarter for the next two years. In addition, the Monetary Policy Report published in July 2020 included the annual averages for CPI inflation in 2021 and 2022, which is information that we take into account. For simplicity, we have linear interpolation between the dates for which there are no quarterly forecasts. Spline interpolation, which is more flexible, does not produce noticeably different results.

Source: Bank of Canada

Figure 10. Norway. CPI, outcomes and Norges Bank's forecasts
Annual percentage change
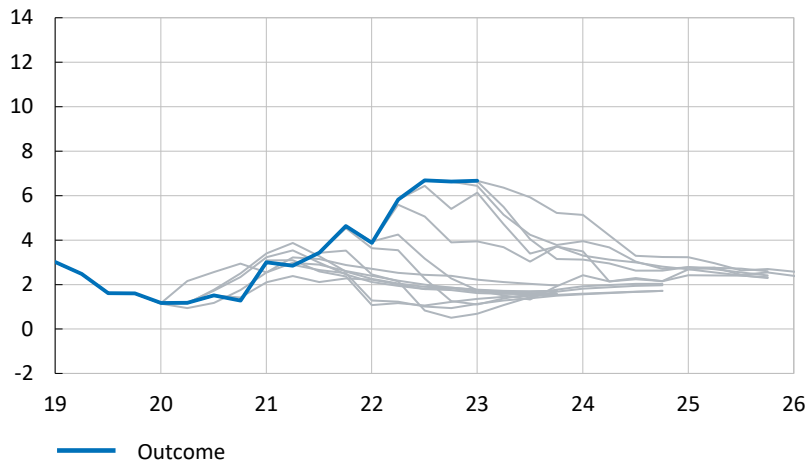
Source: Norges Bank

Figure 11. New Zealand. CPI, outcomes and Reserve Bank of New Zealand's forecasts
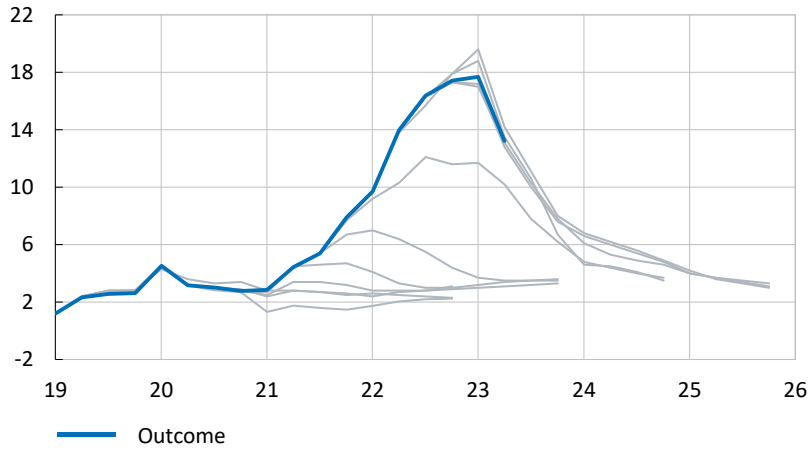
Annual percentage change

Outcome
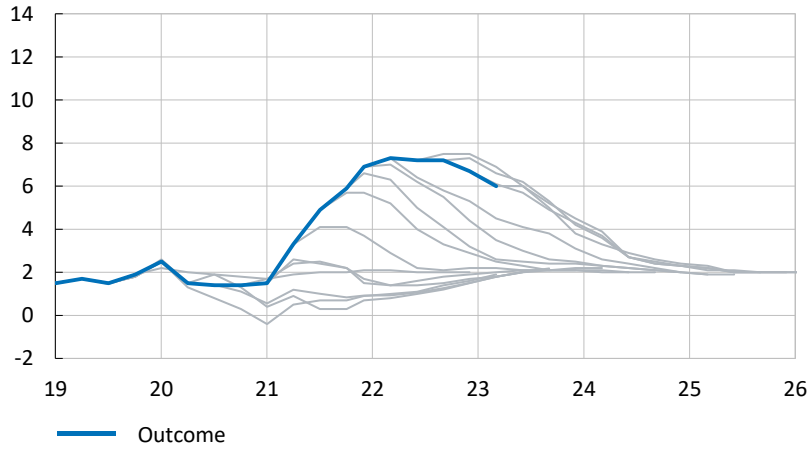
Note. Between May 2020 and January 2021, the Reserve Bank of New Zealand published no forecasts but three different scenarios. The speed of recovery and the duration of the restrictions were important differences between the three scenarios. See Reserve Bank of New Zealand (2022) for a detailed description. We evaluate the main scenario.
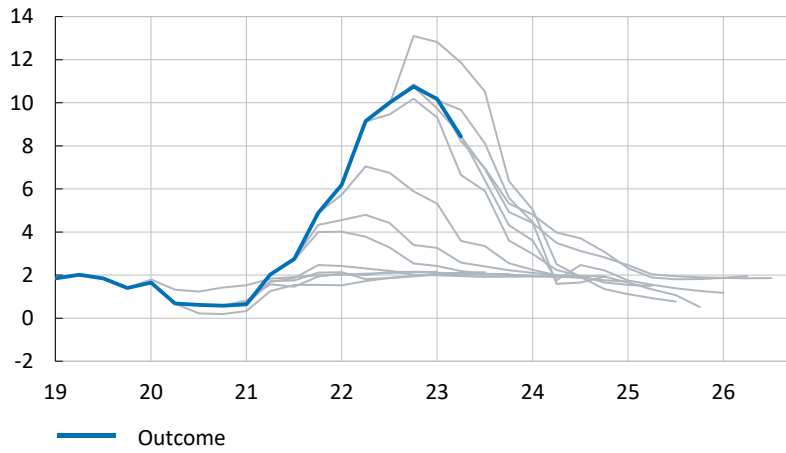
Source: Reserve Bank of New Zealand

Figure 12. Poland. CPI, outcomes and Narodowy Bank Polski's forecasts
Annual percentage change
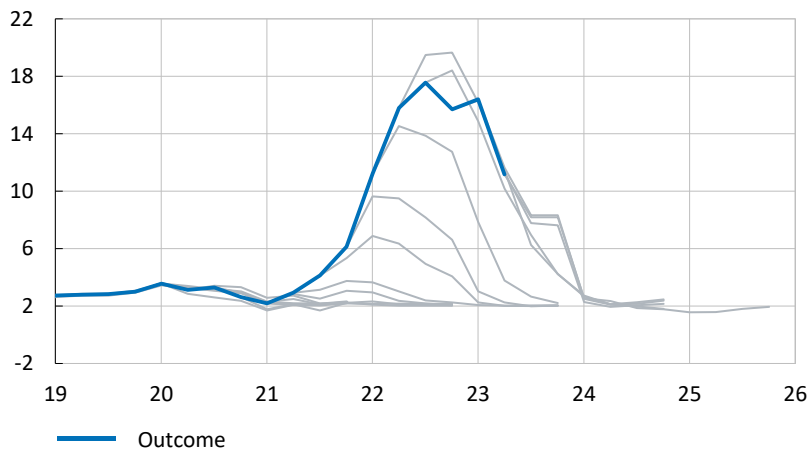

Outcome

Source: Narodowy Bank Polski

Figure 13. United Kingdom. CPI, outcomes and Bank of England's forecasts
Annual percentage change

Note. The forecasts we evaluate are those presented in the Monetary Policy Reports.
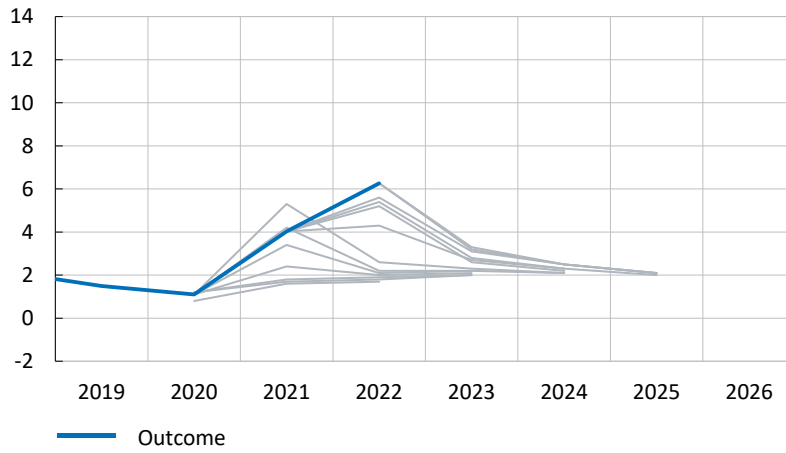
Source: Bank of England

Figure 14. Czech Republic. CPI, outcomes and Česká národní banka's forecasts
Annual percentage change

Source: Česká národní banka

**Figure 15. United States. PCE, outcome and Federal Reserve forecasts
Annual percentage change**

Note. The forecasts we evaluate, shown in the figure above, are the median PCE inflation between June 2020 and June 2023. Unlike many other central banks, the Federal Reserve publishes forecasts for inflation in the fourth quarter of each year (compared to the fourth quarter of the previous year). We evaluate these against average inflation for 2021 and 2022. The results are similar if we instead interpolate the forecasts linearly. Outcomes pertain to vintage 2023-07-30.

Source: Federal Reserve Board, Federal Open Market Committee Projections materials