ARTICLE – Trend development of the Swedish krona

The krona's nominal exchange rate in competitiveness-weighted terms (measured using the krona index KIX) is on approximately the same level today as it was in 1993, the first year with a variable exchange rate. Against some specific currencies, the krona is weaker than in 1993, but against other currencies it is on a level close to or stronger than it was 25 years ago. However, the krona exchange rate has weakened considerably against many currencies in recent years, and, if the development of prices and costs in national currencies is simultaneously taken into account, the krona is currently weak according to most measures. The real krona exchange rate showed a weakening trend for several decades, approximately until the global financial crisis. This development can be explained by weaker productivity in Sweden than in other countries during a period and periodic deterioration in Sweden's terms of trade. During the 2010s, different measures of the real exchange rate provide a divided picture of the krona's development. But the overall view is nevertheless that the krona is weak at present and can be expected to become stronger in the period ahead as interest rates rise more in Sweden than abroad and uncertainty over global trade policy abates. However, there is significant uncertainty over how large, how rapid and how soon an appreciation of the krona could be. The Riksbank is therefore continuing with its analytical work to shed light on and better understand the development of the krona.

Is the krona weak?

The recent depreciation of the Swedish krona has provoked an intensive debate. However, the recent depreciation of the krona exchange rate need not necessarily mean that it is fundamentally weak. The depreciation could also mean that the krona is returning to a more normal level after a temporary period of being unusually strong. For example, the Swedish krona has depreciated by 11 per cent against the Norwegian krone since the first quarter of 2016 but, over the year before that, it had appreciated to the same extent. At present, the exchange rate against the Norwegian krone is at the same level as in 1993, the first year with a variable exchange rate. At the same time, the krona has weakened by about 15 per cent against the euro and by around 45 per cent against the Swiss franc.

Making a more universal statement over the development of the krona exchange rate thus means balancing a number of different currencies. This is done in KIX (the krona index), which weighs a number of bilateral exchange rates on the basis of how significant they are for Sweden's foreign trade. According to KIX, the krona is currently on about the same level as in 1993, when the krona had just depreciated by 20 per cent in conjunction with the introduction of variable exchange rates. However, KIX includes a number or emerging market economies that have been given increasing weights due to their growing significance for world trade. On average, the emerging market economies have had comparatively high inflation and

thus weak exchange rate development, as exchange rates tend to adjust themselves so that prices for goods and services that are traded internationally do not differ too much from country to country. Against the currencies of more similar countries, the krona has depreciated in nominal terms since 1993 and much of this depreciation has taken place in recent years.

The real exchange rate – a comparison of price levels in common currency

It has been pointed out in the debate that, because of the development of the exchange rate, a Swedish krona buys fewer and fewer goods and services abroad compared with in

Figure 4:20. Real KIX divided into nominal KIX and price level difference
Index 18 November 1992=100

Legend:
— Real KIX
— Nominal KIX
■ Price level difference in national currencies

Source: The Riksbank
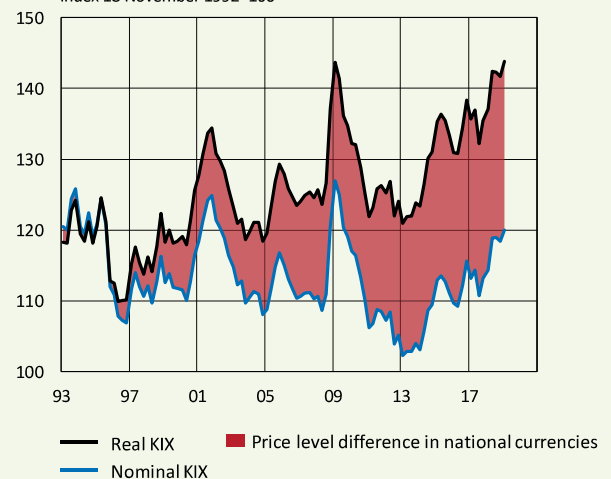
Sweden. For many reasons, this is also the most relevant kind of comparison to make – between price levels in common currency. This comparison is generally referred to as the real exchange rate and is defined as the product of the nominal exchange rate and the ratio between a foreign and domestic price index.[18]

By comparing the CPIF for Sweden and similar price indices for the countries included in KIX, the measure usually representing the krona's real exchange rate, the real KIX, can be obtained. Figure 4:20 shows how this index has developed since 1993, divided into development in nominal KIX and the difference in price levels. It clearly indicates that the nominal KIX is on the same level as in 1993 but that a growing price level difference has made the krona weaker in real terms, as inflation in Sweden has been lower than abroad.

Different measures of the real exchange rate
This picture of how the difference in price levels has developed is based on the consumer price index. However, it is not necessarily the most appropriate way of measuring the real exchange rate, partly because index structures and measurement methods differ among countries. Another consumer-price-based alternative is to construct a real exchange rate based on the purchasing power parity (PPP) statistics compiled by the OECD and Eurostat in order to compare real income levels in different countries. The advantage of these PPP data is that they are based on comparisons of prices of identical products, although the data set is narrower than common consumer price indices and is updated significantly less frequently and with a greater delay.[19]

Another possibility is to use the GDPdeflator which is intended to capture the price level of the total output in each country. It is also possible to use costs instead of prices, and calculate the real exchange rate based on the unit labour cost in different countries. Use of this method avoids variations due to changes in companies' price mark-ups and alleviates the difficulties with comparability that can be caused by the way in which consumer price indices are constructed. At the same time, the unit labour cost captures the labour cost and not the total cost of a produced unit, which can affect the picture of the relative price level if the profit share were to develop differently in Sweden and abroad. In contrast to consumer prices, the GDP deflator also includes prices of goods and services that do not go to private consumption (for

example exports and investments), and excludes prices of imported goods and services.

Trend depreciation of the real exchange rate up until the financial crisis
Figure 4:21 shows real effective – i.e. trade-weighted – exchange rates for Sweden up until the end of 2018 based on these various measures.[20] The real exchange rate calculated using the consumer price index and the GDP deflator gives the impression that the depreciation since 2012 is a continuation of a trend that has been ongoing since the 1970s. The other measures also indicate a trend depreciation of the krona's real exchange rate. However, the trend for these measures is less obvious after 1993.

Figure 4:21. Different measures of the Swedish real effective exchange rate
Index 1995=100, annual data up to and including 2018

| Consumer price index | Unit labour cost |
| PPP | GDP deflator |
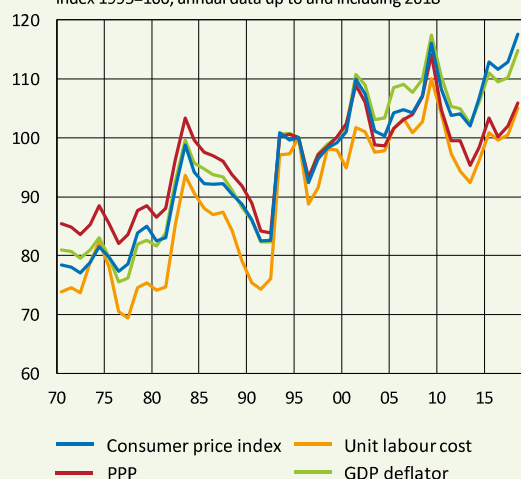
Note. The names specify which price or cost measure has been used to deflate the real exchange rate. There are no data for certain measures for certain countries prior to 1995. The sample is limited to countries and years in which there are data available for the measures based on the consumer price index, PPP and GDP deflator. The real exchange rate based on unit labour costs is an inverted and reindexed version of the OECD's "Competitiveness Indicator, Relative Unit Labour Costs, Overall Economy".

Sources: OECD, World Bank and the Riksbank

The differences between the measure that uses the consumer price index and those based on unit labour costs and PPP data can partly be an expression of differences in the price measurement methods that form the basis for each country's consumer price index. The fact that the development differs between the consumer price index and unit labour costs can also in part reflect that domestic output has a different composition to domestic consumption.

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[18] $Real\ exchange\ rate = Nominal\ exchange\ rate \times \frac{Foreign\ price\ index}{Domestic\ price\ index}$.

[19] PPP stands for Purchasing Power Parity. Significantly fewer products are used in the construction of PPP data than in the construction of consumer price indices and for each individual sub-index, prices are only collected every third year. The data used here are based on the aggregation of prices referred to as "purchasing power parities for private consumption". Bilateral real exchange rates in relation to the United States and the euro area calculated on the basis of these data were shown in the

article "Development of the Swedish krona in the longer term" in Monetary Policy Report, October 2018.

[20] To make the presented measures of the real exchange rate as comparable as possible, some of the emerging market economies included in KIX have not been weighed in before 1995. Data are also missing for the euro area as a whole prior to 1995 and have been replaced by an aggregate of a smaller group of countries. Overall, this mean 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.

PPP data also make it possible to directly ascertain whether the krona is strong or weak as the comparison refers to the same basket of goods in Sweden and abroad. If the identical basket were more expensive in Sweden, the krona could be said to be strong, and vice versa if the basket is cheaper. During 2018, the Swedish price level measured in this way was about 20 per cent lower than in Norway but around 15 per cent higher than in the euro area and about 10 per cent higher than in the United States.

What can explain the trend in the krona's real exchange rate?

Overall, the various measures indicate a depreciating trend in the krona's real exchange rate since the 1970s, but one which seems to be less obvious since 1993, depending somewhat on which measure is given the greatest weight. What can explain this trend?

In traditional economic theory, a trend depreciation of a country's real exchange rate is normally explained by slower productivity growth at home than abroad or by a trend deterioration in the country's terms of trade.[21]

Relative productivity growth is normally reflected in the development in GDP per capita relative to other countries. Between 1970 and 1993, GDP per capita grew more slowly on average in Sweden than in the KIX-weighted countries (see Figure 4:22). This may be an important cause of the depreciation in the real krona exchange rate during this period. After that followed a ten-year period of relatively rapid growth in Swedish GDP per capita. Between 2006 and 2009, Swedish GDP per capita fell back slightly relatively to other countries and has since then been largely unchanged compared with the KIX countries as a whole.

The period of relatively high Swedish productivity growth between 1998 and 2006 coincided in the main with a clear deterioration in the Swedish terms of trade (see Figure 4:22). The terms of trade for a small, open economy like Sweden's are mainly dictated by global market prices. They can in turn be determined by supply factors such as technological development or raw material deposits. The most obvious examples of countries whose exchange rates covary considerably with the country's terms of trade are those whose production and exports are strongly orientated towards individual raw materials. But even with other production patterns, trends in a country's export prices and

import prices, that are important for the exchange rate, can arise. The deterioration in the terms of trade that occurred between 1998 and 2006 affected both Sweden and a few other countries, including Finland and South Korea, that export high-tech products with fast technological development and hence rapidly falling costs and prices.[22]

Figure 4:22. Sweden's terms of trade and GDP per capita relative to other countries
Index 1995=100, annual data up to and including 2018 (for GDP per capita in 2017)

— Sweden's terms of trade
— Sweden's GDP per capita relative to the KIX
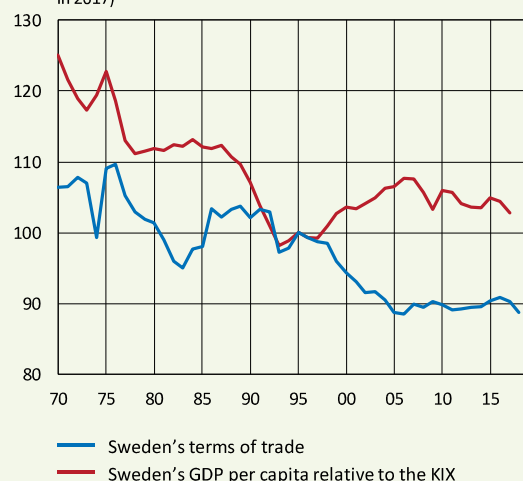
Note. The aggregate weighting of the KIX countries' GDP per capita has been done using the same sample of countries and years as those described in the note to Figure 4:21 and in footnote 20.

Sources: IMF and World Bank

In summary, the trend depreciation of the real exchange rate in 1970–1993 is compatible with the trend development of traditional explanatory variables during the same period. The continued krona depreciation between 1998 and 2006 coincided with an increase in GDP per capita relative to other countries of 5 per cent but a simultaneous deterioration in the terms of trade of about 10 per cent. The reason for a continued depreciation of the real exchange rate up until 2009 could be that GDP per capita fell back relative to other countries between 2006 and 2009, but after that, it is difficult to find support in traditional explanatory variables for a weakening trend – or equilibrium level – in the real krona exchange rate. [23]

The development of Sweden's foreign trade (and other international transactions) should also be linked to the exchange rate. Starting at the beginning of the 1990s, the

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[21] When productivity development is faster than abroad, wage growth and ultimately the prices of such goods and services that are not traded internationally should be higher. This is a crucial link in the reasoning behind the "Balassa-Samuelson Hypothesis", which posits that the real exchange rates of economies with relatively rapid productivity growth can be expected to appreciate. Terms of trade are defined as the ratio between the export price index and the import price index. See further M. Berka, M. B. Devereux, and C. Engel (2018), "Real Exchange Rates and Sectoral Productivity in the Eurozone", *American Economic Review* 108(6): 1543–1581.
[22] The Export Inquiry (SOU 2008:90) ascertained in 2008 that "an important explanation for the decline in the terms of trade is that Sweden's economy is specialised in high-tech industries, the rapid technological development of which is leading to cost reductions and product price falls. In addition, many Swedish

companies operate in specialist market segments in which an increase in supply from Sweden quickly leads to reduced prices."
[23] The literature identifies a number of additional factors that can affect real exchange rates at least temporarily, including the level of public consumption, trade barriers and demographic factors. A review of such variables and estimates of the real effective exchange rates of 48 countries can be found in L. A. Ricci, G.M. Milesi-Ferretti, and J. Lee (2008), " Real Exchange Rates and Fundamentals: A Cross-Country Perspective", IMF Working Paper 08/13. However, a preliminary review in relation to the euro area indicates that the changes in these variables over the last few decades have been so minor that they can only have had a marginal impact on the real exchange rate in relation to the euro.

Swedish current account first increased from a deficit of 1 per cent of GDP in 1993 to a surplus of 8 per cent in 2006. Since then, the surplus has gradually fallen (See Figure 4:11). There is no simple correlation between the current account and the exchange rate but one hypothesis that forms the basis of parts of the IMF's recurring analysis of the degree of under- and overvaluation of various currencies posits that the more in balance foreign trade is, the closer the real exchange rate is to its long-term equilibrium level.[24]

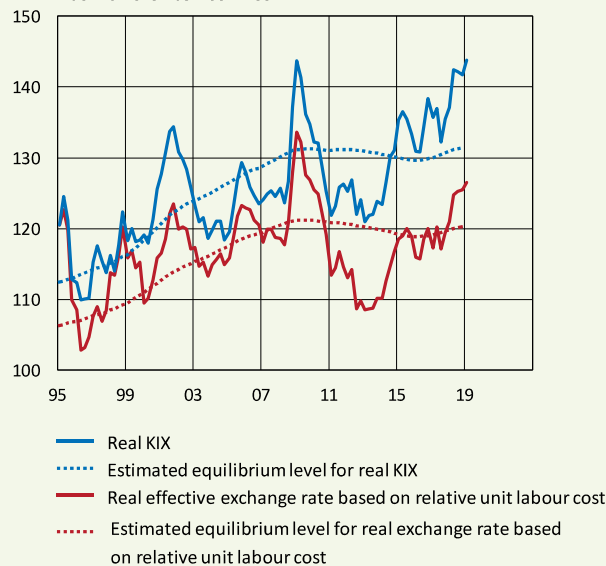**The development of the real exchange rate in an empirical model**

It is clear from the reasoning above that there are periods when the development in traditional explanatory variables drags the real exchange rate in different directions. This is an argument in favour of using an empirical model to weigh together the impact of various factors on the real exchange rate. The Riksbank regularly uses a time series model with time-varying equilibrium levels in order to simultaneously explain the equilibrium level of the real exchange rate and its deviations from this equilibrium level. A combination of the estimated trend in relative GDP per capita and the estimated trend in the terms of trade is assumed to explain the equilibrium level. At the same time, the current account balance and differences in relation to other countries in short-term and long-term interest rates are assumed to be behind the deviations of the exchange rate from the equilibrium level. The model is estimated using data from 1995 onwards, both on real KIX and on the krona's real exchange rate based on relative unit labour cost. Real KIX and the krona's real exchange rate based on relative unit labour cost, as well as the estimated equilibrium levels are reproduced in Figure 4:23.

According to these estimates, using both real KIX and relative unit labour cost, the clear trend deterioration in the terms of trade between 1998 and 2006 affects the krona exchange rate more than the relatively limited increase in relative GDP per capita that took place during the same period. This explain the depreciation of the krona's estimated equilibrium level during this period (see Figure 4:23). As both the terms of trade and relative GDP per capita have been largely unchanged since then, no major changes in the estimate equilibrium level have occurred either.

With the estimate of how the equilibrium level has developed also follows a picture of when the krona was stronger or weaker than its real equilibrium level. If we focus on the period since the global financial crisis, we see that the krona was weak according to both measures during the most intensive phase of the financial crisis in 2009. This was a period when the financial markets and the global economy were characterised by very considerable uncertainty – not

least with regard to the economies of the Baltic countries, to which Swedish banks were significantly exposed.

Figure 4:23. Estimated equilibrium level for real exchange rate measured using two different measures
Index 18 November 1992=100

- ——— Real KIX
- ········ Estimated equilibrium level for real KIX
- ——— Real effective exchange rate based on relative unit labour cost
- ········ Estimated equilibrium level for real exchange rate based on relative unit labour cost

Source: The Riksbank

In the years after the financial crisis, the krona was strong. During this period, the economic situation stabilised in the Baltic economies and monetary policy moved in a less expansionary direction in Sweden than in many other countries. Since 2017–2018, the krona has once again been weak. At the same time, interest rates in Sweden have been low compared with those abroad and economic policy uncertainty has been unusually high, not least with regard to trade policy.

The krona today and in the future

In conclusion, we can note that there are important differences between different measures of the real exchange rate, but that there is a great deal to suggest that the krona is currently weaker than a long-term equilibrium level. The krona can therefore be expected to appreciate in the period ahead as interest rates in Sweden rise relative to other countries and the uncertainty surrounding global trade policy decreases. As the inflation rate in Sweden is expected to be approximately the same as in other countries, it is reasonable to predict that the adjustment will take place in the form of a strengthening of the nominal exchange rate.

Based on the current state of knowledge, however, it is very difficult to say just how large the krona appreciation can be expected to be, when it will start and how quickly it will happen. The Riksbank therefore intends to continue to contribute analyses that shed light on and increase understanding of the krona's development.

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[24] See, for instance, IMF, *2018 External Sector Report: Tackling Global Imbalances amid Rising Trade Tensions*, which presents the assessment that 2017 current

account surplus in Sweden exceeded the level that was compatible with fundamental factors and that this in turn indicated that the krona was undervalued.