

## ARTICLE – Development of the Swedish krona in the longer term

As the development of the krona affects inflation, it is important for the Riksbank to form an idea of the krona exchange rate going forward. Exchange rates vary substantially and the difficulty in making exchange rate forecasts is widely acknowledged, both over the short and long terms. But there is evidence that real exchange rates, which is to say nominal exchange rates adjusted for relative price levels, tend to move towards a more sluggish equilibrium level. The Riksbank therefore makes an assessment of this level, which functions as an anchor for forecasts of both the real and the nominal exchange rate. The current assessment is that the real exchange rate measured in terms of the krona index (KIX) will be within the interval of 120 to 135 five to ten years ahead, which is a weaker level compared with the previous assessment. This interval means that the krona can be expected to appreciate by about 5–15 per cent in real terms over the next five to ten years.

In an article in the Monetary Policy Report of July 2013, the Riksbank presented the assessment that the real krona exchange rate, measured in terms of the KIX index adjusted for the international consumer price level in relation to the Swedish price level measured in terms of the CPIF, could be expected to be in the interval 110–125 in the longer term.<sup>16</sup> Since then, the real krona exchange rate has weakened at the same time as there have been changes both in fundamental factors and in the estimates made by the Riksbank and other analysts. There is therefore reason to provide an updated picture of the Riksbank's assessment of the real exchange rate in the longer term.

Exchange rates vary substantially and it is widely acknowledged that they are difficult to forecast. A well-known and previously common conclusion is that it is not possible to make a better forecast for the future exchange rate level than the one obtained by simply assuming that the current level will prevail.<sup>17</sup> However, real exchange rates appear to be anchored at more sluggish levels

or trends.<sup>18</sup> The Riksbank's forecast for the development of the krona exchange rate is therefore based on an assessment of an equilibrium real exchange rate.

### Purchasing power parity as a starting point

A common basis for the assessment of the equilibrium exchange rate is purchasing power parity – that goods and services can be expected to cost the same in different countries after conversion to the same currency.<sup>19</sup> At relative purchasing power parity, the price levels in different countries are not necessarily the same, measured in the same currency, but the relationship between them is constant. Over time, the prices rise or fall by the same percentage in the different countries. If relative purchasing power parity prevails, the real exchange rate will be constant – when inflation is higher than in other countries, the nominal exchange rate depreciates, and vice versa.<sup>20</sup>

Figure 4:19 shows a few different measures of real exchange rates between the Swedish krona and the euro and the US dollar respectively.<sup>21</sup> Eurostat and the OECD regularly

<sup>16</sup> See the article "A long-term perspective on the krona" in the July 2013 Monetary Policy Report.

<sup>17</sup> See Meese, R. A. and Rogoff, K. (1983), "Empirical Exchange Rate Models of the Seventies: Do they fit out of sample?", *Journal of International Economics*, vol. 14, pp. 3–24.

<sup>18</sup> While nominal exchange rates can seemingly behave irrationally (see Bacchetta, P. and van Wincoop, E. (2018), "Puzzling Exchange Rate Dynamics and Delayed Portfolio Adjustment", Meeting Papers 675, Society for Economic Dynamics), there are now a number of studies indicating that the propensity of real exchange rates to gravitate towards the mean can be utilised to forecast both real and nominal exchange rates in the slightly longer term. See, for example, Engel, C., Mark, N. C., and West, K. D. (2008), "Exchange rate models are not as bad as you think", *NBER Macroeconomics Annual 2007*, vol. 22, pp. 381–441; Ca' Zorzi, M., Kolasa, M. and Rubaszeka, M. (2017): "Exchange rate forecasting with DSGE models", *Journal of International Economics*, vol. 107, pp. 127–146; Cheung, Y-W., Chinn, M. D., Pascual, A. G. and Zhang, Y. (2017), "Exchange Rate Prediction Redux: New Models, New Data, New Currencies", NBER Working Paper No. 23267; and Eichenbaum, M., Johannesen, B. K., and Rebelo, S. (2017), "Monetary Policy and the Predictability of Nominal Exchange Rates," Finance and Economics Discussion Series 2017–037, Board of Governors of the Federal Reserve System.

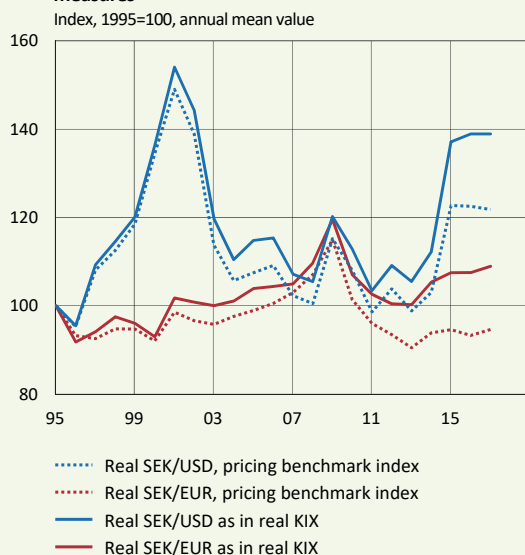
<sup>19</sup> The Economist's Big Mac Index is calculated on the price of a single product which has the advantage of being basically identical the world over. If a Big Mac costs the same in two different countries calculated in the same currency, it is seen as an indication that there is absolute purchasing power parity between these two countries. Occasionally, differences in Big Mac prices are also taken as an indication of the under or overvaluation of the currencies of the countries in question. For examples of this and more discussion of the Big Mac index, see The Economist (2018), "The Big Mac index", <https://www.economist.com/news/2018/07/11/the-big-mac-index>.

<sup>20</sup> For a more detailed account of theories and empirical research into purchasing power parity, see Froot, K. A. and Rogoff, K. (1995), "Perspectives on PPP and Long-Run Real Exchange Rates" in Grossman, G.M. and Rogoff, K. (eds.), *Handbook of International Economics Vol. 3*, Elsevier.

<sup>21</sup> The large fluctuations in the krona's real exchange rate against the dollar coincide with fluctuations in the nominal effective dollar exchange rate. The years around the turn of the millennium were characterised by several major phenomena and events that possibly had an impact on exchange rates, including the so-called IT bubble, the launch of the euro and the terror attack in the United States on 11 September 2001. A common explanation for the dollar appreciation in recent years is growing yield differentials between the US on the one hand and the euro area and Sweden on the other.

compile data on prices of carefully specified goods and services in different countries in order to obtain fully comparable measures of price levels. Bilateral real exchange rates calculated on the basis of these statistics (broken line) indicate that between 1995 and 2017, an appreciation of the krona's real exchange rate occurred in relation to the euro area and a depreciation occurred in relation to the United States. All in all, considering these countries' weights in KIX, this measure paints the picture of a reasonably constant level, over time, of the krona's real exchange rate until the end of 2017.<sup>22</sup> One interpretation of this is that the valuation of the krona in 2017 was in line with relative purchasing power parity.

**Figure 4:19. Bilateral real exchange rates according to different measures**

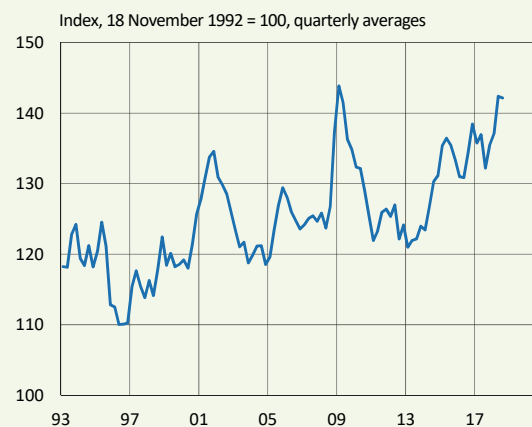


Sources: Eurostat, OECD and the Riksbank

Real exchange rates based on the countries' own consumer price indices (see the solid lines in Figure 4:20) paint a slightly different picture. This calculation method, which forms the basis of the real KIX index that the Riksbank uses in its analysis, gives the view that the real krona exchange rate over the period 1995–2017 weakened against both the euro and the dollar. It is not obvious what lies behind the differences between the two measures, but calculations of price levels are uncertain and methods of calculation can differ from country to country. It is therefore important to consider several different measures when assessing the long-term level. However, the Riksbank's exchange rate forecasts, and the measure we normally publish, concern the real KIX index. Diagram 4:20 shows that real KIX has varied greatly and has weakened since 1993. The average for real KIX since

the transition to a floating exchange rate regime at the end of 1992 is 125.

**Figure 4:20. Real exchange rate, KIX**



Sources: National sources, Statistics Sweden and the Riksbank

#### Driving forces behind trends in the real exchange rate

If the real exchange rate demonstrates long-term trends, which cannot be ruled out based on the development of real KIX, it may be misleading to use an average for a certain historical period when assessing the equilibrium rate. Instead, it is a matter of trying to understand what lies behind the long-term changes. Some of the possible driving forces behind trends in real exchange rates that play a prominent role in both the literature and the Riksbank's analytical tools are described below. But many things can influence the development of the exchange rate and it cannot be ruled out that other factors also play an important part.

One of the most common explanations for why price levels in a joint currency can develop differently in different countries assumes that productivity growth primarily occurs in production that is traded internationally.<sup>23</sup> Prices in this sector are determined internationally, but wages increase apace with productivity and push up wages, and ultimately prices, on goods and services not traded internationally. This, in turn, means that the price level rises more in countries with higher productivity growth and hence that the real exchange rate appreciates in countries that have higher productivity growth than their trading partners.

Productivity growth is roughly reflected in GDP growth per capita.<sup>24</sup> Figure 4:21 shows that Sweden's GDP per capita rose in relation to the KIX-weighted countries between 1993 and 2006. This would speak for an appreciation trend in the real krona exchange rate during that period, in contrast to the depreciation shown in Figure 4:20. A possible contributory reason could be that the increase in relative GDP per capita has been driven by relatively strong Swedish

<sup>22</sup> The same view appears if these real exchange rates are instead calculated with the aid of unit labour costs.

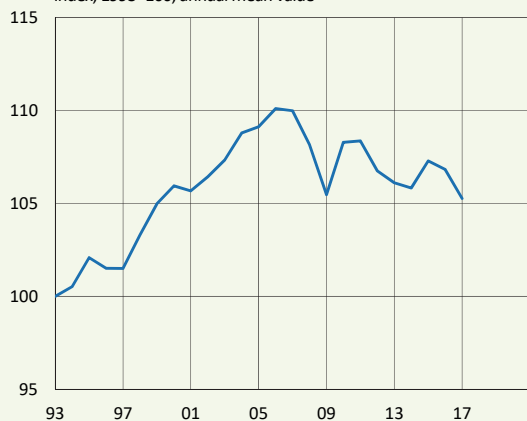
<sup>23</sup> This is also sometimes called the Harrod-Balassa-Samuelson effect. See R. Harrod (1933), *International Economics*, Cambridge University Press, B. Balassa (1964), "The Purchasing Power Parity Doctrine: a Reappraisal", *Journal of Political Economy* 72 (6),

pp. 584-596, and P.A. Samuelson (1964), "Theoretical Notes on Trade Problems", *Review of Economics and Statistics* 46 (2), pp. 145-154.

<sup>24</sup> The level of GDP per capita can, alongside productivity, capture income effects on labour supply (lower labour supply with higher incomes) that can push up wages and hence price levels in the economy.

productivity growth in the services sector – the output of which is traded internationally to a lesser extent – which has restrained price development in this sector and hence weakened the real exchange rate.<sup>25</sup>

**Figure 4:21. GDP per capita in Sweden in relation to KIX-weighted countries abroad**  
Index, 1993=100, annual mean value



Sources: The IMF and the Riksbank

Another possible reason for why real KIX did not appreciate with a rising ratio between GDP per capita in Sweden and abroad is that other factors may simultaneously have affected the real exchange rate in the opposite direction. Factors close at hand include, in addition to productivity, those that are relevant to how rich Sweden is compared with other countries, such as the terms of trade, i.e. the relationship between export prices and import prices expressed in Swedish krona. The more advantageous the terms of trade are in relation to other countries, i.e. the more Sweden receives in exchange for its exports, the stronger the real exchange rate is expected to be. Sweden’s terms of trade showed a weakening trend until the global financial crisis (see Figure 4:22). This can therefore help to explain a real krona depreciation trend over the same period.

**Figure 4:22. Sweden’s terms of trade**  
Index, 1993=100, quarterly values



Source: Statistics Sweden

In other words, the development of Sweden’s GDP per capita in relation to other countries and the terms of trade, respectively, seem to have affected the real exchange rate in opposite directions between 1993 and 2007. After this, these variables have fluctuated less and do not point to a clear weakening of the equilibrium real exchange rate in recent years.

**The current account balance and the real exchange rate**

Another perspective on the real exchange rate takes its starting point in the current account balance. This reflects how a country’s total saving relates to the total value of investments made there. During certain periods, a country’s saving can be relatively high and its investments relatively low. For saving to exceed investment, exports need to exceed imports and that requires a weak real exchange rate. If there is reason to believe that Sweden’s saving will decrease in the period ahead or that its investment demand will increase relative to other countries, there is also reason to expect a stronger future exchange rate.

Since the changeover to a floating exchange rate in late 1992, Sweden has had a current account surplus corresponding to an average of 5 per cent of GDP (see Figure 4:23). This is a comparatively large surplus in an international comparison and could be a sign that the krona will appreciate in the longer term. However, the current account surplus has declined considerably over the past ten years, down to around 3 per cent of GDP, which is an indication that there is now less scope for the krona to appreciate than before.

**Figure 4:23. Current account balance**  
Percentage of GDP, four quarter moving average



Source: Statistics Sweden

**The real exchange rate 5–10 years ahead**

It is not possible to observe the equilibrium real exchange rate. It is therefore difficult to determine how correct various assessments of this level have been and which method functions best. Table 4:1 therefore shows estimates of the

<sup>25</sup> For example, statistics from the ECB indicate that productivity growth in the service sector (measured as output per hour worked) since 1995 has been approximately twice as high in Sweden as in the euro area.

equilibrium real exchange rate with different assumptions, which all form the basis of the Riksbank's total assessment of an interval for the real exchange rate five to ten years ahead.

The Riksbank's own estimates of the equilibrium real exchange rate are made using models that at the same time explain the equilibrium real exchange rate based on trends in relative GDP (or GDP per capita) and the terms of trade as well as the deviation in the actual real exchange rate from the equilibrium rate with the net external position, the current account and interest rate differentials in relation to other countries.

The IMF makes annual assessments of normal levels of individual member countries' current account balances based on factors deemed important for saving and investment. If the current account balance exceeds the normal level, the conclusion is that the exchange rate is undervalued. The most recent estimate from the IMF means that Sweden's current account surplus in 2017 was larger than can be justified by fundamental factors in the medium term and that the krona is therefore undervalued and can be expected to strengthen.<sup>26</sup>

It cannot be ruled out that we are experiencing a trend towards an increasingly weak real KIX that is driven by something other than the development of the variables discussed above. Something indicating this is that real KIX weakened by over 10 per cent between 1995 and 2017, at the same time as other measures indicate that the real exchange rate has in principle remained unchanged over the same period. It may therefore be worth observing some measure of the trend development in the real KIX without taking account of any underlying driving forces. A so-called Hodrick-Prescott filter meets this criterion and, when applied to the annual average of the real KIX, including the Riksbank's forecast for the period until the end of 2021, it gives a current trend level of 135.

**Table 4:1. Estimates of the equilibrium real exchange rate and the Riksbank's assessment of the real exchange rate 5–10 years ahead**  
KIX, index 18 November 1992 = 100

Estimate	Equilibrium real exchange rate
Purchasing power parity <sup>27</sup>	125
Estimates using Riksbank models	122 – 129
IMF	122 – 135
Trend level, based on Hodrick-Prescott filter <sup>28</sup>	135
<b>The Riksbank's assessments</b>	<b>Real exchange rate 5–10 years ahead</b>
Interval published in 2013	110 – 125
<b>Current interval</b>	<b>120 – 135</b>

The different estimates of an equilibrium real exchange rate form the basis of the Riksbank's assessment of an interval for

the real exchange rate five to ten years ahead. The interval published by the Riksbank in 2013 and the new revised update of this interval are shown at the bottom of the table.

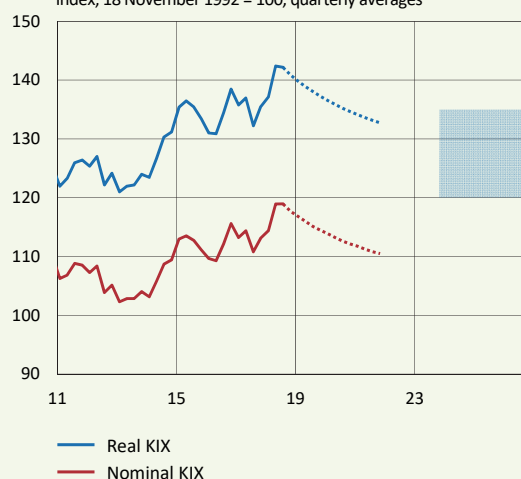
In the third quarter of this year, real KIX was at 142, which is weaker than the different estimates and assessments of the equilibrium real rate in Table 4:1. This indicates that it is likely that temporary factors are making the krona weak at present. One of these is interest-rate differentials in relation to other countries. The krona depreciation that took place since the start of 2014 coincided with Swedish interest rates falling in comparison with corresponding interest rates abroad. For example, the gap between Swedish two-year government bonds yields and their German equivalents decreased by just over half a percentage point, and the gap with the US equivalents decreased by just over three percentage points.

### The future development of the krona

All in all, it is thus the Riksbank's assessment that a reasonable interval for the real exchange rate measured in terms of KIX, 5–10 years ahead, is between 120 and 135 (see Figure 4:24).

The krona is currently above this level, which means that it is expected to appreciate in the years immediately ahead. As

**Figure 4:24. Real and nominal exchange rate, KIX**  
Index, 18 November 1992 = 100, quarterly averages



Note. The blue field shows the Riksbank's assessed interval for the real exchange rate 5–10 years ahead.

Sources: National sources, Statistics Sweden and the Riksbank

inflation during the same period is expected to be about as high in the KIX-weighted countries as in Sweden (measured in terms of the CPIF), the nominal exchange rate will strengthen at about the same rate as the real krona exchange rate (see Figure 4:24).

<sup>26</sup> International Monetary Fund (2018), *External Sector Report: Tackling Global Imbalances amid Rising Trade Tensions*.

<sup>27</sup> Average for the real KIX since 1993Q1.

<sup>28</sup> The filter has been applied to annual data for the real KIX, including the Riksbank's forecast for the period until the end of 2021. The adjustment parameter used is 100, which is normal in the filtering of annual data. The revised value applies to 2018.