Fluctuations in inflation and output have gradually diminished

Since the economic recovery began in early 2010, the post-crisis loss of output has largely been reclaimed and unemployment has declined significantly. Inflation has subsided as well, after skyrocketing in the wake of the currency crisis, and is now on target. Over time, fluctuations in inflation and output have diminished as well.

This is illustrated in Chart 1, which shows how the volatility of inflation and output developed from the adoption of the inflation target early in 2001 until Q4/2013. The period is divided up into four sub-periods of just over three years each.¹ The first two sub-periods are from Q1/2001 to Q1/2004 and from Q2/2004 to Q4/2007. Together, these two sub-periods capture the period from Iceland's adoption of its inflation-targeting monetary regime until the onset of the global financial crisis. The third sub-period extends from Q3/2007 until Q3/2010, therefore including the financial crisis and its most severe economic repercussions. The last sub-period extends from Q4/2010 until Q4/2013, covering the early part of the recovery and the gradual normalisation of economic activity.

As the chart indicates, output fluctuations gradually diminished after the adoption of the inflation target in 2001, although there was no discernible reduction in inflation volatility until well into 2005. Output growth continued to stabilise through the middle of the decade, whereas inflation grew more volatile once again. Both inflation and output volatility increased dramatically when the financial crisis struck. Inflation volatility peaked early in 2009, with a standard deviation of 41/2%, and volatility of output growth peaked a year later, in early 2010, with a standard deviation of 6%. During the last sub-period, however, the fluctuations receded again. Beginning in early 2012, swings in inflation diminished rather rapidly, while output growth remained volatile. In 2013, however, output volatility began to diminish. By the fourth quarter, its standard deviation was down to 1.7% and the standard deviation of inflation was 1.2%. Although the standard deviation of inflation is now broadly similar to that in the mid-2000s, the standard deviation of output growth is at its lowest since the turn of the century. In terms of fluctuations in these two variables, the domestic economy is at its most stable since the beginning of the 21st century. It appears that this decline in output and inflation volatility is not due solely to the gradual tapering of the effects of the financial crisis, as stability also appears to be greater than it was before the crisis struck.

Why have fluctuations in inflation and output declined?

What, then, lies behind this increased stability of output and inflation? Are the shocks hitting the economy smaller or less frequent? Could increased stability be due to structural changes in the economy that enhance its resilience against shocks? Or could it be that monetary policy implementation has improved, resulting in greater inflation and output stability?

At first glance, it appears difficult to assert that monetary policy can claim the credit, as economic theory indicates that if monetary policy is formulated and implemented in the most efficient manner, it cannot reduce inflation volatility without exacerbating output volatility (and vice versa). It was the economist John Taylor who first demonstrated this in a paper from 1979. Taylor showed that even though there is no long-run tradeoff between inflation and output growth,² there is in fact a downward-sloping long-run

Box I-1

Enhanced economic stability and the role of monetary policy

Chart 1 Output and inflation volatility Three-year standard deviation of annual changes in quarterly data



Sources: Statistics Iceland, Central Bank of Iceland.

More precisely, four equal 13-quarter periods. The standard deviation of annual inflation and annual GDP growth is therefore based on a 13-quarter moving window. The results are the same if output fluctuations are measured with the standard deviation of the output gap instead of the standard deviation of GDP growth.

This is what is referred to when economists say that the Phillips curve is vertical in the long run. Research and painful experience from the runaway inflation years in the 1970s

Chart 2 Taylor curves: the efficient monetary policy frontier



The chart shows different pairs of fluctuations in inflation and output. The downward slope shows the efficiency frontier (Taylor curve); that is, the pair of the smallest achievable fluctuations in inflation and output. Points B, C, and D reflect differences in the relative monetary policy weights on inflation and output deviations. Point A is within the efficiency frontier and therefore illustrates inefficient monetary policy, while Point E is on the new frontier, which has shifted towards the origin of the graph.

Source: Central Bank of Iceland.

relationship between the smallest possible fluctuations in the two. Therefore, "efficient" monetary policy can only reduce volatility in one of the two variables at the cost of increased volatility in the other. This downward-sloping relationship is generally referred to as the Taylor curve or the efficient monetary policy frontier. An example of the Taylor curve can be seen in Chart 2.

In order to explain this relationship, it is possible to consider the monetary policy response to a negative economic shock - for instance, a supply shock stemming from rising oil and commodity prices. Such a shock would generally reduce domestic activity and employment levels while increasing inflationary pressures. If monetary policy responds with an interest rate increase, the inflationary effects of the shock should be relatively short-lived; however, the tighter monetary stance exacerbates the contractionary effects. Monetary policy is therefore faced with two choices: it can focus on containing the inflationary impact of the shock while exacerbating fluctuations in output, or it can tolerate greater inflation volatility in order to mitigate the effect of the shock on output.³ Chart 2 illustrates these two options. Point B shows monetary policy that emphasises mitigating the impact of the shock on output and is therefore willing to take time to bring inflation back to target, and point D shows monetary policy that places greater emphasis on rapid mitigation of the inflationary impact, with the associated increase in output volatility. Both options represent equally efficient monetary policy; the difference lies simply in different emphasis on inflation versus output stability. In 1993, Taylor himself introduced a simple monetary policy rule that assigned equal weights to stabilising inflation and output. The result is the well-known Taylor rule, which is used in monetary policy formulation as a simple rule of thumb and an estimate of the desirable monetary stance at any given time. Point C could be an example of such monetary policy.⁴

This description of monetary policy tradeoffs is based on the assumption that monetary policy is at the efficiency frontier; i.e., it is formulated and implemented in the most efficient way possible. This implies that it is not possible to reduce volatility of inflation without exacerbating swings in output (and vice versa): the frontier defines the pairs of the smallest possible fluctuations in inflation and output that can be achieved, assuming a given economic structure and the shocks the economy has sustained. In reality, it is possible to imagine that monetary policy is not implemented efficiently and is therefore inside the efficiency frontier instead of being on it (Point A in Chart 2). If so, it is possible to reduce volatility of both inflation and output with improved monetary policy implementation, thereby moving closer to the frontier. It is also possible that smaller fluctuations in inflation and output reflect a shift of the frontier towards the origin of the graph, where the smallest possible fluctuations in the two variables have become smaller than before (Point E in Chart 2).

Therefore, monetary policy could be a factor in the increased stability of domestic inflation and output in the recent term if policy

2

and 1980s have led to a consensus among economists, that it is not possible to use monetary policy to stimulate output growth (or reduce unemployment) permanently by merely being willing to tolerate higher inflation.

^{3.} This implies that monetary policy is not faced with the same tradeoff when responding to a demand shock that combines an increase in demand and inflation (or the reverse). In that instance, monetary policy can combat the effects of the shock and simultaneously reduce volatility in inflation and output.

^{4.} According to Taylor's original version of the Taylor rule, the deviation of inflation from target is assigned a weight equal to that of the deviation of output from potential output: $i = (r^* + \pi) + 0.5(\pi - \pi^7) + 0.5x$ where i is the central bank's policy rate, r^* is the equilibrium real interest rate, π is inflation, π^T is the inflation target, and x is the output gap. For further discussion, see Central Bank of Iceland (2012, Chapter 3).

implementation has improved, moving it closer to the underlying frontier, or if the frontier itself has shifted towards the origin. This could be the result of increased predictability and transparency of monetary policy and improved anchoring of inflation and inflation expectations,⁵ as can be seen in Chart 3, which shows that both measured and underlying inflation have subsided recently. Longterm inflation expectations have been more persistent, although they, too, have subsided. All of these factors reduce fluctuations in interest rates, inflation, and inflation expectations while enhancing their predictability. This contributes to reduced volatility of real interest rates and exchange rates, which in turn contributes to reduced output volatility. A firmer anchor for inflation expectations can also reduce the risk of sudden "inflation scares", which can be an independent source of inflation and output volatility (see, for instance, Goodfriend, 1993). By the same token, a firmer anchor can weaken the pass-through of fluctuations in the exchange rate and oil and commodity prices to inflation (see, for example, Devereux, Engel, and Storgaard, 2003). Furthermore, the possibility cannot be excluded that there is increased understanding of the functioning of the economy and the role of monetary policy in inflation formulation, as improved understanding of this role can reduce volatility of inflation and output (see, for example, Bernanke, 2004).

It is also possible that volatility of inflation and output have diminished because external shocks are simply fewer and smaller than before. It is difficult, however, to argue that the external environment is more advantageous, given the persistent headwinds facing the domestic economy in recent years, including massive deleveraging and restructuring of domestic balance sheets in the wake of the crisis and the steep deterioration in terms of trade. On the other hand, it can be argued that the capital controls have somewhat sheltered the domestic economy from the impact of global financial market unrest, including that related to the eurozone debt crisis and the uncertainty related to the tapering of the US Federal Reserve's quantitative easing programme last year. In this respect, the capital controls have pulled in the same direction as monetary policy and have enhanced economic stability, although they are doubtless very costly in the long run. It should be noted, though, that the Central Bank's new foreign exchange market intervention policy has also played a part in reducing exchange rate volatility in the recent term. Furthermore, the impact of the global business cycle on the domestic economy could have grown with the increased importance of external trade.

Although it is too early to identify the main reasons for increased macroeconomic stability, there is good reason to assume that improvements in the monetary framework and implementation have played an important role. This would be consistent both with the experience of other countries and with the large number of studies strongly indicating the role of monetary policy in reducing inflation and inflation volatility in other countries (see, for instance, Bernanke, 2004, and Cecchetti *et al.*, 2007).⁶

International comparison

Studies show that volatility of output and inflation has generally been more exaggerated in Iceland than in other industrialised





Inflation

10-yr inflation expectations²

Inflation target

 Interquartile range of different measures of underlying inflation (core indices 3 and 4 excluding tax effects; trimmed mean (excluding extreme values that change by 5 to 25% between months) and weighted median). 2. Breakeven inflation rate from the nominal and indexed yield curves.
Sources: Statistics Iceland, Central Bank of Iceland. 3

As is stated in Dincer and Eichengreen (2014), the increase in transparency of monetary policy in Iceland has been one of the most striking among developed countries in the past five years.

^{6.} Other countries' experience shows also that substantial imbalances can accumulate in the financial system, even though inflation and output are stable. This can ultimately lead to severe economic instability. For this reason, the spotlight, both in Iceland and abroad, has been on various macroprudential tools and their interaction with conventional monetary policy instruments. See, for example, Borio (2014).

Spread between measurements of core inflation¹

Chart 4

Tradeoff between inflation and output volatility in Iceland and other OECD countries¹



The dots represent figures for Iceland, and the squares show corresponding average figures for OECD countries.
Sources: OECD, Statistics Iceland, Central Bank of Iceland.

Chart 5

Tradeoff between inflation and output volatility in Iceland and the other Nordic countries¹



1. The dots represent figures for Iceland, and the squares show corresponding average figures for the other Nordic countries. *Sources:* OECD, Statistics Iceland, Central Bank of Iceland.

Chart 6

Tradeoff between inflation and output volatility in Iceland and 10 developed emerging economies¹



 The dots represent figures for Iceland, and the squares show corresponding (median) figures for the 10 least-developed OECD countries (Chile, Estonia, Israel, Mexico, Poland, Slovakia, Slovenia, Czech Republic, Turkey and Hungary).
Sources: OECD. Statistics Iceland. Central Bank of Iceland. countries (see, for instance, Einarsson *et al.*, 2013, and Pétursson, 2008). The findings Honjo and Hunt (2006) also indicate that the efficiency frontier lies above the corresponding frontiers in other industrialised countries with similar monetary policy frameworks.⁷ The monetary policy tradeoffs have therefore been less favourable in Iceland, and the opportunity cost (in the form of wider swings in output) of maintaining price stability has been greater than in other industrialised countries. The above-mentioned studies explore a number of possible reasons for this, but in the main, it can be said that the structure and the small size of the Icelandic economy and the frequent natural shocks striking it are chief among them.

As Chart 4 shows, however, the difference between Iceland and other OECD countries has narrowed in the past three years.⁸ The OECD countries moved closer to the origin during the 2000s, a development reflecting diminishing economic fluctuations around the world,⁹ although the financial crisis set them back significantly. Volatility in inflation and output has diminished again in the past few years but remains more pronounced than before the crisis. Developments since the turn of the century have therefore been broadly in line with those in Iceland, and what is most notable is that, while volatility in Iceland is still above the OECD average, the difference has become much smaller.

The comparison group includes the largest industrialised countries in the world, however, and it could therefore be more appropriate to compare Iceland with other small industrialised countries. Chart 5, for instance, gives a comparison with the other Nordic countries. The developments are broadly congruent among the countries shown: they managed to reduce inflation volatility as the decade progressed, and in the wake of the financial crisis they have done so again, although output volatility remains greater than it was before the crisis. In this comparison, the results in Iceland are even more noticeable, as the fluctuations in inflation and output growth have become quite similar to those in the other Nordic countries, whereas they were much more pronounced before and during the financial crisis. Chart 6 shows a corresponding comparison with 10 developed emerging market countries (i.e., the 10 OECD countries classified as emerging economies). Again, Iceland's progress is notable: fluctuations are very similar in the last sub-period, after having been considerably wider in Iceland during previous sub-periods. Chart 7 shows, however, that fluctuations in these 10 countries' inflation and output growth were larger, on average, in the previous decade, and larger than they have been in Iceland since the turn of the century. Economic policy reform has been quite successful in these countries, some of which had experienced persistent instability. Their success shows that there can be a time lag before progress becomes visible, not least when there is a long history of undisciplined economic policy. But it shows beyond a doubt that it is possible to take great strides in enhancing economic stability through sound economic policy.

Conclusion

In recent years, fluctuations in inflation and output in Iceland have diminished sharply from their post-crisis peak. They have also diminished in comparison with pre-crisis levels. While the period in question is relatively short, it seems that some progress has been made in stabilising the domestic economy. Comparisons with other countries

- 8. Each dot on Charts 4-6 corresponds to the last dot in each sub-period in Chart 1.
- 9. This has been termed "the great moderation". See, for example, Blanchard and Simon (2001) and Stock and Watson (2003). See also Daníelsson (2008).

^{7.} The comparison includes the US, the UK, Canada, and New Zealand. For further discussion, see also Central Bank of Iceland (2012, Chapter 3).

show that, even though inflation and output are still more volatile in Iceland than they are, on average, in other OECD countries, the difference is much smaller than it was both before and during the financial crisis. A corresponding development can be seen vis-à-vis the other Nordic countries and developed emerging countries, with fluctuations in Iceland's inflation and output now broadly in line with these two groups.

It can be argued that monetary policy plays an important role in this success. With increased predictability and transparency and with effective application of a wider range of policy instruments, monetary policy has been successful in gradually reducing inflation and anchoring it more firmly. This has diminished the volatility of inflation and inflation expectations, which in turn has mitigated fluctuations in real interest rates and the real exchange rate, ultimately reducing volatility in real variables such as output and unemployment.

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Chart 7

Tradeoff between inflation and output volatility in Iceland and 10 developed emerging economies in the 1990s¹





 The dots represent figures for Iceland, and the squares show corresponding (median) figures for the 10 least-developed OECD countries (Chile, Estonia, Israel, Mexico, Poland, Slovakia, Slovenia, Czech Republic, Turkey, and Hungary) during corresponding periods in the 1990s.

Sources: OECD, Statistics Iceland, Thorarinn G. Petursson (2008), Central Bank of Iceland.