A financial measure of inflation expectations

By Malin Andersson and Henrik Degrér
Monetary Policy Department

A satisfactory measure of inflation expectations is useful for the conduct and evaluation of the confidence in the Riksbank's monetary policy. Here a financial measure is derived from the interest rates of nominal bonds and real interest rate bonds. The conclusion is that the derived measure provides inflation expectations similar to those obtained in surveys, albeit with a greater variation over time. As the financial measure can be produced on a continuous basis, there is good reason to use this as a complement to the surveys.

The significance of inflation expectations

Inflation expectations are a measure of the market participants' confidence in the Riksbank's inflation target. Current inflation expectations can also reflect expectations of future monetary policy conduct. For these reasons, it is important to have satisfactory measures of how various different participants assess the future development of inflation.

The measures of inflation expectations used at the Riksbank stem mainly from surveys.

The measures of inflation expectations used at the Riksbank stem mainly from surveys of households and market participants. However, these surveys have certain flaws. It is quite possible, for instance, that the surveys do not provide a completely correct picture of inflation expectations. The reason for this is that the surveys are carried out at long time intervals and that the responses therefore do not comprise relevant information occurred after the specific survey. Another aspect is that households sometimes have access to less information than the participants in the mar-

kets, which could mean that they make poorer inflation judgements than the money market participants.[1]

An alternative measure of expectations could be derived from financial asset prices.

An alternative measure of expectations could be derived from financial asset prices, which reflect actual transactions where the participants risk monetary losses if they make the wrong decision. The advantages of this method are that the results are continuous and provide a more immediate measure of inflation expectations than the surveys. In addition, it becomes possible to measure inflation expectations in a more long-term perspective here than by the surveys currently made. Financial measures also improve the opportunities to investigate the connection between inflation expectations and monetary policy expectations.[2] However, there is a tangible disadvantage in that there are method problems in using this measure.

Firstly, we will describe a method for calculating inflation expectations on the basis of nominal bonds and real-interest rate bonds. After this, we will analyse how well this financial measure agrees with the traditional survey measure.

Description of the method

The method used to derive inflation expectations is based originally on Fisher's identity.

The method used to derive inflation expectations (here called the forward interest rate method) is based on Fisher's identity, according to which the nominal interest rate can be described as

$$i \equiv r + \pi^e + \lambda \qquad (1)$$

that is to say, the nominal risk-free interest rate, i, consists of the real risk-free interest rate, r, the expected inflation rate, π^e, and a risk premium, λ.

To enable to use Fisher's identity to calculate expected inflation, we need to know real risk-free interest rate, nominal risk-free interest rate and liquidity and credit risks.

The risk premium depends on many factors. However, the most significant of these are probably the credit risk, the liquidity risk and the inflation risk on the respective markets for index-linked and nominal bonds.[3] The identity above can therefore be rewritten as follows

[1] A simple analysis shows that the participants in the money market historically speaking appear to be better at forecasting the actual inflation rate than households.

[2] See Dillén & Hopkins (1998).

[3] The premiums probably have completely opposite effects. The liquidity premium tends to underestimate inflation expectations, as index-linked bonds generally have a lower liquidity than their nominal equivalents. The inflation premium leads to an overestimation of inflation expectations, as the risk of inflation is normally greater than the risk of deflation.

$$i + \lambda_i \equiv r + \lambda_r + \pi^e + \lambda_\pi \quad (2)$$

where λ_i is the risk premium for the nominal bond, λ_r is the risk premium for the index-linked bond and λ_π is the inflation risk premium. The expected inflation rate can be obtained if the other components are known. Thus, it is necessary to know the real risk-free interest rate, the nominal risk-free interest rate and the risk premiums in order to be able to use Fisher's identity to calculate expected inflation. At the moment, there are seven index-linked bonds and fifteen nominal bonds (benchmark bonds) listed on the money market. As these bonds contain a risk premium, they cannot be used straight off in Fisher's identity. The risk premium must compensate the holder of the bond for what is known as a liquidity risk, that is, the costs that can arise if the bond cannot be sold when the holder wishes to sell, and for credit risk, which is the risk that the issuer of the bond (in this case the government) cannot meet its payment obligations. As both index-linked bonds and benchmark bonds are issued by the central government, the credit risk can be assumed to be almost negligible. However, the size of the liquidity premium on the respective market is more difficult to determine. Market participants estimate that the liquidity premium is approximately 20 interest rate points higher on the index-linked bond market than on the nominal bond market.

Finally, the identity also comprises an inflation risk premium.

Finally, the identity also comprises an inflation risk premium, λ_π.[4] The size of this premium can depend on the expected variation in the rate of inflation, to the extent that when the variation increases, the holder of a nominal bond requires compensation for the increased risk that actual inflation will be higher than expected inflation. In other words, a higher inflation rate normally involves greater uncertainty, which leads to a higher inflation risk premium. As Sweden has had a low or moderate inflation during the period surveyed (1996 to 2001), this premium is set to zero in the continued analysis.

The models are adjusted with regard to expected inflation in the following calculations by taking into account a total risk premium that is 20 interest rate points higher for index-linked bonds than for nominal bonds.[5]

The forward interest rate method involves deriving implied forward interest

[4] Dillén & Hopkins (1998) describe how the lower inflation expectations during the 1990s appear also to have been partly due to a lower regime shift premium, which reflects the market participants' assessment that the probability of a return to a period of high inflation has declined.

[5] This unfair treatment of the risk premium naturally involves some risk of a distortion in the result. It is probable that periods of flight of capital to bonds, such as during the Asia crisis, may contribute to subduing inflation expectations. The flight of capital during the Asia crisis 1998 also involved an increase in the real liquidity risk premium relative to the nominal. The measure should therefore be interpreted with some caution, especially during this period.

The forward interest rate method involves deriving implied forward interest rate curves for both index-linked bonds and nominal bonds, and then calculating implicit inflation from these two curves.

rate curves for both index-lined bonds and nominal bonds, and then calculating implicit inflation from these two curves.[6] This method makes it possible to calculate implied inflation expectations one to two years' ahead, which is the time horizon of greatest interest in monetary policy. However, one problem with this method is that the maturity structure for nominal and index-linked bonds differs to a large degree. On average, index-linked bonds have a much longer maturity than nominal bonds. The average maturity for index-linked bonds is approximately twelve years, while the average for nominal bonds is around three years.

How good is the new method?

Inflation expectations according to surveys vary less than inflation expectations calculated by the forward interest rate method.

Inflation expectations obtained through surveys such as HIP and Prospera vary to a lesser degree than the results for inflation expectations calculated using the forward interest rate method. This applies both at one year ahead and at two years' ahead (see Figures 1 and 2).[7] The difference could be due to systematic differences between the money market participants' tendencies to respond and their actions (or discrepancies between the analysts who respond to the surveys and the traders). However, the difference could also be method-related and be ascribed to overly rigid assumptions regarding, for instance, a liquidity risk premium during the Asia crisis.

Nevertheless, the survey responses and the forward interest rate method provide the same curvature and indicate inflation expectations that were at their lowest during the measuring points in spring 1999. This could be explained by the fact that both the financial measure and the surveys provide inflation expectations that reflect the actual inflation outcome. The forward interest rate method and the surveys specify expectations that on average exceed actual inflation during the period analysed. Compared with the surveys, however, the forward interest rate method has stated on average since 1998 a marginally higher expected inflation rate one year ahead and a slightly lower expected inflation rate two years' ahead.

[6] In this article we have used smoothing splines to calculate real and nominal implied forward interest rate curves. Smoothing splines are described in detail in Fisher, Nychka & Zervos (1995).

[7] Inflation expectations according to the surveys refer to expected values.