

After peaking at 18.6% at the beginning of 2009, following the sharp depreciation of the króna, inflation slowed down to the Central Bank's 2.5% inflation target early in 2014 and remained close to target for most of the year. It fell even further at the end of 2014 and bottomed out at 0.8% early in 2015. Since then it has picked up slightly but remained at or below 2%. Inflation has therefore been below target for over two years, which is unprecedented in the fifteen years since the adoption of inflation targeting in Iceland in March 2001. What are the main reasons for this, and has the drop in inflation been larger and faster than could have been foreseen when the disinflation episode began in early 2014? This Box attempts to answer these questions and quantify the forces underlying this development.

A simple model of inflation

In order to assess the main drivers of the disinflation episode, the inflation equation in the Central Bank's quarterly macroeconomic model, QMM, is used.¹ The equation is based on a conventional Phillips curve where current inflation is determined by recent inflation and expected future inflation. The impact of past inflation reflects general inflation stickiness, which could be, for instance, because of widespread indexation of goods and services prices to past inflation. The impact of inflation expectations on current inflation reflects that price formation is also affected by expectations about future developments in inflation. For example, firms are likelier to raise their output prices if they expect inflation to rise in the future. By the same token, employees are likely to demand larger pay rises if they expect increased inflation in the future.

According to the Phillips curve, inflation is also determined by the intensity of factor utilisation in the economy; i.e., how large an output gap exists. Because some of the goods and services consumed in Iceland come from abroad, global inflation and the exchange rate of the króna can also have a direct impact on domestic inflation. The effects of imported inflation can also surface in domestic production, some of which requires imported intermediate inputs. Finally, as labour is an important input into domestic production of goods and services, inflation will also depend on wage developments; therefore, if wage costs rise in excess of productivity growth, inflation can rise as a result, both directly and through rising inflation expectations and increased demand, thereby widening the output gap.²

Key reasons why inflation has been below target in recent years

As Chart 1 indicates, inflation has been below target since the beginning of 2014. The deviation from target increased throughout the year, peaking in Q1/2015, when inflation was 1½ percentage points below the target. Since mid-2015 it has been about ½ a percentage point below the target. The chart also illustrates the contribution of individual determinants of inflation according to the Phillips curve. In order to measure the contribution of each factor, inflation is estimated according to the model, but running a sequence of counter-

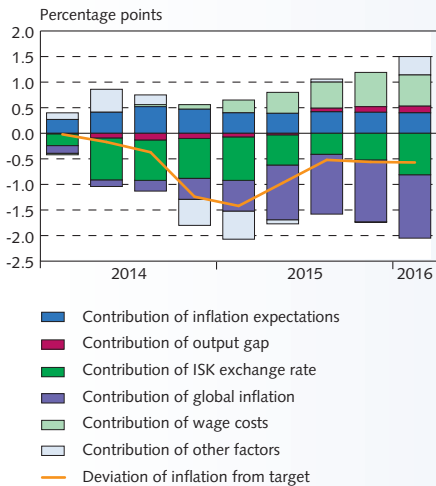
Box 5

Why has inflation been so low in the past two years?

1. Ásgeir Daniélsson, Bjarni G. Einarsson, Magnús F. Gudmundsson, Svava J. Haraldsdóttir, Thórarinn G. Pétursson, Signý Sigmundardóttir, Jósef Sigurdsson, and Rósa Sveinsdóttir (2015). "QMM: A quarterly macroeconomic model of the Icelandic economy. Version 3.0." Central Bank of Iceland, *Working Paper*, no. 71. Information on the inflation equation can be found on pages 68-70 in the handbook.

2. Further discussion of the economic basis of such inflation models can be found, for instance, in Thórarinn G. Pétursson (1998), "Price determination and rational expectations", *International Journal of Finance & Economics*, 3, 157-167, and (2002), "Wage and price formation in a small open economy", Central Bank of Iceland, *Working Paper*, no. 16.

Chart 1
Deviation of inflation from target and contribution of determinants¹



1. Deviation of inflation from target and contribution of individual determinants to the deviation, based on the inflation equation in the Bank's QMM (see explanation in main text). "Other factors" represents the portion of the deviation not captured by the equation.

Source: Central Bank of Iceland.

factual simulations where the factor in question is consistent with inflation at target. In order to estimate the contribution of inflation expectations, inflation is therefore calculated based on the assumption that inflation expectations were in line with the 2.5% target for the entire period. The same is done with global inflation and unit labour costs. To calculate the contribution of the exchange rate, inflation is calculated based on the assumption that the exchange rate had remained unchanged throughout the period, and the contribution of the output gap is determined by calculating inflation assuming that no output gap had existed during the period. The simulations are dynamic, so that the inflation paths are determined by past inflation from the simulation rather than observed past inflation. The decomposition therefore captures the contribution of the factor in question through past inflation as well.³

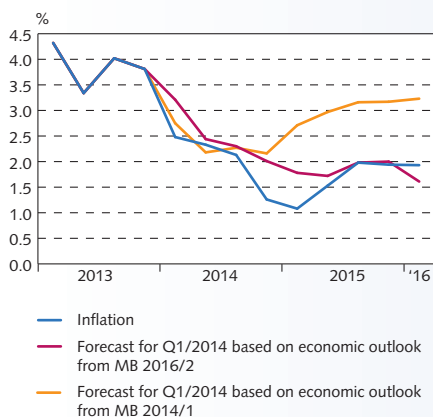
It is unsurprising that exceptionally low imported inflation is the main reason for low domestic inflation in the past two years. This is due both to the appreciation of the króna (particularly early on) and low global inflation (particularly in 2015), which is due primarily to the steep drop in oil and commodity prices. The slack in the economy until the beginning of 2015 also pulled inflation down below the target, but these effects disappeared as the year progressed and reversed by the year-end. Offsetting the factors that have pulled inflation down below target is the fact that long-term inflation expectations have persistently been above target. According to the Phillips curve, inflation would have been around ½ a percentage point lower if inflation expectations had been consistent with the target. Finally, the chart shows how last year's large pay rises begin increasingly to offset reduced import prices.

Inflation has subsided more than could have been foreseen at the beginning of 2014

It is also interesting to examine the extent to which the disinflation from the beginning of 2014 onwards was foreseeable and the extent to which it was driven by factors that could not have been predicted. To determine this, Chart 2 shows two inflation paths calculated using the Phillips curve: on the one hand, a path based on the most recent assessment of developments in the determinants of inflation and, on the other hand, a path based on the projected developments in these determinants, which were used as a basis for the forecast prepared in January 2014 and published in *Monetary Bulletin* 2014/1. As the chart indicates, inflation has developed broadly as the Phillips curve indicates, in terms of the current assessment of developments in underlying explanatory variables. The largest deviation appears in late 2014 and early 2015, when inflation subsides more than the equation indicates. Overall, however, the Phillips curve gives a relatively accurate view of the disinflation episode early on and the rise in inflation since H2/2015.

The disinflation early in 2014 is also well in line with what the Phillips curve indicates based on the economic outlook as it was at the beginning of that year. However, based on that information, in-

Chart 2
Inflation paths based on differing assumptions¹



1. Inflation paths based on the economic outlook used as the basis for the forecasts in *Monetary Bulletin* 2016/2 and 2014/1 (except for inflation expectations, which are unchanged in the comparison).

Sources: Statistics Iceland, Central Bank of Iceland.

3. In the QMM, inflation expectations are determined by the future inflation rate forecast by the model, so as to ensure internal consistency between forecasted and expected inflation. In the simulations carried out here, however, it is more appropriate to use measures of actual inflation expectations; therefore, ten-year inflation expectations obtained from the Central Bank's market inflation expectations survey are used. Chart 1 also shows the contribution of "other" factors, which is the sum of deviations of inflation from target that the equation does not capture. This can include conventional forecasting errors not captured by the equation or measurement errors in explanatory variables during the period (for example, measurement errors in inflation expectations, the output gap, and unit labour costs). It could also reflect that the effects of the variables concerned during the period in question differ from historical experience.

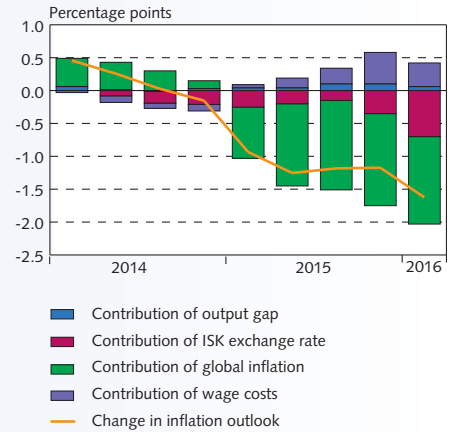
flation according to the equation should have remained unchanged in Q4/2014 and then risen from the beginning of 2015 onwards, measuring about 3.2% by mid-year, or about 1 percentage point more than it actually did. As Chart 3 shows, the main reason for this deviation is global inflation, which turned out much lower than was forecast at the beginning of 2014, owing mainly to the aforementioned decline in global oil and commodity prices. Pulling in the same direction is the fact that the króna has been stronger than was anticipated at the beginning of 2014, but offsetting it are the recent wage increases, which have been larger than previously forecast.

What does this mean for the inflation outlook?

Imported deflationary pressures stemming from the appreciation of the króna and low global inflation are the main reason inflation has been below target for the past two years. Domestic factors have pulled in the opposite direction. Large and unforeseen reductions in import prices are also the main explanation for the Central Bank's over-prediction of inflation in the recent term.

The composition of the offsetting factors in inflation developments gives cause for concern, as it could indicate that inflation will increase again when the effects of the rising exchange rate and falling global oil and commodity prices subside. The risk is that only the effects of the offsetting domestic factors will remain: those that have pushed inflation upwards and have a tendency to be more persistent, particularly the effects of inflation expectations and the output gap.

Chart 3
Change in inflation outlook since 2014 and contribution of determinants¹



1. Difference in inflation paths based on the economic outlook used as the basis for the forecasts in *Monetary Bulletin* 2016/2 and 2014/1 and the contribution of individual determinants (except for inflation expectations, which are unchanged in the comparison).
Source: Central Bank of Iceland.