

In daily news reporting, the term interest rate almost always refers to the nominal interest rate. However, the real interest rate is more relevant to consumption and investment decisions. This economic commentary aims to describe the real interest rate concept and illustrate developments in Sweden in recent years. The real repo rate is also illustrated, both the outcome and the Riksbank's forecast. In conclusion, the historical development of short-term real interest rates in Sweden is discussed.

## Real interest rates in Sweden

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### Nominal and real interest rates

Nominal interest rates reflect the value in kronor at various points in time. They give a nominal amount in the future in relation to a nominal amount today. Real interest rates express value in real units compared with a real unit in the future. The real unit in practice is often the basket of goods and services on which the consumer price index, CPI, is based. A nominal one-year interest rate of 5 per cent, for example, means that SEK 100 will give SEK 105 in a year's time, while a real one-year interest rate of 5 per cent means that 100 goods will give 105 goods in one year's time.

Real interest rates are of crucial importance for people's economic decisions concerning consumption, savings, production and investment. Assume that a person is considering whether to buy goods today or in one year. The price of the goods today is SEK 100. If the person decides to wait a year the money is saved at a nominal interest rate of 5 per cent. The person will then have SEK 105 after one year. Assume further that the person believes that the price of the goods will be the same in one year. Then the real interest rate is the same as the nominal interest rate, i.e. 5 per cent, since the savings are sufficient to purchase "105 per cent of the goods" in one year. We can thus see that the nominal and real interest rates are related through expected inflation, which in this example is 0.

It is also mainly through the effect on real interest rates that monetary policy affects the real economy. Consequently, for many reasons it is important to observe real interest rates for different durations and also to study the real repo rate. One problem, however, is that there are no reliable market quotations of real interest rates for the majority of relevant durations. The Fisher equation, named after the economist Irving Fisher, makes it possible to estimate approximate real interest rates even when there are no market quotations for inflation-linked bonds.<sup>2</sup> In the Fisher equation, nominal and real interest rates are related through the following relationship:

$$i_t = r_t + E_t \pi_{t+1},$$

where  $i_t$  denotes the nominal interest rate in year  $t$  with a duration of one year, for example.  $r_t$  denotes the corresponding real interest rate, while  $E_t \pi_{t+1}$  denotes the expected inflation rate in year  $t$  between year  $t$  and  $t+1$ . The nominal interest rate is the equivalent of the real interest rate plus expected inflation. The real interest rate is therefore the nominal interest rate minus expected inflation. When calculating the real interest rate the difficulty in practice is mainly in finding suitable measurements of inflation expectations for the relevant duration. In connection with the Fisher equation, the Fisher effect is also sometimes discussed. This is a hypothesis that the nominal interest rate moves with the expected inflation rate so that the real interest rate remains constant. A rise in the nominal interest rate would therefore reflect a rise in the expected inflation rate.<sup>3</sup> However, as we will see, the real interest rate has varied quite considerably in Sweden.

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<sup>2</sup> For a detailed derivation of the Fisher equation, see for example Paul Söderlind and Lars E.O. Svensson, "New techniques to extract market expectations from financial instruments", *Journal of Monetary Economics* 40 (1997), pp. 383-429.

<sup>3</sup> See for example Frederic S. Mishkin (1993): "Is the Fisher effect for real? A reexamination of the relationship between inflation and interest rates", NBER working paper nr. 3632.

The real interest rate can be seen as a measurement of expected real return on a nominal bond. It is important to realise that this concept differs from realised real return on a nominal bond. The realised real return on a nominal bond is the nominal interest rate minus the realised rate of inflation. The realised real return on a nominal bond differs from the real rate of interest to the extent realised inflation differs from expected inflation. Normally, realised inflation fluctuates more than expected inflation. Hence realised return on a nominal bond fluctuates more than the real interest rate. It could also be said that the real interest rate is an ex ante concept, while realised real return is an ex post concept.

We can now return to the example above. The nominal and real interest rates were both 5 per cent, since the price of the goods was expected to be the same in a year's time. Assume that the person decided to buy the goods in one year. It is found that the price of the goods has risen by 10 per cent to SEK 110. In that case the money saved is not sufficient to buy the goods. The nominal interest rate of 5 per cent has been "eaten up" in that the price of the goods has risen by 10 per cent. This means that the realised real return on the saving was -5 per cent.

Figure 1 shows the one-year real interest rate calculated as the difference between the nominal interest rate on one-year government bonds and the expected inflation rate one year ahead as expressed in the National Institute of Economic Research Consumer Tendency Survey and Prospera's survey, which includes purchasing managers, the social partners and money market agents. The nominal one-year interest rate is shown as a comparison. We see that the real interest rate using Prospera's survey and the Consumer Tendency Survey gives a very similar picture of the development of the real interest rate during the period.

Figure 1 also shows the realised real return on a nominal one-year government bond. It is calculated as the difference between the nominal interest rate on one-year government bonds and realised inflation. The real interest rate was lower than the realised real return between 1996 and 2005, while the opposite is true in the past year. The reason for this is that inflation expectations on average overestimated inflation between 1996 and 2005; in the past year, however, inflation has been higher than expected. Figure 1 also shows that both the nominal and the real interest rates fell until 2005. Real interest rates rose thereafter, but in recent years they have again fallen, despite a rise in nominal interest rates. For a short period at the end of the 1990s, the realised real return on nominal government bonds rose sharply and was even higher than the nominal interest rate. So inflation was negative, which was in no way reflected in the inflation expectations a year earlier. Thus the real interest rate did not rise in the same way. Figure 1 illustrates the importance of differentiating between the nominal interest rate, the real interest rate and realised real return, since these variables do not always develop in the same way. In the same way as for the one-year interest rate, the real interest rate and realised real return can also be calculated for nominal government bonds maturing in 2 and 5 years. This gives approximately the same picture of interest rate development.

## Real repo rate development in Sweden.

Using the Fisher equation it is also possible to calculate a real repo rate. Figure 2 shows real repo rates calculated using inflation expectations derived from the National Institute of Economic Research Consumer Tendency Survey and Prospera's surveys. In addition the real repo rate is shown, calculated as the difference between the repo rate and the Riksbank's inflation forecasts for one year ahead.<sup>4</sup> The Riksbank started to publish inflation paths in the 1997:4 Inflation Report. The nominal repo rate is shown in Figure 2 as a comparison. We see that the real repo rate is showing the same falling tendency as the real one-year interest rates between 1996 and 2005.

<sup>4</sup> According to the Fisher equation the real repo rate should be calculated as the nominal repo rate minus expected inflation for the duration of the repo rate. This duration is, however, very short. Consequently, expected inflation is used as an approximation for the coming year. This also facilitates a comparison with the real repo rate calculated using inflation expectations according to surveys, where the shortest horizon is one year.

In recent years the nominal repo rate has increased from 1.5 per cent to 4.25 per cent; in other words, 2.75 percentage points. The real repo rate (measured in terms of the Riksbanken's inflation forecasts) has gone from about -0.5 per cent to about 1.5 per cent during this period; a rise of about 2 percentage points. The real repo rate path is very similar regardless of whether survey expectations or the Riksbank's forecasts are used. However, using the Riksbank's forecasts the real repo rate was somewhat higher in the period 2003-2005, since the Riksbank's inflation forecasts were lower than expectations according to surveys. The average real repo rate on the basis of survey expectations was about 1.5 per cent between 1996 and 2008. Measured on the basis of the Riksbank's inflation forecasts the real repo rate in the period 1997-2008 was about 1.7 per cent.

At present the real repo rate is just over 1.5 per cent. What have the Riksbank's latest forecasts for the nominal repo rate and inflation meant for the real repo rate? Figure 3 shows the nominal and real repo rate forecasts in connection with the Monetary Policy Update in April 2008. Figure 3. Nominal and real repo rate based on the Riksbank's forecasts

Note The inflation forecasts have been extended by one year in relation to the published forecasts.

We see that the forecast in the Monetary Policy Update in April was that the repo rate will remain at about 4.25 per cent in the future. The real repo rate development means that the interest rate will continue to rise to about 2 per cent. Is this high or low in a historical perspective? One way of shedding light on this is to look at real short-term interest rates over long periods of time. The next section shows such an analysis.

## The long-term path of the short-term real interest rate

Figure 4 shows the nominal and real short-term interest rate between 1979 and 2008, since records of inflation expectations have been kept in the National Institute of Economic Research Consumer Tendency Survey since 1979. The repo rate is shown from 1992, but the yield on three-month treasury bills is shown for the entire period.<sup>5</sup> As we can see, the three-month yield has followed the repo rate very closely since 1992.

The nominal short-term rate fluctuated around a constant trend at a very high level between 1979 and 1992: at its peak it was about 15 per cent and at its lowest point about 9 per cent. However, the real short-term interest rate showed a rising trend in this period, particularly in the late 1980s and early 1990s. Between 1987 and 1992 the real short-term interest rate rose from about 4 per cent to about 13 per cent.

Since the early 1990s the nominal and real short-term interest rates have followed a similar path, as we have already seen. The real short-term interest rate fell sharply at the beginning of the 1990s, from about 13 per cent to 5 per cent, and then continued to fall more or less constantly until 2005. In recent years it has risen somewhat.

The average real interest rate for the entire period from 1979 to 2008 was about 4 per cent. Average actual inflation was about the same as the expected inflation according to the National Institute of Economic Research household surveys: about 4 per cent. The average nominal 3-month rate was about 8 per cent, which means that the average real 3-month rate was about 4 per cent. As we saw earlier, the average short-term real interest rate in the last 10-year period was, however, only about 1.5 per cent.

The unavailability of direct measures of inflation expectations before 1979 is a problem if you want to look at earlier real short-term interest rates. Simplified assumptions have been made instead, which imply that the expected inflation in the following year is the same as the actual inflation for the current year. This assumption means that households have adaptive expectations.<sup>6</sup>

<sup>5</sup> The data are quarterly averages.

<sup>6</sup> Development from 1979 is relatively similar using this method, compared with the real interest rate calculated using inflation expectations according to the National Institute of Economic Research Consumer Tendency Survey. It is also reasonable, since households' inflation expectations seem to be largely guided by the current realised inflation rate. See the box "Households' Inflation Expectations" in the Monetary Policy Report 2007:3. The assumption of expectations also means that they do not systematically underestimate or overestimate inflation over long periods. The mean value of expected inflation and actual inflation is the same.

Figure 5 shows a nominal and real short-term interest rate in Sweden for the period 1923 to 2008, that is the last 85 years. From 1970 the CPI and interest rate data is taken from the Riksbank and Statistics Sweden, and the interest rate used is the three-month yield on treasury bills just as in the previous figure. Data from before 1970 is taken from the Riksbank's database "Historical monetary statistics", and the short-term interest rate there is the discount rate, since no treasury bills existed.<sup>7</sup> Interest rates from as far back as 1857 are available in this database. In connection with the first world war and the years following there were powerful fluctuations in inflation. The development after this turbulent period is therefore shown in Figure 5.

By and large the nominal interest rate rose for the entire post-war period until the middle of the 1980s, and a long period of falling interest rates started at the beginning of the 1990s. This partially reflects the development of inflation, but the real interest rate also varied. The real interest rate showed a falling trend until the second world war, and then rose in the 1960s to bottom out in the early 1970s. The real interest rate rose sharply in the late 1970s and peaked in the early 1990s. Like the nominal interest rate, the real interest rate has fallen sharply since the beginning of the 1990s.

It is clear that there have been episodes of negative real interest rates. What does this mean? Assume that a person borrows SEK 100 for one year at a nominal interest rate of 5 per cent. If inflation over the year is 10 per cent the realised real return is about -5 per cent. This means that in terms of purchasing power, or "goods", the person only needs to pay back 95 per cent of the amount borrowed. If the person had instead saved SEK 100 this means that it would not have been profitable in terms of purchasing power; after one year the money saved would only be worth 95 per cent of the original savings.

What does the historical development say about the possible long-term level of the real short-term interest rate? An obvious advantage of looking at data for long periods is that we see for example that the period of very high real interest rates in the late 1970s and early 1980s was preceded by a 10-year period of negative real interest rates. Between 1970 and 2008 the average level of the nominal short-term interest rate was around 7.5 per cent and inflation about 5.5 per cent, which means that the short-term real interest rate was about 2 per cent. That is considerably lower than for the period 1979-2008, when the average real interest rate was about 4 per cent.

The mean value of the real interest rate for the entire period from 1857 to 2008 is about 2.5 per cent. The mean value of the real interest rate for the period from 1923 to 2008 is about 1.6 per cent. However, this period of time includes episodes such as the Second World War and the Korean war, when inflation was temporarily very high. If the past 50 years are studied instead, the average short-term real interest rate is somewhat higher: about 1.9 per cent.

An overall conclusion from these data is that the real short-term interest rate has fluctuated considerably, but a normal long-term value seems to be about 2 per cent. Seen in a very long-term perspective, this means that the Riksbank's forecast in the April 2008 Update is that the real short-term interest rate will rise to a historically normal level.

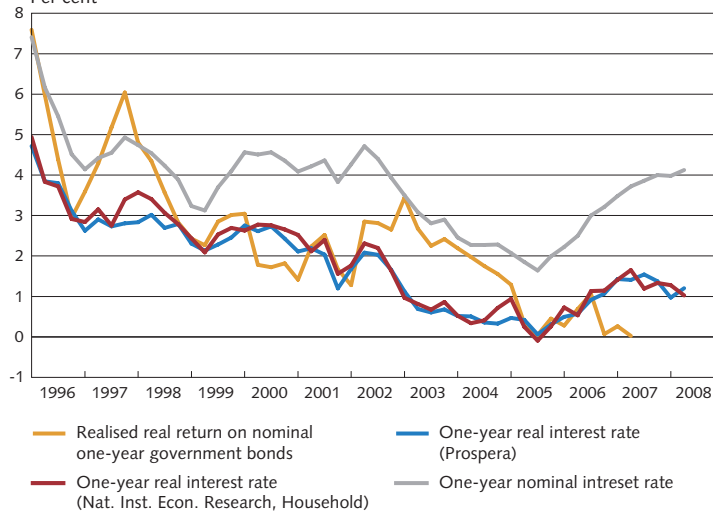
## Overall conclusions

The past 15-year period has been characterised by falling real interest rates in Sweden. Since 2005 the real interest rate has risen somewhat. The Riksbank's forecast is that the short-term real interest rate will continue to rise to about 2 per cent. This level is in line with the long-term average in Sweden, even if the real interest rate has shown substantial short-term variations.

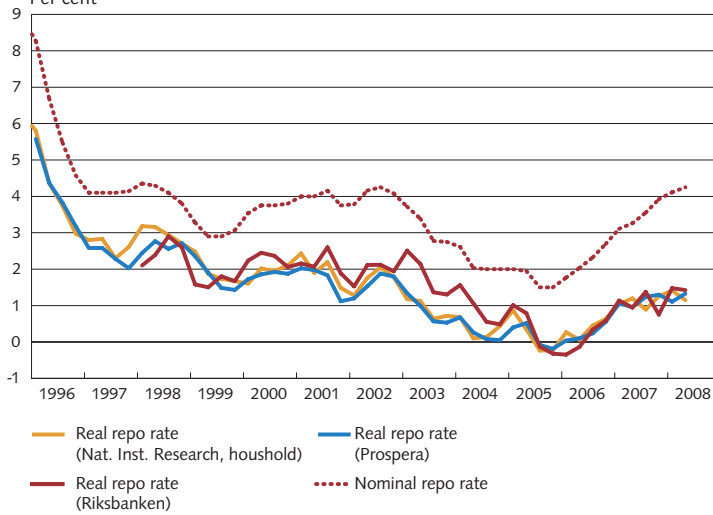
<sup>7</sup>For further information on these data, please visit [www.riksbank.se](http://www.riksbank.se) and refer to the section "Research" and "Historical monetary statistics".

## Figures

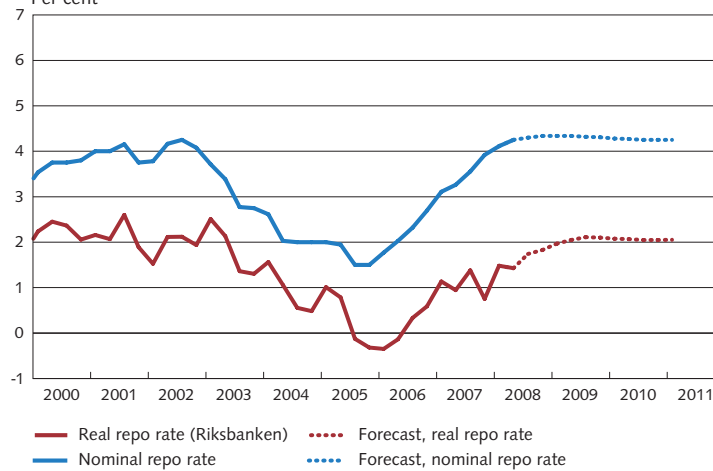
**Figure 1. Nominal one-year interest rate, real one-year interest rates and realised real return on nominal government bonds**  
Per cent



**Figure 2. Real and nominal repo rate**  
Per cent



**Figure 3. Nominal and real repo rate based on the Riksbank's forecasts**  
Per cent



Note The inflation forecast have been extended by one yeat in relation to the published forecasts.

Figure 4. Nominal and real short-term interest rate in Sweden, 1979–2008

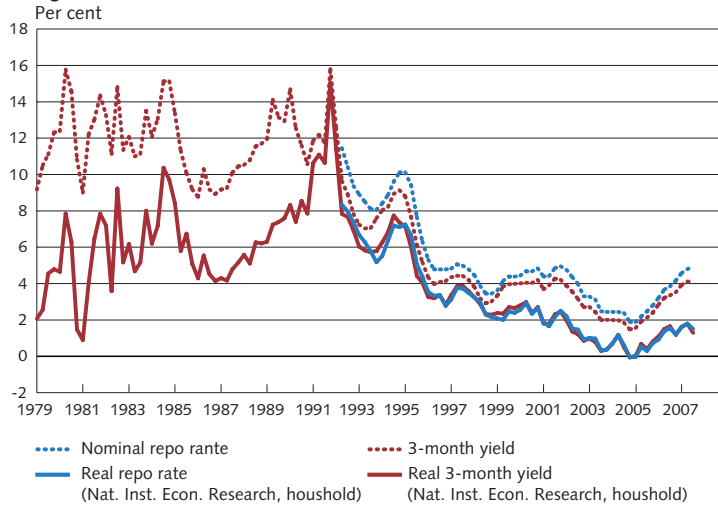


Figure 5. Nominal and real short-term rates in Sweden, 1923–2008

