

Reliable measures of inflation expectations – i.e., the inflation rate that households and businesses expect in the future – are important for the conduct of monetary policy. Among other things, inflation expectations affect firms' pricing decisions and workers' wage demands. For instance, workers are likelier to demand large nominal wage increases when they expect high inflation. Firms are also likelier to agree to such demands if they expect large general price increases. Inflation expectations are therefore an important determinant of inflation. In order to keep inflation at the target for a sustained period, the Central Bank must ensure that expectations about future developments in inflation are also close to target.

Methods of measuring inflation expectations

Inflation expectations are usually measured in two ways: with surveys and through analysis of the yield curve in the bond market. The Central Bank of Iceland uses both of these methods. Experience has shown that there can sometimes be a discrepancy between survey findings and the indications from the bond market (Chart 1). This is partly because the breakeven inflation rate in the bond market is based on a comparison of interest on nominal and indexed bonds, which includes, in addition to inflation expectations, a risk premium that can vary over time.¹ As a result, it is not possible to determine inflation expectations directly from the interest rate spread; only the sum of inflation expectations and the risk premium can be directly observed. This risk premium can be divided into two parts. The first part contains the compensation that risk-averse investors demand in order to consider investments in indexed and nominal bonds equally attractive; that is, the risk premium that accompanies investment in nominal bonds due to uncertainty about the inflation outlook. This part of the risk premium is often called the *inflation risk premium*. The other part of the risk premium reflects factors such as varying relative bond liquidity, including differing demand and supply effects and possible differences in tax treatment. In Iceland, it may also reflect differences in default risk because of uncertainty about the position of the Housing Financing Fund (HFF), the main issuer of indexed bonds. This part of the risk premium is commonly referred to as the *liquidity premium*. In general, the inflation risk premium can be expected to be positive, while the liquidity premium can be either positive or negative, depending, for instance, on how relatively deep the markets for indexed and nominal bonds are.

At first glance, it might seem as though surveys give a cleaner measurement of actual inflation expectations. The reliability of such surveys depends on a number of factors, however, such as respondents' inflation awareness, the size of the survey sample, and the number of respondents. Nor is it a given that all respondents will have the same measure of inflation in mind when they respond. Therefore, survey-based inflation expectations contain possible measurement errors. Surveys of inflation expectations are also generally carried out every few months, while observations from the yield curve are available much more frequently. Furthermore, inflation expectations from the bond market are based on actual trades in the market. Both methods therefore have their advantages and disadvantages.

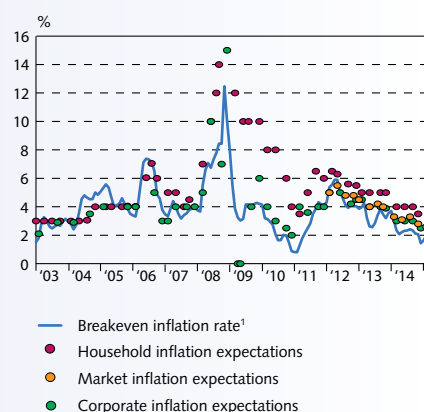
Information from the bond market and from survey questionnaires can be used together in order to obtain a more reliable estimate of the risk premium and therefore a more accurate estimate of inflation expectations. This Box discusses estimates of the risk premium according to international research and what it could be in Iceland.

1. Estimates of market participants' inflation expectations obtained from inflation swaps are also available in many other countries.

Box 1

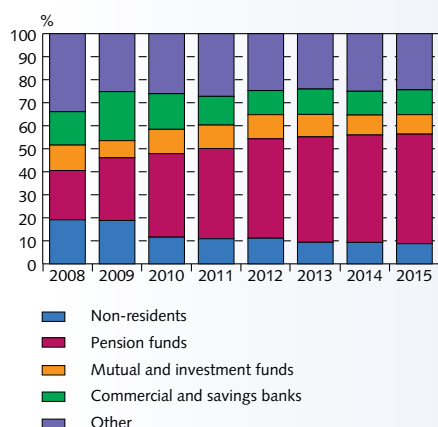
Risk premia and estimates of inflation expectations in the bond market

Chart 1
Inflation expectations and one-year breakeven inflation rate
January 2003 - April 2015



1. Forward breakeven inflation rate based on nominal and indexed yield curves (monthly averages). The breakeven rate indicates the expected annual inflation rate in one year's time.
Sources: Gallup, Central Bank of Iceland.

Chart 2
Owner classification of Government-guaranteed
bonds 2008-2015¹



1. Based on data until 31 March 2015.
Source: Icelandic Securities Depository.

International studies of risk premia in the bond market

There are a number of international studies that estimate the size of risk premia. Most studies focus on the US market, and they indicate that the one-year risk premium is in the range of 0- $\frac{1}{3}$ of a percentage point and the ten-year premium $\frac{1}{2}$ -1 percentage point.² Studies of the UK bond market give similar results, or five- and ten-year risk premia in the $\frac{3}{4}$ -1 percentage point range, whereas studies of the euro area give lower results, or a ten-year premium of about $\frac{1}{4}$ of a percentage point.³ All of these studies indicate that risk premia can vary over time, and many indicate as well that they rise further along the yield curve (i.e., they are higher for longer bonds). They also imply that risk premia increase as inflation grows more volatile and uncertainty about the inflation outlook increases.

Possible reasons for higher risk premia in Iceland

It is likely that risk premia are higher in Iceland than in other industrialised countries. For instance, inflation has been more volatile in Iceland. In addition, bond liquidity is probably less in Iceland because of the small size of the domestic bond market. As a result, relatively small trades can have a significant effect on prices – and therefore on risk premia – without any actual change in inflation expectations.

The supply and demand effects resulting from the capital controls have also reduced the liquidity of some bond series in recent years and distorted their pricing to an extent. The effects on shorter nominal Treasury bonds are due largely to the fact that, in recent years, the vast majority of them have been held by non-resident investors, whose assets are locked in by the capital controls.⁴ The additional restrictions recently placed on these non-residents probably exacerbate the problem. The effects of the capital controls are not limited to the short end of the yield curve, however; they affect price formation on longer bonds as well. In all likelihood, the controls have stimulated pension funds' demand for domestic Treasury and HFF bonds, as is reflected in a doubling of their proportional holdings since 2008 (Chart 2). The steady demand from these large funds has reduced market turnover, with the associated impact on price formation, particularly in the case of indexed Treasury and HFF bonds, whose issuance has been limited in recent years. Because of the funds' size and the rules governing their accounting, price formation in the market for indexed bonds is probably less effective than it would otherwise be, which could surface, for example, in wide bid-ask spreads.

Estimating risk premia in the Icelandic bond market

With the methodology described in Gürkaynak *et al.* (2010), it is possible to estimate risk premia in the domestic bond market from survey questionnaire results and the spread between indexed and non-indexed bonds. The one-year premium can be estimated, but it is more difficult to obtain a reliable estimate of longer-term premia because of a shortage of surveys of long-term inflation expectations over a long enough period of time. As a rough estimate, the one-year risk premium appears to have been about $\frac{1}{2}$ a percentage point, on average, from January 2002 through April 2015. In line with international research, the estimate implies also that the

2. See, for example, Ang *et al.* (2008), Buraschi and Jiltsov (2005), Chen *et al.* (2010), Chernov and Mueller (2012), D'Amico (2008), Durham (2006), and Campbell and Viceira (2001).

3. See, for example, Campbell and Shiller (1996), Shen (1998), and Joyce *et al.* (2010) for the UK, and Hördahl and Tristani (2012, 2014), for example, for the euro area.

4. Non-residents now own nearly 60% of issued Treasury bonds maturing in the next four years.

premium fluctuated during the period, with a standard deviation of 1½ percentage points. This is a somewhat higher short-term premium than is indicated by the studies cited above, but it accords well with the results of a Central Bank's survey among market agents, conducted in late January. According to that survey, market agents estimated the one-year inflation risk premium at 0.4, on average, and the two- and five-year premia at 0.5 and 0.8 percentage points, respectively.

The above-described empirical estimates of the risk premium should be interpreted with some caution, however, owing to a shortage of short-term indexed Treasury and HFF bonds, which increases the uncertainty at the short end of the real yield curve and thereby the uncertainty about short-term premia. Changes in the spread between nominal and real rates need not necessarily reflect changes in inflation expectations or risk premia; they may simply reflect changes in observed inflation. This highlights the importance of further research into risk premia in the Icelandic bond market. The above-described results indicate, however, that the bond market risk premium in Iceland is probably somewhat higher than that in other developed countries, which is unsurprising given Iceland's history of high and volatile inflation.

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