ARTICLE– The Riksbank's exchange rate forecasts

The Riksbank's monetary policy does not have the goal of affecting the development of the exchange rate, but aims to attain the inflation target and a balanced development of the real economy. However, as changes in the krona exchange rate affect both inflation and the real economy, it is nevertheless important to analyse and forecast the development of the krona. An article in last year's Account of Monetary Policy discussed how the krona affects inflation. The aim of this article is to discuss the Riksbank's exchange rate forecasts. The forecasts are based on an assessment of the real krona exchange rate in the longer term. Over the past year, the Riksbank has conducted a review of exchange rate forecasts, that has resulted in two main changes. Firstly, the equilibrium level of the real krona exchange rate is deemed to be weaker than had previously been assumed and, secondly, the krona exchange rate is deemed to adjust towards this level more slowly. A thorough review of the definitions of the real exchange rate, trade-weighted exchange rate and real equilibrium exchange rate can be found in the preceding article "Analysing exchange rates – a few key concepts".

In the latest evaluation of monetary policy, the Riksdag Committee on Finance noted that, in 2018, the Riksbank had had problems assessing both how the krona would develop and what effects any exchange rate changes would have. It also noted that the debate on the krona depreciation and the Riksbank's assessments had been comprehensive over the year. The Committee therefore assumed that the Riksbank would review its analysis, its methods and models and its communication regarding assessments of the development of the exchange rate. This article presents both the Riksbank's conceptual framework for the development of the krona in the longer term and the review of the exchange rate analysis the Riksbank made over the year.

How does the Riksbank make exchange rate forecasts?

For a long time, the Riksbank's exchange rate forecasts have been based on an assessment of the equilibrium real exchange rate. The reason for this is that economic theory provides guidance over the equilibrium that the real exchange rate should be moving towards a few years ahead. This is described in more detail in the article "Analysing exchange rates – a few key concepts". In its forecast, the Riksbank assesses the exchange rate in two main steps:

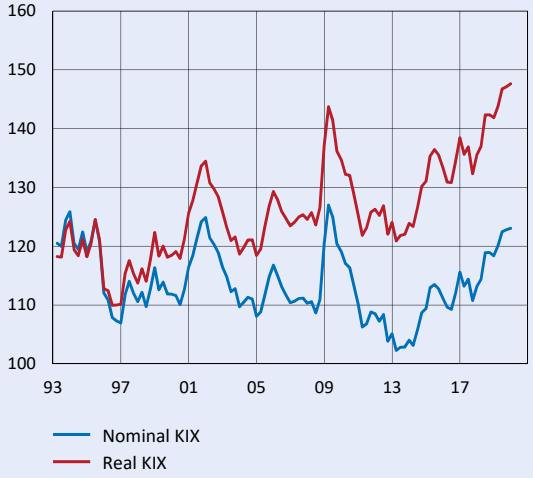
- The real equilibrium level for the krona
- How the krona will move towards the equilibrium level from the current level

Over the years, the greatest focus in the Riksbank's analysis has been on the first of these steps, namely determining the real equilibrium rate in the longer term. The Riksbank has reviewed both steps over the last year.

Step 1: Determining the long-term level of the real exchange rate

Figure 3:13 shows the nominal and real krona exchange rates measured in terms of KIX and CPI over the period with a floating exchange rate, which is to say from 1993 on.[44]

Figure 3:13. Nominal and real krona exchange rates according to the krona index (KIX)
Index, 18 November 1992 = 100



Note. The real exchange rate is calculated using the CPIF for Sweden and the CPI for the rest of the world. The KIX (krona index) is a weighted average of the currencies in the countries that are important for Sweden's international trade. A higher value indicates a weaker exchange rate.

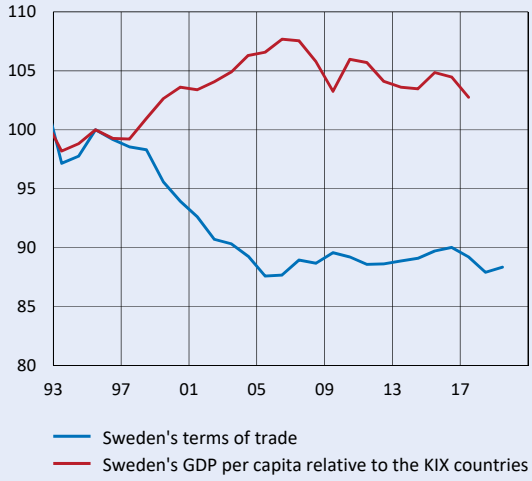
Sources: National sources, Statistics Sweden and the Riksbank

[44] The fixed exchange rate was abandoned on 19 November 1992.

According to the theory of relative purchasing power parity, the real exchange rate does not have any trend, but returns to its average in the long run. In the case of the krona's trade-weighted exchange rate, the mean value since 1993 could be considered to be the equilibrium real exchange rate. Until 2013, the development seemed to correspond fairly well with the theory of relative purchasing power parity. After this, the real exchange rate weakened substantially. But is this a sign of the equilibrium real exchange rate also having weakened?

Figure 3:14 shows two different measures of Sweden's 'wealth' in relation to the rest of the world, which could justify a trend change of the krona's equilibrium real exchange rate: GDP per capita and the terms of trade.[45] Over a ten-year period from the middle of the 1990s, Sweden's GDP per capita developed significantly better than that of other countries. This suggests there was a stronger real equilibrium rate over this period. At the same time, however, the terms of trade fell substantially, which is connected, among other things, with falling prices on the world market for high-tech export products from Sweden. This would instead suggest that the real equilibrium rate had weakened. Over the last ten-year period, there has been no clear trend in either the terms of trade or GDP per capita in relation to the rest of the world.

Figure 3:14. Sweden's terms of trade and GDP per capita relative to other countries
Index, 1995 = 100



Note. Data for the euro area as a whole prior to 1995 is missing and has been replaced by an aggregate of a smaller group of countries. Overall, this means that the sample is limited to 18 KIX countries for the period prior to 1995, which corresponds to 84 per cent of KIX with 1994 weights. Prior to 1995, constant KIX weights from 1994 are used.

Sources: IMF and World Bank

To sum up, traditional explanatory factors – based on the theory that "real exchange rates are stronger in wealthier countries" – do not give any clear indication that the equilibrium real exchange rate has changed in Sweden over the period of floating exchange rates.

When making forecasts for the real exchange rate, the Riksbank has used statistical models, in which the real exchange rate is estimated together with relative GDP per capita and the terms of trade. The estimates have confirmed that there have not been such major changes to the equilibrium real exchange rate, just as the review of Figure 3:14 indicated. Typically, the estimates have been fairly close to a historical average for the real exchange rate since 1993, which is the equilibrium real exchange rate that the theory of relative purchasing power parity had indicated. Consequently, it has not made much difference whether estimates of the equilibrium real exchange rate have been based on theories of Sweden's relative wealth in relation to other countries or on relative purchasing power parity. Other approaches have also been used over the years, above all ones assuming that Sweden's surplus on current account will reach a balance in the long run, which has justified a stronger real exchange rate.[46]

Step 2: How is the krona to move towards the long-term level?

Once the equilibrium real exchange rate has been assessed, it can be compared to the actual real krona exchange rate to obtain an indication of its future direction. The next step of the analysis is to assess *how rapidly the krona will adjust towards its long-term level*. Normally, the Riksbank has assessed that the adjustment to the equilibrium exchange rate will happen "in a few years' time" or in "5–10 years' time". As most of the variation in the real exchange rate over the forecast period of three years is driven by the nominal exchange rate, the adjustment towards the real exchange rate has, in principle, been driven almost completely by the nominal exchange rate. The forecasts for the nominal and real exchange rates have therefore looked very similar, except for the differences in starting point. These differences come from the nominal and real exchange rate having developed differently since 1993 (see Figure 3:13).

One important element in assessing how the krona will adjust towards the equilibrium level is a short-term analysis, aimed at clarifying how conditions on the financial markets affect the krona's movements over the next few quarters. A central part of the short-term analysis is assessing how the krona is affected by different kinds of news on the macroeconomy and Swedish

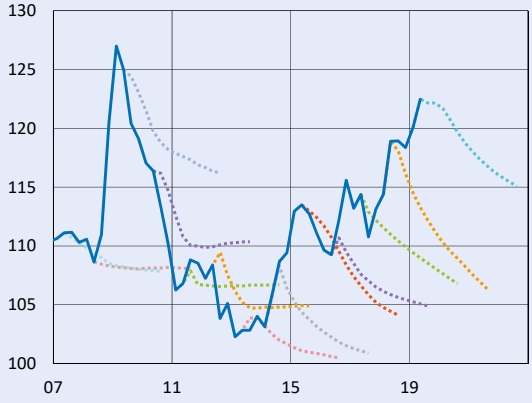
[45] How this functions is described in the article "Analysing exchange rates – a few key concepts".
[46] See, for instance, Lagerwall, Björn and Nessén, Marianne, "The long-term developments of the krona", Economic Commentary no. 6, 2009, Karolina Ekholm, "Monetary policy and the exchange rate", speech published 12 January 2010, "A long-term perspective on the krona", article in Monetary Policy Report, July 2013, and "The krona's development in the longer term", article in Monetary Policy Report, October 2018.

monetary policy. When unease increases on the financial markets, currencies in small open economies like Sweden have a tendency to depreciate. Insights like this can be integrated into the short-term forecast. If the Riksbank expects to communicate a more expansionary monetary policy than is reflected by the market's expectations, this is also deemed to lead to a weaker exchange rate in the short term. The so-called exchange rate channel is one of the ways that monetary policy affects inflation and the real economy.[47]

The krona has become weaker than the Riksbank expected

Figure 3:15 shows the Riksbank's forecasts for the nominal trade-weighted krona exchange rate (KIX) in the Monetary Policy Report for July each year since 2007. As we can see, the forecasts have usually been based on expectations of an appreciation. Normally, however, such appreciations have only occurred in periods preceded by a heavy depreciation. After the krona had depreciated heavily during the global financial crisis of 2008–2009, the Riksbank expected the depreciation to be temporary and to be reversed rapidly. This also proved correct and the krona even appreciated faster than forecast. When the krona depreciated again around 2014, there was also an expectation that it would strengthen rapidly. This did not happen but the krona instead continued to depreciate more or less continuously.

Figure 3:15. A sample of the Riksbank's krona forecasts 2007–2019
Index, 18 November 1992 = 100



Note. The real exchange rate is calculated using the CPIF for Sweden and the CPI for the rest of the world. The KIX (krona index) is a weighted average of the currencies in the countries that are important for Sweden's international trade. A higher value indicates a weaker exchange rate.

Sources: National sources, Statistics Sweden and the Riksbank

The difficulties in forecasting the development of the krona can also be noticed among other analysts. They have had a similar view of expected development and have made similar misjudgements. Figure 3:16 shows the forecasts for the krona exchange rate against the euro made by money market participants 1 and 2 years ahead according to Prospera's survey. The pattern from Figure 3:15 recurs very clearly: just as in the Riksbank's forecasts, strong confidence that the krona will appreciate against the current level is reflected.[48]

Figure 3:16. A sample of Swedish money market participants' krona forecasts 2007–2019
Kronor per euro

Note. The forecasts have been taken from Prospera's quarterly survey for the second quarter of the year for the years 2007–2019.

Sources: Kantar Sifo Prospera and the Riksbank

An ongoing review

As the Riksbank has made relatively large forecast errors in recent years, a more extensive review of the methods used to analyse and forecast exchange rate trends is currently being performed.

The analyses the Riksbank has made over the year have so far been presented in two Economic Commentaries, an article in the Monetary Policy Report for July and a Staff Memo.[49] Further studies will be published in 2020.

Why have the forecasts been wrong?

According to the previously described approach that the Riksbank has used in its exchange rate forecasts, a forecast error for the krona may, in principle, be due to two factors having been assessed incorrectly:

- the real equilibrium level
- the adjustment of the krona towards the equilibrium level

Over the year, the Riksbank has conducted a thorough review of both of these factors.

[47] See "The significance of the krona for inflation", article in Account of Monetary Policy 2018, Sveriges Riksbank, and C.J. Belfrage, V. Corbo and S. Ingves, "Perspective on the krona, inflation and monetary policy", Economic Commentaries No. 13, 2019, Sveriges Riksbank

[48] No forecast for KIX is produced in Prospera's surveys, but the euro is by far the most important currency in KIX and has a weight of about 50 per cent.

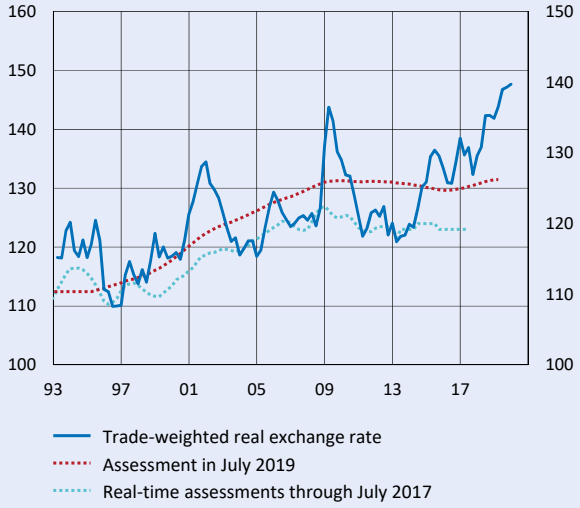
[49] See E. Askestad, A.M. Ceh, P. Di Casola, P. and A. Ristiniemi, "Forecasting the krona", Economic Commentaries No. 12, 2019, Sveriges Riksbank, Belfrage, V. Corbo and S. Ingves, "Perspective on the krona, inflation and monetary policy", Economic Commentaries No. 13, 2019, Sveriges Riksbank, "Trend development of the Swedish krona", article in Monetary Policy Report July 2019, and C. J. Belfrage, P. Bonomolo and P. Stockhammar, "A time-varying equilibrium model for the long run real exchange rate", Staff Memo, February 2020, Sveriges Riksbank.

The equilibrium real exchange rate of the krona is assessed to be weaker

As described earlier, the real exchange rate was about the same level in 2013 as when the krona began to float in 1993. Previously, the Riksbank's assessment was that the actual real exchange rate was close to the real equilibrium real exchange rate at this point. This is illustrated by the turquoise line in Figure 3:17. When the krona depreciated after 2013, the Riksbank thus concluded that the krona had become weaker than its equilibrium level and that it would soon strengthen. As the krona continued to depreciate, the forecasts thereby pointed to greater and greater future appreciations of the krona.

Figure 3:17. Historical assessments of the krona's equilibrium real exchange rate

Index, 18 November 1992 = 100



Note. The real exchange rate is calculated using the CPIF for Sweden and the CPI for the rest of the world. The KIX (krona index) is a weighted average of the currencies in the countries that are important for Sweden's international trade. A higher value indicates a weaker exchange rate.

Sources: National sources, Statistics Sweden and the Riksbank

With a few more years' data available and the support of new methods of estimation, the Riksbank today deems that the krona's real equilibrium level is weaker than had been previously assessed, as shown by the red line in Figure 3:17. The Riksbank bases its assessment on the same fundamental factors as previously, but a new empirical model has been developed as part of this work.[50] A combination of relative GDP per capita and the terms of trade explains the equilibrium level in the model, which is estimated using data from 1995 onwards.

One difference compared with earlier model estimates is that the deterioration of the terms of trade over the ten-year period from the mid-1990s has a greater effect on the equilibrium exchange rate than the improvement in the relationship to other countries of GDP per capita over the same period. The model estimates now imply that the equilibrium real exchange rate weakened quite substantially from 1995 until the financial crisis of 2008–2009. Following this, the model does not give any indication that the equilibrium exchange rate should have changed. This is shown by the red line in Figure 3:17. One contributory factor for recent years' forecast errors may thus have been that the equilibrium real exchange rate was actually weaker than the Riksbank had assessed.[51]

The krona is deemed to be moving more slowly towards the equilibrium level

The Riksbank is now assuming that the equilibrium real exchange rate is weaker than previously assessed. This is therefore a change of "step 1" of the analysis. But the method for making forecasts of *adjustment to equilibrium*, "step 2", has also been modified as a result of the ongoing review.

A large number of models for forecasting the nominal exchange rate over the short and medium terms have been estimated and evaluated.[52] Over the short term, a so-called naive forecast has proved to work well. This means that the forecast for the exchange rate in the period ahead simply stays on an unchanged level in comparison with the one observed at time of forecast. However, as regards forecasts two to three years ahead, the naive forecast works less well. Then, models based on the assumption that the real exchange rate will gradually adjust to a long-run equilibrium give better forecasts.

One way of using these results in practical work is to allow the short-term forecasts to be governed by the prevailing krona exchange rate at forecast date and longer-term forecasts by an assumption of adjustment to long-run equilibrium. The difference compared with previously is that the Riksbank then assessed that the adjustment towards the long-term level would start immediately, instead of after an initial period with an unchanged exchange rate. Compared with the methods previously used, it is now assumed that the *krona's* adjustment to the assessed long-term equilibrium level will now take place at a slower rate.

How then have the inflation forecasts been affected by the changed assessments of the exchange rate? As Figure 3:17 illustrates, the assessment of a weaker real equilibrium exchange rate means that the forecasts do not indicate a real appreciation of the krona to the same extent as before. This implies that the price level in Sweden compared with other countries, measured in the

[50] See C.J. Belfrage, P. Bonomolo and P. Stockhammar, "A time-varying equilibrium model for the long run real exchange rate", Staff Memo, February 2020, Sveriges Riksbank.

[51] For a more detailed review of the Riksbank's changed assessment of the equilibrium real exchange rate, see the article "Trend development of the Swedish krona" in the Monetary Policy Report of July 2019.

[52] For a more detailed description, see E. Askestad, A.M. Ceh, P. Di Casola, P. and A. Ristiniemi, "Forecasting the krona", Economic Commentaries No. 13, 2019, Sveriges Riksbank

same currency, is generally expected to rise more slowly. The Riksbank's analysis indicates the greatest effect on the forecast occurs in the form of the nominal exchange rate forecast strengthening to a lesser extent, but the inflation forecasts also tend to be marginally lower.

The Riksbank constantly works on developing its exchange rate assessments

Even if the assessments are well balanced, forecasts can be wrong, as unexpected events that affect how the krona exchange rate moves in relation to its equilibrium level almost always occur. The ongoing review therefore also includes work that attempts to identify, to a greater extent, the factors underlying the more short-term fluctuations in the krona exchange rate.

This improves the conditions for supplying more accurate exchange rate forecasts going forward. The future will reveal to which extent this actually happens.