

Economic Commentaries

Perspectives on the krona, inflation and monetary policy

Carl-Johan Belfrage, Vesna Corbo and Stefan Ingves¹

Ingves is Governor of the Riksbank. Belfrage and Corbo work in the Monetary Policy Department.

The krona exchange rate both reflects and influences economic developments. However, it can be challenging to sort out what drives the exchange rate and what it means for inflation and monetary policy. The Riksbank and other analysts have been repeatedly surprised by the depreciation of the krona in recent years. In light of these forecast errors, the Riksbank has now opened a review of the methods we use to analyse how the exchange rate develops.

In this Economic Commentary, we use the Riksbank's forecasting experiences as a basis to illustrate and discuss the difficulties of explaining how the krona exchange rate has developed and of assessing how it will develop in the period ahead. We also provide perspective on the relationship between the exchange rate and inflation, with particular focus on how the krona depreciation of recent years has affected inflation in Sweden. Finally, we discuss the relationship between the krona and monetary policy in light of the monetary policy framework with inflation targeting in which we currently work.

The development of the krona has lately been the focus of a lively debate. This is natural, as the exchange rate both reflects and influences economic developments, particularly in small open economies like Sweden. For example, an appreciation of the exchange rate could indicate expectations that the country's growth will be higher than abroad. However, a stronger exchange rate results in lower demand for the goods and services produced in the country, lower import prices and, ultimately, lower inflation. Consequently, the ultimate effects on inflation of exchange rate fluctuations largely depend on what caused those fluctuations. This, however, can be difficult to identify, particularly in real time.

The Riksbank's forecasts have not predicted the krona depreciation of recent years and the krona developments have not been easy to explain, even in retrospect. A major review is therefore currently underway of the methods used by the Riksbank to analyse and forecast exchange rate developments.² In this Economic Commentary, we use the Riksbank's own forecasting experiences to illustrate and discuss the difficulties in assessing how the krona exchange rate will develop and affect inflation in Sweden.

A floating krona exchange rate has been consistent with historically stable inflation

We will focus on the development of the exchange rate and inflation over the last five to ten years. However, as background, it may be interesting to see how events of recent years appear from an even longer historical perspective.

Since 1970, the krona exchange rate has had a weakening trend; see Figure 1. The krona exchange rate also clearly reflects the monetary policy regimes that Sweden has had. Until November 1992, the development of the krona was characterised by various fixed exchange rate arrangements. In periods, this gave a stable and predictable exchange rate, but, in between, abrupt level changes occurred when devaluations were implemented to compensate for costs having risen faster than abroad.³ At the same time, inflation varied between 2 and 14 per cent. Since the krona exchange rate was allowed to float in November 1992 and inflation targeting soon thereafter was introduced as the new monetary policy regime, inflation has been significantly more stable, while the short-term variations in the krona exchange rate have become larger.

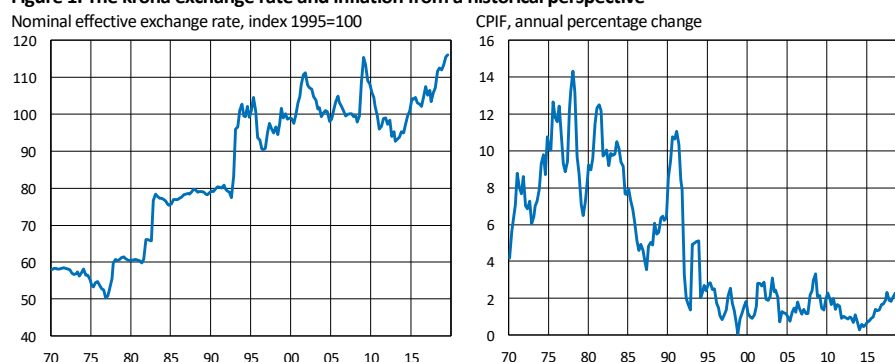
¹ The authors would like to thank Charlotta Edler, Mattias Erlandsson, Jesper Hansson, Marie Hesselman, Jens Iversen, Björn Lagerwall, Åsa Olli Segendorf, Marianne Sterner and Ulf Söderström for their valuable comments. This Economic Commentary has arisen from discussions on the development of the exchange rate that have recently been held both internally at the Riksbank and in international contexts. The views expressed in this Economic Commentary are the authors' personal opinions and are not to be regarded as the Riksbank's official view of these issues.

² See the discussion of a rethink around the exchange rate in Sveriges Riksbank (2019a).

³ See also Sveriges Riksbank (2018a).

Seen over a longer perspective, we can therefore note that a floating and, from time to time, rather volatile exchange rate has been consistent with significantly more stable inflation over the last two decades or so than under previous monetary policy regimes.

Figure 1. The krona exchange rate and inflation from a historical perspective



Note. Quarterly data. The right-hand figure shows the CPI from 1988 on and the similar measure CPI excluding interest expenditure for the period before that.

Sources: BIS, Statistics Sweden and the Riksbank

Making forecasts for the krona is a challenge

With a variable exchange rate, it is generally difficult to explain and forecast changes to the krona exchange rate in real time. For example, over the last five-six years, both the Riksbank and other forecasters have repeatedly expected krona appreciations but have instead been confronted with krona depreciations. In this commentary, we use the Riksbank's experiences to illustrate the challenges in making forecasts of the development of the krona and the effect it has on inflation.

Figure 2 shows the Riksbank's forecasts for the krona on publication of the July Monetary Policy Report every year since 2007. The forecasts have not been especially accurate, particularly not over the last five-six years. When the krona depreciated heavily during the global financial crisis of 2008–2009, the Riksbank expected that the depreciation would be temporary and would soon reverse. This turned out to be a correct analysis, although the appreciation was even faster than expected. When the krona again depreciated around 2014, it was expected that this depreciation would also soon reverse. This was the case even though the krona, in retrospect, seems to have been unusually strong before this depreciation started.

To be able to explain the reasons behind these forecast errors, it is helpful to understand how the exchange rate forecasts are made. The Riksbank's krona forecasts assume that the real exchange rate, that is the level of prices abroad compared to the level in Sweden, after conversion to a common currency, tends to move towards an equilibrium level.⁴ In light of this, the Riksbank's forecast errors could be explained by one or more of the following three factors:

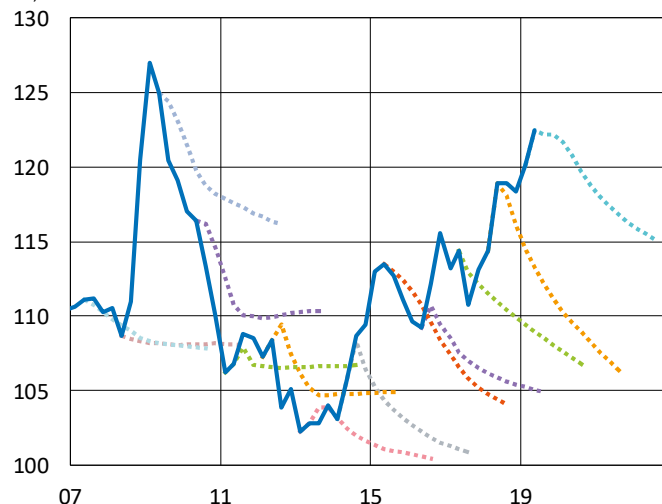
- incorrect assessments of the real equilibrium level,
- incorrect assessments of the way the krona will move towards the equilibrium level,
- or
- unexpected events affecting how the krona exchange rate moves in relation to its equilibrium level.

⁴ The real exchange rate is defined as the nominal exchange rate multiplied by the ratio between the foreign price index and the domestic price index. The research literature says that a good starting point for forecasts is that the real exchange rate a few years ahead will return to an equilibrium level; see, for example, Ca' Zorzi and Rubaszek (2018). This is also confirmed by the Riksbank's own forecast evaluations; see Askestad et al.

We discuss these individually below.

Figure 2. Selection of the Riksbank's krona forecasts over the years 2007–2019

KIX, index 18 November 1992 = 100



Note. Quarterly data. The broken lines show the Riksbank's forecasts in July of each year. The forecasts for the years 2007–2011 refer to the exchange rate aggregate used at that point (TCW), after reindexing to the same level as the KIX. The development of the exchange rate only differs marginally between KIX and TCW over the period covered by these forecasts.

Source: The Riksbank

It is difficult to assess the krona's real equilibrium level

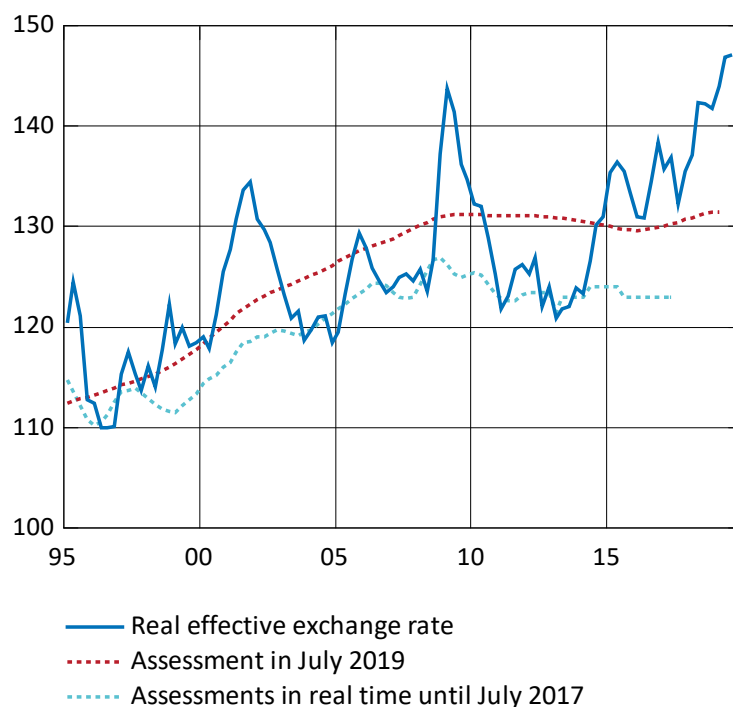
The equilibrium real exchange rate cannot be observed but must be estimated. This estimate is based on economic theory and thereby on certain assumptions concerning which factors determine the level of the equilibrium real exchange rate and how. In addition to this, methods are used that make it possible to obtain estimates of the equilibrium real exchange rate based on the assumed relationships and available data.⁵ The theory, the available statistics and the methods of estimation are all sources of uncertainty in the assessment of the equilibrium exchange rate. Furthermore, new data can change the picture of past levels of the equilibrium exchange rate.

The Riksbank's historical assessments of the equilibrium real exchange rate are shown in Figure 3. For a number of years, assessments were close to the level the actual real exchange rate had at the end of 2013. When the krona depreciated after 2013, we thus concluded that the krona had become weaker than its equilibrium level and that it would soon appreciate. Moreover, as the krona continued to depreciate, our forecasts pointed to greater and greater future appreciations of the krona. With a few more years of data at our disposal and the support of new methods of estimation, the krona is now instead deemed to have been relatively strong around 2013. It is important to remember that this assessment is also highly uncertain. Nevertheless, it provides reason to believe that we have previously been wrong in our assessment of the equilibrium real exchange rate and that this has been a contributory factor in recent years' forecast errors.

⁵ For example, it is common to assume that the krona's equilibrium real exchange rate tends to appreciate when productivity growth is stronger than it is abroad and when the development of world market prices for the goods and services that Sweden exports and imports is favourable. See also Sveriges Riksbank (2019c).

Figure 3. Historical assessments of the equilibrium real exchange rate

Real KIX, index 18 November 1992 = 100



Note. Quarterly data.

Source: The Riksbank

Difficult to assess the way the krona will move towards its equilibrium level

Once an assessment of the real exchange rate's equilibrium level has been made, one must also determine the rate at which the exchange rate will approach the equilibrium level. What can reasonably be expected depends, in turn, on what is assessed to lie behind the deviation in question. For example, if the deviation can largely be explained by interest rate differentials that can be expected to persist for some time, there may be reason to expect a slower process than if the deviation had arisen because of temporary unease on the financial markets. In practice, however, it is difficult to determine why the krona is over- or undervalued in real time. The forecasts are therefore based on an assessment of how rapidly the exchange rate usually approaches the equilibrium level. Until this year, the Riksbank had expected this to proceed relatively rapidly, which has also contributed to the forecast errors being large.

The ongoing review of the methods used by the Riksbank to analyse and forecast the development of the exchange rate includes work on improving the analysis behind the assessments of the equilibrium real exchange rate, finding the pattern of adjustment to the equilibrium level that gives the best forecasts and identifying, to a greater extent, the factors behind the deviations from the equilibrium level.⁶ Part of this work has already had some impact on the Riksbank's exchange rate forecasts. For example, the exchange rate is now expected to remain at or close to its current level for a year, after which it will slowly start its adjustment towards the equilibrium level, as reflected by the most current of the forecasts shown in Figure 2.

⁶ One example of this is Askestad et al. (2019). Further contributions are being worked on and will be published over the coming months.

Unexpected events affecting the krona exchange rate

Even if the assessments of the equilibrium level and the adjustment towards this were well-balanced, forecast errors could still be significant. The reason for this is that economic conditions continually change in a way that causes developments to diverge from the forecasts. These changes can be driven by events closely related to the actual determination of the exchange rate, such as participants on the financial markets changing their assessment of the risk of holding assets in kronor instead of other currencies. In general, though, they are likely due to events related to the business cycle that simultaneously affect many other variables, such as changing conditions for international trade. Recent years' forecast errors have probably largely been due to such events, which have led the exchange rate to move in unexpected ways, often in the opposite direction from the forecasts. We discuss the krona in relation to other variables in the following sections.

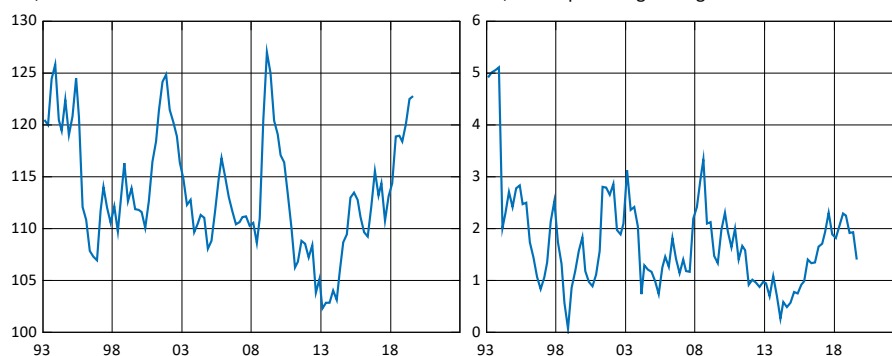
The krona and inflation – a complicated relationship

It has been difficult to make forecasts for the krona exchange rate and it remains very difficult to predict the extent to which the krona will appreciate or depreciate in the period ahead. At the same time, it is important for the Riksbank to be able to understand and make reasonable forecasts for the development of the exchange rate, as krona movements, to some extent, affect inflation. Inflation in Sweden and the krona exchange rate have largely followed each other in recent decades, as can be seen in Figure 4. For example, inflation started to fall in 2011 and was very low during the period around 2013 when the krona was at its strongest. The krona then started to depreciate more or less at the same time as inflation steadily rose, from its lowest point in 2014 to the two per cent target, where it has remained since 2017.

Figure 4. The krona exchange rate and inflation during the inflation-targeting regime

KIX, index 18 November 1992 = 100

CPIF, annual percentage change



Note: Quarterly data.

Sources: Statistics Sweden and the Riksbank

The depreciation of the krona and rising inflation of recent years have thus coincided. However, it is not straightforward to use this observation to draw conclusions on the exchange rate's pass-through to inflation, that is the extent to which consumer prices move when the exchange rate changes.⁷

Inflation not surprisingly high, despite the unexpectedly weak development of the exchange rate

The Riksbank's forecast errors can serve as an illustration in this regard too. Considering that the exchange rate, since 2014, has consistently come out at surprisingly weak levels, it would

⁷ In this Commentary, we focus primarily on the impact on consumer prices. See Sveriges Riksbank (2018b) for a more comprehensive review of the pass-through from the krona to inflation.

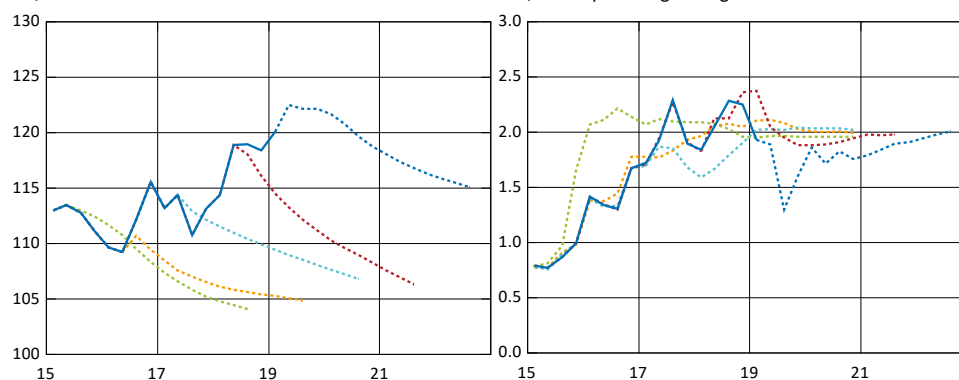
be reasonable to expect inflation, at the same time, to have been surprisingly high. However, this has not been the case. Instead, inflation has largely been in line with the Riksbank's forecasts; see Figure 5. This could be due to exchange rate pass-through having been unexpectedly weak over this period. It could also be the case that the development of prices, apart from the price movements driven by the exchange rate, has been weaker than expected.

A closer look at recent years' price growth in various product groups could provide some clues about the exchange rate pass-through. Prices for many goods with large import content have risen faster than normal, which is what might have been expected given the depreciation of the krona. However, at the same time, prices for clothes, shoes and foreign travel, for example, which normally tend to covary with the exchange rate, have increased unusually slowly given the development of the krona.⁸ Overall, price growth within the different product groups indicates that prices have moved with the exchange rate, albeit to a lesser extent than was previously normal.

Figure 5. Inflation in line with the Riksbank's forecasts

KIX, index 18 November 1992 = 100

CPIF, annual percentage change



Note. Quarterly data. The broken lines show the Riksbank's forecasts in July of each year

Sources: Statistics Sweden and the Riksbank

The other factor contributing to inflation being close to the forecast at the same time as the exchange rate has become significantly weaker is that other variables that are important for inflationary pressures have developed less strongly than the Riksbank predicted. For example, inflation abroad, not least in the euro area, has been lower than expected by the Riksbank and other analysts. The relationship between inflation in Sweden and inflation abroad is complicated and, like other economic correlations, depends on the driving forces behind the fluctuations. However, it is reasonable to assume that low inflation abroad affects Swedish inflation negatively to some extent, as it implies that import price inflation becomes lower. Another surprise has been the weak growth of wages in light of recent years' high resource utilisation. A strong labour market usually goes hand in hand with high wage increases, but, over the last five-year period, this connection has not been as clear. These factors have thus contributed to inflationary pressures being lower than expected. At the same time, monetary policy has been adjusted to the development of inflationary pressures and the repo rate has thereby become lower than in our forecasts over the entire period. This has also driven part of the development of inflation and the exchange rate.

⁸ See Sveriges Riksbank (2019d).

The relationship between the exchange rate and inflation depends on the development of the economy at large

The reasoning above illustrates that the relationship between the exchange rate and inflation cannot be understood independently of the development of the rest of the economy. We therefore need analyses of general equilibrium, which take into account that everything is interrelated and identify the underlying driving forces that simultaneously affect both the exchange rate and other macroeconomic variables. Earlier analyses of this kind by the Riksbank show that the development of inflation after a change in the krona exchange rate can vary heavily.⁹ A depreciation of the krona does not always have to coincide with rising inflation. What happens depends on what lies behind it – lower demand can, for example, yield both a weaker krona and lower inflation. It is thus possible to have significant forecast errors in the exchange rate but not in inflation, or vice versa. Seen over a longer period, the estimated exchange rate pass-through to aggregate inflation in Sweden is, on average, low.

However, even in a general equilibrium model, it can be difficult to capture everything of significance for the relationship between the exchange rate and inflation. This applies, not least, when structural changes take place in the economy. Sweden has an extensive foreign trade and Swedish companies' production structures are globally integrated. This means that exchange rate fluctuations can also have significant consequences for the cost of intermediate goods and services. Changes in global production and trade patterns can therefore be significant for the effects a fluctuation in the exchange rate may have on inflation. Changes in which currencies are used for invoicing of exports and imports can also be important for exchange rate pass-through. Other structural changes, such as digitalisation, also affect the patterns by which companies set their prices.¹⁰

In times of structural transformation, it is a challenge to understand and capture, in economic models, how companies set prices. At the same time, this is a key factor when it comes to predicting the connection between the exchange rate and inflation. Data analyses and economic models offer important insights. Apart from these, the Riksbank's Business Survey also forms an important source of relevant information about how companies set prices.

Interviews with companies provide important insights into how the exchange rate affects prices

The Riksbank conducts regular interviews with Swedish companies to gain deeper insights into their competitive situation, demand and pricing. In these surveys, one of the questions that the companies have been asked is how the exchange rate affects their pricing. In recent years, the companies have signalled that the competitive situation has prevented them from raising prices, even though costs for imported input goods have increased as the krona has depreciated.¹¹ In other words, the weakening of the exchange rate in recent years has had a normal pass-through to producer prices on the whole, while the adjustment of prices facing consumers has been smaller than normal.

However, the fact that this has been the situation in recent years does not mean that exchange rate fluctuations cannot have a considerable effect on consumer prices. Responses from companies suggest a tendency to allow exchange rate fluctuations to influence pricing to the extent that they are large and are expected to last. The research literature also

⁹ See Corbo and Di Casola (2018). Similar studies have been conducted using data, for example, for the United Kingdom and the euro area by Forbes et al. (2018) and Comunale and Kunovac (2017), respectively.

¹⁰ See Georgiadis and Gräß (2019) for discussions of how global value chains affect exchange rate pass-through to prices. See Campa and Goldberg (2005) and Casas et al. (2017) for discussions of the importance of invoicing currencies on pass-through. Possible effects of digitalisation on pricing and inflation are discussed in Sveriges Riksbank (2015) and Sveriges Riksbank (2018c).

¹¹ See Sveriges Riksbank (2019b).

suggests that pricing is primarily affected by large exchange rate fluctuations. There are studies that show that exchange rate pass-through tends to be non-linear in the sense that the pass-through to inflation is greater following large movements in the exchange rate than it is following small ones.¹² In other words, inflation does not just move more in absolute terms but also responds more strongly in relative terms to larger exchange rate fluctuations. Small exchange rate fluctuations thereby have small and short-lived effects on prices, or none at all, while larger and more persistent fluctuations can have a significant impact on pricing.

Perspectives on the krona and monetary policy

Since Sweden abandoned the fixed exchange rate regime at the end of 1992, price stability in the form of an inflation target of two per cent has been the principal objective for monetary policy in Sweden. The exchange rate thus cannot be, and is not, an objective for monetary policy. In a world of free capital movement and in the presence of an inflation target, it is unavoidable that the exchange rate will fluctuate and be determined by the market. However, as we discussed above, the exchange rate is important for the economy in general and inflation in particular.

The link between the krona and monetary policy goes via inflation

Normally, the exchange rate is taken into account by monetary policy in an indirect manner, through its effects on inflation. Some exchange rate fluctuations stem from factors such as changes in risk assessment among participants on the financial markets, and monetary policy may then have to react to the effects on inflation these entail. However, the exchange rate is also normally affected by how monetary policy develops in Sweden in comparison to other countries. Repo rate increases normally lead to a stronger krona and cuts to a weaker one, with ensuing effects on inflation. This so-called exchange rate channel forms part of how monetary policy works.

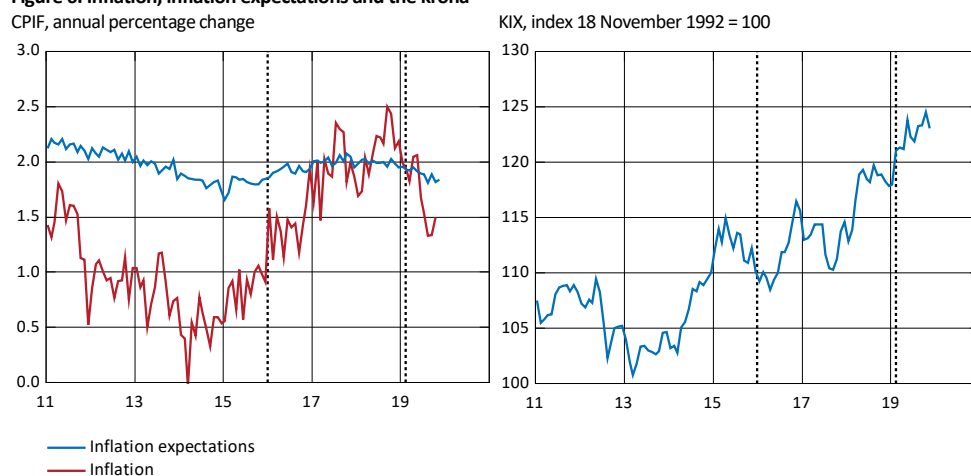
When pass-through to inflation is normal, no special focus is needed on the development of the exchange rate. However, as pass-through varies in force and over time, it can sometimes be justifiable to attach particular importance to the effects that the exchange rate has on inflation. When exchange rate fluctuations are large and sudden, the impact on inflation can be more substantial than normal. The impact of the exchange rate can also temporarily be of greater significance for monetary policy if inflation or inflation expectations deviate more substantially from the target. In such a situation, further deviations may risk undermining the role of the inflation target as nominal anchor.

Increased attention to the exchange rate's effects on inflation during the years 2016–2018

During the period 2016–2018, the Riksbank took account of the possibility that a larger exchange rate fluctuation could have a major impact on inflation and raised its preparedness to intervene on the foreign exchange market.¹³ At the start of 2016, after a series of repo rate cuts to negative levels and large asset purchases with the aim of pushing down rates on longer maturities, inflation had started to recover slightly from its historically low levels. However, long-term inflation expectations remained low and displayed a downward trend; see Figure 6. The Riksbank's assessment was that a large and excessively rapid appreciation of the krona in this situation could break the upward trend that was starting to be seen in inflation.

¹² See, for example, Ben Cheikh (2012) and Bussière (2013).

¹³ At an extraordinary monetary policy meeting on 4 January 2016, the Executive Board of the Riksbank took the decision needed to be able to intervene instantly on the foreign exchange market, as a complementary monetary policy measure to safeguard the rise in inflation. As of the second six months of 2018, the Riksbank's communication has gradually placed less emphasis on the exchange rate. This mandate ceased to apply in February 2019.

Figure 6. Inflation, inflation expectations and the krona

Note. Monthly data. The inflation expectations refer to money market players' survey responses about CPI inflation in 5 years. The broken vertical lines mark the period in which the Riksbank had heightened readiness to make foreign currency interventions.

Sources: Kantar Sifo Prospera, Statistics Sweden and the Riksbank

However, the krona did not appreciate substantially during this period and the Riksbank therefore never intervened on the foreign exchange market. Instead, the krona depreciated. One possible explanation for this could be the uncertainty that has characterised the development of global trade policy and the global economy for some time, but the depreciation could also partly be due to monetary policy gradually having become more expansionary. During this period, the development of underlying inflation was weaker than expected and, on a number of occasions, the Riksbank adjusted its forecasts for the repo rate downwards.

Monetary policy may thus have contributed to the weakening of the krona during the period when the Riksbank had a heightened readiness to make foreign currency interventions. But the weakening over the last year is more difficult to explain with reference to monetary policy. There has been no reason to expect the Riksbank to yet again raise its readiness to intervene on the foreign exchange market as both inflation and long-term inflation expectations have been close to the inflation target for some time. In addition, over the last year, the repo rate has been raised slightly in comparison to other countries' interest rates, which normally suggests a stronger krona. It is possible that international developments have played a part also in the continued depreciation of the krona. So far, however, it is difficult to say precisely why the krona is weak at present.

The work of improving the forecasts for the krona continues

It is very difficult to make exchange rate forecasts and, for some periods, it is a challenge even to explain afterwards what has caused a change in the exchange rate. Having said that, there is reason to continue to strive for a better understanding of what drives the krona exchange rate, how it can be forecast and how it interacts with inflation.

In recent years, the Riksbank and other analysts have repeatedly been surprised by the development of the krona. It remains difficult to say with certainty why the krona is weak at present. Work is under way at the Riksbank to gain a better view of this, as well as to develop our assessment of the equilibrium level of the real exchange rate and of how the adjustment of the krona exchange rate to the equilibrium level can be expected to proceed. This work has already left its mark on the Riksbank's current forecasts. Time will tell how accurate these

will be, what will cause the unavoidable forecast errors and which improvements of analyses and assessments the remaining work will result in.

The krona matters for monetary policy through its influence on inflation, as monetary policy in Sweden has an inflation target. The exchange rate thus cannot be, and is not, a target for monetary policy. However, the exchange rate is important for the economy in general and inflation in particular. The Riksbank will therefore continue to regularly analyse and carefully monitor the development of the exchange rate and its effects on the Swedish economy.

References

- Askestad, E., A. M. Ceh, P. Di Casola and A. Ristiniemi (2019), “Forecasting the krona”, Economic Commentary no. 12, Sveriges Riksbank.
- Ben Cheikh, N. (2012), “Non-linearities in exchange rate pass-through: Evidence from smooth transition models”, *Economics Bulletin* 32, pages 2530-2545.
- Bussière, M. (2013), “Exchange Rate Pass-Through to Trade Prices: The Role of Nonlinearities and Asymmetries”, *Oxford Bulletin of Economics and Statistics* 75, pages 731-758.
- Campa, J. and L. Goldberg (2005), “Exchange Rate Pass-Through into Import Prices”, *The Review of Economics and Statistics* 87, pages 679-690.
- Casas, C., F. J. Díez, G. Gopinath and P.-O. Gourinchas (2017), “Dominant Currency Paradigm: A New Model for Small Open Economies”, Working paper 264, International Monetary Fund.
- Ca’ Zorzi, M., and M. Rubaszek (2018), “Exchange rate forecasting on a napkin”, Working Paper 2151, European Central Bank.
- Comunale, M. and D. Kunovac (2017), “Exchange rate pass-through in the euro area”, Working Paper 2003, European Central bank.
- Corbo, V. and P. Di Casola (2018), “Conditional exchange rate pass-through: evidence from Sweden”, Working Paper 352, Sveriges Riksbank.
- Forbes, K., I. Hjortsoe and T. Nenova (2018), “The shocks matter: Improving our estimates of exchange rate pass-through”, *Journal of International Economics* 114, pages 255-275.
- Georgiadis and Gräßl (2019), “Global value chain participation and exchange rate pass-through to export and import prices”, Economic Bulletin 5/2019, European Central Bank.
- International Monetary Fund (2019), Regional Economic Outlook Europe: Facing Spillovers from Trade and Manufacturing November 19.
- Sveriges Riksbank (2015), “Digitalisation and inflation”, article in Monetary Policy Report, February.
- Sveriges Riksbank (2018a), “1976 – Wave of devaluations starts”, available at <https://www.riksbank.se/sv/om-riksbanken/historia/1900-1999/devalveringsvagen-inleds/>
- Sveriges Riksbank (2018b), “The significance of the krona for inflation”, article in Account of monetary policy.
- Sveriges Riksbank (2018c), The Riksbank’s Business Survey, May.
- Sveriges Riksbank (2019a), Minutes of the Executive Board’s Monetary Policy Meeting, April.

Sveriges Riksbank (2019b), The Riksbank's Business Survey, May.

Sveriges Riksbank (2019c), "Trend development of the Swedish krona", article in Monetary Policy Report, July.

Sveriges Riksbank (2019d), Monetary Policy Report, October.