Riksbank study

# Evaluation of the Riksbank's fore-casts

Click here to enter text.

NO. 1 2021, 24 March

S V E R I G E S  R I K S B A N K

# Table of contents




**Riksbank studies**

Riksbank studies contain articles with advanced analysis and examination of relevant questions. Their aim is to contribute knowledge and understanding of issues relevant to the Riksbank. Riksbank studies are staff publications. Publication is approved by the appropriate Head of Department. The opinions expressed in each of the articles are those of the authors and are not to be seen as the Riksbank's standpoint.

# Foreword

The Riksbank is an authority under the Riksdag, the Swedish Parliament, with responsibility for monetary policy in Sweden. Monetary policy is decided by the Executive Board of the Riksbank. Monetary policy affects the economy and inflation with a time lag. Forecasts of economic developments in general, and of inflation in particular, are therefore an important part of the Riksbank's decision guidance.

This study evaluates the Riksbank's forecasts for a number of central economic variables. The Riksbank's accuracy is also compared with the forecasting precision of other forecasters. The study is a complement to the report Account of Monetary Policy 2020. This forecast evaluation focuses on forecasts for the period 2011–2020, with a special analysis of the forecasts for 2020. The report has been produced by the Monetary Policy Department. Most of the work on this study has been performed by Jesper Johansson, Mårten Löf, Sebastian Rask and Ard Den Reijer.

Jesper Hansson

Head of the Monetary Policy Department

# Summary

This study analyses and evaluates the Riksbank's forecasts for a number of central economic variables for the period 2011–2020. The report opens with a description of how economic developments in 2020 compared to the forecasts. In the second section of the report, we compare the Riksbank's forecasts with those made by other forecasters.

The economic crisis in the wake of the pandemic contributed to GDP growth and inflation both in Sweden and abroad that were considerably lower than expected in relation to the forecasts made before the crisis. This is true for both the Riksbank's forecasts and those of other forecasters. Wage growth was also unexpectedly low as wage negotiations that were due to take place at the beginning of the year were postponed. At the same time, the Swedish krona was unexpectedly strong at the end of last year in relation to the forecasts made from mid-2019 onwards.

When the pandemic hit the global economy, future economic developments became very uncertain. A year on, it can be noted that although GDP fell substantially in 2020, growth was unexpectedly high and unemployment unexpectedly low at the end of the year in relation to the forecasts made just before the outbreak of the pandemic.

For the period 2011–2020, the Riksbank had on average a relatively high degree of accuracy in its forecasts for unemployment in relation to the forecasts of others. The accuracy of the Riksbank's forecasts for GDP growth and CPIF inflation was in line with that of other forecasters, while the forecasts for the repo rate were the least accurate. However, the difference in accuracy between different forecasters is generally small. The Riksbank's forecasts for 2020 for growth and inflation were less accurate than those of other forecasters. The accuracy in the forecasts for unemployment and the repo rate was in line with that of others.

# 1 Economic developments in 2020 in comparison to forecasts

In this section, we compare outcomes for economic developments in 2020 with the forecasts published by the Riksbank and others in 2018, 2019 and 2020. The focus is on the variables normally used to explain the development of inflation.

The economic crisis in the wake of the pandemic contributed to GDP growth and inflation both in Sweden and abroad that were considerably lower than expected in relation to the forecasts made before the crisis. In relation to forecasts made after the outbreak of the pandemic, however, growth was unexpectedly high and unemployment unexpectedly low at the end of the year.

## 1.1 Inflation lower than 2 per cent in 2020

CPIF inflation amounted on average to 0.5 per cent in 2020 (see 0). This was significantly lower than the previous year and also low in relation to a historical average. Among the sub-groups, it was primarily energy prices that fell more than usual. Service prices also rose slowly, which is deemed to be due to a fall in demand caused by the pandemic. The rate of increase in food and goods prices was instead higher than historical averages.

During the pandemic, household consumption has changed to an unusually large degree. Periodically, some services have hardly been consumed at all. These include package holidays, hotel stays, restaurant visits and various types of entertainment such as theatres, cinemas and sporting events. On the other hand, the consumption of some goods has increased as people have stayed at home to a greater extent. This applies to the consumption of food, games, DIY products and home electronics. The prices of the products consumed less have in many cases increased relatively slowly, while prices of many of the products consumed more have increased relatively rapidly. However, the inflation statistics are extremely uncertain during the pandemic, as the restrictions have meant that certain services have not been consumed at all and their prices have therefore not been measured.[1]

**Table 1. Sub-groups in the CPIF**
Weight and average annual rate of increase in per cent

| | Weight 2020 | 2000-2019 | 2019 | 2020 |
|---|---|---|---|---|
| **Services** | 45.6 | 1.8 | 2.0 | 1.4 |

[1] See also Sveriges Riksbank (2021).

| | Weight 2020 | 2000-2019 | 2019 | 2020 |
|---|---|---|---|---|
| **Goods excluding food** | 26.6 | -0.4 | -0.1 | 0.1 |
| **Food** | 17.6 | 1.9 | 2.6 | 2.1 |
| **Capital stock index** | 3.1 | 5.3 | 5.8 | 5.6 |
| ***CPIF excluding energy*** | 93.0 | 1.4 | 1.6 | 1.3 |
| **Energy** | 7.0 | 3.9 | 3.2 | -9.7 |
| ***CPIF*** | 100.0 | 1.6 | 1.7 | 0.5 |

Note. Weight refers to the weighting coefficient in the CPIF.

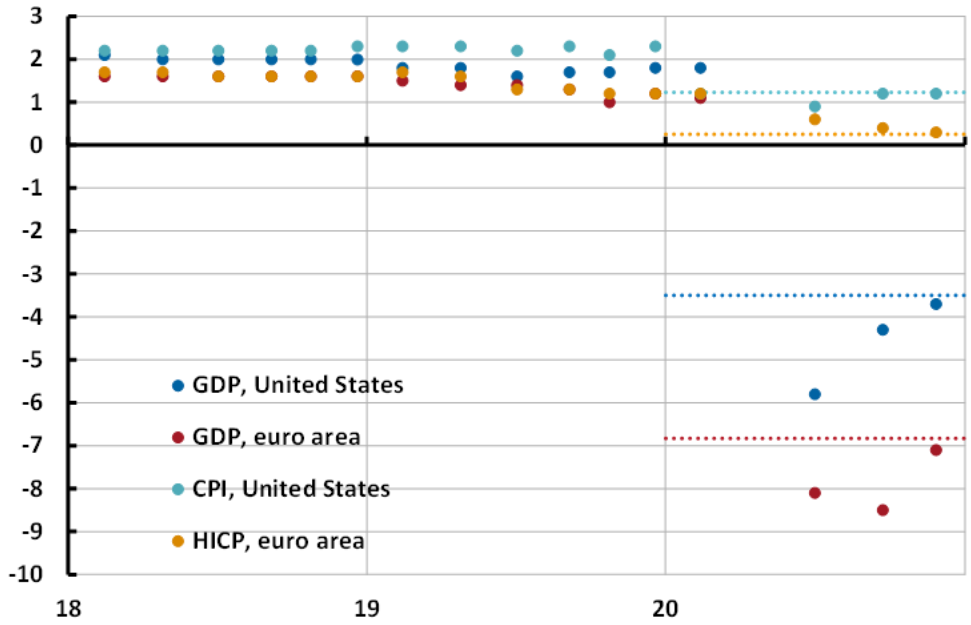
Source: Statistics Sweden.

## 1.2 Growth and inflation abroad lower than forecast

The pandemic led to unexpectedly low growth and inflation abroad in 2020 in relation to the forecasts made in 2018 and 2019. When the pandemic broke out in the spring of 2020, the Riksbank and other forecasters made substantial downward revisions in their forecasts for growth and inflation in the euro area and the United States (see 1.3). In relation to the Riksbank's forecasts from July and September, however, growth was actually unexpectedly high last year.[2]

**Figure 1. The Riksbank's forecasts for growth and inflation abroad (points) and outcomes (broken lines) for 2020**

Annual percentage change




Sources: National sources and the Riksbank.

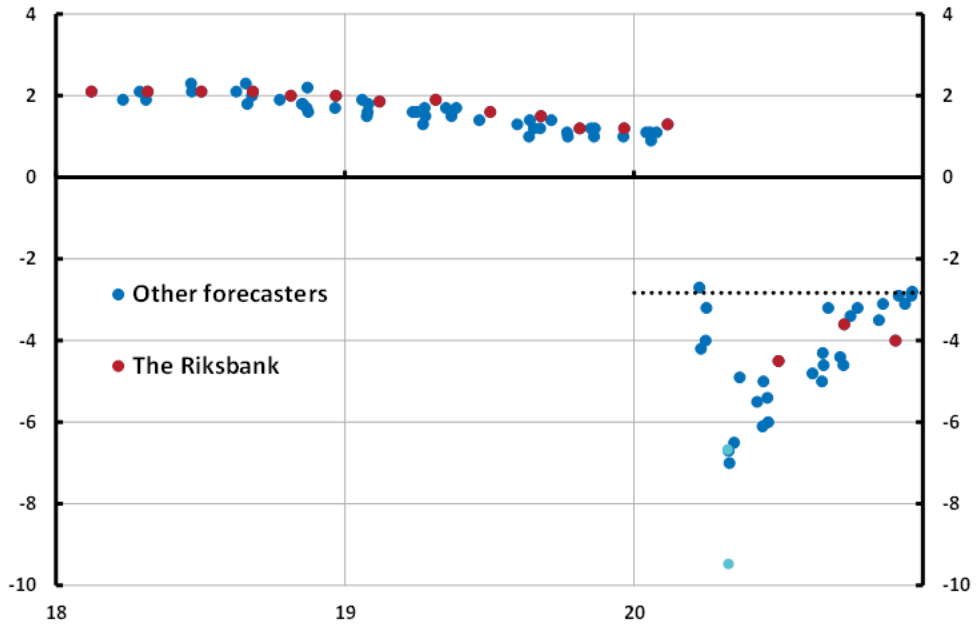
[2] Only four forecasts were published in 2020. As from last year, the number of Monetary Policy Reports was reduced from six to five per year. In the Monetary Policy Report from April, only scenarios for a few variables were published.

## 1.3 Unexpectedly low growth and inflation in Sweden

As in other countries, GDP growth in Sweden was significantly lower in 2020 than in the forecasts made by the Riksbank and other forecasters prior to the pandemic. In 2018 and 2019, GDP growth in 2020 was expected to amount to between 1 and 2 per cent. In the spring of 2020, the forecasts were revised down sharply and, according to the latest statistics, GDP fell by 2.8 per cent in 2020 (see 0).[3] Development in most expenditure components has been weaker than expected in 2020 in relation to the forecasts made before the pandemic (see 0). The clearest surprise has been in household consumption and exports, while investment has been affected to a lesser degree.

**Figure 2. The forecasts of the Riksbank and others for GDP in Sweden (points) and outcomes (broken lines) for 2020**

Annual percentage change




Note No forecasts were published in MPR April. Instead, the report contained 2 scenarios for future developments for a small number of variables. These are depicted as turquoise spheres in the figure.

Sources: Statistics Sweden, the Riksbank and each forecaster respectively.

In a very short time, the pandemic changed the conditions for economic developments entirely. To begin with, however, it was difficult to know how deep and how prolonged the decline would be, based on regular statistical sources. Traditionally, most statistics are published monthly or quarterly, and with a time lag. To be able to assess the extent of the crisis more quickly, the Riksbank started to research and develop new statistical sources and forecasting methods. One source of information was

[3] According to the National Accounts for the fourth quarter of 2020, published on 26 February 2021.

direct contacts with companies and by mid-March, the Riksbank had already conducted its first telephone interviews with around 50 companies.[4] The Riksbank also started to collect and analyse daily and weekly statistics more than usual, including restaurant and hotel bookings and card transactions. As this gave us access to real-time indicators, it became easier to make more detailed monthly GDP forecasts that were able to capture the sharp fluctuations in the economy.

In relation to the forecasts made at the beginning of the pandemic, the economy developed better than expected last year, particularly in the third quarter (see **Fel! Hittar inte referenskälla.**). This applies in particular to exports and investment, both of which increased unexpectedly rapidly after the decline in the spring (see 0). It was not only Swedish exports that recovered; the same development was also seen abroad and in global trade. Investment growth was relatively strong compared with how it usually develops in relation to GDP during a recession. One explanation is that demand for housing, which normally decreases in more noticeable economic downturns, has been unusually high during the pandemic and housing prices have increased rapidly. This led to a relatively rapid rise in housing investment, although other investment also held up relatively well.

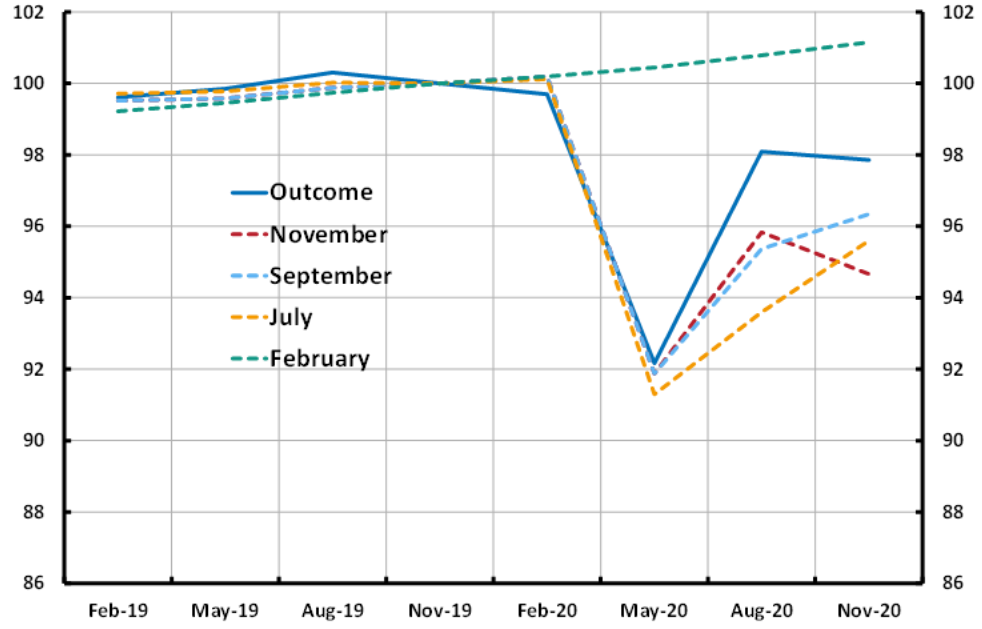
However, the forecast error for investment is affected by a major downward revision in the investment level in 2019 that occurred in connection with the publication of the National Accounts for the fourth quarter of 2020.[5] If this had been known earlier, growth-rate forecasts for 2020 would have been higher. The forecasts for household consumption, on the other hand, were accurate during the pandemic. The pandemic hit household consumption hard and it was still 4.5 per cent lower in the fourth quarter of 2020 than in the fourth quarter of 2019.

[4] See Sveriges Riksbank (2020a). This was an increase in the contacts with companies that take place regularly as part of the Riksbank's Business Surveys. These more frequent telephone contacts continued for the rest of the year.

[5] According to Statistics Sweden, the revision was due to two large, one-off, negative amounts being added in intellectual property rights 2019 (see Statistics Sweden 2021)

**Figure 3. The Riksbank's forecasts for GDP in 2020 and outcomes**

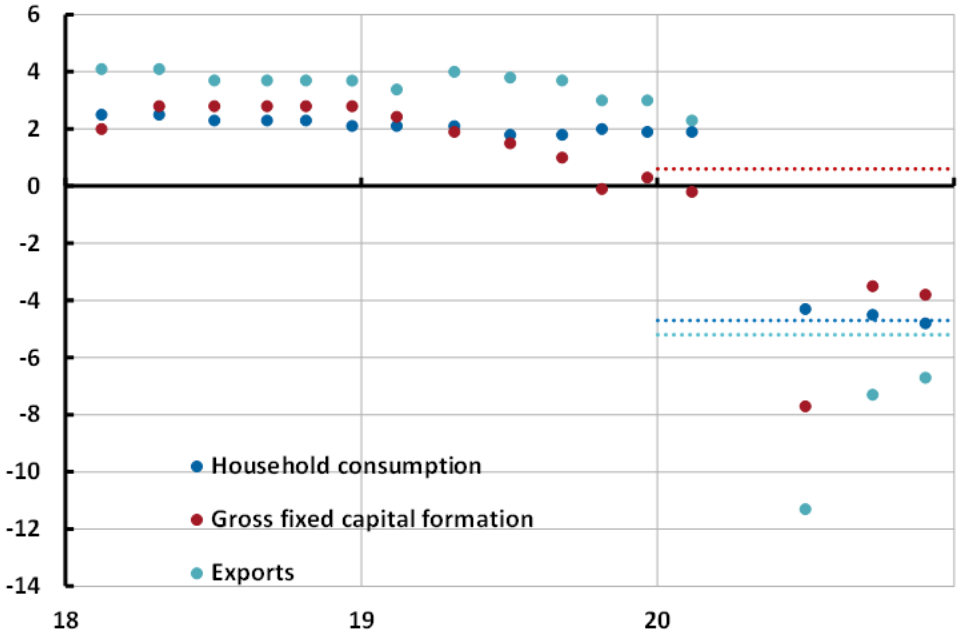
Index fourth quarter 2019=100, seasonally adjusted data




Sources: Statistics Sweden and the Riksbank.

**Figure 4. The Riksbank's forecasts for consumption, investment and exports (points) and outcomes (broken lines) for 2020**

Annual percentage change

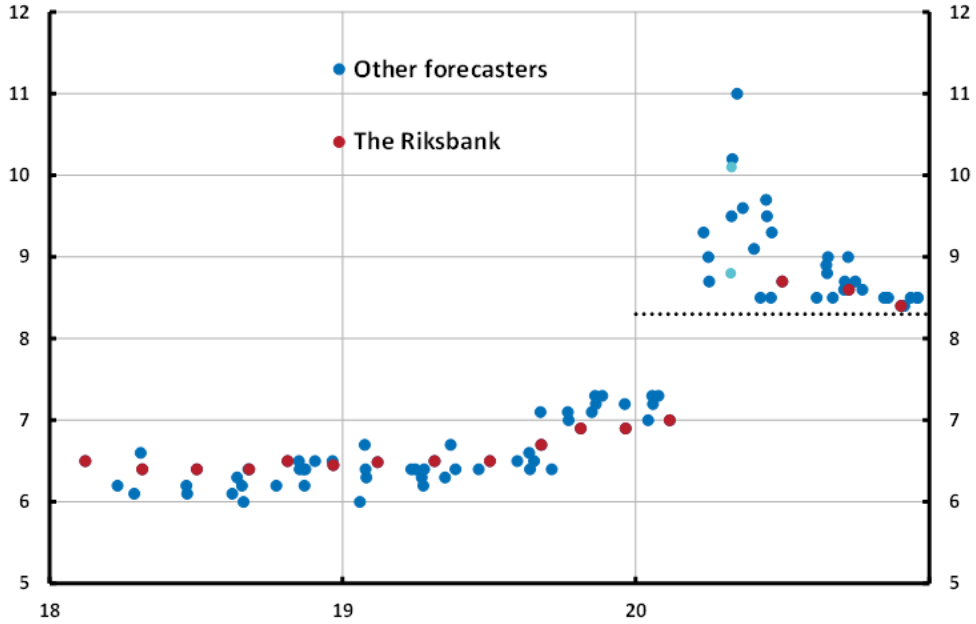



Sources: Statistics Sweden and the Riksbank.

The labour market was also unexpectedly weak in the wake of the pandemic (see 0).[6] However, the unexpectedly rapid recovery in GDP meant that the forecasts made after the pandemic had started were too pessimistic. Neither employment nor labour fell as much as we thought they would and development was unexpectedly strong in the second half of 2020. Towards the end of the year, labour force participation was back at approximately the same level as before the outbreak of the pandemic while employment was lower. State support to short-time work compensation schemes helped more people in permanent employment to keep their jobs compared with previous crises. The number of permanently employed persons fell at the beginning of the crisis but was back at approximately the same level as before the pandemic at the end of the year. Unemployment was at its highest during the summer but then fell towards the end of the year. However, unemployment was still just over 1.5 percentage points higher in the fourth quarter of 2020 compared with the fourth quarter of 2019.

**Figure 5. The forecasts of the Riksbank and others for unemployment in Sweden (points) and outcomes (broken lines) for 2020**

Percentage of labour force aged 15-74




Note No forecasts were published in MPR April. Instead, the report contained 2 scenarios for future developments for a small number of variables. These are depicted as turquoise spheres in the figure.

Sources: Statistics Sweden, the Riksbank and each forecaster respectively.

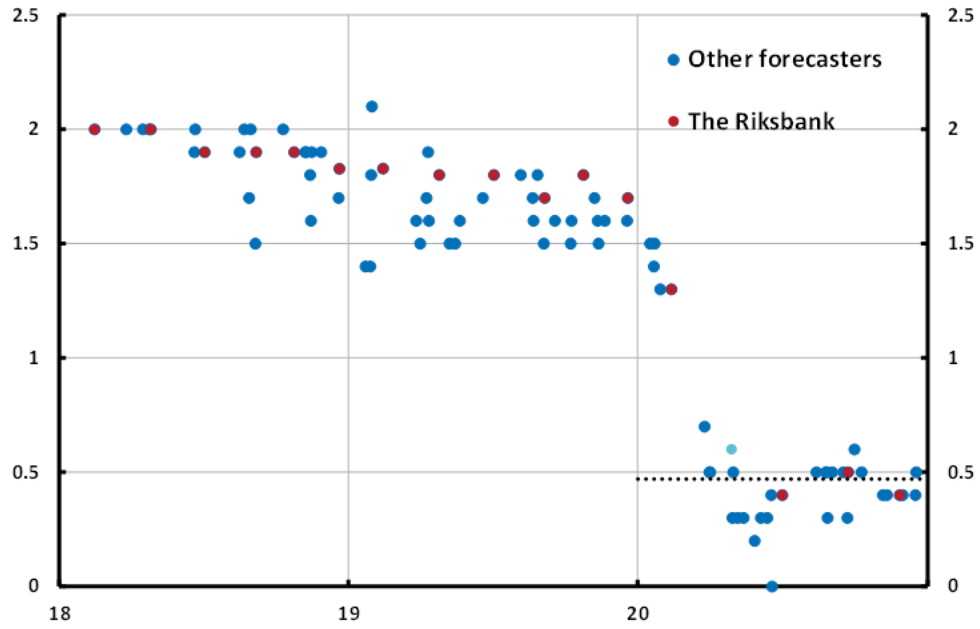
[6] The forecasts published before the Monetary Policy Report in December 2019 were partly based on incorrect statistics. The labour market statistics based on the Labour Force Surveys were substantially revised for 2018 and 2019 after serious quality flaws were detected in the data collection. Unemployment was revised upwards from July 2018 until June 2019 but was revised downwards for the months July to September 2019.

Inflation was unexpectedly low in relation to the forecasts of the Riksbank and others (see 2, 2 and **Fel! Hittar inte referenskälla.**). It has been restrained in different ways by low growth and weak development on the labour market. First, low demand on the labour market led to low wage growth and thus low cost increases for companies.[7] Second, it was more difficult than usual for companies in certain badly affected service sectors to raise prices due to the collapse in demand. Third, the low demand, both in Sweden and abroad, contributed to unexpectedly low energy prices that also kept inflation down.

Towards the end of the year, an unexpectedly rapid appreciation of the Swedish krona also helped to keep inflation down. The krona developed more strongly than expected at the end of last year in relation to the forecasts made from mid-2019 and onwards, but was still weaker in relation to the forecasts made in 2018 and the first half of 2019 (see 2).

**Figure 6. The forecasts of the Riksbank and others for CPIF in Sweden (points) and outcomes (broken lines) for 2020**

Annual percentage change

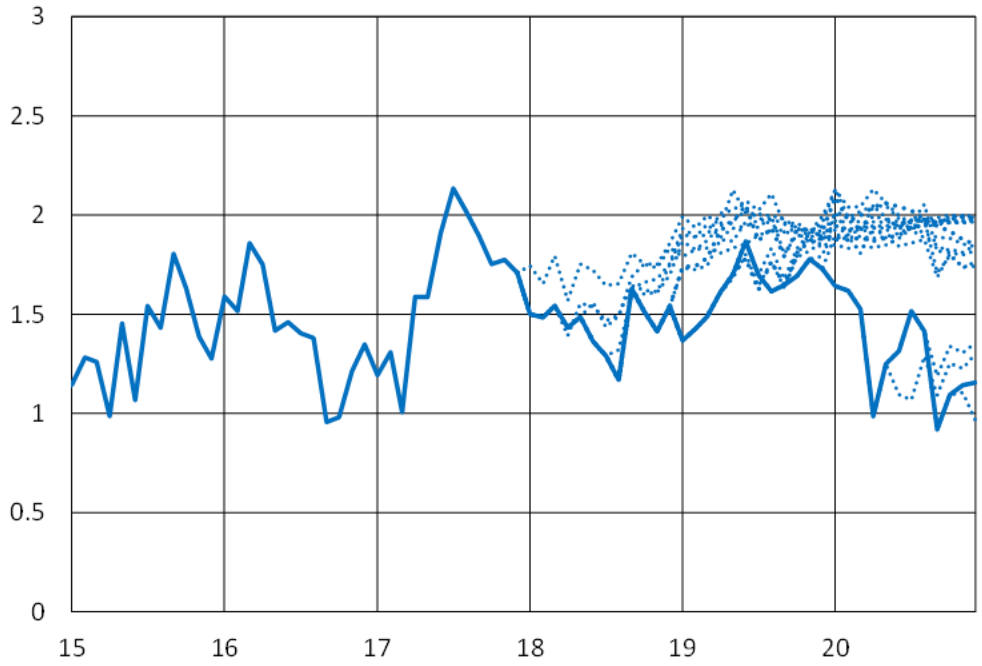



Note No forecasts were published in MPR April. Instead, the report contained 2 scenarios for future developments for a small number of variables. These are depicted as turquoise spheres in the figure. In both scenarios, CPIF inflation amounted to 0.6 per cent in 2020.

Sources: Statistics Sweden, the Riksbank and each forecaster respectively.

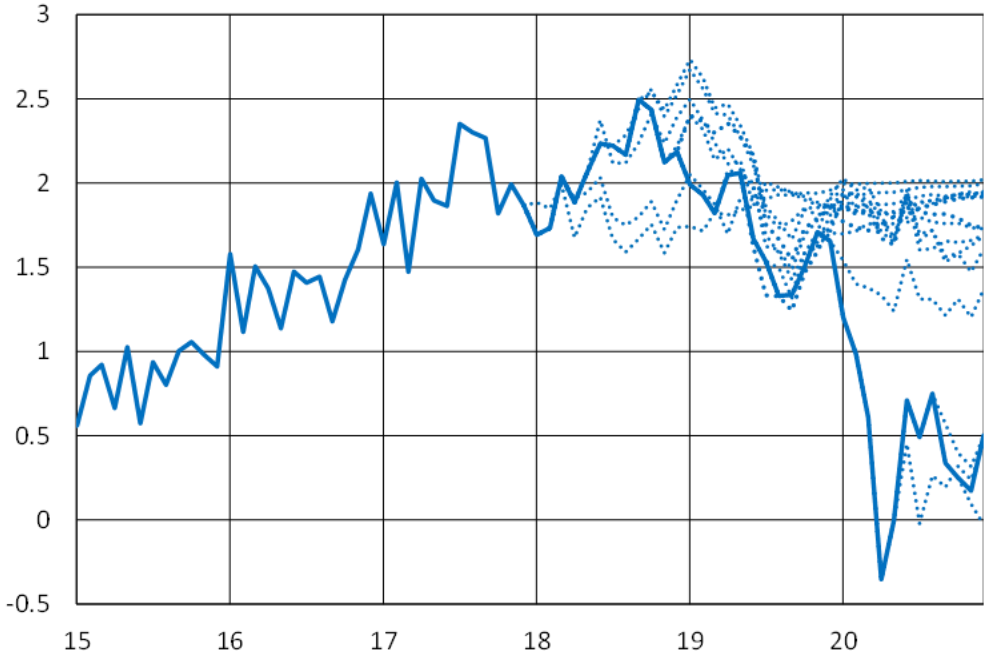
[7] Wages increased significantly more slowly than expected in 2020. Wage negotiations due to be held at the beginning of the year were postponed because of the pandemic. For much of the labour market, this meant that new agreements began to apply from November instead of from April and that the centrally agreed wage level stood still for some of last year.

**Figure 7. CPIF excluding energy, outcomes and the Riksbank's forecasts**
Annual percentage change




Sources: Statistics Sweden and the Riksbank.

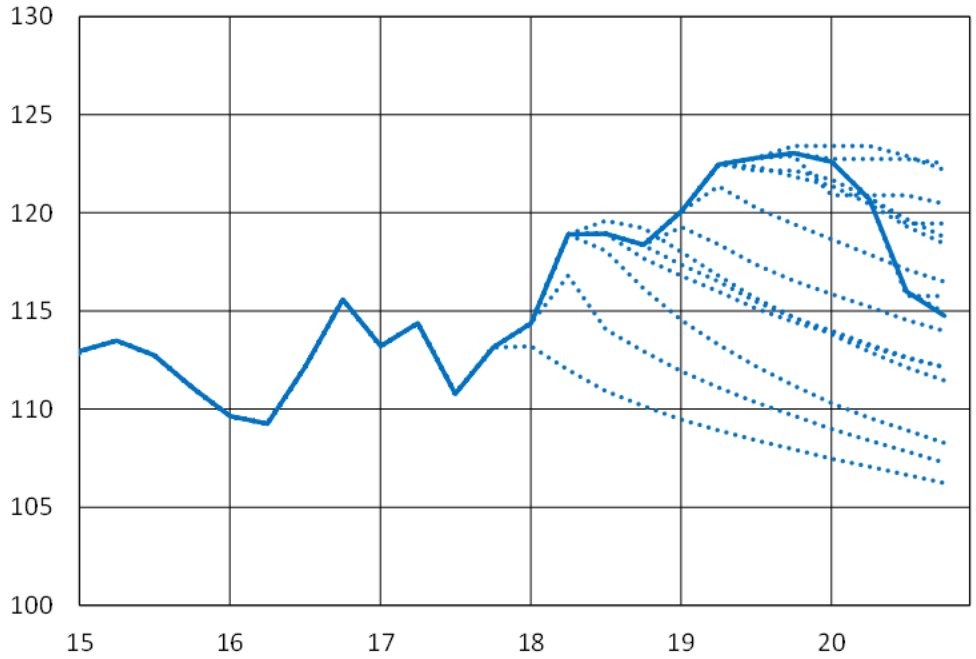
**Figure 8. CPIF, outcomes and the Riksbank's forecasts**
Annual percentage change




Sources: Statistics Sweden and the Riksbank.

**Figure 9. KIX, outcomes and forecasts**

Index




Note. The KIX (krona index) is a weighted average of the currencies in 32 countries that are important for Sweden's international trade. A higher value indicates a weaker exchange rate.

Source: The Riksbank.

# 2 Forecast evaluation

The beginning of this section discusses different measures of forecasting precision. We then compare the Riksbank's forecasts with forecasts made by other analysts for the period 2011–2020. The results just for 2020 are then discussed and we also analyse the Riksbank's inflation forecasts in the short term in more detail. The forecasts evaluated are those made in the same year and the year before. Forecasts for the whole of 2020 therefore refer to forecasts published in 2019 and 2020.

For the period 2011–2020, the Riksbank had a relatively high degree of accuracy in its forecasts for unemployment in relation to the forecasts of others. The accuracy of the Riksbank's forecasts for GDP growth and CPIF inflation was in line with that of other forecasters, while the forecasts for the repo rate were the least accurate. However, the difference in accuracy between different forecasters is generally small. The Riksbank's forecasts for 2020 for growth and inflation were less accurate than those of other forecasters. The accuracy in the forecasts for unemployment and the repo rate was in line with that of others.

## 2.1 Measures of forecasting precision

One of the most common evaluation measures when studying forecasts is average forecast error, or mean error. This shows whether there is any systematic over- or underestimation in the forecasts. In this report, forecast error is expressed as outcome minus forecast, with a positive mean error thus indicating that outcomes, on average, have been higher than the forecasts, while a negative value implies the opposite. Even if the mean error is close to zero, this does not necessarily mean that the forecasts have been accurate. Major positive and negative forecast errors can cancel each other out, giving a mean error that is close to zero, and giving the impression that accuracy has been good despite it not having been so. We therefore also report the mean absolute error, i.e. the average of the absolute value for the forecast errors.[8] The average mean absolute errors in the forecasts for 2011-2020 and for 2020 are shown in 0.

**Table 2. Average absolute errors in forecasts for 2011-2020 and for 2020 made in the same year or the year before**

Percentage points

| | 2011-2020 | | | 2020 | | |
|---|---|---|---|---|---|---|
| | **GDP** | **Unemployment** | **CPIF** | **GDP** | **Unemployment** | **CPIF** |
| FiD | 0.85 | 0.37 | 0.30 | 2.76 | 1.17 | 0.56 |
| KI | 0.74 | 0.35 | 0.27 | 2.75 | 1.02 | 0.54 |
| LO | 0.77 | 0.36 | 0.27 | 3.00 | 0.72 | 0.48 |
| NORDEA | 0.79 | 0.33 | 0.33 | 2.83 | 0.93 | 0.59 |
| RB | 0.71 | 0.28 | 0.34 | 3.39 | 1.19 | 0.86 |
| SEB | 0.86 | 0.42 | 0.33 | 2.85 | 1.41 | 0.60 |
| SHB | 0.85 | 0.40 | 0.30 | 3.20 | 1.25 | 0.75 |
| SN | 0.70 | 0.37 | 0.40 | 2.66 | 0.98 | 1.10 |
| SWED | 0.84 | 0.42 | 0.39 | 3.08 | 1.26 | 0.78 |
| **Mean** | **0.79** | **0.37** | **0.33** | **2.95** | **1.10** | **0.70** |

Note. Abbreviations as follows: FiD=Ministry of Finance, KI=National Institute of Economic Research, LO=Swedish Confederation of Trade Unions, RB=The Riksbank, SHB=Svenska Handelsbanken, SN=Confederation of Swedish Enterprise and SWED=Swedbank

Source: Respective analyst and the Riksbank.

As forecasts are made at different frequencies and on different occasions, forecasters do not have access to the same information at the time of forecasting. This makes it difficult to compare their accuracy. A forecaster whose analysis is based on more up-to-date statistics should be more accurate. It is therefore important to consider differences in access to information when comparing accuracy. This is why an adjusted mean absolute error that tries to take this into account is presented in the analysis.[9] In practice, the adjustment is made by adjusting the forecast error of a forecaster for

[8] The absolute value refers to a number's distance to zero. Both 1 and –1 therefore have the absolute value of 1.

[9] The method has been developed at the Riksbank, see Andersson and Aranki (2009) and Andersson, Aranki and Reslow (2016). A brief description of the method is given in the Appendix.

how an average forecaster's forecast error has decreased historically when the forecast has, for example, been made two months later and data for two additional months has therefore been available. This adjustment is deemed to be "too small" with regard to the forecasts made prior to and after the outbreak of the pandemic respectively. Normally, having access to two more months of data when making a forecast should not necessarily make much difference. But in 2020, whether a forecast was made in February or in April was of crucial importance.

## 2.2 Assessment of forecasts for 2011-2020

**Fel! Hittar inte referenskälla.** - 0 show average forecast error (mean error) and adjusted mean absolute error for GDP growth, unemployment, CPIF inflation and the repo rate. The forecasts have been made by Swedish forecasters for the period 2011–2020.[10]

The red bars show the systematic errors or mean errors, where the forecast errors are consistently expressed as outcome minus forecast. The figures show that the systematic error for e.g. the Riksbank's GDP forecasts is negative, which means that growth on average has been lower than expected over the latest ten-year period. The negative bars in **Fel! Hittar inte referenskälla.** show that inflation on average has been lower than expected in relation to the forecasts of all forecasters.

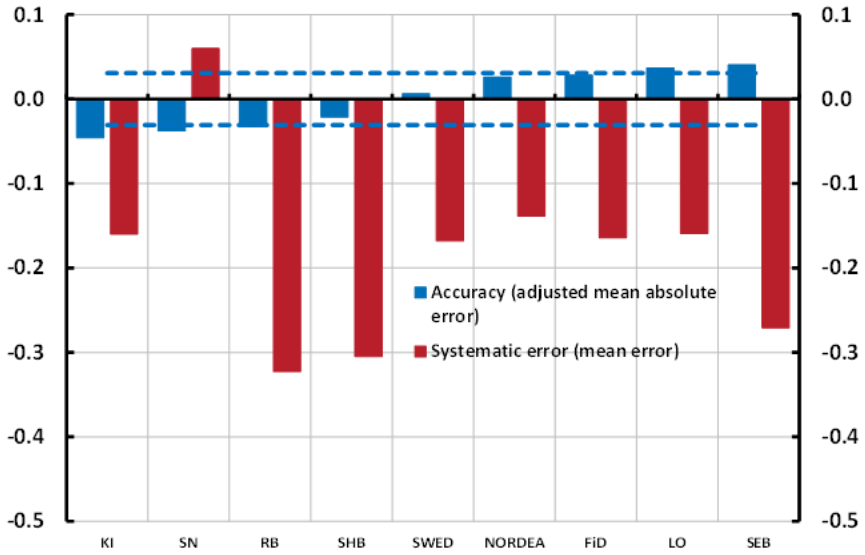
The blue bars in **Fel! Hittar inte referenskälla.** - 0 show the adjusted mean absolute error. The measure is reported as a deviation from the mean value for all forecasters, which means that they are equal to zero on average. A negative value shall be interpreted as the accuracy of a certain forecaster being better than average. A positive value indicates the opposite. In the figures, forecasters are sorted according to the adjusted mean absolute error so that the most accurate ones are furthest to the left. There are differences in accuracy among them, but these are small. The difference between the best and worst forecaster, as regards CPIF inflation, for example, is only 0.1 percentage points (see **Fel! Hittar inte referenskälla.**). Over the period, the Riksbank's forecasts have been relatively accurate for unemployment. The Riksbank's accuracy in the forecasts for GDP growth and CPIF inflation has been in line with the average, while the accuracy of the forecasts for the repo rate has been worse than that of others.

If the observed forecast errors for the period 2011 to 2020 are considered as a sample of a greater population of forecast errors, it is possible to calculate, using the standard deviations in the forecast errors, a 95-per cent confidence interval to discern whether there are significant, non-random differences in the accuracy of the different forecasters. Such an interval shows that the Riksbank's accuracy has been significantly better than average for unemployment and significantly worse for the repo rate. Accuracy for GDP growth and CPIF inflation has been in parity with the average (see **Fel! Hittar inte referenskälla.** - 0).

[10] See note on 0 for an explanation of abbreviations in the figures

**Figure 10. GDP growth, accuracy and systematic errors in forecasts made by various analysts for 2011-2020**

Percentage points

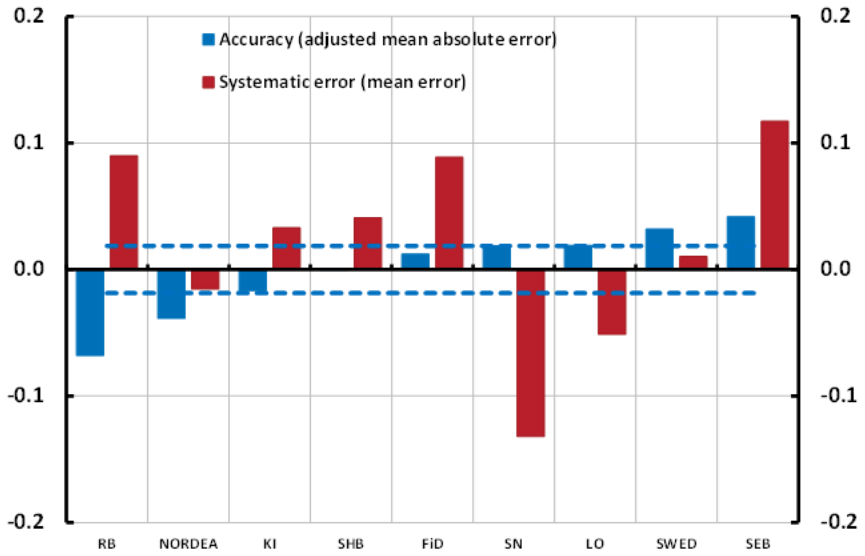



Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

**Figure 11. Unemployment, accuracy and systematic errors in forecasts made by various analysts for 2011-2020**

Percentage points

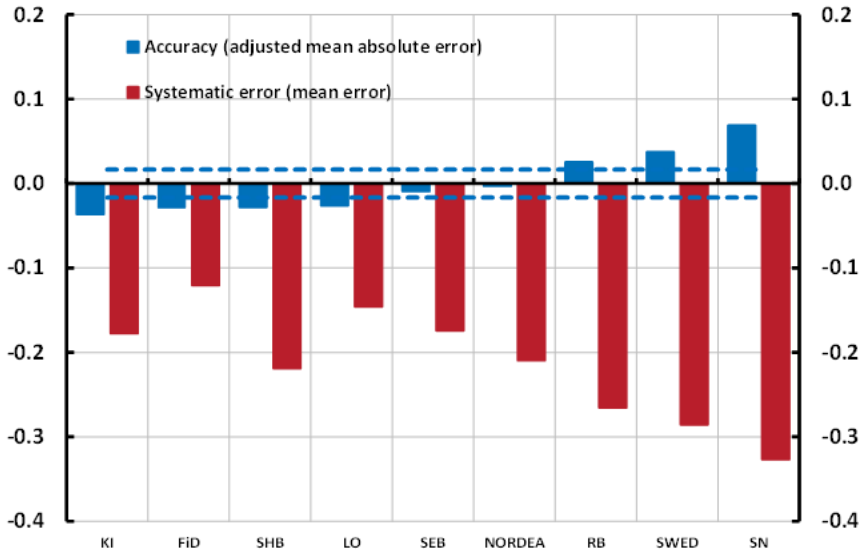



Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

**Figure 12. CPIF inflation, accuracy and systematic error in forecasts made by various analysts for 2011-2020**

Percentage points

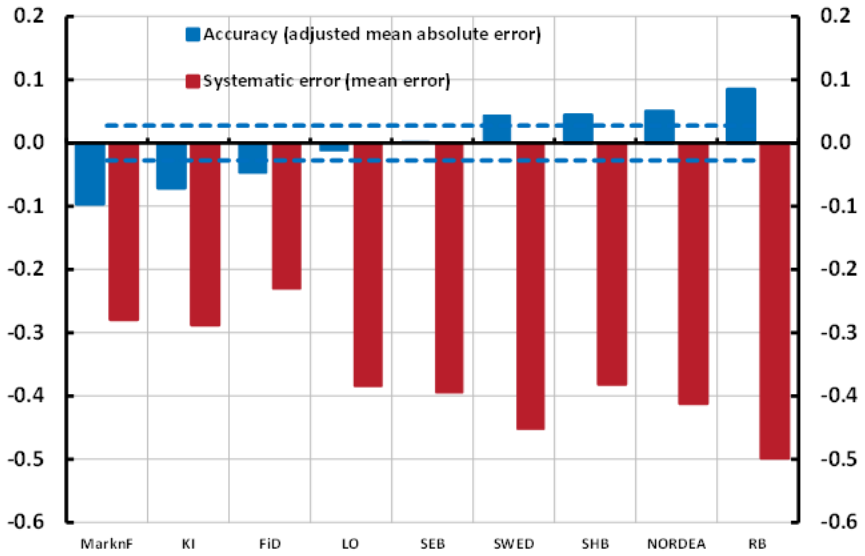



Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

**Figure 13. Repo rate, accuracy and systematic errors in forecasts made by various analysts, 2011-2020**

Percentage points



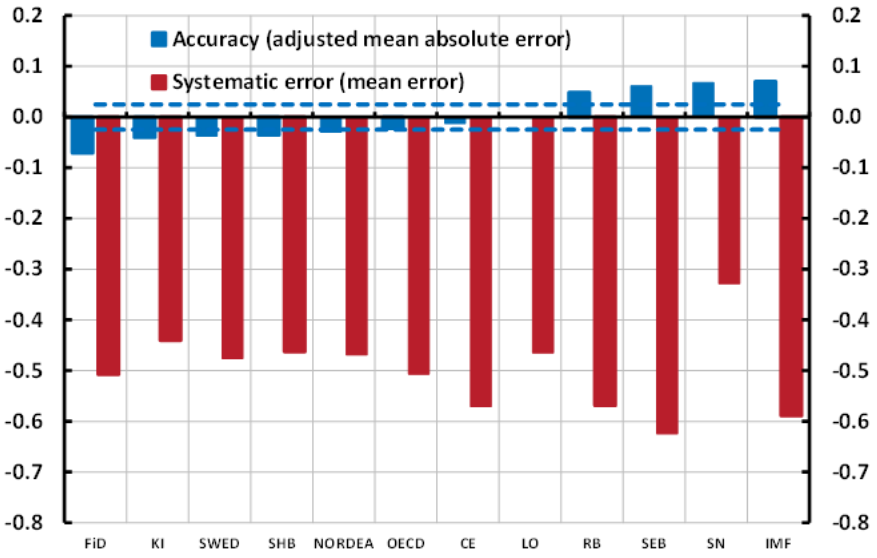

Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

0 – **Fel! Hittar inte referenskälla.** show the results for GDP growth and inflation in the United States and the euro area. On average, the forecasts for GDP growth in both the United States and the euro area have been too high during the period 2011–2020 (see the red bars). The same applies to inflation. The blue bars in 0 to **Fel! Hittar inte referenskälla.** show that the Riksbank's accuracy in the forecasts for inflation abroad has been close to the average, while the forecasts for growth have been slightly worse than those of other forecasters.

**Figure 14. GDP growth in the United States, accuracy and systematic errors in forecasts made by various analysts, 2011-2020[11]**

Percentage points



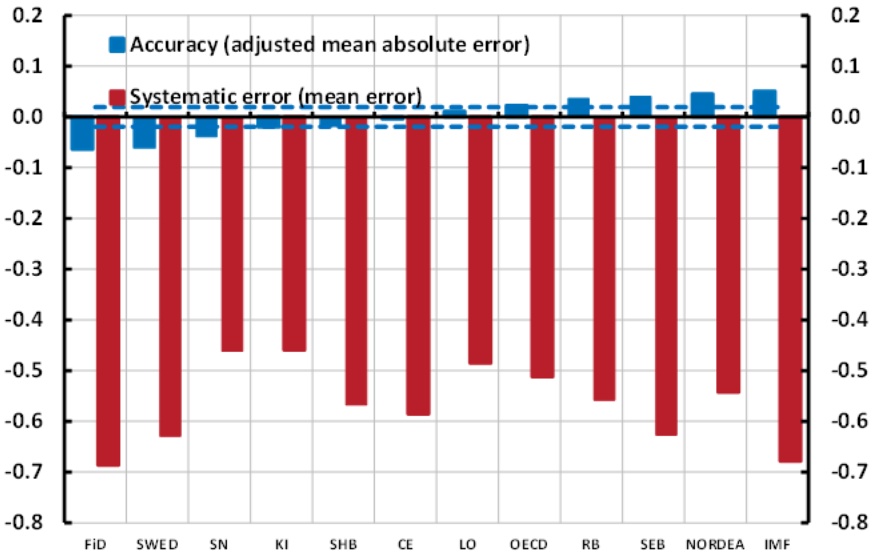

Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

[11] CE refers to the forecasts reported by Consensus Economics every month.

**Figure 15. GDP growth in the euro area, accuracy and systematic errors in forecasts made by various analysts, 2011–2020**

Percentage points

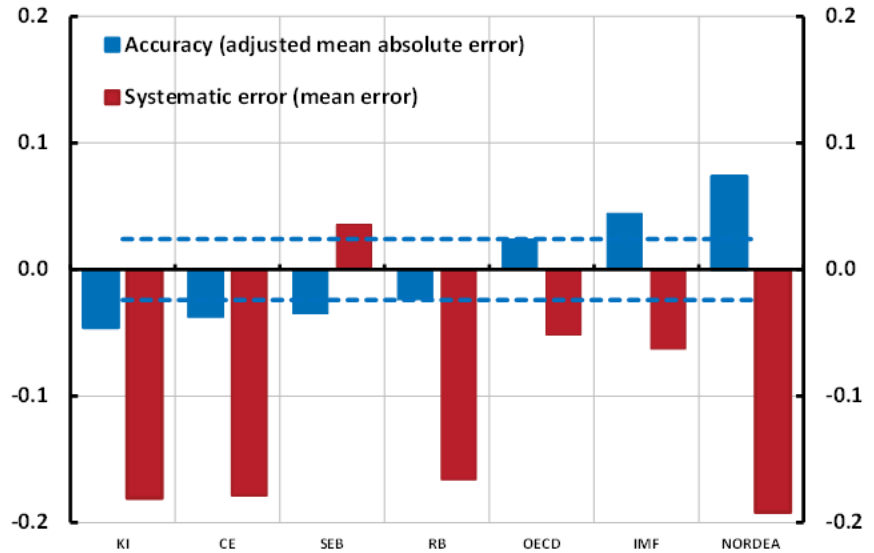



Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

**Figure 16. CPI inflation in the US, accuracy and systematic errors in forecasts made by various analysts, 2011-2020**

Percentage points

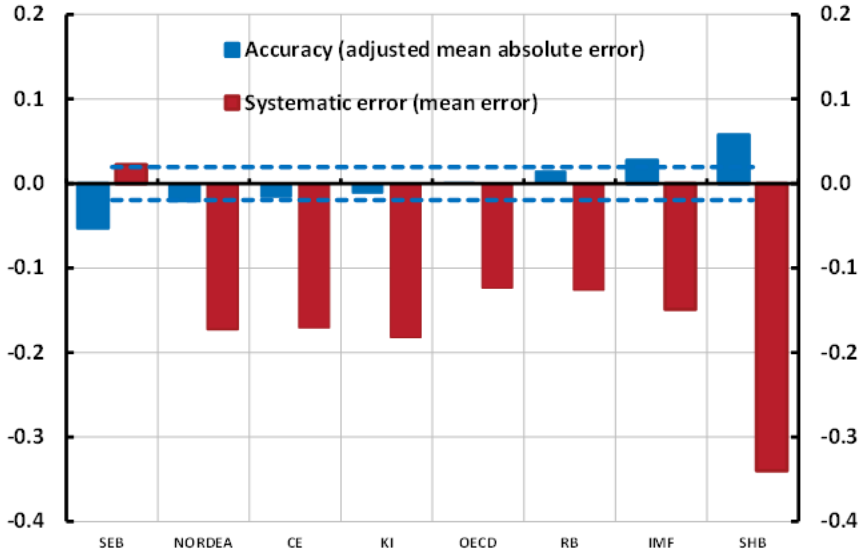



Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

**Figure 17. HICP inflation in the euro area, accuracy and systematic errors in forecasts made by various analysts, 2011–2020**

Percentage points



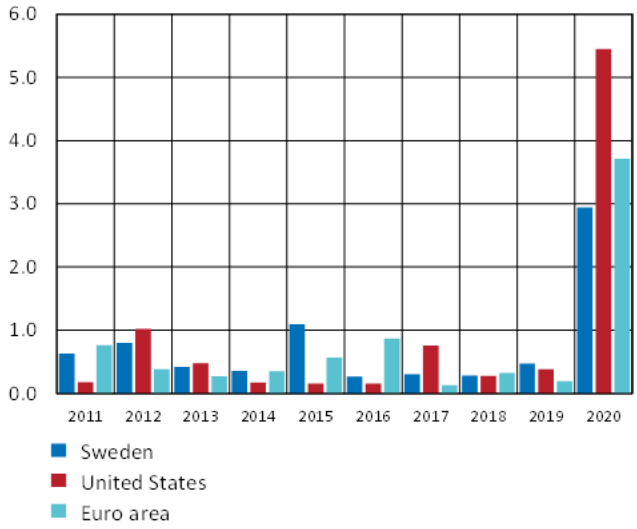

Note The broken lines show a 95-per cent confidence interval calculated using the standard deviation in all adjusted mean absolute errors for all forecasters over the period 2011-2020. The interval is calculated as 2*standard deviation/square root of number of forecast errors.

Sources: Respective analyst and the Riksbank.

## 2.3 Varying levels of difficulty in making forecasts in different years

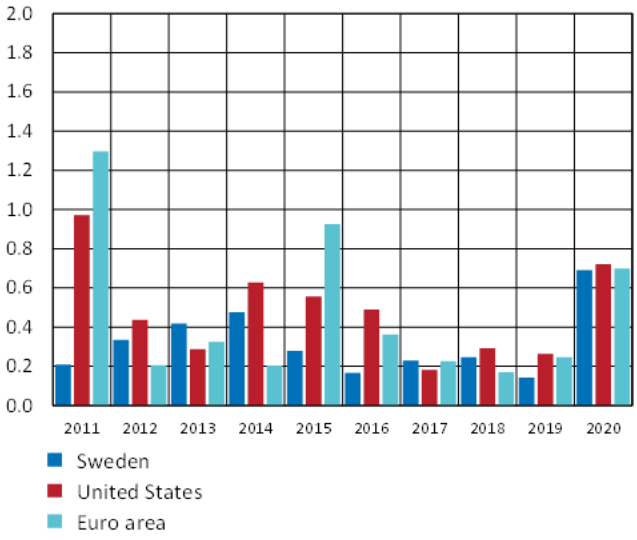
To gain a measure of how difficult it has been to forecast different variables over time, an average of the mean absolute error of different forecasters year by year can be calculated. Such average mean absolute errors are shown for GDP growth and inflation in Sweden, the United States and the euro area in 2.4 and 2.4 below. In 2020, the average mean absolute errors were unusually large in all regions, particularly for GDP.

**Figure 18. Average mean absolute errors for GDP growth 2011-2020**




Sources: Respective analyst and the Riksbank.

**Figure 19. Figure 1. Average mean absolute errors for inflation**




Note Klicka här för att ange anmärkning.

Sources: Respective analyst and the Riksbank.

## 2.4 Evaluation of forecasts for 2020

In this section, we evaluate the forecasts for 2020 in the same way as for 2011-2020 in Section 2.2. The results are shown in Figure 22–0 in Appendix 1. All forecasters had expected higher GDP growth and lower unemployment both in Sweden and abroad last year than turned out to be the case. This is obviously linked to the pandemic that no-one predicted prior to it breaking out in the spring of 2020. Inflation was also unexpectedly low last year in the wake of the pandemic.

## 2.5 Evaluation of the Riksbank's inflation forecasts in the short term

In this section, we study how accurate the Riksbank's inflation forecasts have been in the short term, i.e. one to three months ahead. The Riksbank published monthly forecasts are compared with forecasts from a number of forecasters that normally report their figures every month.[12]

As from the beginning of 2020, the Riksbank publishes five forecasts a year: February, April, July, September and November.[13] As new forecasts are not published every month, two, or sometimes three, inflation outcomes may be published before a new forecast from the Riksbank is published. The analysis therefore includes forecasts one to three months ahead from the Riksbank. These different forecast periods are compared with assessments from other forecasters that make forecasts prior to each new inflation outcome. In their case, it is therefore only a question of forecasts one month ahead. This means that the other forecasters always have access to as much or more information than the Riksbank in this analysis.[14]

In 0, we have compiled the annual average of the monthly forecast errors (outcome minus forecast) for CPIF inflation. The results show that the Riksbank has overestimated inflation in the short term every year except 2017. The red bars, labelled "Mean value forecast", shows average forecast errors when a mean value of the forecasts of other analysts has been calculated. The mean value forecast shows the same pattern as the Riksbank's forecasts, but the systematic forecast errors are smaller.[15]

[12] Bloomberg publishes one-step forecasts (forecasts one month ahead) every month from a number of forecasters. The number of forecasters, excluding the Riksbank, is 10 during the studied period 2013–2020. They include the major Swedish banks and other private financial agents.

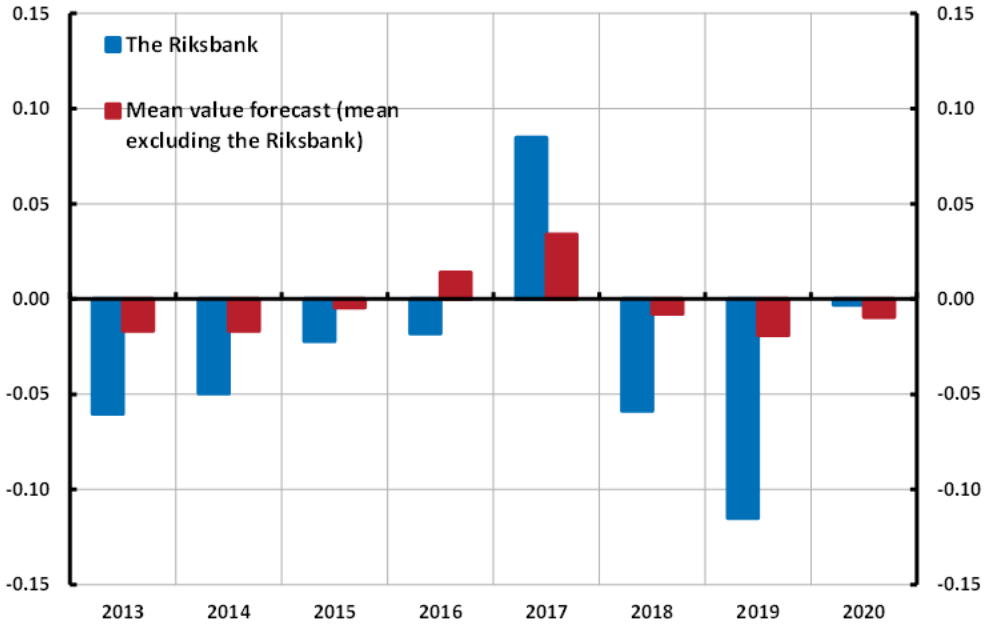
[13] No forecasts were published in April 2020 (only two scenarios for future developments) as a result of the pandemic. Prior to 2020, six forecasts a year were published.

[14] Forecasts from other forecasters should thus, in most cases, be more accurate than the Riksbank's most recently published forecast. Even in cases in which the Riksbank's forecast refers to inflation one month ahead, other forecasters have a certain advantage, as their forecasts are often made only a couple of days ahead of the CPIF outcome. How well updated the information available is on the development of, for example, fuel prices, electricity prices and exchange rates is often important.

[15] Such a mean value forecast is normally the most reliable seen over longer periods, see for example Stock and Watson (2004).

**Figure 20. Monthly forecast errors for CPIF inflation, 2013-2020**

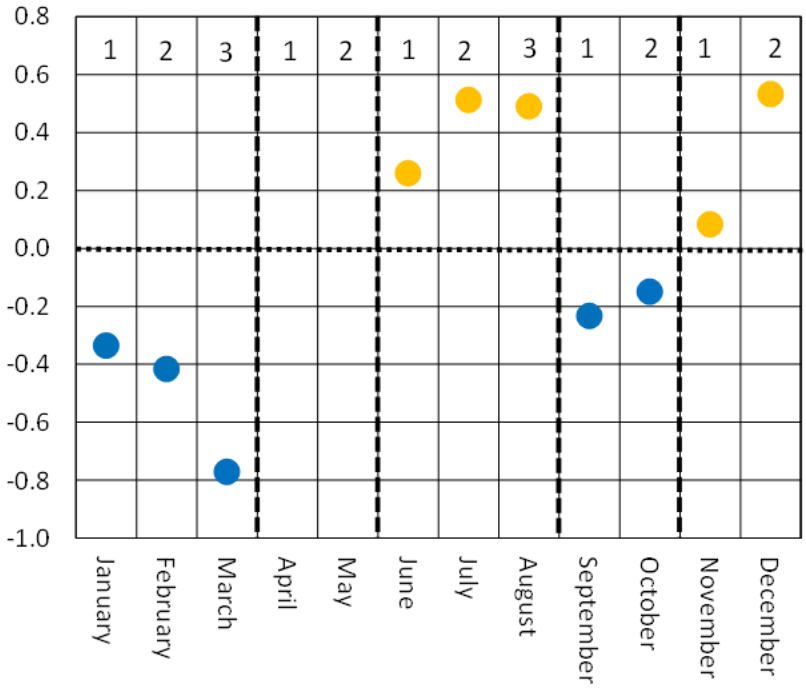
Percentage points (annual average)




Source: The Riksbank.

**Fel! Hittar inte referenskälla.** shows forecast errors for CPIF inflation for January to December 2020. The figures at the top of the figure show the information that was available to the Riksbank. A one means this is a one-step forecast. In April, the Riksbank published a Monetary Policy Report with different scenarios instead of a main forecast. There is thus no one-step forecast for April and no two-step forecast for May. Blue dots indicate a negative forecast error, i.e. the outcome was lower than the forecast. Yellow dots indicate a positive forecast error.

**Figure 21. The Riksbank's forecast errors for CPIF inflation in 2020**
Percentage points




Source: The Riksbank.

In January, the forecast error amounted to –0.3 percentage points. In the forecast, which was published in the Monetary Policy Report on 12 February, the Riksbank had access to the outcome in the CPIF up until the end of December 2019, which means that it was a one-step forecast. Prices rose slightly more slowly than expected in most of the sub-groups. The basket effect was unusually large in 2020 and the Riksbank's conclusion was that much of the forecast error could be explained by this. The negative forecast errors at the beginning of the year shown in **Fel! Hittar inte referenskälla.** therefore largely depend on the unexpectedly low inflation in January. The errors then remained in the forecasts made for February and March. In March, the negative forecast error was even larger due to an unexpectedly rapid fall in fuel prices

In the Monetary Policy Report in April, the Riksbank chose to describe possible developments in two scenarios instead of in one detailed forecast. So no new monthly forecasts were published and no forecast errors can be presented for April and May in **Fel! Hittar inte referenskälla.**. The coronavirus pandemic was now starting to make a clear impression on the inflation figures. For example, Statistics Sweden was having difficulty measuring certain service prices and had to replace them with estimated values.

Over the summer, the forecast errors were positive and rose from 0.2 percentage points in June to around 0.5 percentage points in July and August. In the forecast published in the Monetary Policy Report on 1 July, the Riksbank had access to CPIF figures up to the end of May. It was primarily prices of goods, in particular clothes and shoes, that increased more than expected. Prices of other services also increased faster than expected as did electricity prices.[16]

[16] An example is car rental prices that increased rapidly in June and July.

Compared with the other months of the year, the forecast errors in September and October were relatively small. In the forecast published in the Monetary Policy Report on 26 November, the Riksbank had access to CPIF figures up to the end of October. The forecast error in November was relatively small. Service prices, with several estimated prices in the foreign travel product group, rose slightly more rapidly than expected, as did electricity prices. The trend continued and strengthened in December, when higher fuel prices also contributed to the forecast error.

In 0, we compare different forecasters' accuracy over the short term. Here, both average forecast error (mean error) and mean absolute error (MAE) are presented for the period January 2013–December 2020. If forecasts had been made for all months of this period, there would be 94 of them in total. [17] Eleven individual forecasters including the Riksbank are included in the comparison. The row marked "Mean value forecast" shows the result when an average of all forecasts (excluding those of the Riksbank) is evaluated. In this analysis, the mean value forecast takes second place in the ranking. Over the period, the most accurate analyst has a mean absolute error of 0.12. The Riksbank comes in eleventh place (if the mean value forecast is included) with a mean absolute error of 0.17. Nine individual forecasters have thus on average made somewhat more accurate forecasts than the Riksbank during this period, but the differences are very small.[18] It can also be noted that the Riksbank, on average, has forecast slightly too high inflation in the short term.

**Table 3. Evaluation of short-term forecasts for CPIF inflation on a 1–3 month horizon, 2013-2020**

| Ranking | Forecaster | Average error | MAE | # Forecasts |
|---|---|---|---|---|
| 1 | Forecaster with lowest MAE | −0.02 | 0.12 | 90 |
| 2 | Mean value forecast | 0.00 | 0.13 | 94 |
| **11** | **The Riksbank** | **−0.03** | **0.17** | **94** |
| 12 | Forecaster with highest MAE | 0.01 | 0.17 | 74 |

Note. MAE stands for mean absolute error. The forecasting error is calculated as outcome minus forecast.
Sources: Bloomberg and the Riksbank.

In 0, the Riksbank's two- and three-step forecasts have been removed. The forecasts of the other analysts for those months have also been excluded. The analysis is therefore based on the 46 months for which the Riksbank has published one-step forecasts.[19] It is now easier to compare the results, but there are fewer forecasts. The Riksbank comes in fifth place with a mean absolute error of 0.14. Three individual forecasters and the mean value forecast have made more accurate forecasts on average. All forecasters have also on average overestimated inflation one month ahead.

[17] It should be 96 forecast months, but no figures have been used for April and May 2020 in the analysis. This is because the Riksbank did not publish any monthly forecasts for these months.

[18] The mean value forecast is not an individual forecaster.

[19] In 2013–2019, there were six one-step forecasts every year. In 2020, there should have been five, but no forecast was published in April.

**Table 4. Evaluation of short-term forecasts for CPIF inflation on a one-month horizon, 2013-2020.**

| Ranking | Forecaster | Average error | MAE | # Forecasts |
|---|---|---|---|---|
| 1 | Mean value forecast | −0.02 | 0.12 | 43 |
| 2 | Forecaster with lowest MAE | −0.04 | 0.13 | 46 |
| **5** | **The Riksbank** | **−0.06** | **0.14** | **46** |
| 12 | Forecaster with highest MAE | −0.09 | 0.18 | 31 |

Note. MAE stands for mean absolute error. The forecasting error is calculated as outcome minus forecast.
Sources: Bloomberg and the Riksbank.

# References

Andersson, M.K., Aranki, T. (2009), “Forecasters' performance – what do we usually assess and what would we like to assess?”, Economic Review 2009:3, Sveriges Riksbank.

Andersson, M.K., Aranki, T., and Reslow, A. (2017), “Adjusting for information content when comparing forecast performance”, Journal of Forecasting 36, 784-794.

Statistics Sweden (2021), “Kommentarer till BNP-beräkningarna. Fjärde kvartalet 2020”, published on the Statistics Sweden website, February 2021

Stock, J.H., and Watson, M.W. (2004), “Combination forecasts of output growth in a seven-country data set”, Journal of Forecasting 23 (6), 405–430.

Sveriges Riksbank (2021a), “Changed consumption during the pandemic affects inflation” article in Monetary Policy Report, February 2021.

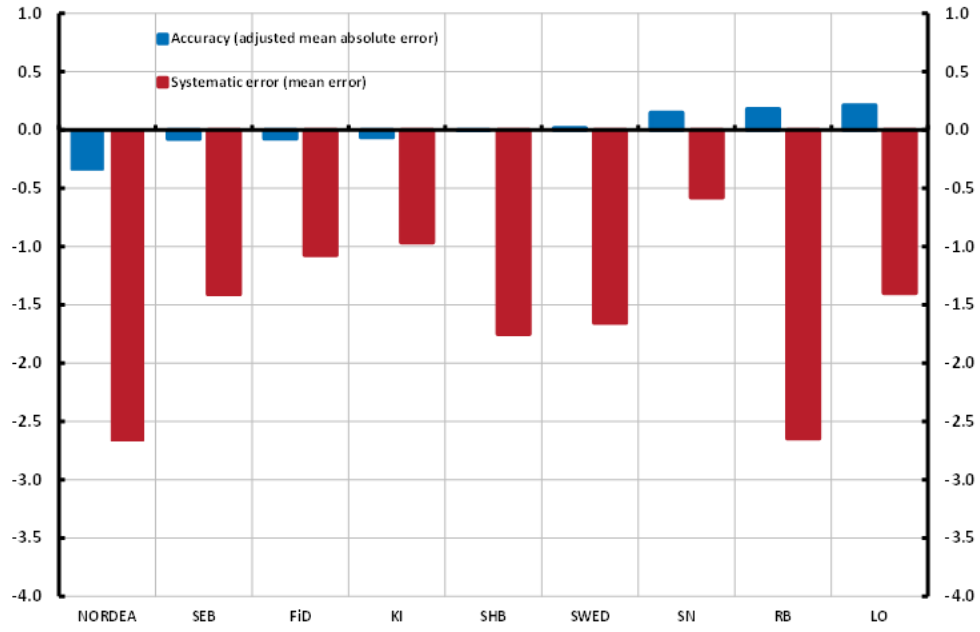
Sveriges Riksbank (2021b), “Changed consumption during the pandemic affects inflation”, Economic Commentaries, No. 14 2020.

Sveriges Riksbank (2020a), “In the wake of the coronavirus pandemic. Everything has changed in two weeks”, The Riksbank’s Business Survey, February and March 2020.

# APPENDIX 1: Forecasts for 2020

**Figure 22. GDP growth, accuracy and systematic errors in forecasts for 2020 made by various analysts, 2019-2020**

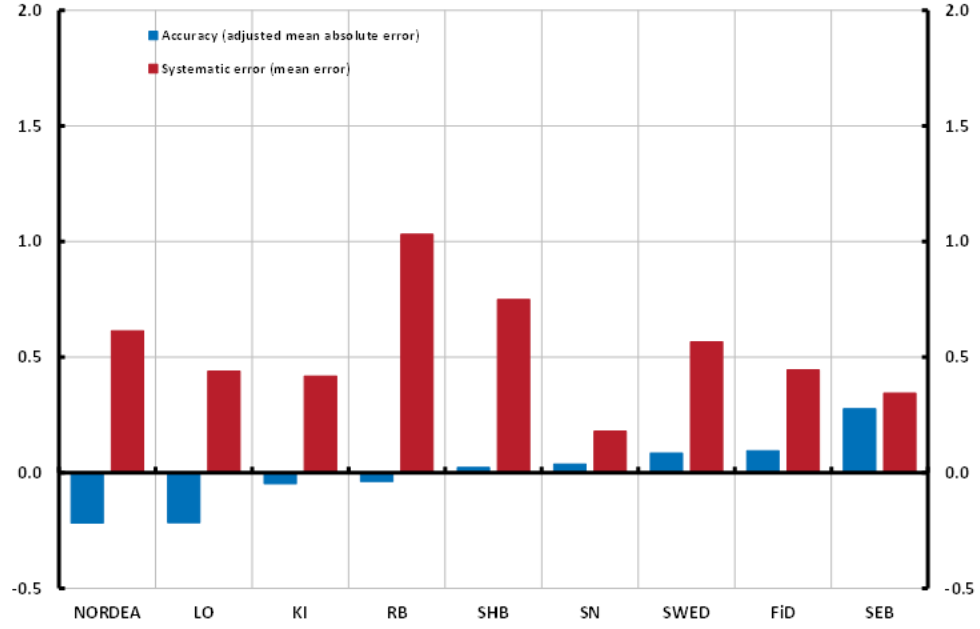
Percentage points




Sources: Respective analyst and the Riksbank.

**Figure 23. Unemployment, accuracy and systematic errors in forecasts for 2020 made by various analysts, 2019-2020**

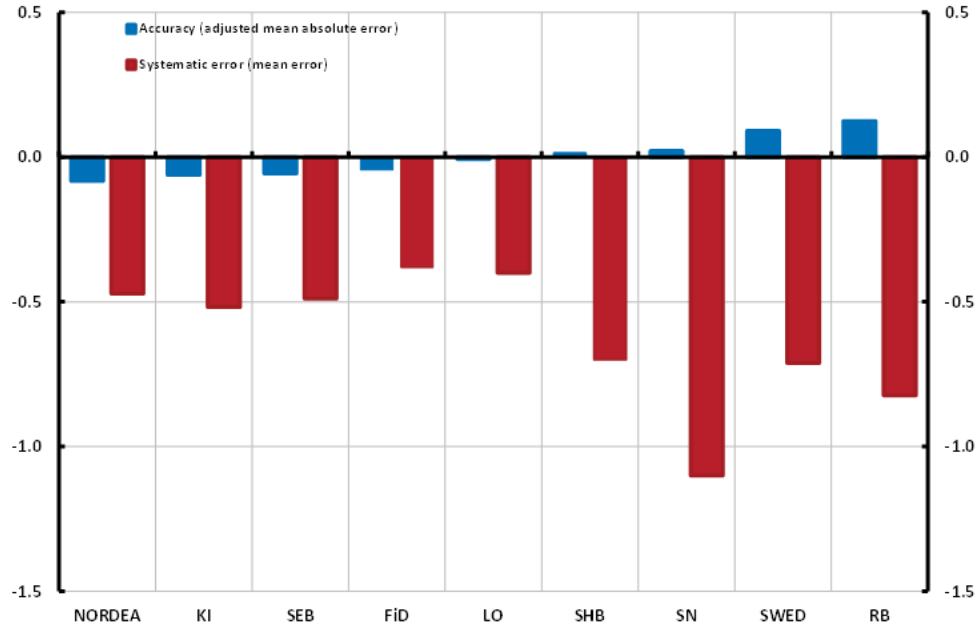
Percentage points




Sources: Respective analyst and the Riksbank.

**Figure 24. CPIF inflation, accuracy and systematic errors in forecasts for 2020 made by various analysts, 2019-2020**

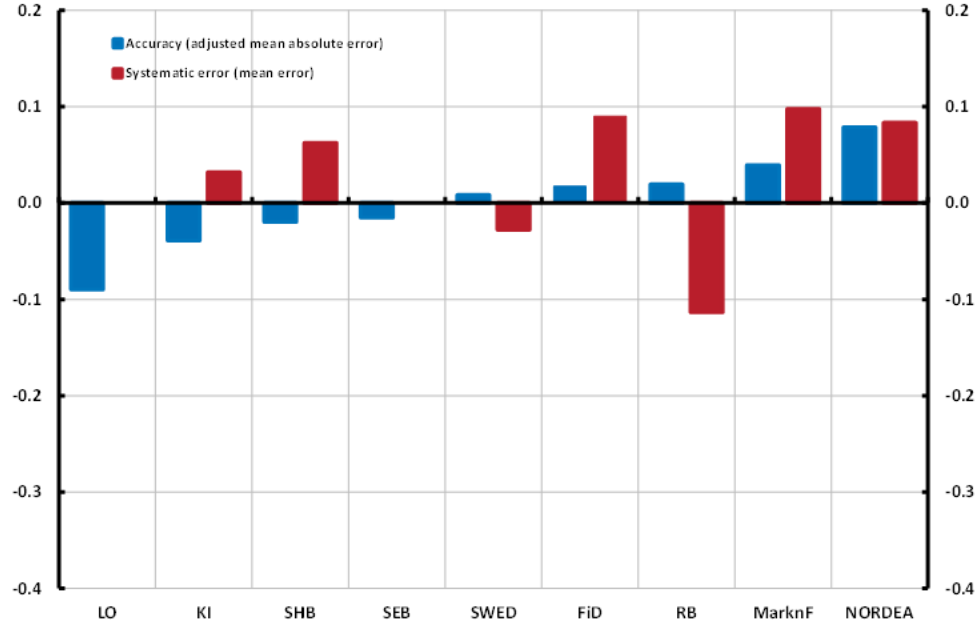
Percentage points




Sources: Respective analyst and the Riksbank.

**Figure 25. Repo rate, accuracy and systematic errors in forecasts for 2020 made by various analysts, 2019–2020**

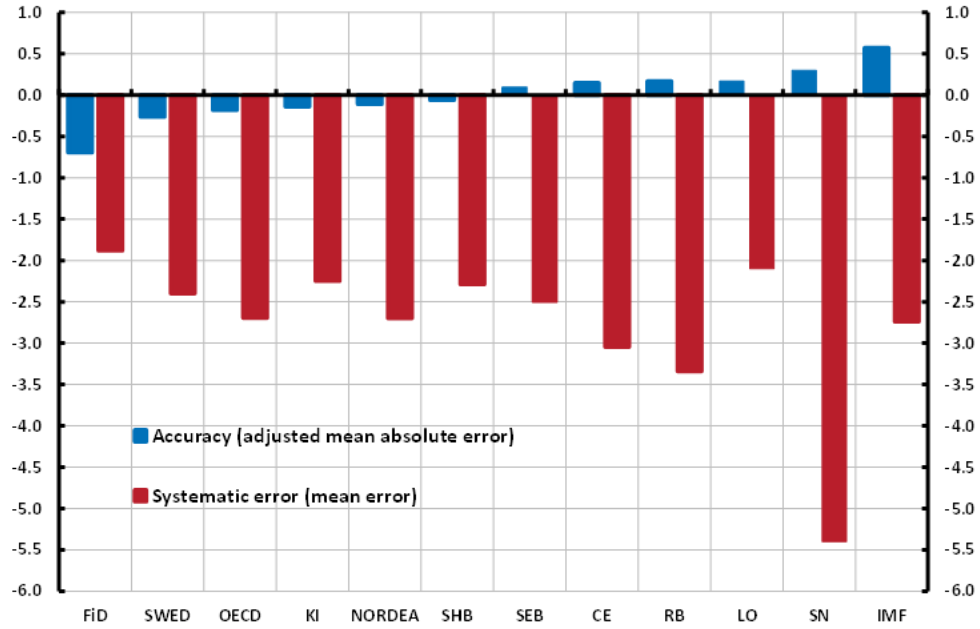
Percentage points




Sources: Respective analyst and the Riksbank.

**Figure 26. GDP growth in the United States, accuracy and systematic errors in forecasts for 2020 made by various analysts, 2019-2020**

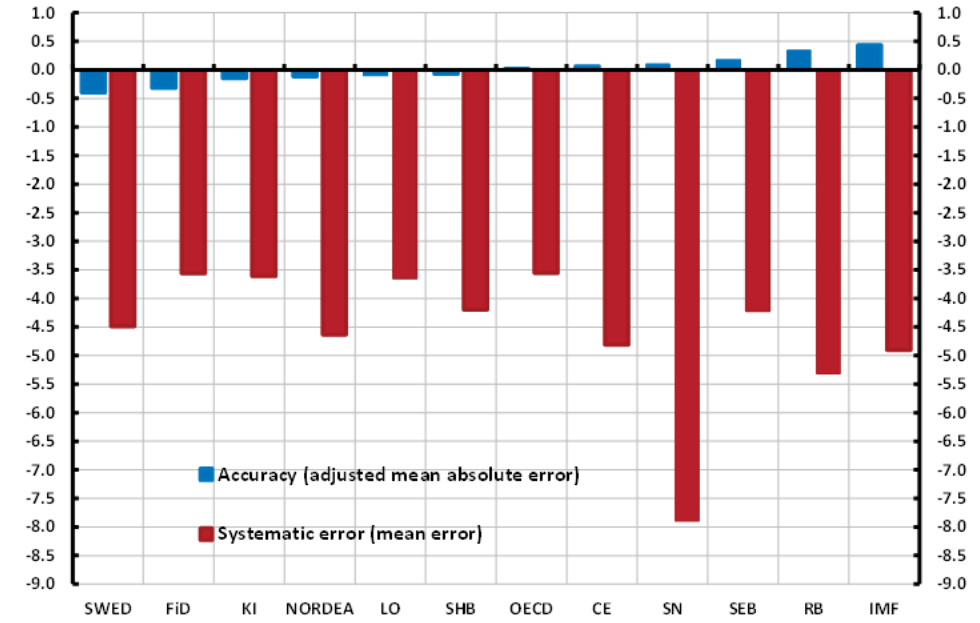
Percentage points




Sources: Respective analyst and the Riksbank.

**Figure 27. GDP growth in the euro area, accuracy and systematic errors in forecasts for 2020 made by various analysts, 2019-2020**

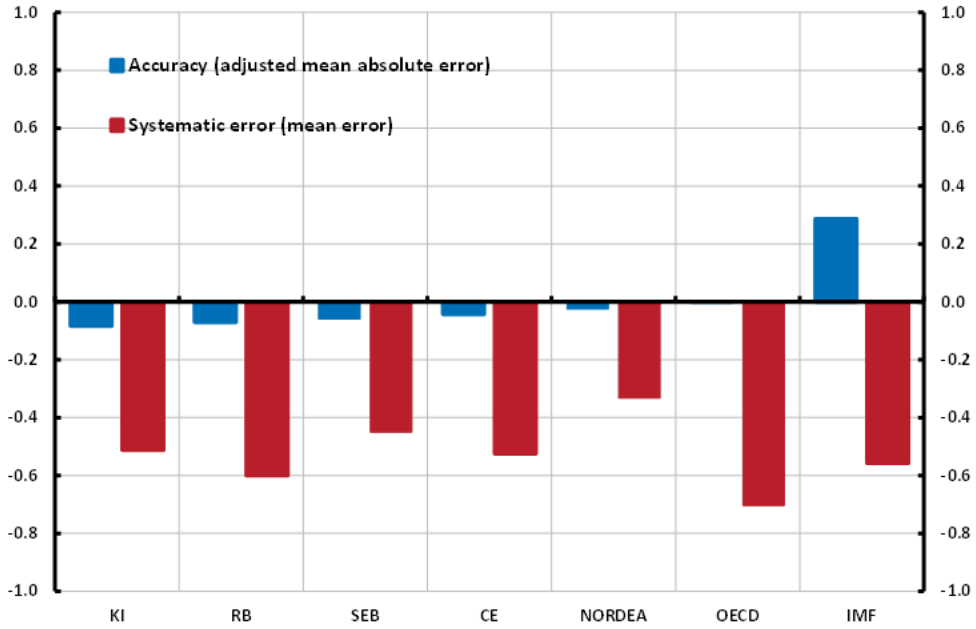
Percentage points




Sources: Respective analyst and the Riksbank.

**Figure 28. CPI inflation in the United States, accuracy and systematic errors in forecasts for 2020 made by various analysts, 2019-2020**

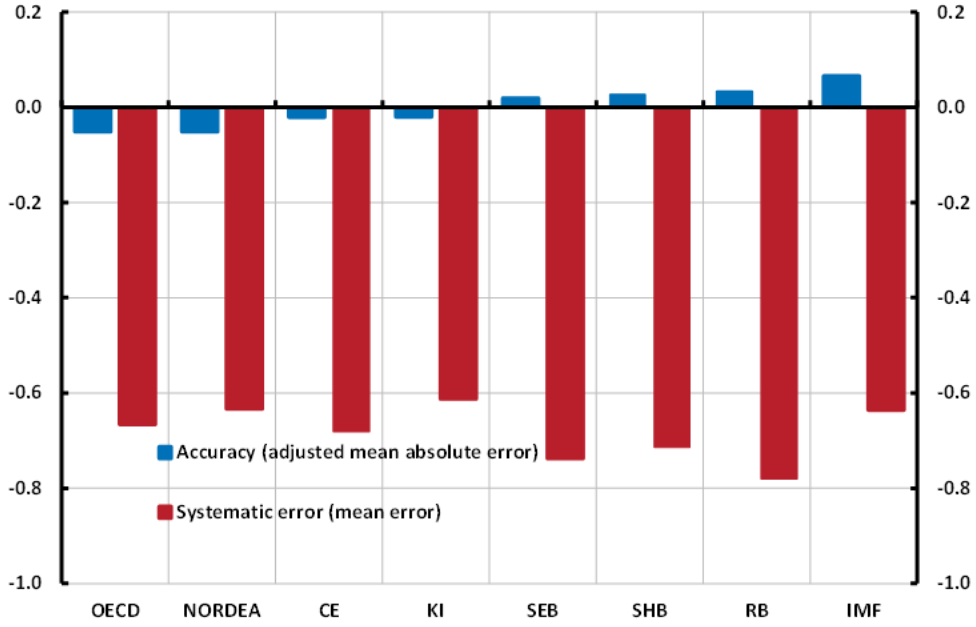
Percentage points




Sources: Respective analyst and the Riksbank.

**Figure 29. HICP inflation in the euro area, accuracy and systematic errors in forecasts for 2020 from various analysts, 2019-2020**

Percentage points




Source: Respective analyst and the Riksbank.

# APPENDIX 2: Measuring accuracy

Let $x_t$ be an outcome for an economic variable $x$, for example the inflation rate or GDP growth for a specific period, $t$. Assume also that $x_{it,h}$ is a forecast for $x_t$, made by forecaster *i* a certain number of months $h$ before the outcome is published. The absolute forecasting error $\varepsilon_{it,h}$ is then given by

$$\varepsilon_{it,h} = \left|x_t - x_{it,h}\right|. \quad (1)$$

In this study, $x_t$ refers to yearly averages, for example GDP growth in 2008, and the forecasts evaluated refer to the current or next year. This means therefore that $h \leq$ 24 months. In order to summarise the accuracy of forecaster *i*, its mean absolute error (MAE) can be calculated as

$$MAF_t = \frac{\sum \varepsilon_i}{n_i}, \quad (2)$$

where $n_i$ is the number of forecasts made by forecaster *i*. The measure shows how much the forecasts have deviated from the outcome on average and it can be used to compare forecasting precision, or how accurate various forecasters have been.

In practice, forecasters publish their forecasts at different points in time. If forecast horizon *h* differs among forecasters, it also means that the forecasters have access to different amounts of information when making their forecasts. It is therefore not entirely fair to directly compare the mean absolute error between them. A forecaster *i* that often publishes its forecasts late, has a low *h* on average, and should therefore on average have a better accuracy than others.

In order to correct the measure of accuracy because forecasters have access to different amounts of information when they make their forecasts, Andersson et al. (2016) propose dividing the absolute forecast error into different components. The results from this decomposition can then be used to calculate accuracy or forecasting precision in a fairer way. The decomposition is done by estimating the equation

$$\varepsilon_{it,h} = \delta M_{it,h} + \mu_i + \mu_{i,t=c} + \lambda_t + e_{it,h}. \quad (3)$$

The first component in the equation, $M_{it,h}$, depends on the volume of information available at point in time *h*, when forecaster *i* publishes its forecast. The two components thereafter reflect the forecasters' general precision. The average accuracy of forecaster *i* is described by $\mu_i$ whereas the term $\mu_{i,t=c}$ captures the forecasting ability when evaluating individual years, *c*. The fourth term, $\lambda_t$,, takes into account the fact that some years are more difficult to forecast than others. Finally, the residual $e_{it,h}$ is the part of the forecasting error that the equation is not able to capture. It is assumed to be randomly allocated, with the mean value of zero and constant variance.

The annual growth rate for a specific year, *T*, is a function of all quarterly or monthly growth rates during years *T–1* and *T*. Andersson et al. (2016) show that the growth

rates have different weights in the annual growth.[20] This weighting scheme is used to construct $M_{it,h}$ in equation (3). The volume of information that forecaster *i* has in the publication month is here approximated by the accumulated weight up to a certain month, $W_{it,h}$. So the weight increases the closer one is in time to the definitive outcome. The time effect in equation (3) is defined as

$$M_{it,h} = 1 - W_{it,h}. \quad (4)$$

When $W_{it,h}$ increases, $M_{it,h}$ decreases and equation (4) can be seen as an approximation of the information that is missing when the forecast is published. The coefficient $\delta$ in equation (3) captures the marginal effect on the forecasting error of having access to less information, and the effect is allowed to vary over time.

Equation (3)is estimates over all $n$ forecasters and horizons. Based on the estimates of $\mu_i$ and $\mu_{i,t=c}$, the adjusted mean absolute error is defined for a certain year as

$$\mu^*_{i,t=c} = \hat{\mu}_{i,t=c} + \hat{\mu}_i - \frac{1}{n}\sum_j\left(\hat{\mu}_{j,t=c} + \hat{\mu}_j\right). \quad (5)$$

The adjusted mean absolute error is therefore defined as the deviation from an average of all forecasters. A negative value means that forecaster *i* makes better forecasts than the average while a positive value means that the forecaster has made poorer forecasts than the average.

[20] See the discussion about table 1 in Andersson et al. (2016), which describes the weighting scheme for quarterly data. This study uses monthly weights.


**SVERIGES RIKSBANK**
Tel +46 8 - 787 00 00
registratorn@riksbank.se
www.riksbank.se

PRODUCTION SVERIGES RIKSBANK.