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Dear readers,

In this edition, we present articles about various monetary policy issues: the role of international dependence in domestic forecasts, the level of the inflation target, household expectations of mortgage rates and how monetary policy is conducted in Norway.

- **Do Swedish forecasters take sufficient account of Sweden's international dependence?**

  Jesper Lindé and André Reslow analyse whether Swedish forecasters take sufficient account of Sweden's strong international dependence in their forecasts of domestic developments. They compare the Riksbank's GDP growth and inflation forecasts with a number of major Swedish forecasters, including the National Institute of Economic Research.

  The analysis shows that both the National Institute of Economic Research and the Riksbank take very little account of other countries in their long-term GDP and inflation forecasts. In the short term, however, the amount of consideration given to international inflation in the revised projections is in line with the comovement observed in the data, while the near-term revisions of the GDP forecasts still do not sufficiently factor the dependency on foreign GDP into account. They also show that the weak influence of other countries on the long-term forecast revisions is not due to Swedish monetary policy having been more active than the historical behaviour.

- **What role does the level of the inflation target play?**

  Mikael Apel, Hanna Armelius and Carl Andreas Claussen analyse what academic research says about the optimal rate of inflation. They also discuss arguments in the policy-oriented debate on the level of the inflation target. In the international discussion there have been proposals to increase the inflation target, which is at or close to 2 per cent in most developed countries.

  One conclusion the authors draw is that the threshold for increasing the target is high, primarily because there are significant practical problems linked to abandoning a target that is already established and changing to another one. The article also analyses the challenges central banks may face in the near term as regards achieving the current targets.

- **Are household expectations of future mortgage rates realistic?**

  Erik Hjalmarsson and Pär Österholm analyse Swedish households' expectations of future mortgage rates against the backdrop of a debate suggesting that they perhaps have been unrealistically low in recent times. The surveys of household expectations published by the National Institute of Economic Research each month are used in order to estimate expectations of mortgage rates in the short, medium and long term.

  The authors find that expectations in the long term are around 4.7 per cent, which is deemed in line with the long-term repo rate level plus a reasonable spread between the repo rate and the mortgage rate.

- **How is monetary policy in Norway conducted from a Swedish perspective?**

  Anders Vredin analyses how monetary policy in Norway is conducted from a Swedish perspective. In both Norway and Sweden, monetary policy is based on numerical inflation targets, but there are both similarities and differences in the monetary policy strategy. Historically, the differences between the countries' nominal and real interest rates have been small and the nominal exchange rate between the Norwegian and Swedish krona has been very stable. Overall, this indicates rather small differences in monetary policy

between the two countries, despite differences in central bank independence. One reason for the small differences is that both Norway and Sweden are strongly dependent on developments abroad and have been affected by, for example, the decline in global real interest rates over the past decades.

The article finishes with a review of the challenges faced by the countries after the global financial crisis as regards monetary policy objectives and means and financial stability.

Read and enjoy!

Claes Berg

Contents

Do Swedish forecasters properly account for Sweden's international dependence?

Jesper Lindé and André Reslow*
Jesper Lindé is Head of Research at the Riksbank and André Reslow is currently on leave of absence from the Riksbank for PhD studies at Uppsala University

Sweden is a small, open economy that is affected to a large extent by developments abroad. An important question is whether Swedish forecasters take sufficient account of Sweden's international dependence in their forecasts of domestic developments. In this study, we analyse this for forecasts made during the period 2007–2017 for GDP growth and inflation. We compare the Riksbank's forecasts with those of a number of major Swedish forecasters, including the National Institute of Economic Research (NIER). The analysis shows that several forecasters, including the Riksbank and NIER, take too little account of other countries in their long-term GDP and inflation forecasts. In the short term, however, the influence of foreign inflation is in line with the correlation in the data, while the influence of foreign GDP growth is still slightly lower than the correlation in actual outcomes even in the short term. Finally, we show that the weaker influence from other countries in the forecasts cannot be explained by monetary policy is more aggressive in the forecasts compared with how the repo rate *de facto* has been set in relation to policy rates abroad.

1 How other countries affect the Swedish economy

After a number of tough years for the global economy with weak growth and low inflation, particularly in the euro area, the International Monetary Fund (IMF) now finally projects that an improvement in the world economy lies ahead.[1] An important question for Sweden is what such an improvement means for GDP growth and inflation in Sweden, and what implications this normally has for monetary policy in Sweden if interest rates abroad rise.

Sweden is a small open economy with substantial international trade; the export (import) share of GDP were about 45 (40) per cent in 2016. The globalisation of financial markets in recent decades has also increased the financial ties between Sweden and other countries. Economic activity is therefore largely governed by developments abroad. An early study stressing the importance of other countries for Swedish economic cycles is Lindbeck (1975), who argues that economic cycles in Sweden closely follow the pattern and timing we see in other industrialised countries. Lindé (2003) finds formal support for Lindbeck's conclusions and shows that fluctuations abroad explain a significant proportion of the fluctuations in Swedish growth and inflation. The correlation between Swedish and foreign GDP growth is as high as 0.9, while the correlation between domestic and foreign CPI inflation is around 0.5. But even if the correlation for inflation is lower than for growth, it is important to note that it is still a high and clearly significant correlation.

* We are grateful to Claes Berg, Stefan Laséen, Karl Walentin and participants at a policy seminar at the Monetary Policy Department for their comments. We would also like to thank Leonard Voltaire for his expert help with coding and Gary Watson for translating the Swedish text to English. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of Sveriges Riksbank.

1 See the IMF's edition of 'World Economic Outlook' published on 24 July, http://www.imf.org/en/Publications/WEO/Issues/2017/07/07/world-economic-outlook-update-july-2017.

The finding that inflation is also strongly interconnected with other countries is supported by Ciccarelli and Mojon (2010), who show that inflation in the industrialised world seems to be largely a global phenomenon, where almost 70 per cent of the variation in 22 OECD-countries can be explained by common factors. Furthermore, Aastveit et al. (2016) analyse to what extent economic variations in Canada, Norway, New Zealand and the United Kingdom can be explained by developments abroad and through which channels these work. They find that a significant proportion of the economic variations in these countries can be explained by developments abroad and that the trade channel is most significant.

Given Sweden's strong international dependence, an important question is whether forecasts from Swedish forecasters, including the Riksbank, have had a neutral revision pattern for domestic variables relative to changes in the international forecast. What then does a neutral revision pattern for the relationship between domestic and foreign variables mean? Our way of looking at this question is that a revision of the foreign outlook should result in a revised view of domestic developments with a degree of change in line with historical correlations in actual outcomes. Of course, this need not apply to every single revision. In certain situations, an international revision can be more or less linked to the domestic view depending on the origin of the revision and whether the economic policy response is more or less aggressive than normal. But on average over a longer period, the correlation in actual data should be reflected in the corresponding correlation between the forecast revisions, given that the structure of the economy (including how monetary and fiscal policy are conducted) has not changed to any great degree.[2]

In this article, we analyse this issue for a number of Swedish forecasters. We start by studying the Riksbank's forecasts made during the period 2007–2017 for GDP growth and inflation. We then compare the Riksbank's forecasts with those of a number of other major Swedish forecasters, including the National Institute of Economic Research (NIER), the Ministry of Finance and the major Swedish banks. Our focus is, however, on the Riksbank and, to a certain extent, the NIER. We also study the role of monetary policy in the forecasts, as different assumptions regarding monetary policy design can have important consequences for the impact of revisions to the foreign outlook.

Justiniano and Preston (2010) find that standard macroeconomic models for small, open economies cannot easily capture the effects of fluctuations abroad. This could lead us to believe that there is a weaker correlation in the revisions than what we see in the data. However, the forecasts we study are not pure model forecasts but rather better viewed as 'assessment forecasts'. In these judgmental forecasts, we should expect that forecasters are aware of the actual correlation in the data and that they are also aware of the models' potential inability to sufficiently include developments abroad in the analysis, and thus make correctly assessed forecast revisions.[3]

Despite this, our findings suggest that the Riksbank and the NIER have both had a slightly less-than-neutral revision pattern, i.e. they have taken slightly too little account of foreign GDP growth in their forecasts for domestic GDP growth in relation to the correlation in the outcome data in the short term. The regression coefficient for Swedish GDP growth as a function of foreign GDP growth (KIX) is 1.42 in the data and 0.91 in the Riksbank's forecast revisions. The NIER seems to have taken slightly more account than the Riksbank and has a regression coefficient of 1.09 (regarding the euro area) in the short term. For the Riksbank, we can draw the conclusion that the regression coefficient is statistically significantly lower

2 Please note that developments in a small country like Sweden should only have a marginal, if any, effect on other countries. In a forecasting process, this normally allows us to consider international forecast as exogenous when working out the domestic forecast. In other words, the international forecast is allowed to influence the domestic forecast but the domestic forecast normally does not influence the forecast for international developments. This relationship, which is true for GDP growth, inflation and policy rates alike, means that simple and straightforward methods can be used to perform our analysis.

3 Lindé and Reslow (2017) show that models are not so important when it comes to explaining the Riksbank's published forecasts. Instead, it seems as if informal judgments have a large influence on the Riksbank's forecasts. One possible explanation why the Riksbank has deviated from the models is that it has had a different view of the impact of international developments.

than the coefficient in the data (KIX). We cannot, however, draw the conclusion that the NIER's regression coefficient is significantly lower than the regression coefficient in the data (1.20 for the euro area). For inflation, both the Riksbank and the NIER seem to have taken reasonable account in the short term of foreign inflation in their forecasts for domestic inflation. For this variable, the correlation in the forecasts is even slightly stronger and closer to historical patterns (0.46) for the Riksbank (0.45) compared with the NIER (0.42).

At longer forecast horizons – two- to three-years ahead – we find that the influence of international developments in the forecast revisions for both domestic GDP and inflation is much lower than stipulated by historical patterns. As far as the Riksbank is concerned, the regression coefficient for GDP at the three-year horizon amounts to −0.02, which is to be compared with 1.42 in the data. The findings also indicate that the major Swedish banks take account of developments abroad to approximately the same degree as the Riksbank with regard to GDP and inflation 1–2 years ahead. It is important to point out, however, that the data material does not allow for the same in-depth analysis for the banks as for the Riksbank and the NIER.

We argue that the smaller impact on domestic GDP growth and inflation at longer forecast horizon is hard to explain by more aggressive monetary policy. Indeed, when we study the role of monetary policy in the forecasts, we find that the influence of foreign policy rates is high but yet lower in the short term than the historical pattern specifies, and about the same for both the Riksbank and the NIER. At longer forecast horizons, however, we see certain differences between the Riksbank's and the NIER's interest rate forecasts. In the longer term, the Riksbank's repo rate forecast revisions are still substantially influenced by revisions of foreign interest rates, while the influence on the NIER's forecast revisions is virtually non-existent.

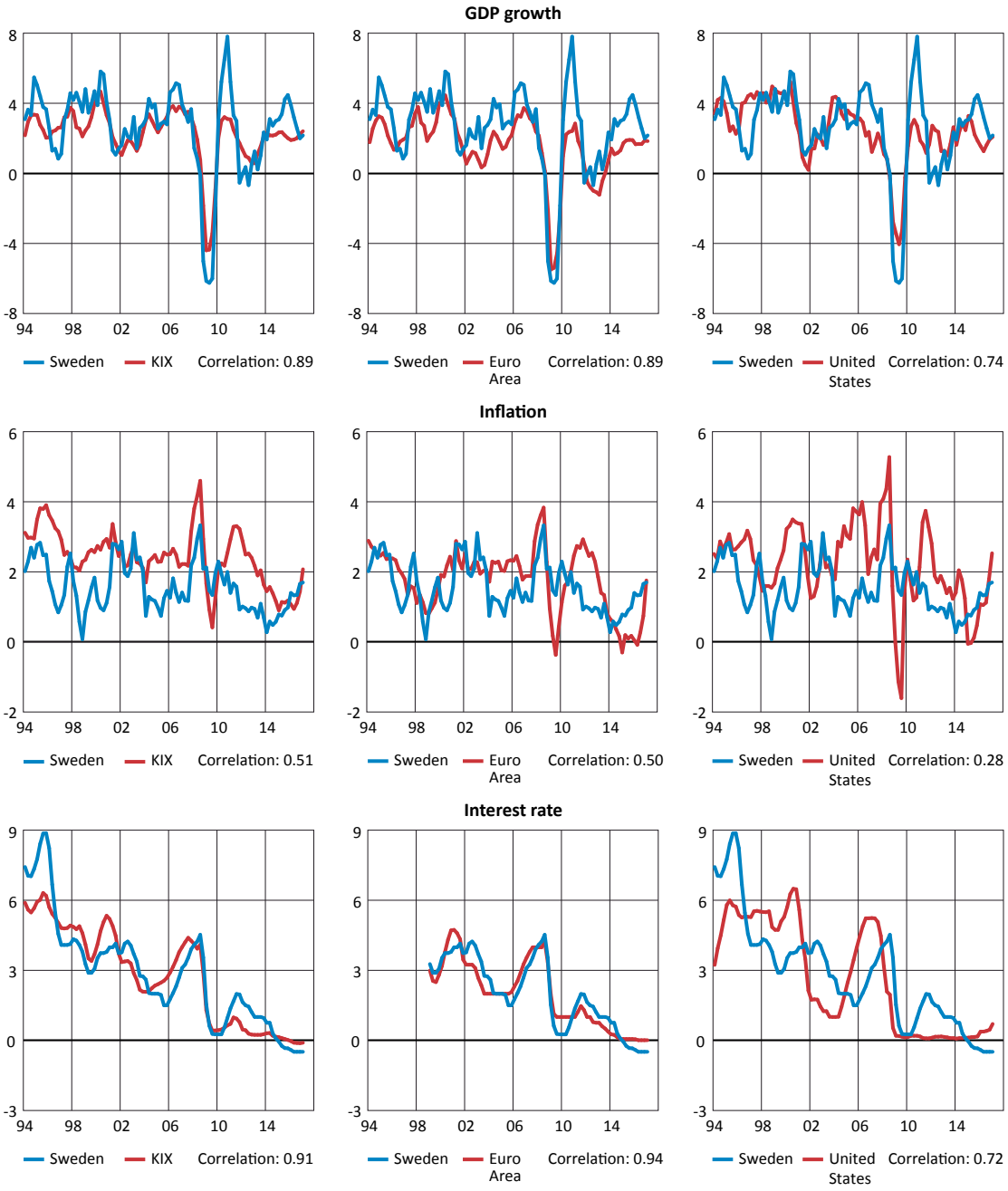
The rest of the article is arranged as follows. Below we begin by looking at the correlation between economic development in Sweden and abroad in the data. Then we analyse how the Riksbank has taken account of international developments in its forecasts. In Section 4, we study the NIER's forecasts and in Section 5 we make a comparison with other Swedish forecasters. In Section 6, we discuss the role of monetary policy in the forecasts and in Section 7, we provide a few concluding reflections.

2 Sweden's international dependence

Sweden's strong links to other countries manifests themselves in high positive correlation coefficients between, for example, Swedish and foreign GDP growth, inflation and interest rates. Figure 1 shows quarterly data on Swedish and foreign GDP growth (top row), inflation (second row) and the policy rate (third row). We show the Swedish variables together with three different international 'measures'. The first column refers to KIX-weighted countries abroad.[4] The second column shows the euro area and the third column the United States. Both GDP growth and inflation are measures as the annual rate of change in output and the price level, that is $(X_t - X_{t-4})/X_{t-4}$. Throughout the article, we use the annual change instead of quarterly growth (inflation) expressed as an annual pace (that is: $4(X_t - X_{t-1})/X_{t-1}$). This is because economic policy is focused on responding to underlying changes in the economy and these underlying changes are better measured in terms of the annual rate of change rather than in terms of the annualized quarterly rate. Another more practical reason for our choice is that many institutions (perhaps for the reason just discussed) only make and publish forecasts for the annual rate of change.

4 Foreign variables are weighed together with KIX weights, which capture the relative significance of the countries to which Sweden exports and from which it imports. For other countries, inflation is measured in terms of the CPI or HICP, while inflation in Sweden is measured in terms of the CPIF, which adjusts for the direct effects of changes in the repo rate as this measure gives a more accurate comparison.

Figure 1. Covariation between Sweden and other countries
Annual percentage change and percent respectively



Note. Inflation in Sweden refers to the CPIF. The CPIF is the CPI with a fixed mortgage rate. KIX-weighted interest rate refers to KIX4-weighting, which includes the Euro Area, the United States, the United Kingdom and Norway. GDP and inflation in annual percentage change and interest rates in per cent.
Sources: National sources, Statistics Sweden and the Riksbank

The interest rates in the chart refer to the policy rate for each country/region respectively (the repo rate for Sweden, the EONIA rate for the euro area, the Federal Funds Rate for the United States, and a weighted policy rate for the KIX area). The figures generally show a very high degree of covariation (correlation) between Sweden and other countries, even if the correlation with KIX-weighted countries and with the euro area seems to be slightly higher than the correlation with the United States. For inflation and the GDP growth rate, these high correlations are not driven by trends in the data, but for the interest rate series, there is a clear downward trend that reinforces the degree of covariation. When we remove these trends, the degree of covariation weakens slightly, especially between Sweden and

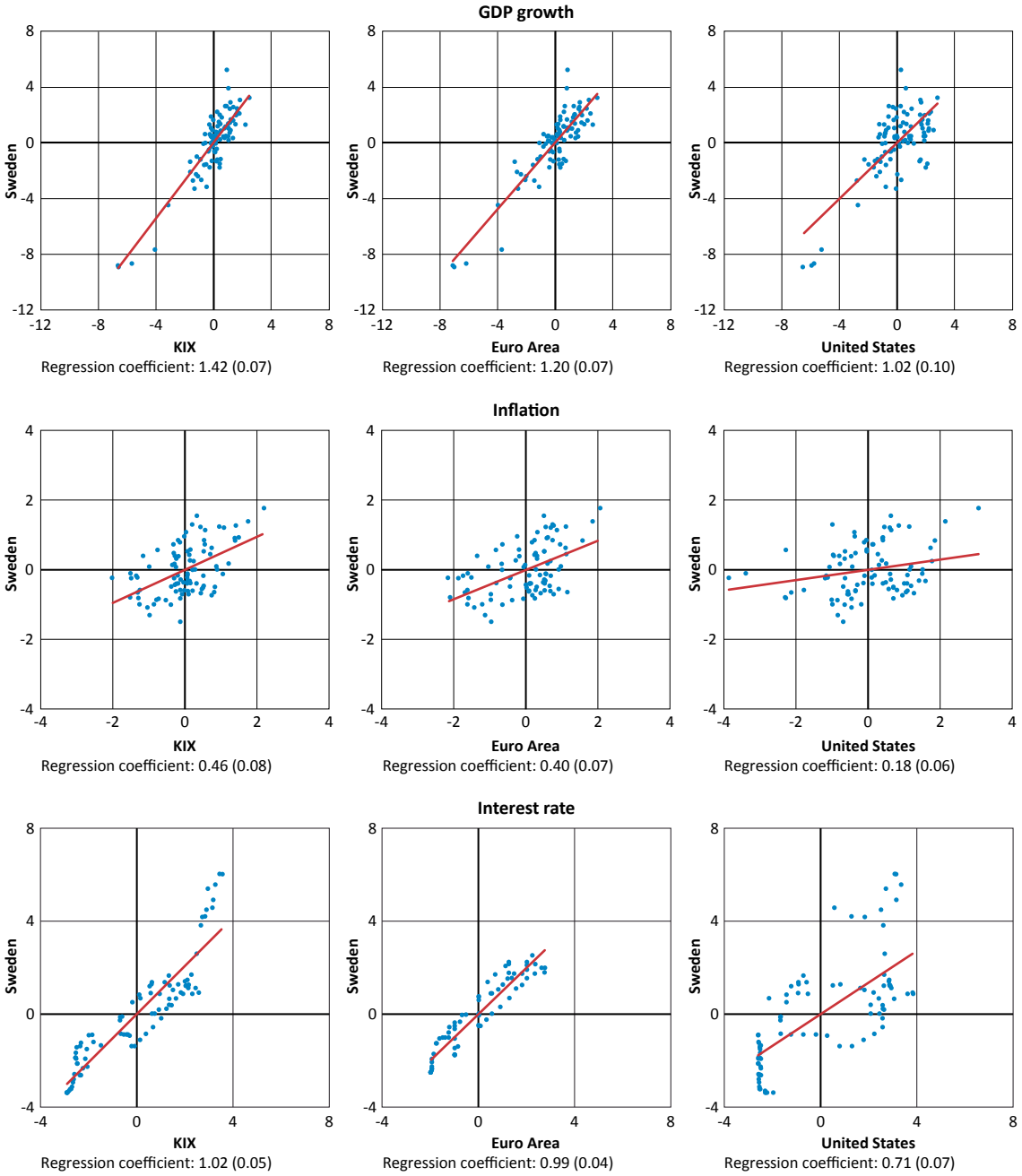
the United States. But the trend seems to be common and likely reflects a decline in the global equilibrium rate over time. This is formally supported by econometric estimates that provide very similar estimates for the downward trend in the various interest rates. This is why we choose to report the results for the interest rates at the levels shown in the chart. It can also be noted that if we were to calculate a so-called KIX2 index – i.e. a KIX-weighting including only the euro area and the United States – the correlations for GDP growth and inflation would be approximately 0.90 and 0.50 respectively and for the interest rate the corresponding coefficient is 0.90. These correlations are very close to those for the broader KIX index, which is not so surprising as the euro area and the United States together constitute around 55 per cent of KIX.

We can also illustrate the same data as we used in Figure 1 in a scatter plot. We do this in Figure 2, where we plot the Swedish series for each variable on the vertical axis and the foreign series on the horizontal axis for each time observation. As the Swedish and foreign series have different averages, the time series have been demeaned to be able to draw the charts using the same scale on the x- and y-axis. In the charts, we have also plotted a regression line through the points. The slope of the regression line captures the historical pattern and measures how much the Swedish variable changes on average when the international variable changes by one unit. The figure in brackets specifies the standard deviation for the regression coefficient – the higher the standard deviation, the greater the uncertainty regarding the regression coefficient. Using classical inference methods, a 95-percent confidence interval is formulated for the true regression coefficient by subtracting and adding two standard deviations from the point estimate.

In Figure 2, we can see that, when we measure the foreign economy using KIX, the regression coefficients for all the variables are higher compared with when we use the euro area or the United States. We obtain the lowest regression coefficients when we use the United States as the foreign measure. For GDP growth, the regression coefficient is greater than one for all measures of the foreign economy. For KIX, it is as high as 1.42. The fact that the regression coefficient for GDP growth is 1.42 implies that variations in foreign growth are very important for variations in Swedish growth. Specifically, the coefficient implies that a temporary increase in GDP growth abroad by 1 percentage point usually coincides with an increase in GDP growth in Sweden of 1.42 percentage points.[5] For inflation, the regression coefficient is 0.46 when we use the KIX index and 0.40 when we use the euro area. For the United States, the correlation is significantly weaker with a coefficient of 0.18. For the policy rates, the regression coefficients are very high – around 1 – for the KIX- and euro area, while it is significantly lower, although still relatively high, for the United States (0.71).

5 The reason why the coefficient exceeds 1 is that growth in Sweden is more volatile than the weighted average of growth among our trading partners. It is not due to the fact that Swedish GDP growth has on average been somewhat higher than growth abroad during the period.

Figure 2. The relationship between the economy in Sweden and abroad
Annual percentage change and per cent respectively



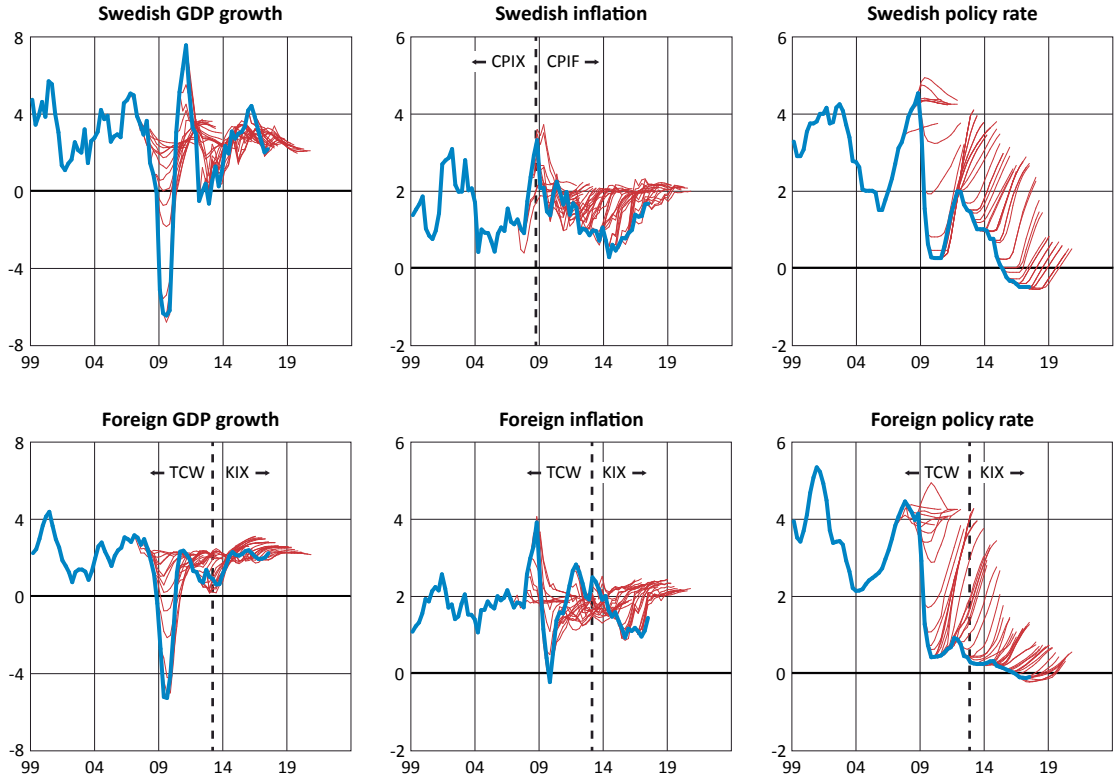
Note. Mean-value adjusted data. Standard error in brackets. GDP and inflation in annual percentage change and interest rates in per cent.
Sources: National sources, Statistics Sweden and the Riksbank

Apart from Figure 2 indicating that the regression coefficients are high, another important insight from the charts is that the uncertainty regarding these coefficients is relatively low. This means that changes abroad contain a clear signal for Swedish developments. Take, for example, the regression coefficient between Swedish and KIX-weighted GDP growth. A 95-percent uncertainty band is about 1.3–1.6, which means that there is a very strong signal that changes abroad have a major impact on the Swedish economy. For inflation, the corresponding uncertainty band is 0.3–0.6 and for the policy rate, it is approximately 0.9–1.1. The absolute impact is therefore smallest for inflation and it is shrouded in considerable uncertainty – but it should nevertheless be remembered that the confidence interval indicates a clearly positive impact.

3 The influence of foreign developments in Riksbank's forecasts

The Riksbank makes forecasts and publishes them in connection with its monetary policy decisions (normally 6 times per year). On each occasion, the Riksbank makes a forecast that looks ahead at least three years. In the forecasting process, an assessment is made of developments in the economy in Sweden and abroad. Figure 3 presents the forecasts that we are studying for the period 2007–2017.[6] In the Monetary Policy Report in July 2008, the Riksbank changed over from making forecasts for the CPIX inflation measure to making forecasts for the CPIF.[7] The Riksbank has also made forecasts for KIX-weighted countries abroad since the Monetary Policy Report in February 2013. Prior to February 2013, the Riksbank made forecasts for TCW-weighted countries abroad.[8]

Figure 3. The Riksbank's forecasts for Swedish and foreign GDP growth, inflation and the interest rate
Annual percentage change and per cent respectively



Note. Actual data (thick blue line) refers to the latest known outcomes for GDP growth and inflation, while the forecasts refer to real-time forecasts conditional on real-time outcomes that do not coincide with the latest known outcomes. The forecasts can therefore fluctuate somewhat when compared with the subsequent outcomes on which they were not based on. This is especially true at the time when the inflation-series was changed from CPIX to CPIF and the periods when the international weighting is changed from TCW to KIX. GDP and inflation in annual percentage change and interest rates in per cent.
Source: The Riksbank

6 We include forecasts up to and including the Riksbank's forecasts in connection with the April 2017 Monetary Policy Report.

7 In order to understand the difference between the CPIX and the CPIF, one needs to know that the index for interest costs for owner-occupiers in the CPI is calculated as follows: *Interest cost index = Interest rate index * Capital stock index*. The CPIX excludes the entire interest cost index and the direct effect of changes in indirect taxes and subsidies. When calculating the CPIF, only the interest rate is held constant and the change in the interest cost that is derived from the change in the capital stock is thus still there. The CPIF is therefore referred to as 'the CPI with a fixed interest rate'. An important difference is that the entire interest cost index is excluded from the CPI when calculating the CPIX and a change in the capital stock may therefore not have any effect on CPIX inflation but an effect on CPIF inflation.

8 The most significant difference between TCW and KIX is that the TCW weights were not changed each year but were based on trade flows in 1989–1991. As a result, TCW-weighted variables do not capture the increased importance of emerging market economies for the Swedish economy. The KIX weights are, on the other hand, updated annually based on available trade data and therefore take into account changes in Sweden's trading patterns. Another difference is that KIX includes more countries than TCW.

From the charts in Figure 3, it is not possible to see with the naked eye how much the Riksbank takes international developments into account in its forecasts. To investigate this, we must study the covariation between the Swedish and the foreign variables analogically as in Figure 2. We do this by studying the covariation between the Riksbank's forecast revisions for Swedish and foreign variables during a given time period. The forecast revisions are obtained by calculating the difference between the forecasts made between each Monetary Policy Report for international GDP growth and inflation and the corresponding revisions for the Swedish variables. We use the following formula to calculate revisions:

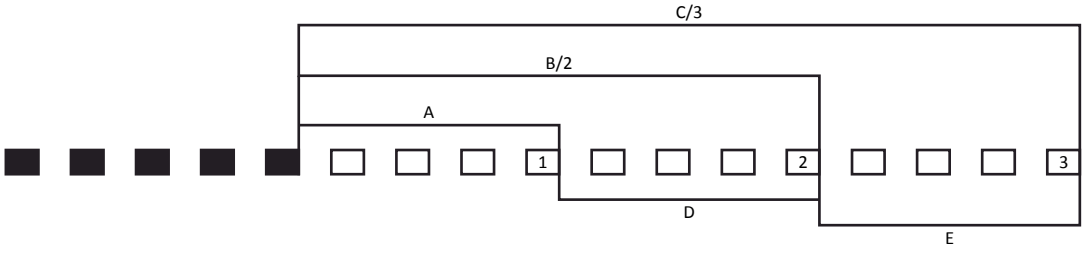
$$(1) \qquad Revision_{t,h}^{New} = Forecast_{t,h}^{New} - Forecast_{t,h}^{Previous}$$

The formula above means that the forecast revision on a given forecasting occasion is obtained by calculating the difference between the new forecast and the preceeding forecast round. A concrete example is when the Riksbank makes a forecast at the monetary policy meeting in April 2017 for inflation three years ahead. A forecast for inflation was also made in connection with the monetary policy meeting in February 2017. The revision is then the difference between the two forecasts:

$$(2) \qquad Revision_{2017,h}^{April} = Forecast_{2017,h}^{April} - Forecast_{2017,h}^{February}$$

It is worth noting that we can calculate this revision on different horizons, *h*. This means that on each forecasting occasion, we can take different parts of the forecast into consideration. The forecasts we investigate are illustrated in Figure 4. The black boxes refer to available outcomes. At the end of outcomes, a three-year forecast is made at a quarterly frequency. Each quarter is illustrated by a white box. The figures 1, 2 and 3 represent the one-, two- and three-year horizon in the forecast. The lines and letters A–E denote different ways of calculating comparable 'one-year' forecasts. A denotes the first year in the forecast, B denotes a two-year forecast which is divided by 2 to obtain an average of the two years. Correspondingly, C denotes a three-year forecast which is divided by 3 to obtain a three-year average. One can also calculate a forecast, D, which denotes the second year in the forecast, and a forecast, E, which denotes the third year in the forecast. Please note therefore that the third year in the forecast refers to the end of year two to the end of year three across the forecast horizon. It is important to clarify that new and previous forecasts are calculated so that they correspond calendar-wise. The previous forecast may hence need to be shifted a quarter or two horizon-wise.

Figure 4. Calculation methods for different forecast horizons for a given forecast



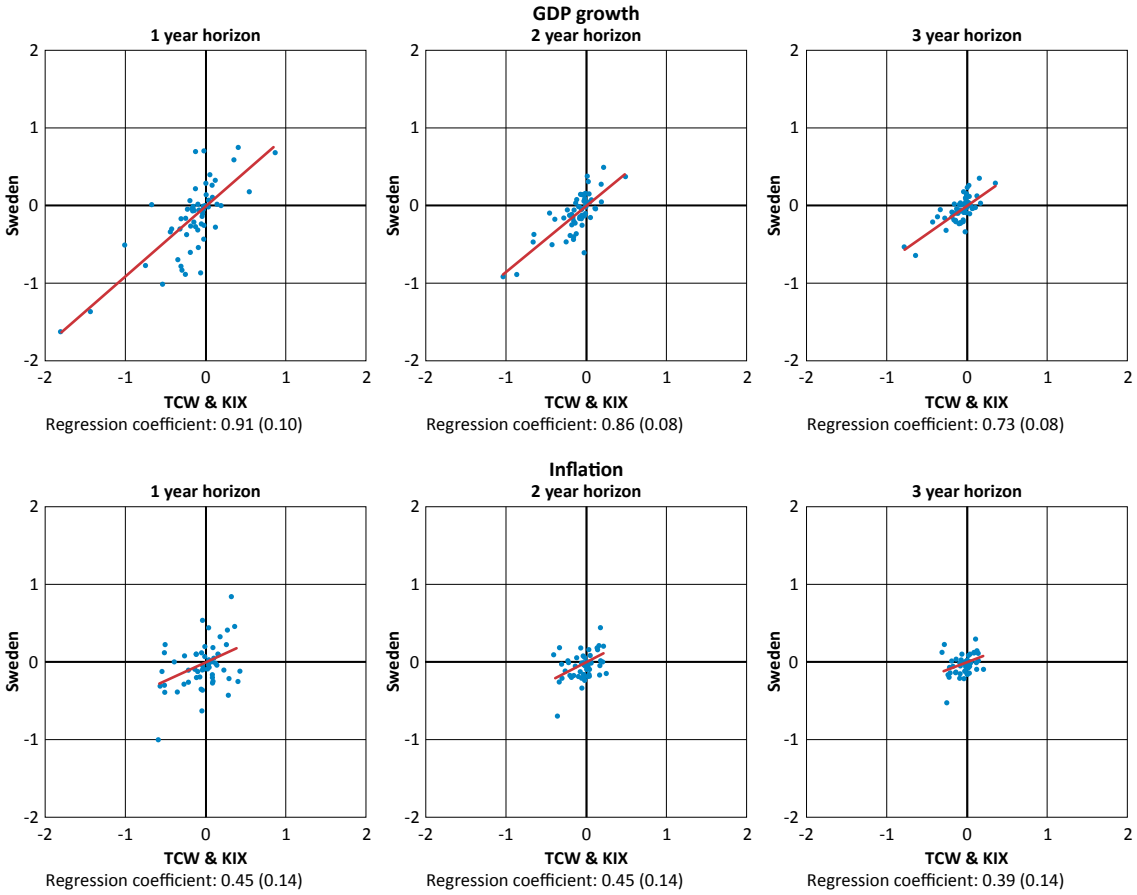
Note. Black box denotes quarterly outcome. White box denotes forecast quarter. The figures 1, 2 and 3 mark out the one-, two- and three-year horizon in a forecast. The lines and letters A–E denote different ways of calculating forecasts.
Source: Own illustration

We calculate forecast revisions based on the forecasts in Figure 3. We disregard the periods when the Riksbank changed over from TCW to KIX trade-weighted international variables and the periods when the Riksbank switched from CPIX to CPIF. With the forecast revisions

that we have calculated, we can therefore illustrate this data in scatter plots for different horizons in the same way as in Figure 2.

In the figures in Figure 5, you can see the revisions of the foreign variable on the horizontal axis and the revisions of the corresponding Swedish variable for GDP growth and inflation on the vertical axis. We will discuss the policy rate in Section 6. In the figure, you can see revisions of forecasts corresponding to the principles A, B and C in Figure 4. For each variable respectively, the regression coefficients in the figures in Figure 5 should therefore be in line with the regression coefficients seen in the data in Figure 2. When we plot the regression line, we do not allow for a constant. This is because, intuitively speaking, there cannot be a constant in revisions. If we allowed for a constant, the revisions would drift away uncontrollably in the long term, which is unreasonable.[9]

Figure 5. Revisions of forecasts for Swedish and foreign (KIX) GDP growth and inflation
Revisions, annual percentage change



Note. Standard error in brackets. The 1-, 2- and 3-year horizons refer to the calculation methods A, B and C from Figure 4.
Source: The Riksbank

From Figure 5, we see that a relatively strong short-term correlation for GDP growth, 0.91. However, this regression coefficient is significantly lower than the one we observed in the data (1.3–1.6).[10] In the longer term, the influence of other countries diminishes further, so that on average across the whole forecast horizon (i.e. the three-year horizon, method C in Figure 4), we only have a coefficient of just over 0.7. For inflation, we see in the short

9 An alternative to studying the forecast revisions is to simply plot the forecasts on a level in the same way as Figure 2. The results using this alternative approach are presented in Appendix B and do not differ from the forecast revisions we analyse in the main text. We prefer to study the forecast revisions as they show marginal effects on domestic variables when the international picture is revised for different horizons during the forecast period.

10 Appendix A presents methods for calculating significance. Generic tables with all significance tests are also presented there.

term that the regression coefficient (0.45) is in line with historical patterns (the regression coefficient is between 0.3 and 0.6 in the data according to Figure 2). In the longer term, the curve coefficient decreases, but on average across the forecast horizon, the influence is still in line with historical patterns according to the results in Figure 5. This may indicate that the influence of other countries is lower than historical patterns in the longer term. We will analyse this in more detail in the following section.

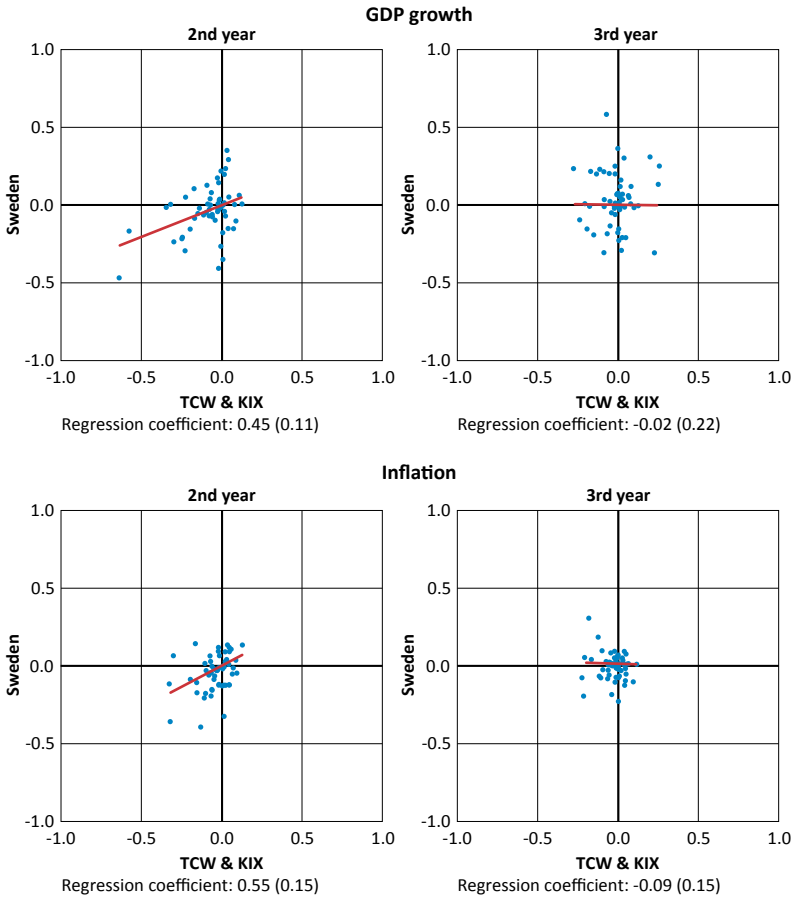
3.1 Longer-term forecast revisions

In Figure 5, we saw that the regression coefficient for both GDP revisions and inflation revisions decreased the further forward we looked during the forecast horizon. One year ahead, we had a coefficient for GDP of around 0.91 while the coefficient was only 0.86 two years ahead and finally 0.73 at the three year horizon. This demonstrates that the Riksbank projections takes foreign developments more into account in the short term than in the long term. However, it does not show the extent to which the Riksbank does this, as the variance in the forecasts can differ at different horizons. In order to perform a more exhaustive analysis, we have to study revisions of forecasts according to the principles D and E from the illustration in Figure 4, in addition to studying forecasts according to principles A, B and C. In other words, we must study forecasts for the second and third year separately across the forecast horizon. Figure 6 presents estimates of principles D and E. The first column shows that the regression coefficient for revisions between the end of year one in the forecast and the end of year two in the forecast is around 0.45 for GDP growth and 0.55 for inflation. The second column, which shows revisions between the end of year two and the end of year three, has a coefficient close to zero for both GDP growth and inflation. This is consistent with the results from Figure 5, i.e. the Riksbank has taken foreign influences more into account in the short term in both the GDP and the inflation forecasts. The higher regression coefficients three years ahead in Figure 5 relative to the revisions during the third year in Figure 6 are due to the fact that in Figure 5 we look at an average over the three years in the forecast and that the variations in the forecast for the longer forecast horizons are small in relation to the variation in the forecasts during the first year.[11]

An important question that we have not analysed so far is whether the impact of other countries varies over time. A natural division of our data material to investigate this is to separate the period with TCW-weights and KIX-weights and recalculate the results that only cover the KIX-weighted foreign block. This corresponds to forecasts made from 2013 onwards, i.e. primarily including forecasting rounds when monetary policy was rerouted in a more expansionary direction. For this period, we obtain a greater impact from foreign revisions in the short term. The regression coefficient for GDP growth for the one-year horizon then amounts to 1.3 with a standard deviation of 0.35 (which is higher as the material is now only based on 25 observations instead of twice as many for the entire period). For inflation, the corresponding figure is 0.52. On longer horizons, the correlation is as before much weaker. For GDP growth and inflation, the regression coefficients are −0.41 and −0.12 respectively during the third year, which can be compared with −0.02 and −0.09 in Figure 6 below. Both qualitatively and quantitatively, the results are very similar to the results in Figures 5 and 6. The difference being that, for this period, we cannot reject the conclusion that the Riksbank has taken adequate account of foreign GDP growth in the short term. We can only reject the hypothesis that the GDP forecast implies a neutral revision pattern relative to changes in the international forecast on the longer forecast horizons. The greater uncertainty surrounding the influence of foreign developments in the forecast revisions during this period is natural as fewer observations are used.

11 A fundamental insight in linear regression analysis is that the regression coefficient is mostly governed by observations with the highest variation around the mean value. For this reason, the regression coefficients for the average revisions at the two-year and three-year horizons shown in Figure 5 are governed by the revisions one year ahead as their variation is significantly higher. Normally, the forecasts further ahead are not revised to the same extent.

Figure 6. Revisions of forecasts in the longer term
Revisions, annual percentage change



Note. Standard error in brackets. The figures refer to the calculation methods D and E from Figure 4.
Source: The Riksbank

Is the lower correlation in the longer term a cause for concern? Not necessarily. A common view is that monetary policy affects inflation with a certain time lag, and active monetary policy offers one reason for the low correlation between the forecast revisions for Swedish and foreign inflation during the third year, compared with the first year of the forecast. A well-balanced monetary policy implies that changes in the repo rate counteract the variations in foreign inflation in the longer term. CPIF inflation therefore comes close to target at the end of the forecast horizon. In the shorter term, it is more difficult to counteract foreign inflationary impulses – such as major changes in the oil price – as effectively. The impact on the one-year horizon in the forecasts is therefore greater than during, for example, the third forecast year. In other words, a strong covariation in the shorter term and a weak covariation in the longer term is exactly what one would expect if monetary policy is well-balanced. We discuss the role of monetary policy in more detail in Section 6, in which we also analyse the Riksbank's interest rate revisions.

4 Comparison with the National Institute of Economic Research

So far, we have only studied the Riksbank's forecasts. What about other forecasters? Few other institutions publish and make the same amount of forecast data available as the Riksbank. This makes it difficult to carry out the same detailed evaluation as we can do for the Riksbank. One institution that provides a relatively large amount of forecast information

is, however, the National Institute of Economic Research (NIER). We therefore perform a similar analysis of the NIER's forecasts to make a comparison with the Riksbank. In the next section, we further expand the comparison by studying the forecasts of a number of other institutions, including the major Swedish banks.

One problem when we compare the Riksbank's forecasts with those of the NIER is that the latter does not publish forecast paths for international variables at a quarterly frequency. They are only available as full-year forecasts for the period 2009–2017.[12] As regards to international forecasts, we use the NIER's forecasts for the euro area, as it does not publish forecasts for KIX-weighted international variables. The analysis is not therefore completely comparable with our previous analysis.

Just as for the Riksbank, we calculate revisions in the NIER's forecasts by taking the difference between two consecutive forecasts. As the NIER publishes forecasts for the current year and the following one to two calendar years, the results obtained here should be compared with the results on the two-year horizon for the Riksbank (i.e. method B in Figure 4). To gain an understanding of the impact in the short and longer term, we also present results from two different horizons. One horizon refers to the last calendar year in the forecast, which is about two years ahead on average (i.e. Alternative D in Figure 4). The other horizon refers to the penultimate full-year in the forecast, which should be compared with the results for the Riksbank's one-year horizon. Just as for the Riksbank, we plot the forecast revisions for Sweden and other countries (the euro area) for the different horizons in a scatter plot.

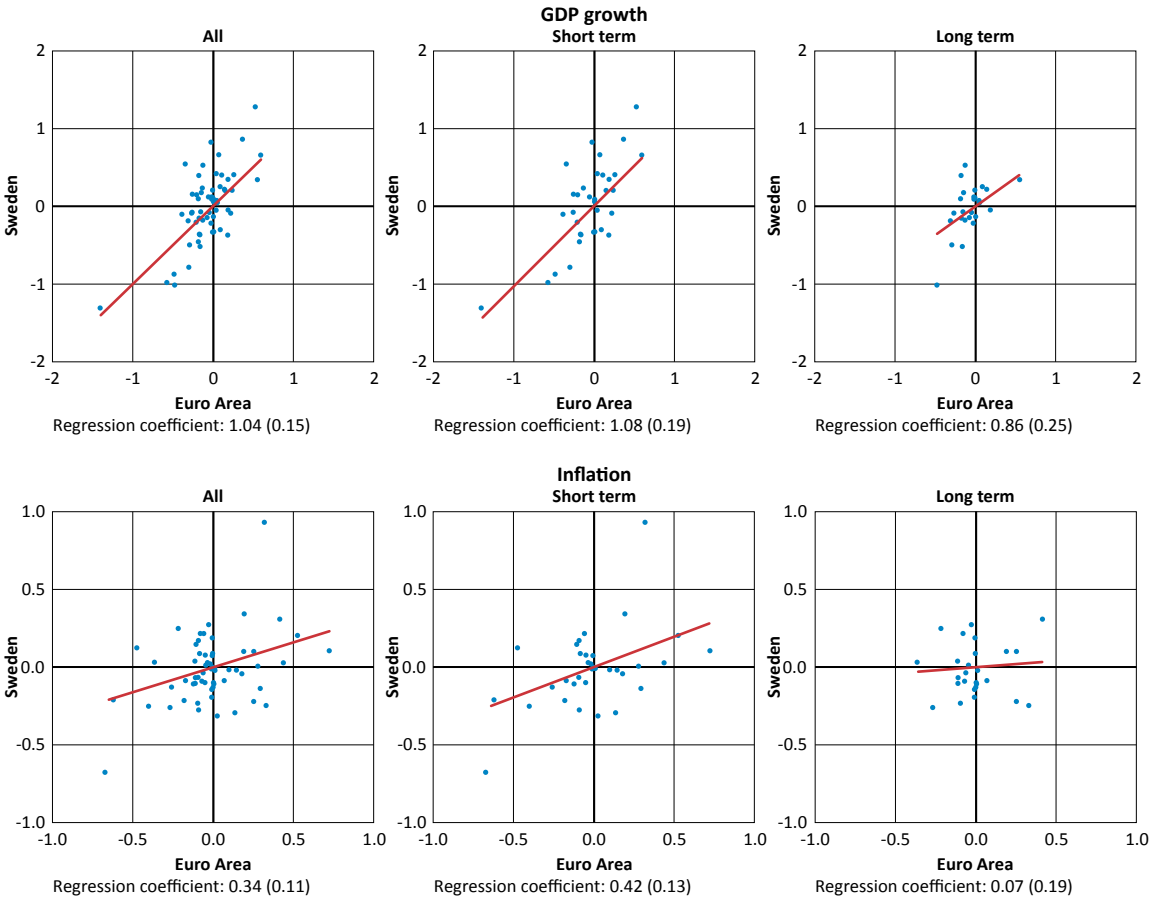
Figure 7 shows the revisions of the foreign variable on the horizontal axis and revisions of the corresponding Swedish variable on the vertical axis. The regression coefficient for the regression line through the scatter points tells us the extent to which the NIER has on average revised its view of domestic developments when it has revised its view of developments in the euro area. We see similar tendencies as we did for the Riksbank: The correlation between Sweden and abroad is weaker in the longer term in the forecasts. Especially for inflation, we see that the correlation is very weak for the longer forecast horizon, while it is in line with the data in the short term. For GDP growth, the correlation is lower than in the data for all horizons, but the difference is not statistically significant.[13] For inflation, the correlation in the short term is well in line with the data but in the long term, the correlation is close to zero. However, the correlation in the long term has a considerable degree of uncertainty in the estimate, which means that we can only say that it is significantly lower than the data on a 10-percent significance level.[14]

12 Last available forecast refers to the forecast published in June 2017.

13 For GDP growth in the short term (and hence also for all horizons), there is an unusual observation (which refers to the financial crisis in autumn 2008) with a major downward revision of foreign GDP growth (around –1.5 percentage points) and a relatively minor revision (about –1.2 percentage points) of Swedish GDP growth. If we exclude this observation, the regression coefficient increases from 1.04 to 1.11 for all horizons. This is slightly higher, but not significantly different. Neither is it obvious why this observation shall be excluded.

14 In the same way as for the Riksbank, we also present the NIER's forecasts in levels in Appendix B.

Figure 7. Revisions of forecasts for Swedish and foreign GDP growth and inflation
Revisions, annual percentage change



Note. Standard error in brackets.
Source: National Institute of Economic Research

5 Comparison with other forecasters

Comparing the Riksbank with other forecasters can provide both valuable information to help understand the forecasting institution's actions and an indication of what has been possible and not possible to predict. If, for example, all institutions have taken foreign developments too little or too much into consideration, it may be genuinely surprising events that are the basis for their actions. On the other hand, if an individual institution differs from the others, it seems reasonable to assume that another specific assessment or assumption about the economy lies behind the deviations. In this part of the analysis, we look at how the Riksbank and some other large forecasting institutions in Sweden have taken foreign developments into account in their domestic forecasts. As data for all forecaster is only available for a shorter horizon (the current and following year), the focus of the analysis is on a comparison between the institutions and not primarily with the actual data.

5.1 Data for comparison with other institutions

The forecasting institutions studied are, in addition to the Riksbank: the Ministry of Finance, the National Institute of Economic Research (NIER), SEB, Svenska Handelsbanken, Nordea, Swedbank, the Swedish Trade Union Confederation (LO) and the Confederation of Swedish Enterprise. Several of these institutions make significantly fewer forecasts in a year than the Riksbank. We have elected to deal with this by dividing the institutions into three groups. The Ministry of Finance and the NIER make up a group we call *Government.* SEB, Svenska

Handelsbanken, Nordea and Swedbank constitute a group we call *Banks* and finally, LO and the Confederation of Swedish Enterprise make up the group *Labour market institutions.*[15] The groups are explained in more detail in the discussion of the actual analysis.

Due to limitations in the data for a few of the institutions, a smaller amount of information is used here compared with the previous analysis of the Riksbank's forecasts. More specifically, we use the same data material here as is used every year in the forecast comparison conducted by the Riksbank to compare forecasting performance.[16] This data material consists of forecasts made for average outcomes for the current and following full-year for the period 2008–2017.[17] For example, the Riksbank made six forecasts in 2015, each of which contained forecasts for GDP growth for 2015 (current year) and for GDP growth in 2016 (following year). This means that several forecasts in the data material were made on different occasions (and different horizons) but refer to the same outcomes. The Riksbank has therefore made six forecasts for the 2016 outcome during 2016 and six forecasts during 2015. This gives forecasts with horizons of potentially between one and twenty-four months. A complication is that the various forecasting institutions make a different number of forecasts during the year and they make them at different times of the year. This means that the data is not entirely comparable between the different institutions. For our purpose, it should still provide valuable insights into how Swedish forecasters act as we are not interested in forecasting precision but in their revision patterns. We calculate forecast revisions for each institution respectively for the variables Swedish GDP growth and inflation (CPIF), euro area GDP growth and inflation (HICP) and U.S. GDP growth and inflation (CPI). After calculating the revisions for the United States and the euro area, we weight these together in a KIX2 index. The broader KIX index we used to analyse the Riksbank's forecasts can no longer be used as few institutions apart from the Riksbank make forecasts for KIX-weighted countries abroad. Together, however, the euro area and the United States constitute about 55 per cent of the broader KIX index, which should be a good approximation of the broader KIX index.[18]

An important aspect to point out is that the forecasts in this data material consist of actual outcomes to a significantly higher degree than in previous sections. A full-year forecast made with a horizon of one month has access to a large share of the outcome and only a small part actually needs to be forecast. In the data material that we use, we have an average forecast horizon of about twelve months, which provides an average forecast in which almost half the outcome is known.[19]

5.2 Account taken of other countries by Swedish forecasters

In Figure 8 and 9, we plot revisions for other countries on the horizontal axis and the domestic revisions on the vertical axis in scatter plots for each group respectively. Through the scatter points, we also plot a regression line in the same way as before. We have also drawn a yellow line showing the correlation in KIX2-calculated data. For GDP growth (Figure 8), we see that the Riksbank and the banks have coefficients close to one. For the labour market and government institutions, we have the highest coefficients. For the government institutions, including the Ministry of Finance and the NIER, it is worth noting that the picture does not significantly change if we treat them as separate institutions. But even if the results indicate that the Ministry of Finance and the NIER have taken

15 The *Labour market institutions* group is excluded in the analysis of inflation due to a lack of data. For the same reason, Swedbank is excluded from the *Banks* group in the inflation analysis. It is also worth noting that, for inflation, the *Government* group is mainly made up of the NIER, as we only have a few observations for the Ministry of Finance.

16 See, for instance, Sveriges Riksbank (2017).

17 The data material covers forecasts made before 22 June 2017.

18 In the calculation of the so-called KIX2 index, we have used the relative KIX weights 0.85 for the euro area and 0.15 for the United States.

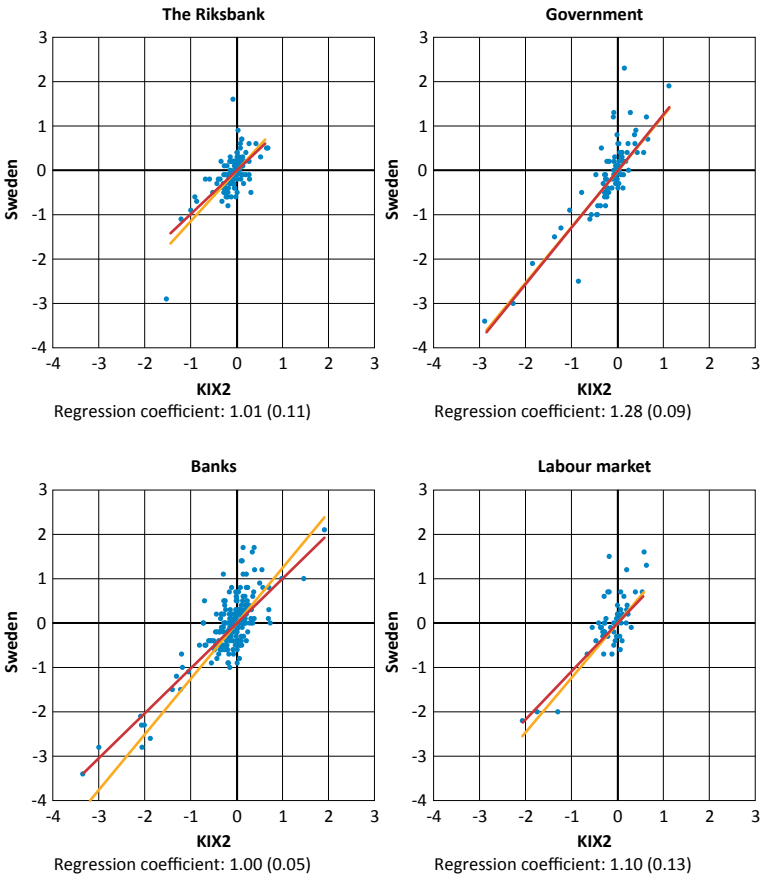
19 See Andersson et al. (2017) for a more detailed discussion on the significance of the horizon and calculation of outcome weights in outcomes and forecasting errors.

developments in the euro area and the United States more into account in their revisions in the short term compared with the Riksbank, the private banks and the labour market institutions, we cannot draw the conclusion that the difference is statistically significant. The difference in point estimates are not large enough and the standard deviations for the point estimates (figures in brackets) are relatively high. Finally, we can note that the results in Figure 8 indicate that the Riksbank has taken this foreign measure more into account than KIX-weighted countries abroad. In Figure 5, we saw that the regression coefficient for GDP growth was 0.91 for the one-year horizon while for KIX2 we have 1.01 in Figure 8. As fluctuations abroad measured using the KIX2 index have less impact on the Swedish economy than the KIX index, this relationship may seem surprising.[20] A possible explanation is that the euro area and the United States receive a little extra attention during a forecasting process, as they are the world's largest economies. One should also remember that the horizon is not completely comparable with our earlier analysis. In the material for this section, the horizon varies potentially from one to twenty-four months as previously noted. On shorter horizons, a lot of outcome information is available and it then seems natural that the correlation in the data is correctly reflected in the forecast.

Figure 9 presents the results for inflation. For the Riksbank and the banks, we once again see similar results. For the government institutions, we observe a coefficient that is slightly lower. The results are in line with what we saw in the comparison between the Riksbank and the NIER. One difference between the Riksbank and the other forecasters (government and banks) in Figures 8 and 9 is that the Riksbank has made notably smaller revisions of foreign growth. This is because the Riksbank publishes more forecasts each year, and it is therefore natural that the revisions in each given forecasting round is smaller in magnitude. We have hence verified that the results for the Riksbank are robust when we remove two forecasting rounds each year (the April and September forecasts). In this case, the regression coefficient increases to 1.1 for GDP growth and to 0.37 for inflation which compares well to the coefficients for the other institutions.

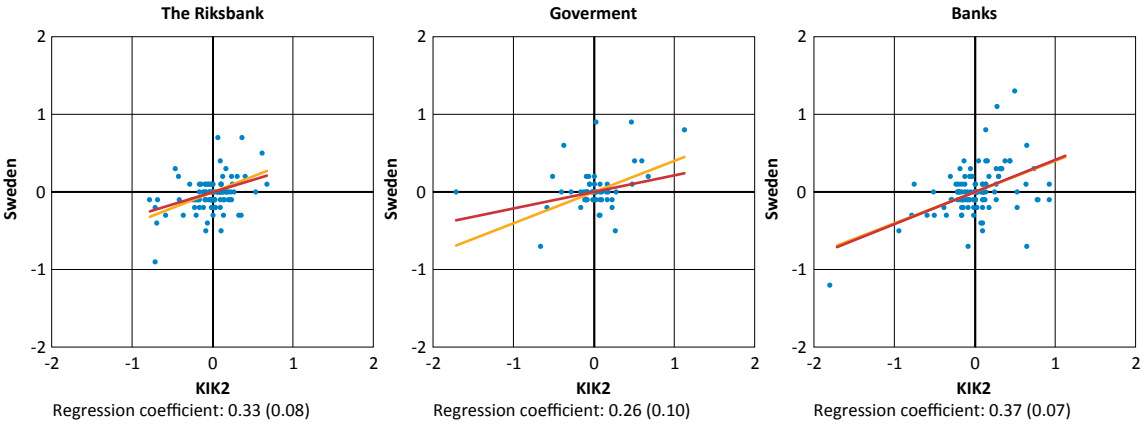
20 The regression coefficient in the data is 1.26 for the KIX2 index according to Figure 8 while the coefficient is 1.42 for the KIX index according to Figure 2.

Figure 8. Revisions for KIX2-weighted GDP growth
Revisions, annual percentage change



Note. Red line shows regression line through the points. Yellow line shows correlation in data for KIX2: 1.26 (0.07). Standard error in brackets.
Sources: Each institution respectively and the Riksbank

Figure 9. Revisions for KIX2-weighted inflation
Revisions, annual percentage change



Note. Red line shows regression line through the points. Yellow line shows correlation in data for KIX2: 0.37 (0.07).
Sources: Each institution respectively and the Riksbank

6 The role of monetary policy in the forecasts

The design of monetary policy is of central importance in the forecasts. A common conceptual framework about the functioning of the economy is that central banks can use monetary policy to influence the development of domestic GDP growth and inflation.[21] When the Executive Board of the Riksbank adopts a particular monetary policy, they also make an assessment of what monetary policy will be conducted in the future. They normally do this by communicating an interest rate path. This interest rate path is part of the monetary policy decision and has a direct effect on the forecasts of, for example, GDP and inflation published by the Riksbank. In other words, an interest rate path is associated with an assumption about how inflation is going to develop. A different interest rate path would, all else equal, give a different inflation forecast.

Why then is monetary policy of interest in the discussion about taking international developments into account? In very simple terms, one can say that an foreign revision can be dealt with in two ways in the forecast. The first option is to allow the changed view of international developments to 'impact' the domestic forecast in full. The second option is to 'counteract' the foreign impulse with an active, well-balanced monetary policy. To understand this a little better, we will perform a conjectural experiment. Let's say that the Executive Board decides on a certain interest rate level and an interest rate path that brings inflation back to target at a desirable pace. At the next policy meeting, their assessment is that foreign inflation needs to be revised down. In other words, they now think foreign inflation will be lower than they previously thought. According to historical patterns, lower foreign inflation is often an indication of lower inflation in Sweden as well. The domestic inflation forecast should therefore be revised down. But recalling that the Executive Board was satisfied with the inflation projection they envisaged at the previous meeting, it is reasonable to assume that the Executive Board at its next meeting will take a decision on a different rate level and a different rate path in order to counteract the change from abroad.

One should remember, however, that a common perception of monetary policy is that it works with a time lag. This means that it is only partly possible to counteract a foreign impulse in the short term. In the longer term, it should, however, be easier to influence inflation through monetary policy. This means that we can expect foreign revisions to have a greater impact in the short term as monetary policy cannot counteract the revision. On the other hand, monetary policy has a greater chance of counteracting the impact of foreign revisions on domestic variables in the longer term. So an important question is whether the Riksbank has conducted a sufficiently active monetary policy to justify a reduction in the longer-term impact from abroad in the forecasts. To examine this, we next study outcomes contra forecasts for the repo rate.

6.1 Monetary policy in the data and the Riksbank's forecasts

We start by looking at how the policy rate in Sweden and abroad has developed historically. In Figure 1, we showed how the repo rate in Sweden has covaried with a number of different measures of the policy rate abroad. We saw that the correlation between the repo rate in Sweden and the policy rate in the euro area has been very high between 1999 and 2017. Even the correlation with the KIX-weighted policy rate (we use a KIX4-weighting which included the euro area, the United States, the United Kingdom and Norway) is very high.[22] As before, we also plot this data in a scatter plot. Figure 2 illustrates what the correlation looks like in the data. The regression coefficients show that the policy rate in Sweden has

21 According to conventional theory, monetary policy can only influence real variables like GDP growth in the short term. In the long term, monetary policy is normally considered neutral and only influences nominal variables such as inflation. Long term in this context is normally deemed to be beyond the three-year forecast horizon.

22 KIX4 is what the Riksbank bases its forecast on. Together, the euro area, the United States, the United Kingdom and Norway make up 65 per cent of KIX.

on average changed 'one-to-one' with the policy rate abroad (KIX or the euro area). As the euro area weighs very heavily in this weighting, it is not so surprising that the euro area and KIX have a similar impact. The correlation with the United States is weaker and considerably more uncertain. From the chart, we see a notably higher dispersion around the regression line for the United States. It also appears from Figure 1 that there tends to be a phase shift between the repo rate and the US federal funds rate, with the latter changing earlier. The correlation between them is therefore slightly stronger if we compare the current policy rate with changes that occurred in the federal funds rate six months previously.

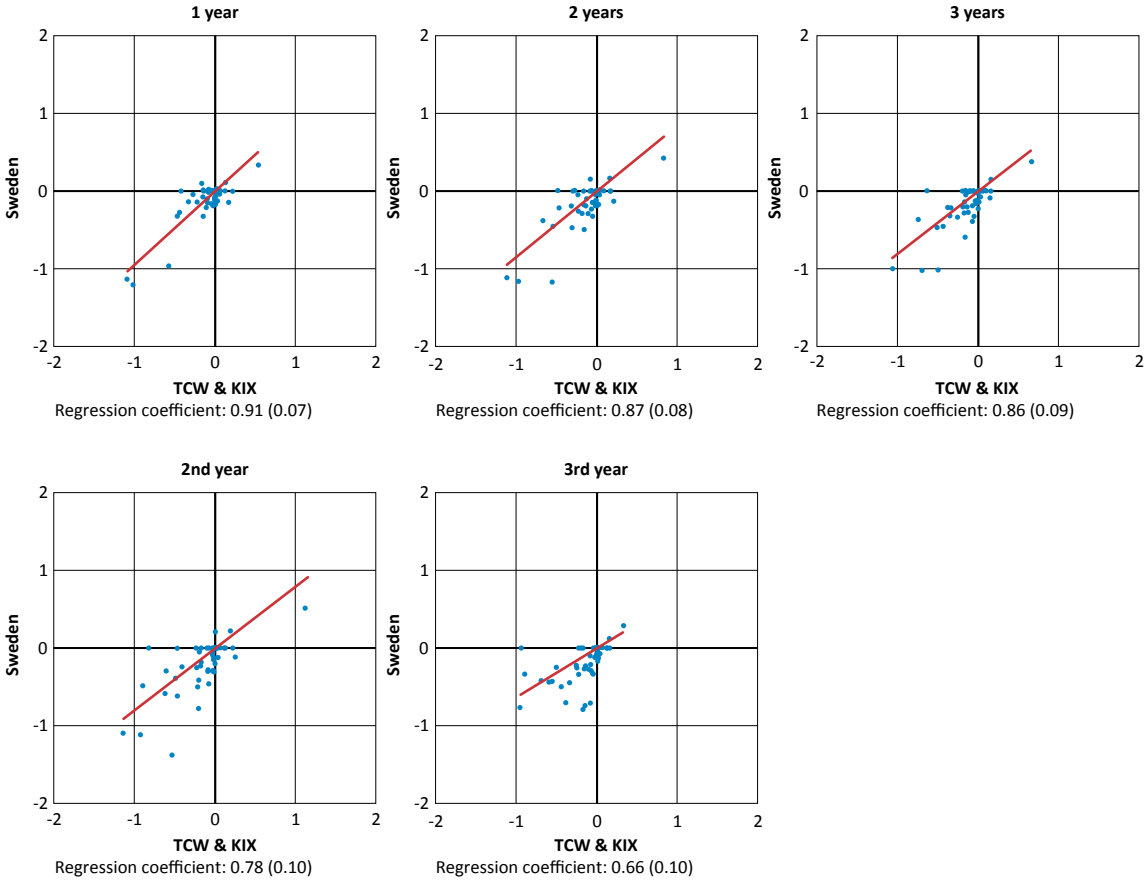
Figure 3 shows the Riksbank's forecasts for the repo rate in Sweden and the Riksbank's forecasts for the KIX-weighted policy rate. The similarity between the profiles of the domestic forecasts and the international forecasts is clear from the figure. It is also clear that the interest rate has been surprisingly low both in Sweden and abroad. As before, by calculating revisions between two consecutive forecasts, we can plot the revisions in scatter plots. But how strong is the correlation between the domestic and foreign rates in the revisions? To study this, we follow the analysis in Figures 5 and 6 and plot the revisions in the foreign rate (x-axis) for all forecasting rounds against the revisions in the Swedish repo rate (y-axis) for all forecasting rounds. By plotting a regression line through the points, we then obtain a measure of what the correlation has looked like in the Riksbank's interest rate forecasts. There is, however, a slight difference from what we did with the GDP growth rate and inflation in Figures 5 and 6: When we calculate the interest rate forecasts according to the principles in Figure 4, we calculate the revisions for alternatives A, B and C between two consecutive forecasting rounds as the difference between the average for the 4, 8 and 12 first quarters respectively in the later forecasting round. The choice of starting quarter is hence guided by the later forecasting round. The principles D and E are calculated as follows: the average of quarters 5–8 and the average of quarters 9–12 respectively.[23]

Figure 10 shows the results of this exercise. The figures in the first row show the correlation one, two and three years ahead in the forecasts. As can be seen, the correlation is relatively high on all horizons but slightly low in relation to the correlation in the data (1.02). It is not significantly lower than the data, however. The second row in Figure 10 shows the correlations between the revisions during the second and third year in the forecast respectively.[24] The coefficient is 0.78 when we look at the second year in the forecast, and 0.66 when we look at the third year. These two coefficients are significantly lower than the coefficient in the data. Quantitatively, these results are not in line with the same analysis we made for GDP and inflation. In that analysis, we saw that the correlation was close to zero during the third year in the forecasts. Qualitatively, the results for the repo rate at longer horizons are similar to those obtained for GDP growth and inflation in the sense that the comovement in the revisions is lower.

23 When we calculate the revisions three years ahead, we lose six observations because we cannot calculate the difference from the previous forecasting round on the twelve-quarter horizon. This is because the previous forecasting round sometimes does not extend far enough. We chose to exclude these six revisions for the shorter horizons as well in order to keep the number of revisions constant over the different horizons.

24 According to principles D and E illustrated in Figure 4.

Figure 10. Revisions of the forecast for Swedish and foreign policy rate
Revisions, per cent



Note. Standard error in brackets. The figures refer to the calculation methods: A, B, C, D and E.
Source: The Riksbank

How do these figures compare with historical patterns? We saw in Figure 2 that the correlation in actual data suggested a regression coefficient of around one for both the euro area and KIX-weighted countries abroad with an uncertainty band of 0.9–1.1. So even if the Riksbank has taken significant account of interest rates abroad in its forecasts, it has done so to a slightly less extent than is implied by a neutral revision pattern.

The results from Figure 5 and Figure 6 demonstrate that the Riksbank has, in the short term, allowed foreign revisions to have a relatively substantial impact on GDP and inflation according to the correlations in the outcome data, albeit slightly weak for GDP growth. In the long term, however, the Riksbank has not allowed foreign revisions to have much of an impact. This may be because the Riksbank, in its forecasts, has felt that it is conducting a monetary policy that has counteracted the foreign impulse and hence has been able to 'steer' domestic developments in the longer term. However, the results in Figure 10 do not suggest that the Riksbank has been more activist in its rate-setting in the forecast than historical patterns might imply. The Riksbank has revised the domestic forecast for the interest rate on all horizons to almost the same extent as the foreign revision, albeit slightly weaker than the correlation in the outcome data.

In other words, the Riksbank has changed its monetary policy stance between the Swedish repo rate and foreign policy rate in line with the historical patterns, but, despite this, it has had a significantly smaller impact of international developments on domestic GDP growth and inflation on longer forecast horizons. If the regression coefficients for the interest rate in Figure 10 had been greater than one, it would have been a sign that the monetary policy in the forecasts had been more aggressive than the historical patterns and a smaller

impact in the longer term could therefore have been justified. As the regression coefficients now seem to be slightly below one, it is more difficult to argue that the Riksbank has been more active. From a monetary policy perspective, therefore, it appears difficult to justify a smaller impact of revisions to foreign inflation on domestic inflation for the longer forecast horizons.[25] However, there may be a few other reasons why the Riksbank has expected a smaller impact of international developments on domestic forecasts in the longer term.

First of all, it can be an expression of the Riksbank having different views on the transmission mechanism in Sweden and abroad. It might be that the Riksbank expects the impact from the interest rate in Sweden to be more rapid and possibly also stronger than in other countries. This might be reasonable provided that Sweden is a very open economy. It is also possible that the transmission mechanism is faster now than it used to be as Sweden's integration with the rest of the world has increased both in terms of trade and via financial markets. One way of trying to quantify a different view of the transmission mechanism is the exchange rate. The exchange rate is a forward-looking price determined by the impact of various shocks affecting the economy. It may be that the Riksbank has made different assessments of how the exchange rate covaries with GDP growth, inflation and the nominal policy rate to what historical patterns indicate and this may have led the bank to deviate from historical patterns with regard to the covariation between foreign and domestic variables in the longer run across the forecast horizon (also in the short run for GDP growth). We have therefore examined the relationship between the real KIX exchange rate and the three domestic variables in the data, and what these relationships look like in the Riksbank's forecast revisions. We report these results in Appendix C. In the appendix, however, we show that the Riksbank's forecast revisions for the covariation between the real exchange rate and annual GDP growth, inflation and the nominal repo rate do follow historical patterns in the data. In the data, there is a significantly positive correlation between the real exchange rate and GDP growth and the repo rate: A stronger appreciated exchange rate is associated with higher GDP growth and the repo rate. Even so, there is no significant direct correlation between inflation and the real exchange rate, and the causality between these variables is not obvious. The real exchange rate, domestic interest rate, inflation and GDP growth are all endogenous variables so, without making additional assumptions, we cannot say which variable has caused which. Still, this is not what is important here. The important thing here is that the correlation between these variables in the Riksbank's forecast revisions looks approximately the same as in the data. We can therefore rule out deviating exchange rate assessments as an important factor behind the lower influence of international developments in the long-term. Hence, it seems that the influence of foreign variables is lower than in historical patterns would suggest.

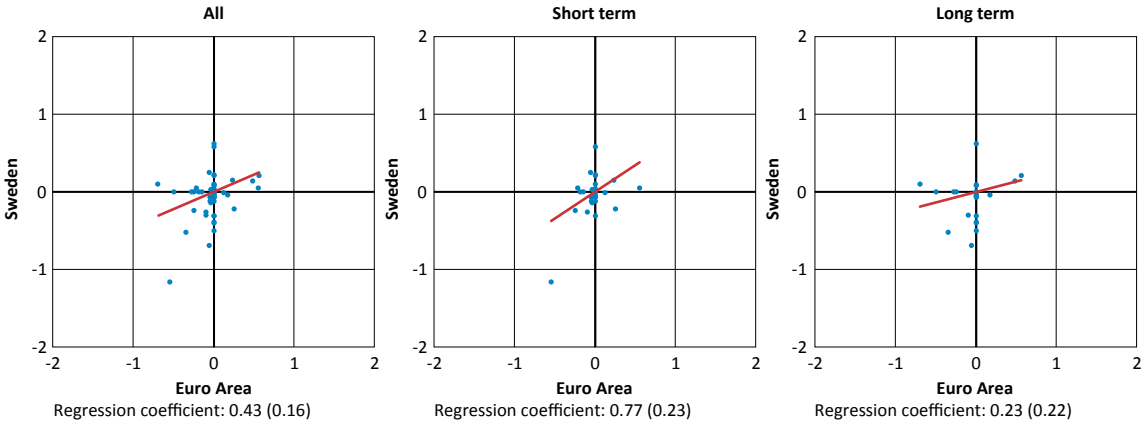
Another explanation for why the correlations deviate might be that Sweden, to a greater extent than other countries, is deemed to have more effective so-called 'automatic stabilisers', in which the public sector fiscal balance varies according to the economic situation without active decisions being necessary. A greater degree of and more efficient automatic stabilisers would then lead to the economy returning to long-term equilibrium more quickly.

25 This reasoning is valid in a traditional, backward-looking model, in which only actual interest rate changes affect economic activity and inflation. In a model with forward-looking expectations, such as Ramses, a similar change in the *actual* interest rate may stabilise the economy *better* if the central bank communicates a *greater willingness* to respond to deviations of inflation around the target and the GDP growth rate across the forecast horizon. Doing so causes the variation in these variables to decrease, which results in it not being necessary to actually change the interest rate more than normal in equilibrium. To investigate this possible explanation for the results, we have estimated a simple Taylor rule for the Riksbank's revisions of the repo-rate path on revisions of the inflation forecast and the GDP growth rate one year ahead and between year two and year three across the forecast horizon (alternative A and E respectively in Figure 4). When we do that, we find no support for a more aggressive policy stance across the longer forecast horizon. Our simple reasoning that monetary policy has not been sufficiently aggressive therefore seems also to be valid in a framework with forward-looking expectations.

6.2 The National Institute of Economic Research's interest rate forecasts

Due to a lack of data, we cannot perform the same analysis for all the other institutions. The National Institute of Economic Research (NIER) has, however, published interest rate forecasts that we can use. Figure 11 shows the NIER's interest rate revisions. In Figure 11, we do not really see the same pattern as we do for the Riksbank. For the NIER, we see a weak correlation that is statistically proven to be lower than in the data for the longest forecast horizon while we saw tendencies towards a continued strong correlation in the Riksbank's revisions. In the NIER's interest rate forecasts, we see that large number of revisions for the euro area and Sweden are zero or close to zero, as the NIER does not seem to have changed the outlook for monetary policy very often.

Figure 11. The National Institute of Economic Research's revisions of the forecast for Swedish and foreign policy rate
Revisions, per cent



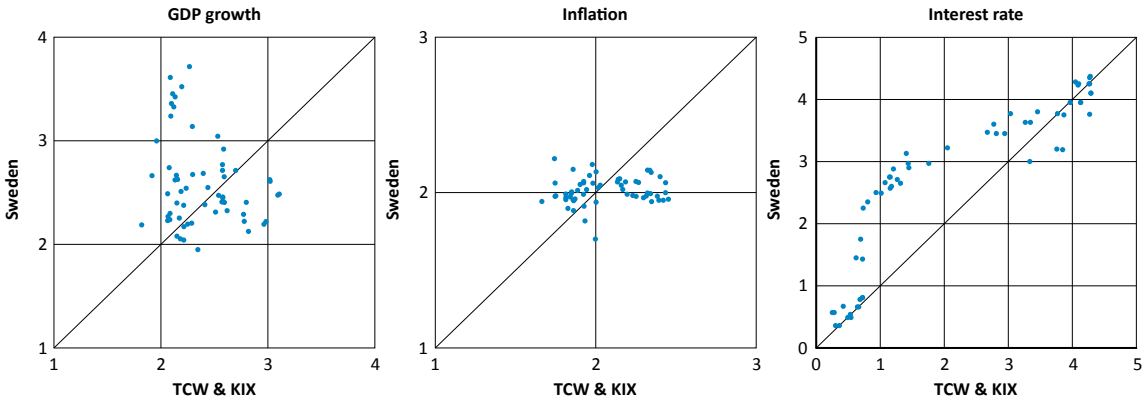
Regression coefficient: 0.43 (0.16) | Regression coefficient: 0.77 (0.23) | Regression coefficient: 0.23 (0.22)

Source: National Institute of Economic Research

6.3 End-point analysis

The weak correlation between the revisions for other countries and Sweden for GDP and inflation further out during the projection horizon can possibly be explained by the fact that the Riksbank, in the long term, forecasts a return to long-term equilibrium. By studying the end points in the forecasts, we can gain further insights into this. We start by selecting and plotting the last observation from each forecast from Figure 3 in a scatter plot, where the observation for the foreign variable is on the x-axis and the domestic variable is on the y-axis. In addition, we include a 45-degree line to facilitate interpretation. If the end-point observations are above the line, it means that the Riksbank has, on average, had a higher end point in the domestic forecast compared with the international forecast, and a lower end point if the points are below the line. In Figure 12, we see that the Riksbank has possibly had a slightly higher end point in the domestic GDP forecasts. We also see that the Riksbank has often had a higher domestic interest rate at the end of the forecast than it has had for its projection of the foreign policy rate. For inflation, it is not possible to see any clear pattern regarding whether the Riksbank has had a lower or higher inflation in the end points. On the other hand, one can quite clearly see that the dispersion is significantly greater for foreign inflation in relation to domestic inflation in the longer run.

Figure 12. End points in the Riksbank's forecasts
Annual percentage change and per cent

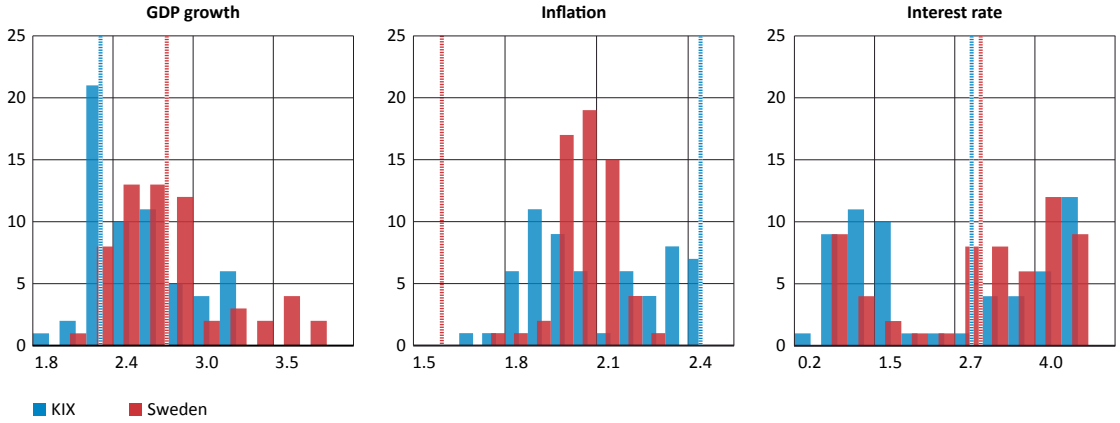


The data points in Figure 12 can also be illustrated by showing what the distributions look like. Figure 13 shows distributions for the forecasts' end points for the domestic and foreign variables separately. The subplots in Figure 13 confirm what Figure 12 initially suggested for GDP growth – they are very similar but the forecasts for Swedish GDP growth are slightly higher. For the interest rate, we see two clusters: One with a higher interest rate, 3–4 per cent and one with a lower rate, 0–2 per cent. Once again, we see that the forecasts for monetary policy are characterised by slightly higher end points in the Swedish interest rate forecasts. For inflation, it is now even clearer that the longer-run forecasts for Swedish CPIF inflation are clearly characterised by a return to a long-term equilibrium around the inflation target of 2 per cent. This can be seen by the very tight clustering of the distribution around 2 per cent, i.e. the inflation target. For foreign inflation, the distribution is not so concentrated in the end points. The foreign inflation forecasts refer to KIX-weighted countries abroad, and if we calculate a KIX-weighted inflation target, it turns out to be approximately 2.4 per cent.[26] In other words, the longer-term foreign inflation forecasts are often characterised by them not being expected to return to the long-term equilibrium, despite the fact that many of the countries included in the KIX index have an inflation target and conducts monetary policy in a similar way to how it is done in Sweden.[27] For the policy rates and GDP growth, we see a similar dispersion in the end-point forecasts.

26 It is important to point out that it is not possible to calculate an exact measure of KIX-weighted inflation target as a number of countries do not have a point target for inflation. For example, the European Central Bank's target states that inflation shall be below but close to 2 per cent. The Swiss central bank has specified a target for inflation of below 2 per cent. The central bank in Australia has a target that specifies a target interval of 2–3 per cent. Some countries have even changed their inflation target during our study period. In other words, there is uncertainty about the level of the KIX-weighted inflation target.

27 For the economic region with the greatest weight in the KIX index, the euro area, we unfortunately only have access to the Riksbank's end-point forecasts for the period 2013–2017. For this period, these vary between 1.4 and 1.9 percentage points, which is systematically lower than the ECB's inflation target of 'close to, but just below 2 per cent'. However, as the dispersion in the end-point forecasts for the euro area is not higher than in the Riksbank's end-point forecasts for CPIF, as shown in Figure 13, and as the number of observations is small (25), the possibility of drawing any wide-ranging conclusions about any differences between the forecasts for Sweden and the euro area is limited.

Figure 13. End-point distribution
Frequency



Note. Broken vertical lines refer to average values in actual data from 1994.
Source: The Riksbank

7 Concluding remarks

In this study, we have analysed how the Riksbank and other Swedish forecasters have taken international developments into account in their forecasts for Swedish GDP growth, CPIF inflation and the repo rate. Our focus has been on whether a revision of the view on international developments has led to a revised view on domestic developments in line with historical patterns.

Sweden is a small, open economy that is strongly influenced by developments abroad. The fact that the assessment of international developments is also important for the assessment of domestic developments is reflected in the Riksbank's forecasting process. When the Riksbank prepares an economic forecast, it starts work by making an assessment of economic activity and inflation abroad, with a particular focus on countries with strong trade links with Sweden. The euro area and the United States are particularly important in this regard.[28]

Our findings, however, indicate that the Riksbank has taken too little account of foreign GDP growth in its forecasts for Swedish GDP growth in relation to historical correlation patterns, especially in the longer run. The National Institute of Economic Research (NIER) has also taken less account of international developments than is implied in the outcomes, although the difference for the NIER is not statistically significant. The findings also show that the major Swedish banks and key labour market insitutions have similar results to those of the Riksbank. For inflation, the results suggest that both the Riksbank and the NIER have taken reasonable account in the short term of foreign inflation in their forecasts for domestic inflation. In the longer term, however, both seem to have taken very little account of international developments in their inflation forecasts. Once again, the results for the major Swedish banks are in line with the results for the Riksbank.

For policy rates we found that both the Riksbank and the NIER take considerable account of foreign policy rates in the short term, albeit slightly less than historical patterns prescribe. At longer forecast horizons, we see certain differences between the Riksbank and the NIER. The Riksbank continues to incorporate substantial influence of international developments in the longer term while the NIER takes little account of foreign rate-setting in its long-term forecasts. These findings mean that a more active monetary policy stance cannot easily explain the lower impact on domestic GDP growth and inflation on the longer forecast horizons. Only if the domestic interest rate-setting had been more aggressive than

28 See Hallsten and Tägström (2009) for a description of the forecasting process.

prescribed by historical patterns would it have been possible to motivate a smaller impact from a monetary policy perspective. Other assessments must be behind the more limited impact in the Riksbank's and NIER's medium- and long-term forecasts.

Finally, it is important to point out that we have not in this study looked at forecasting performance, with regard to either domestic or international developments. An institution that does not revise its domestic forecast in line with its foreign revisions could possibly motivate this by stating that it considers its international assessment to be particularly uncertain. Such a reasoning may, however, be problematic if it is extended to apply over a longer period of time. It is difficult to see any reason why it would be fundamentally much more difficult to forecast international developments (e.g. KIX, the euro area or the United States) than domestic developments.[29]

29 See Sveriges Riksbank (2017) for an evaluation of the forecasting performance of various forecasting institutions. See also Aranki and Reslow (2015) for an evaluation of the Riksbank's international forecasts.

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Appendix A

When we examine whether a regression coefficient in forecast revisions is statistically significantly different from the corresponding regression coefficient in the data, we calculate the following Z-statistic:

(3) $$Z=(\hat{\beta}_{data}-\hat{\beta}_i)/\sqrt{\sigma^2_{data}+\sigma^2_i}$$

where $\hat{\beta}_{data}$ denotes the estimated regression coefficient in the data and $\hat{\beta}_i$ denotes the estimated regression coefficient in the forecast revisions. σ denotes standard error in the estimates of the coefficients in the data and revisions respectively. Given our Z-statistic, we can then calculate a significance test with two-sided *p*-values. The null hypothesis in the test is that the two coefficients β_{data} and β_i are the same. A low *p*-value (normally below 0.05) allows us to reject the null hypothesis that they are equal. Tables A1 and A2 present *p*-values for the various regression coefficients calculated for the Riksbank and the National Institute of Economic Research respectively.

Table A1. Testing statistical significance in the Riksbank's revisions

	GDP	Inflation	Interest rate
1 year	0.00	0.93	0.23
2 years	0.00	0.95	0.12
3 years	0.00	0.66	0.11
2nd year	0.00	0.57	0.03
3rd year	0.00	0.00	0.00

Note. The figures refer to p-values. A low p-value allows us to reject the null hypothesis that the regression coefficients in the revisions are the same as the regression coefficients in the data.

Table A2. Testing statistical significance in the National Institute of Economic Research's revisions

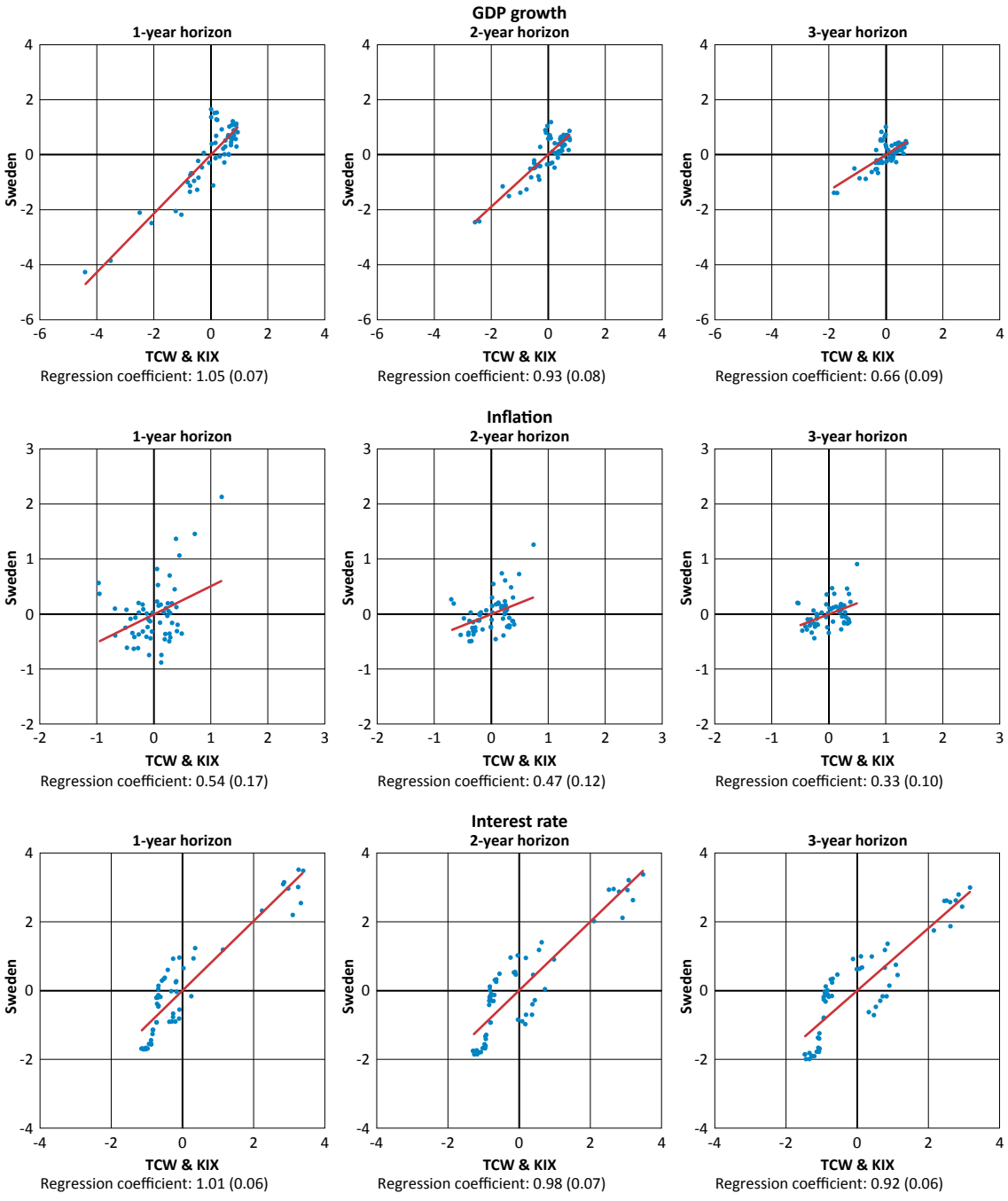
	GDP	Inflation	Interest rate
All	0.33	0.65	0.00
Short	0.55	0.89	0.36
Long	0.19	0.10	0.00

Note. The figures refer to p-values. A low p-value allows us to reject the null hypothesis that the regresion coefficients in the revisions are the same as the regression coefficients in the data.

Appendix B

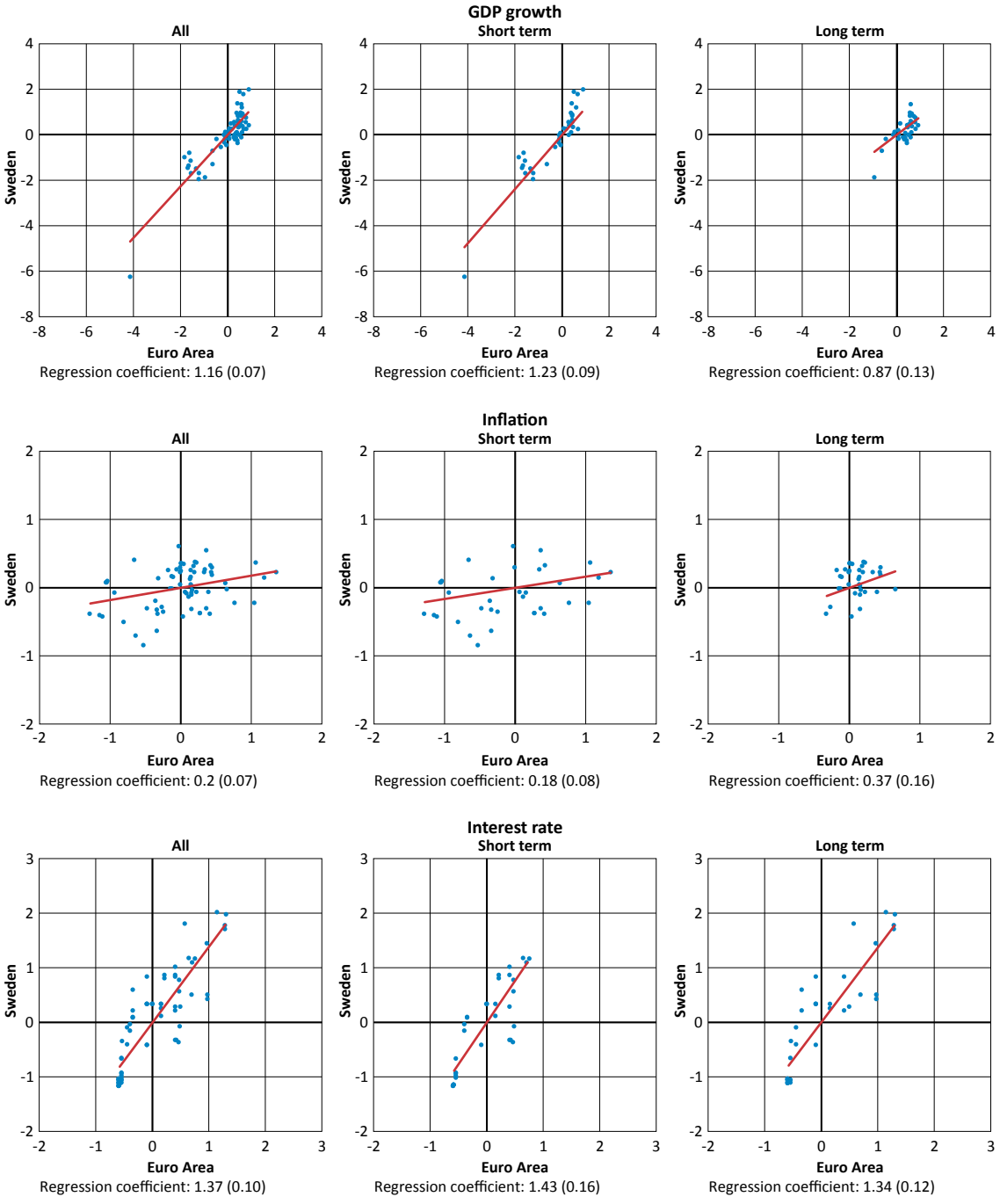
In this appendix we present the correlation in level between the foreign forecast and the domestic forecast. We present results for both the Riksbank (Figure B1) and the National Institute of Economic Research (Figure B2).

Figure B1. The Riksbank's forecasts in level
Forecasts, demeaned data



Note. Standard error in brackets. The figures refer to the calculation methods A, B and C from Figure 4.
Source: The Riksbank

Figure B2. The National Institute of Economic Research's forecasts in level
Forecasts, demeaned data

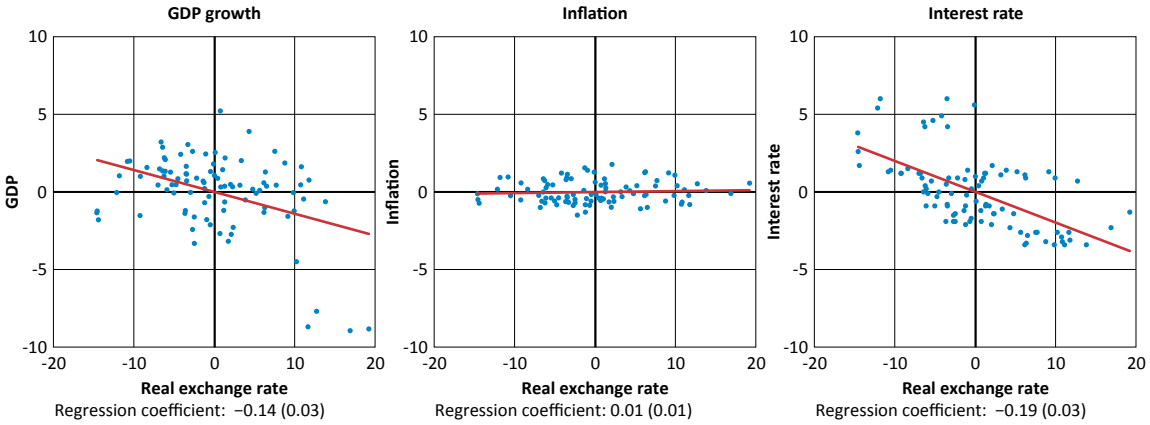


Note. Standard error in brackets.
Source: National Institute of Economic Research

Appendix C

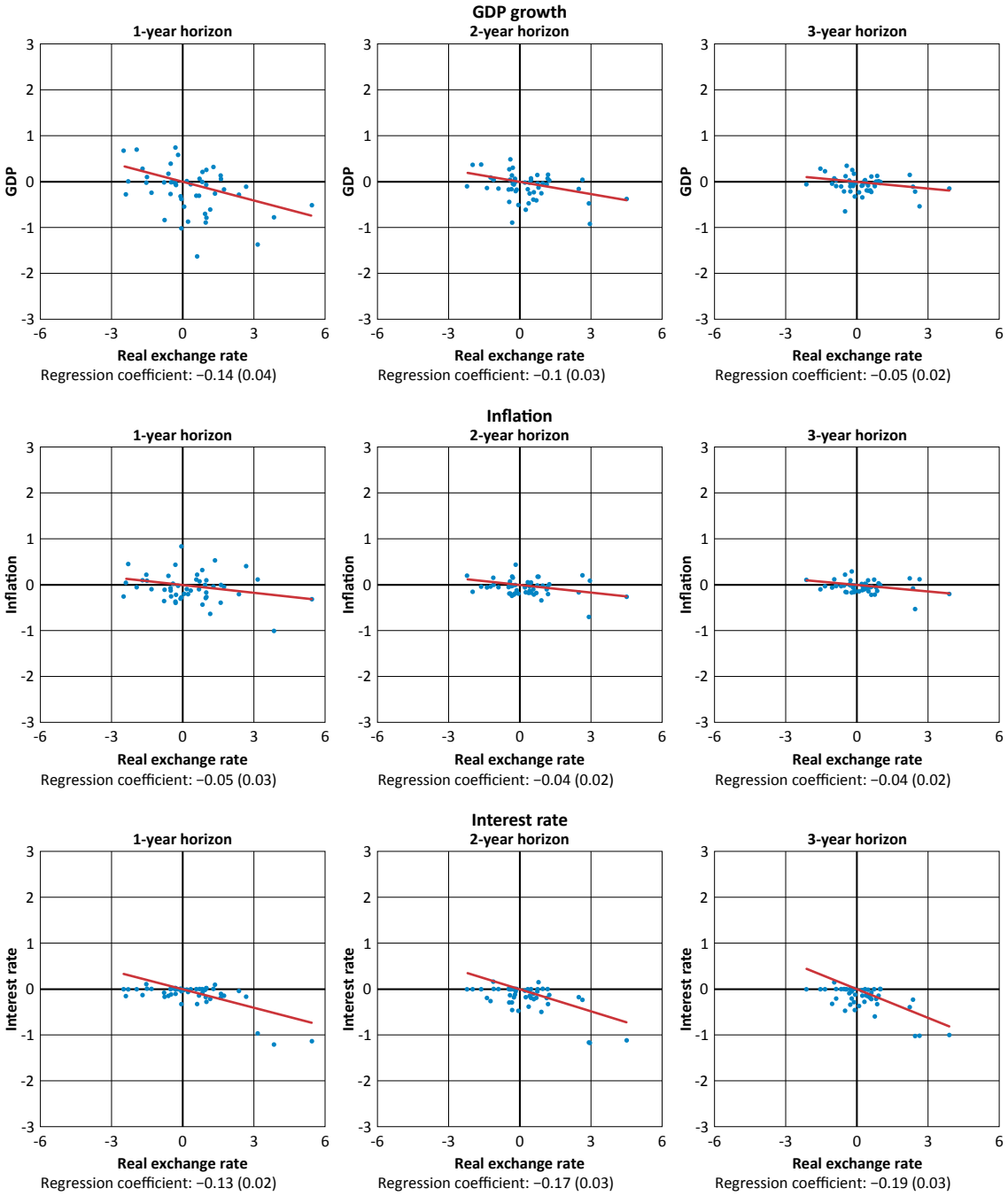
In this appendix, we present the covariation between the real exchange rate and out three domestic variables: GDP growth, inflation and the nominal repo rate. Figure C1 shows the correlations in the data and Figure C2 shows the correlations in the Riksbank's forecast revisions.

Figure C1. Correlation with the real exchange rate in the data
Annual percentage change, index and percentage points respectively



Note. All data has been demeaned. Real exchange rate refers to the KIX-weighted exchange rate.
Sources: National sources, Statistics Sweden and the Riksbank

Figure 17. Revisions of the forecast for the real exchange rate and the domestic economy
Annual percentage change, index and percentage points respectively



Note. Standard error in brackets. Real exchange rate forecasts are calculated by taking the nominal exchange rate forecasts multiplied by the ratio between the forecasts for the foreign and domestic price levels.
Sources: National sources, Statistics Sweden and the Riksbank

The level of the inflation target – a review of the issues

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Most developed countries that conduct inflation targeting have chosen a target level at or close to 2 per cent. Recently, an international debate has arisen on whether this level should be increased. In this article, we review both the arguments in the more policy-oriented debate on the level of the inflation target and what academic research says about the optimal rate of inflation. One conclusion is that the threshold for increasing the target is high, primarily because there are significant practical problems linked to abandoning a target that is already established and changing to another one. The article also discusses the challenges that central banks can face in the near term as regards achieving their current targets.

1 International debate on the level of the inflation target

Recently, an international debate has arisen on the level of the inflation target in developed economies. Several prominent academics and central bank representatives have argued that the inflation target, which is currently at or close to 2 per cent, should be increased.[1] One example that has received particular attention is the open letter written by a number of economists to the US central bank, the Federal Reserve, in June 2017.[2] Federal Reserve Chair Janet Yellen also noted recently that the question of whether the inflation target should be raised is 'one of the most important questions facing monetary policy around the world in the future'.[3]

1.1 Low real interest rates have reduced monetary policy's room for manoeuvre

The background to the debate is that the recovery after the global financial crisis is still sluggish in many parts of the world after almost a decade, while inflation in many countries is below target. A number of central banks have been forced to switch to conducting monetary policy by other means than policy rate adjustments, as this rate has now been cut as far as is deemed possible. The policy rates have been at this level for several years.[4]

The need to keep policy rates so low is not only due to the financial crisis causing such an unusually large negative shock and therefore requiring very expansionary monetary policy.

* We would like to thank Claes Berg, Jesper Lindé, Ulf Söderström and Anders Vredin for valuable comments. The opinions expressed in the article are our own and are not to be seen as the opinions of the Riksbank. We would particularly like to emphasise that the article is not to be interpreted as the Riksbank considering a change in the target level.

1 See, for example, Williams (2009), Blanchard, Dell'Ariccia, and Mauro (2013), Ball (2014), Krugman (2014, May) and Rosengren (2015).

2 http://populardemocracy.org/news-and-publications/prominent-economists-question-fed-inflation-target.

3 See Federal Open Market Committee [FOMC] (2017), p. 14.

4 It is difficult to put an exact number on the policy rate's lower bound, as it varies somewhat among countries, depending on, for example, institutional conditions. It is clear, however, that the bound is not at zero, as most people previously thought.

It is also due to global interest rate levels having fallen for several decades, regardless of the financial crisis. Figure 1 shows real government bond yields in the United States, the United Kingdom and Sweden since 1999.

Figure 1. Real interest rates
Per cent

Note. 10-year yield on indexed-linked government bonds in Sweden, UK and US. Swedish real interest rate is zero coupon rates interpolated from bond rates using the Nelson-Siegel method.
Sources: Bank of England, Federal Reserve, Thomson Reuters and the Riksbank

The reasons for the decline in real interest rates are not fully understood. One explanation that has been put forward is that global saving has increased in recent decades due to, for example, demographic factors. At the same time investment has decreased due to, for example, a falling relative price for capital and lower public investment.[5]

The decline in real rates is a sign of the global, so-called 'neutral', rate of interest having fallen. The neutral rate is an important concept in monetary policy theory. It normally refers to the level of the real rate of interest that neither has an expansionary nor a contractionary effect on the economy.[6] Central banks cannot influence the neutral interest rate but they must consider it when they adjust their policy rates as it is the relation to the neutral rate that determines how expansionary or contractionary a particular monetary policy is. By getting the short-term real interest rate to (temporarily) deviate from the neutral rate, the central bank can influence resource utilisation in the economy. The fact that policy rates around the world are currently low is thus not only due to central banks conducting an expansionary monetary policy. It also depends on the unusually low level of the neutral interest rate, and that the central bank are forced to adapt its policy rates to this low level.

So how does the inflation target fit into the picture? For a given level of the neutral real interest rate, the inflation target determines the level of the neutral *nominal* rate. With a higher inflation target, say 3 per cent, the neutral or normal *nominal* rate would be on average 1 percentage point higher compared to when the inflation target is 2 per cent. There will therefore be 1 percentage point more room to reduce the rate before it reaches its lower bound. An increase in the inflation target to 4 per cent would increase the room for manoeuvre by a further percentage point, and so on. In other words, the purpose of a higher inflation target is to increase the scope for conducting an expansionary monetary policy, by reducing the risk of the policy rate hitting its lower bound.

5 See, for example, Rachel and Smith (2017) for a more detailed account. The Riksbank has discussed the low level of interest rates and its consequences in, for example, Armelius et al. (2014), Ingves (2017) and Sveriges Riksbank (2017).
6 The concept of a neutral or 'natural' interest rate was introduced by the Swedish economist, Knut Wicksell, around 1900. For a detailed discussion, see Lundvall and Westermark (2011).

The scope for stimulating the economy by reducing the rate could also increase in the future if the neutral real interest rate rises. It is difficult to say, however, when this will happen and by how much it will increase. Rachel and Smith (2017) assess that the forces that have pushed the global neutral interest rate down are relatively persistent and that it will remain low for quite a long time to come.[7] Laubach and Williams (2015) and Christensen and Rudebusch (2017) make a similar assessment.[8]

1.2 The structure of the article

The main aim of this article is to provide an overview of both the more policy-oriented debate on the level of the inflation target and the academic research in the field. If Janet Yellen is right in her prediction that the level of the inflation target is an issue that will be much discussed in the period ahead, such an overview may provide a useful starting-point for those wishing to follow the debate.

The rest of the article is organised as follows: In the next section, we go through the benefits and drawbacks of inflation and what inflation targets are in practice. In Section 3, an overview of the academic research on an optimal rate of inflation is presented. Section 4 discusses various arguments against increasing the inflation target. Section 5 focuses in particular on what is perhaps the strongest argument against raising the target – the fact that it can be difficult to change a target that has already become established. There are, however, some challenges that central banks may also face as regards achieving their current targets. These are discussed in Section 6. Section 7 provides a summary.

2 The costs and benefits of inflation, and the inflation target in practice

Before we continue, it may be a good idea to look at why central banks have inflation targets in the first place and why these targets are at their current level.

In developed countries, the most common inflation target level is 2 per cent or slightly above. The level of inflation targets in the OECD countries can be seen in Table 1. Only a few central banks are aiming at an inflation rate lower than 2 per cent. These include the Swiss central bank, whose target is an inflation rate of between 0 and 2 per cent, and the ECB, which defines its target as inflation being below, but close to, 2 per cent.[9]

7 More specifically, Rachel och Smith (2017) estimate that the neutral interest rate will be about or just below 1 per cent in the medium to long term.

8 Goodhart and Pradhan (2017) make a more positive interpretation and argue that global demographic trends will reverse the downward trend in real interest rates over the next decade.

9 The Bank of Canada's and Reserve Bank of New Zealand's target could be interpreted as a target range between 1 and 3, but is, in the case of Canada, formulated as inflation being 'at the 2 per cent midpoint of a target range of 1 to 3 per cent over the medium term', and, in the case of New Zealand, as the focus being to ensure that future inflation is, on average, close to 'the 2 percent target midpoint'.

Table 1. Level of inflation targets in OECD countries

	Target
Australia	2–3%
Canada	2% (mid-point of 1–3%)
Chile	3% ± 1 pp
Czech Republic	2% ± 1 pp
Euro area	Below, but close to, 2 per cent
Hungary	3% ± 1 pp
Iceland	2.5%
Israel	1 – 3%
Japan	2%
Mexico	3% ± 1 pp
New Zealand	2% ± 1 pp
Norway	2.5%
Poland	2.5% ± 1 pp
South Korea	2%
Sweden	2%
Switzerland	Below 2%
Turkey	5% ± 2 pp
United Kingdom	2%
United States	2%

Sources: (Hammond, 2011), www.centralbanknews.info and individual central bank websites

2.1 Problematic with excessively high and excessively low inflation

But why 2 per cent? To begin with, there is a general consensus that *high* inflation can be damaging in many ways. The classic textbook example of costs associated with high inflation is that it can be expensive for companies to change prices ('menu costs') and for private individuals to keep tabs on inflation and adapt to it, partly as a result of the increased cost of holding cash ('shoe-leather costs'). As many social contracts are not entirely indexed to inflation, the costs for unexpectedly high inflation in particular can arise in many ways. For example, it can lead to more people entering higher income tax brackets. It also has a redistribution effect that benefits borrowers at the expense of lenders. When average inflation is high, it also tends to fluctuate substantially from one year to the next. This makes it more difficult to make economic decisions about the future. Experience of historical episodes with high inflation, such as in the 1970s, or even with hyper-inflation, such as in the 1920s, shows that high inflation can be very costly for the economy.

But there are also arguments against inflation being too *low*. One is that wage formation can deteriorate when average inflation is excessively low. The reason is that it has proved difficult in practice to lower nominal wages. If inflation is low and nominal wages cannot be cut, it becomes difficult to adjust real wages between individuals, companies and sectors. This can ultimately bring about both higher unemployment and poorer productivity growth in the economy. These problems can be mitigated if there is a certain underlying inflation in the economy.[10]

Another reason frequently highlighted has to do with the fact that official measures of inflation are normally considered to overestimate actual price rises.[11] This is partly due to the difficulty in differentiating the extent to which a product price rise is a manifestation of

10 See, for example, Akerlof, Dickens, and Perry (1996). As regards discussions about the choice of 2 per cent in Sweden, see for instance Andersson (2003), p. 253.
11 See, for example, Wynne (2008).

improved quality or simply because the price per se has been increased. If such insufficient quality adjustments were common, an inflation target of zero percent would in practice mean that the general price level would fall on average. The exact magnitude of this error component is difficult to estimate, but an inflation target of 2 per cent has been deemed to provide enough latitude.[12]

A third reason is the one we have already discussed. If inflation is low or if economic activity wavers, there should be enough leeway to reduce the policy rate. If the inflation target were, say, 1 or 0 per cent, then inflation would vary around that level. The nominal interest rate will also be lower on average with a lower target. And the lower the interest rate is in normal conditions, the less scope there is to cut it before it reaches its lower bound. With a lower inflation target the policy rate will be at its lower bound more often and for longer periods. Prior to the global financial crisis, the general perception was that an inflation target of 2 per cent would provide enough leeway to lower the policy rate so that this type of problem would not be particularly serious.[13]

2.2 Probably more practical reasons behind the choice of 2 per cent

These arguments may very well have had some significance when inflation targeting was introduced at the beginning of the 1990s. But the main reason was probably more practical. It was probably mostly a question of a quantified target for inflation being an attempt to hold back inflation in countries where this had previously failed. This was definitely the case in Sweden, where higher inflation than in other countries for about 20 years had led to recurrent cost crises and devaluations. When Sweden introduced inflation targeting in 1993 as one of the first countries, the Riksbank noted that underlying inflation at the time was about 2 per cent, and that the aim was to keep inflation at that level.

The fact that 2 per cent became somewhat of a standard for inflation targets did not therefore have much to do with research having established that precisely that figure was the most suitable (see the next section for further details). The practical application of inflation targeting in many ways preceded research and theory development. Probably, 2 per cent seemed for most central banks to be a reasonable level to aim at for average inflation – low enough for participants in the economy not to have to worry about it when making their economic decisions, but at the same time not too high.

When explaining the benefits of an inflation target today, we often focus on a credible target working as a nominal anchor – i.e. a benchmark that guides expectations in the economy. When economic agents have a common view of how prices will develop in the future, it becomes easier to plan for the long term. The inflation target therefore lays the foundations for efficient price and wage formation. If the target succeeds in coordinating inflation expectations, it can also become self-reinforcing. If expectations are in line with the inflation target, and if price and wage formation adapt to these expectations, the probability increases of actual prices becoming consistent with the inflation target.

12 The issue of measurement error in inflation and GDP statistics has been recently brought to the fore by, for example, Summers (2015). In his opinion, measurement errors may well be significant and today's very low inflation can be an overestimation of the actual rate of inflation and the actual real interest rate may correspondingly be underestimated.
13 See, for example, Summers (1991).

3 What does the academic research say?

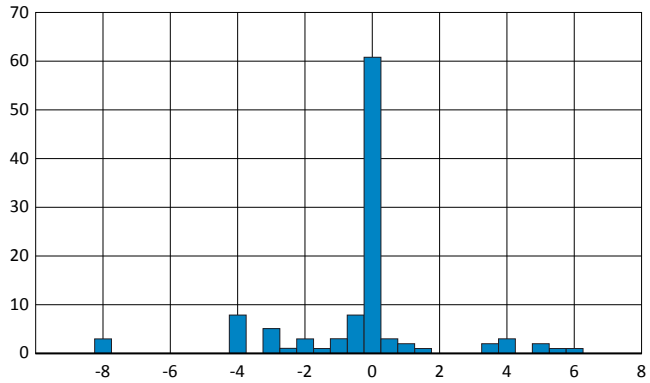
Even if academic research did not play a major role when inflation targeting was introduced, considerable effort has since been expended in attempting to estimate an appropriate target level.

3.1 Optimal rate of inflation

One approach has been to investigate what would be an optimal rate of inflation from a theoretical perspective. Perhaps somewhat surprisingly, the literature has not given particularly strong support for a target of 2 per cent and has even found it difficult to justify why the inflation target should be positive.

Diercks (2017) has compiled all published articles on optimal monetary policy since the mid-1990s. Figure 2 shows the distribution of the different articles' optimal levels for the inflation target. As can be seen, an overwhelming majority of the studies conclude that the optimal rate of inflation is 0 per cent. Many of the studies conclude that optimal inflation is negative, while some state that it is positive. Above all, recent studies tend to result in positive values.

Figure 2. Optimal inflation according to academic studies since the mid-1990s



Source: Diercks (2017)

Our review below is not intended to be a complete review of the literature on optimal inflation. Its aim is partly to explain why so many previous studies concluded that the optimal inflation rate is zero or lower, and partly to provide examples of mechanisms resulting in many newer studies concluding that it is positive.

Two assumptions in particular have led to the result that optimal inflation is zero or negative: that money is demanded for the purposes of making transactions, and that there are price rigidities.

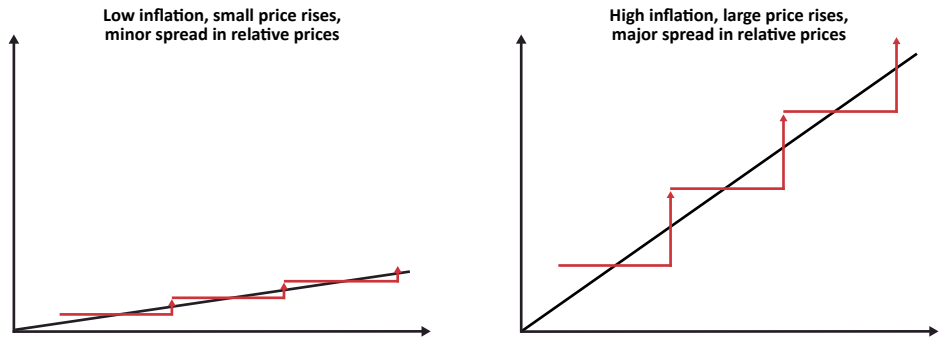
The classic reference for the first assumption is Friedman (1969). His starting point is that money creates social benefit by facilitating transactions but that, at the same time, it is costly to hold as it generates no interest. The participants in the economy thus have an incentive to manage their holdings of money and to retain less of it than they would otherwise. But this is not optimal from a social point of view, because, even if money is costly to hold, it basically costs nothing for the central bank to produce. It is therefore better for the central bank to even out the yields for money and other assets. It does this by setting the nominal interest rate at zero. As the nominal interest rate is the real interest rate plus expected inflation, this means that the central bank strives for inflation to equal the negative of the real interest rate. The so-called Friedman rule says, in other words, that the optimal situation is for prices to *fall* at a rate corresponding to the real interest rate, which is to say a situation with *deflation* rather than inflation.

The presence of price rigidities also means that optimal inflation, in theoretical models, is lower than the inflation targets that central banks have chosen. Many models assume that prices in the economy are adjusted after a delay. A common and relatively robust result from models with sticky prices is that price stability, which is to say inflation of zero per cent, becomes optimal.[14] The reason for this is that price rigidities combined with inflation give rise to inefficient resource allocations. By setting inflation at zero, misallocations and the costs these give rise to can be eliminated.

Assume that companies, for various reasons, are unwilling or unable to adjust their prices particularly often. If there is inflation, companies' relative prices will move away from their optimal values during periods. If companies set their prices for a period to come, their relative prices will decrease over time, apace with inflation, and will not be corrected until the next occasion on which prices are adjusted. As companies are assumed to be able to adjust their prices on different occasions, relative prices for some companies will be too high, while, for other companies, they will be too low. Differences in relative prices among various companies thus do not reflect any fundamental difference, which is to say a distorting effect arises. Companies with high relative prices will produce fewer of their goods than is economically optimal, while those with too low relative prices will produce too much. In other words, the pricing system sends misleading signals over relative production costs and the composition of production therefore becomes inefficient. According to many models, the cost of this is significant. If inflation were instead to be zero, there would be no distorting effects from the spread of relative prices, as companies' prices would constantly stay on their desired, optimal level.

This insight can be illustrated with the help of Figure 3, in which the red line shows how an individual company adjusts its price over time and the black line represents the general level of prices (and the slope of the line is thus inflation). For the sake of simplicity, we assume that the company adjusts its price at specific points in time. When inflation is low (the slope is not steep), price increases for individual companies are small, as is the spread in relative prices. All companies' prices are close to the general price level, regardless of whether the company has recently adjusted its price or has had the same price for a while.

Figure 3. Pricing behaviour and inflation



On the other hand, if inflation is high, price increases for companies will be high. On average, their prices differ more from the average price level and the spread in relative prices becomes greater.

In recent years, a large amount of research has been focused on reviewing the results that suggest that optimal inflation is zero or even negative, and on investigating whether there are mechanisms that make optimal inflation positive and closer to the inflation targets chosen by the central banks. This research can be divided into three different types: Research which (i) add other assumptions to the previous model framework, (ii) assume more

14 See, for example, Schmitt-Grohé and Uribe (2010).

frequent and longer lasting lower bound episodes, and (iii) show how earlier research may have overestimated the costs of higher inflation.

Other assumptions within the previous model framework

An example of the first type of literature is Adam and Weber (2017). Many New Keynesian models assume that companies are randomly given the opportunity to adjust their prices. They usually also assume that companies have the same productivity. Adam and Weber (2017) alter these assumptions so that the possibility of changing a price is connected with an output shock at the firm level. They argue that it can be regarded as the introduction of a new product and that the company can then set whatever price it likes. This increased possibility to adjust prices when necessary (and not just at random) reduces the distortion costs of inflation. This leads to optimal inflation being about 1 per cent in a calibration of the model of US data.

Brunnermeier and Sannikov (2016) analyse the effects of inflation when there are imperfections in financial markets. In their model, households can invest in high-risk physical capital or choose to hold money. There is incomplete insurance against poor outcomes in capital investments (a so-called financial friction), which leads to too low capital investment. The remedy for this is for higher inflation to lower the real interest rate and make it more attractive to invest in capital, which increases the capital stock and thereby growth in the economy.

Just as prices are assumed to be sticky, macro models usually also assume that wages are adjusted after a certain delay and, in particular, that it is difficult to cut nominal wages. Real wages are thus adjusted by nominal wages not being adjusted at the same rate as inflation. Carlsson and Westermark (2016) show that this may lead to higher inflation being optimal. Assumptions over the tax system can also lead to positive inflation becoming optimal. Finocchiaro et al. (2015) analyse the effect of inflation in conjunction with corporate taxation and financial restrictions. In most models, corporate taxation has a distorting effect, as it affects companies' investment decisions, which can lead to insufficient investments. To counteract this, deductible interest has often been introduced. As deductions are based on nominal interest rates, inflation will play a part in companies' decisions. Finocchiaro et al. (2015) show that higher inflation, in total, brings investment decisions closer to the optimal level if corporate loans are limited by demands for collateral, for example in the form of buildings or machines.

The significance of a lower bound for the policy rate

Another aspect that has altered the result that zero inflation is optimal is connected with the policy rate having a lower bound. For the sake of simplicity, this will hereafter be called the zero lower bound (ZLB), even though experience has shown that, in practice, central banks can cut their policy rates some way below zero.

Early studies, which used data from the post-war period until the turn of the millennium, indicated that an inflation target of 2 per cent should entail a lower bound for the policy rate of 0 binding, on average, about 5 per cent of the time (Reifschneider and Willams, 2000). These calculations also indicated that the economy stays in such an episode for about a year, on average. The conclusions from studies including data up until the global financial crisis were similar. Schmitt-Grohé and Uribe (2010) consider that the zero lower bound restriction on the policy rate may occasionally be binding, but finds that optimal inflation is nevertheless about zero.

However, two things that influence this type of calculation have changed. Firstly, the normal level of real interest rates has continued to fall (as was mentioned in Section 1) and, secondly, the policy rate in many large countries has been close to or at the lower bound for long periods in connection with the global financial crisis.

Coibion, Gorodnichenko, and Wieland (2012) allow their calculations to be influenced by the fact that the US economy, at the time of the study, had been at what they assume to be ZLB for three years. This implies that the ZLB episodes are expected to be more frequent, but remain relatively short-lived. The authors conclude that optimal inflation is below 2 per cent.[15] However, the fact that the period of ZLB has subsequently become even longer has led to further reassessments. Dordal-i-Carreras et al. (2016) argue that earlier studies probably underestimate the average duration of ZLB periods and thereby also the gains from higher inflation targets. They adjust the model's shocks to reflect that episodes at the lower bound last longer. In their calculations, the optimal rate of inflation becomes sensitive for how often the lower limit binds, but it ends up somewhere between 1.5 and 4.0 per cent. The midpoint in this interval is 2.7, which is not far from the average among OECD countries at present.

Kiley and Roberts (2017) also conclude that the lower limit binds much more often when they use new data and a lower estimate of the neutral real interest rate. In their simulations, which take into account the latest low interest rate episode, the lower limit binds as often as 40 per cent of the time. The problem becomes so extensive that, on average, production becomes one per cent lower than potential output. According to their calculations, this can be counteracted by the central bank compensating for the low interest rate episodes by allowing higher inflation in normal times. However, the analysis assumes that quantitative easing is not used as an alternative to cutting the interest rate.

Another aspect of ZLB is that there are large differences depending on whether the central bank is able to credibly commit to a particular policy. If the central bank is able to commit, it can reduce the real interest rate and stimulate the economy, even when the policy rate cannot be cut any more, by creating expectations of higher inflation in the period ahead. This makes the effect of a binding lower limit for the policy rate less serious. Billi (2011) finds that the optimal rate of inflation in a model in which the central bank is able to commit becomes between 0.2 and 0.9 per cent. If, on the other hand, the central bank cannot commit but re-optimises in each period, the optimal rate of inflation instead becomes as high as between 13.2 and 15.8 per cent. That there is a large difference depending on whether or not the central bank has a high degree of credibility and can affect inflation expectations is probably an important insight.

Do models with price rigidities overestimate the cost of inflation?

A debate has recently arisen on whether New Keynesian models with price rigidities overestimate the costs of higher inflation. As we noted above, the costs of higher inflation primarily consist of inflation giving rise to an inefficient spread in relative prices among different producers, as the price rigidity means that certain prices remain unchanged while others are changed. The higher inflation is, the greater the spread becomes. If these costs were to be smaller than the theory has so far indicated, optimal inflation would be higher.

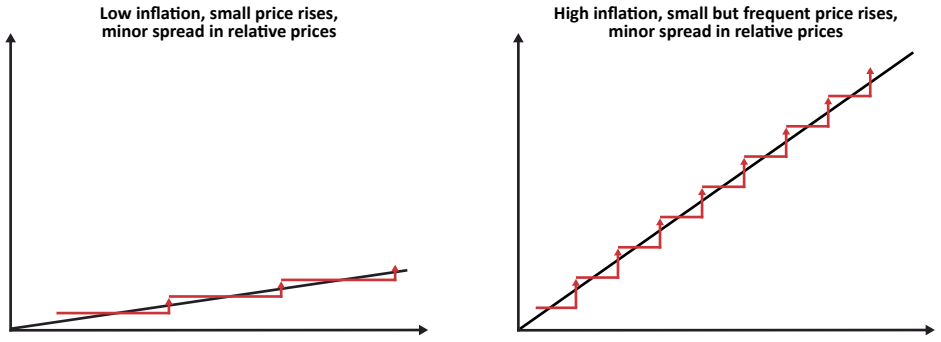
Blanco (2017) uses a model in which higher inflation widens the gap between new and old prices, but where companies also are more inclined to change their prices as a consequence of idiosyncratic shocks. The result is that the spread of relative prices and the misallocation of resources do *not* increase particularly much with inflation. He finds that optimal inflation in such a model is 5 per cent.

Nakamura et al. (2015) investigate the assumption that inflation leads to a large spread of relative prices by studying pricing behaviour in the United States in the late 1970s and early 1980s, when inflation was very high. High inflation means that companies' prices depart from their optimal levels more rapidly and, consequently, it should also be possible to observe greater price changes, as illustrated by Figure 3). The size of the price adjustments should thereby be informative as regards the degree of inefficiency in price allocation.

15 See also Ascari, Phaneuf, and Sims (2015) who draws the same conclusion from a different model.

However, Nakamura et al. (2015) find no signs of greater price adjustments during the period of high inflation – the average price adjustment in the United States has been almost constant over the entire observation period. Instead, they find that the *number* of price adjustments increased notably when inflation was high. As illustrated by Figure 4, this means that companies' prices continually lie relatively close to the general price level, which is to say no great spread in relative prices arises. Nakamura et al. (2015) therefore draw the conclusion that models with exogenous price rigidities overestimate the costs of inflation and that their implications for the optimal rate of inflation should be re-evaluated.

Figure 4. Small and frequent price adjustments and inflation



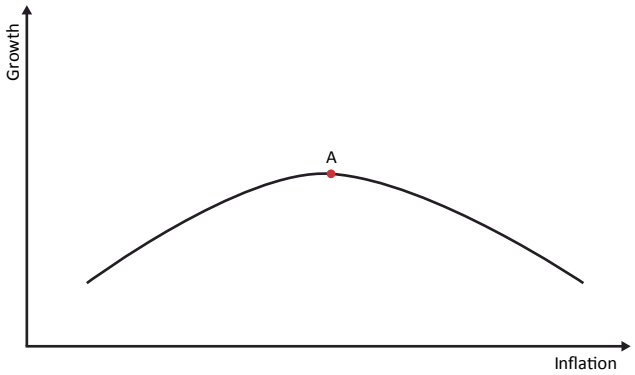
In summary, we can note that there has been a gap between theory and practice in that theoretical models, in many cases, have recommended considerably lower inflation targets than those actually chosen by central banks and governments. Even if the mechanisms in the models are well supported from a theoretical perspective, they do not seem to have been perceived as particularly relevant by economic policy makers. However, models are always simplifications. Newer theories with other mechanisms, also theoretically well supported, have generated higher optimal levels of inflation.

3.2 Empirical studies of the relationship between economic growth and inflation

A completely different approach to finding an appropriate level for the inflation target is to assume a non-linear relationship between inflation and economic growth and empirically attempt to estimate the level of inflation that is most favourable for growth (point A in Figure 5).[16] The literature on this is fairly comprehensive and we only address here some of the most recent and most comprehensive studies.

16 A non-linear relationship between the choice of inflation target and growth does, in a sense, imply that monetary policy can affect the real economy in the long term. However, this does not mean that monetary policy is non-neutral in the sense that this term is normally used – that is to say that long-term growth can be increased by conducting an, on average, more expansionary monetary policy.

Figure 5. The relationship between inflation and GDP growth



López-Villavicencio and Mignon (2011) investigate the relationship in a sample of 44 countries. They find that, in industrialised countries, there is a negative relationship between inflation and GDP growth when rates of inflation exceed 2.7 per cent (this can be seen as the maximum point A in Figure 5). For emerging market economies, the threshold level is significantly higher at 17.5 per cent. For industrialised countries, the relationship is also significant below the threshold, which is to say that, up to a rate of inflation of 2.7 per cent, higher inflation is associated with higher growth. For emerging market economies, on the other hand, the relationship below the threshold is not significant. Kremer et al. (2013) use data for 124 countries and get very similar results. For industrialised countries, they find that the relationship moves from positive to negative at 2.5 per cent and at about 17 per cent for emerging market economies. Neither this study finds that the effect of inflation below the threshold is significant in emerging market economies.

Eggoh and Khan (2014) make a more detailed classification of the 102 countries that they study. They find that the threshold level for high income countries is 3.4 per cent, for middle-income countries (with lower and higher incomes respectively) is 10 and 12 per cent, and for low-income countries about 20 per cent. Cuaresma and Silgoner (2014) study the relationship for 14 EU countries for the period before the European Monetary Union (1960–1999). The method they use allows for several thresholds. They find that the relationship between inflation and growth is positive for rates of inflation of up to 1.6 per cent, then non-significant for an interval and finally negative, albeit not until rates of inflation exceed 16 per cent. All in all, these studies indicate that the estimate for industrialised countries is relatively well in line with the inflation target of 2 per cent chosen by most countries. However, they do not rule out the possibility that the target could be slightly higher.

4 Arguments against raising the inflation target

To sum up, it is not possible to draw any firm conclusions on the appropriate level of the inflation target from academic research. Neither has academic research played any great role in the recent, more policy-oriented debate.

In this debate, the proposal of raising the inflation target has not gone unopposed.[17] One concern raised is that higher inflation could lead to increased uncertainty, making household and corporate economic decisions less efficient.[18] More specifically, and supported by historical data, higher inflation often mean that inflation will also vary more. Apart from leading to increased uncertainty, this could also mean that periods in which the policy rate lies at its lower bound will not necessarily become fewer and shorter. All things equal, greater variation in inflation is reflected by greater variation in the policy rate. It might therefore be that the probability of reaching the rate's lower bound will *not* fall if the inflation target is raised.

17 For compilations of costs linked to a higher inflation target, see, for example, Yellen (2015) (footnote 14), Bank of Canada (2016) and Bernanke (2017).
18 See, for example, Cecchetti and Schoenholtz (2017).

However, if there is confidence in the higher inflation target in the same way as for the lower target, it is not obvious why the variation in inflation should increase. The historically positive covariation between the level and the variation of inflation probably reflects that periods of high inflation have also been periods in which there has been no clear anchor for inflation in the form of an inflation target.[19] Throughout the period of inflation targeting, inflation has varied less than previously and would probably have done so even if the target from the start had been set slightly higher than was the case.

Another argument against raising the inflation target is that it is simply not necessary. Experiences after the crisis show that there are other ways of increasing monetary policy's scope for action. For example, some central banks have shown that the policy rate, in contrast to what was previously thought, does not have to stop at zero but can be cut somewhat further. There is also an ongoing discussion about alternative solutions that would allow the policy rate to be cut to highly negative numbers.[20] But this analysis is still on a fairly abstract academic level. Several central banks have also started to conduct monetary policy via so-called quantitative easing, which is to say purchases of various types of securities on the secondary market. The aim of this kind of measure is to influence rates with longer maturities, which also seems to have been successful.[21]

One possible objection to this argument could be that the possibility of conducting monetary policy via negative interest rates and quantitative easing does not exclude that raising the inflation target can be an effective and useful measure.[22]

Another argument against raising the inflation target has been that it is not certain that a slightly higher inflation target would have made any great difference under the circumstances prevailing during the financial crisis.[23] However, this argument does not seem to be particularly convincing. It is possible that a higher target alone would not have helped, but it would have made it easier for the central banks to conduct a more expansionary policy and could have contributed, at least marginally, to a more positive development than was the case.

Possibly the greatest difficulty in raising the inflation target is discussed in the next section. This is that there are various problems inherent in abandoning an established inflation target and transitioning to another.

5 Difference between changing an inflation target and introducing one

Much of the analysis regarding the suitable level for the inflation target implicitly starts with the question: 'What level would be best if we were starting from scratch and *introducing* an inflation target?' But today the question is more complex and should instead be formulated: 'Should central banks' inflation targets be raised, *given* that there is already a relatively well established inflation target of around 2 per cent?' When answering this question it is necessary to address a number of additional issues that have to do with the transition from one target level to another.

One problem often discussed is that a change in inflation target may give rise to expectations of it being changed again in the future, possibly quite often. Changing the target level too often risks losing the whole point of having an inflation target in the first place. Frequent changes to the inflation target may result in uncertainty regarding what the nominal anchor in the economy actually is, i.e. which inflation figure price and wage formation should be based on.

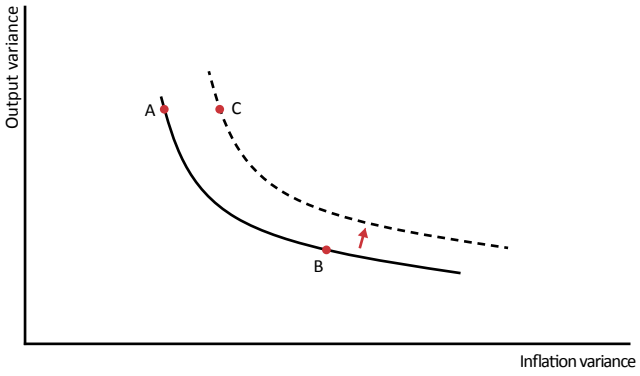
19 See, for example, Ball et al. (2016).
20 See, for example, Agarval and Kimball (2015) and Rogoff (2014).
21 For a more detailed discussion of quantitative easing, see Alsterlind et al. (2015) and De Rezende, Kjellberg, and Tysklind (2015).
22 For a discussion of the repo rate's lower bound, see Alsterlind et al. (2015).
23 See, for example, Yellen (2015).

5.1 Doubts about the inflation target can cause greater fluctuations

If expectations are affected, monetary policy's stabilisation task may become more difficult and economic activity may fluctuate more. Assume that a negative demand shock occurs, that cause inflation to fall. If there is uncertainty about the inflation target, long-term inflation expectations may also fall. This will make the real interest rate increase, i.e. the interest rate corrected for inflation expectations, if the nominal interest rate remains unchanged. The higher real interest rate reinforces the effect of the original negative demand shock and weakens the economy even more, as it is the real interest rate that affects firms and households' investment and consumption decisions respectively. In a corresponding way, a positive shock to demand can make inflation and inflation expectations rise. This lowers the real interest rate and contributes towards further increasing demand. The result thus becomes greater fluctuations in the economy, once confidence in the inflation target is weak and inflation expectations are not well anchored.[24]

This reasoning can be illustrated using Figure 6.

Figure 6. Taylor curve with and without anchored expectations



The curves in the diagram are called Taylor curves and show the trade off the central bank is facing between stabilising inflation and stabilising the real economy.[25] Prioritising the stabilisation of the real economy implies a point like B, in the lower right of the Taylor curve. Such a monetary policy thus results in relatively little variation in the real economy (or output), and relatively much variation in inflation. A monetary policy that places great emphasis on stabilising inflation corresponds to point A in the upper left. The unbroken Taylor curve represents the alternatives available when monetary policy is conducted as well as possible, given the functioning of the economy and the shocks the economy is subjected to – the 'efficient frontier'. Points to the lower left of the efficient frontier, with lower variation in both inflation and the real economy, are thus not possible to attain.

Monetary policy's stabilisation task can thus be more difficult, and fluctuations in economic activity reinforced, if confidence in the inflation target is weak. In Figure 5, this can be illustrated by the Taylor curve being located north-east of the Taylor curve that would apply with a credible inflation target and anchored long-term expectations. The variation in both inflation and output will then be unnecessarily high, as in point C.

24 See, for example, Svensson (2002).

25 The Taylor curve is named after the US economist John Taylor, who first drew attention to this connection, see Taylor (1979).

5.2 Recurrent reviews may play down a change in inflation target

But it could also be problematic if the inflation target is completely irrevocable and set in stone. Even though one should normally stick to an inflation target once it has been determined, the economy may from time to time go through changes that means that a different inflation target would result in more favourable economic development in the long term. It is thus a question of striking a balance: I should be very uncommon to change an inflation target but it should not be impossible.

One way of striking such a balance is to perform recurrent reviews and evaluations of the level of the inflation target and other components of the monetary policy framework as a natural part of the political process.[26] An example of this is the review conducted every fifth year in Canada, which results in a so-called Inflation-Control Agreement between the Bank of Canada and the Canadian Government. This kind of formal process probably helps to play down changes in the inflation target, while at the same time preventing them from happening too often. The Canadian solution provides a 'checkpoint' every fifth year for the level of the inflation target. In practice, however, the target is changed much less frequently. In Canada, the issue of whether the inflation target should be changed was analysed in 2011 as well as in 2016 – the first time whether it should be lowered and the second whether it should be raised. Both times, the decision was to leave the inflation target at 2 per cent.

5.3 … but the initial situation is also important

Even though a formal process with recurrent reviews makes it easier to change the target if necessary, there may be special circumstances to consider on every occasion. One objection to central banks raising the target in the current situation is that it is not very meaningful to announce a new, higher target when inflation has long been below the old target, and already this target seems difficult to reach. Such an announcement may be perceived as rather strange and not very credible. In addition, it means that central banks may initially have to conduct a more expansionary monetary policy to push up inflation. This can be difficult if the policy rate is already very low.

Of course, it can also be argued that the adoption of a higher inflation target need not be so problematic. A higher inflation target can create expectations of higher future inflation, which in turn can reduce real interest rates and stimulate demand and inflation. Another argument is that credibility should in fact be greater for a target higher than 2 per cent. The reason is that the central bank has a greater chance of meeting a higher target, as there is less risk of monetary policy being hampered by the policy rate hitting its lower bound – in the way previously discussed.

Both these arguments are theoretically relevant. But what determines whether the arguments are relevant in practice is how economic agents react. It is they who must be convinced that a higher inflation target is credible and that inflation will indeed rise in the future. It is probably not all that easy to do this in a situation where central banks are finding it difficult even to achieve their existing targets. If long-term inflation expectations are not in line with the target but reflects a belief that inflation will persistently be on some other level, meeting the target becomes considerably more difficult.

5.4 Difficult to raise the target alone

Another aspect is that it can be difficult for a single country to raise the target on its own. Historically, of course, it has not been particularly unusual for individual countries to change their inflation targets. For example, inflation targets in developing countries have often started from a relatively high level. As inflation and inflation expectations have been adjusted downwards, targets have been gradually lowered.

26 See, for example, Ball et al. (2016).

It is much less common that countries *raise* their inflation targets on their own, although this too has happened occasionally. The Reserve Bank of New Zealand expanded its target interval from 0–2 to 0–3 per cent in 1996. In 2003, the interval was reduced to 1–3 per cent. As the Reserve Bank of New Zealand aimed explicitly for the mid-point of the interval, this means that the target has in practice been raised in two steps from 1 per cent to 2 per cent. In 2013, Japan raised its inflation target to 2 per cent from a much lower implicit inflation target. Perhaps the European Central Bank's target definition can be seen as another example. When the ECB introduced its target, the definition was that inflation was to be 'below 2 per cent'. But in 2003, the definition was changed to 'below, but close to, 2 per cent'.

It is important to realise, however, that both when the inflation target in developing countries has been lowered and in those few cases when the target has been raised, the changes have brought the targets closer to the international norm of 2 per cent. If a country were to increase its inflation target from 2 per cent today, it would instead be moving *away from* the prevailing norm. Being the first country to take such a step therefore represents a much greater challenge.

One possible problem with unilaterally changing the target can be that the exchange rate does not adjust as theory prescribes. In theory, differences in the inflation targets of different countries are reflected in adjustments to the exchange rate. If Sweden, for example, had an inflation target of 3 per cent while the inflation target in other countries was 2 per cent, the Swedish krona would depreciate by an average of 1 per cent per year.

Thus, according to theory a flexible exchange rate means that wage and cost developments in Sweden's competitor countries can be ignored when assessing the competitiveness of Swedish companies, as the exchange rate can compensate for differences that may arise. But the social partners in Sweden do not seem to see it this way.[27] The development of the exchange rate is affected by a number of factors, of which competitiveness is just one. It is therefore not possible, they argue, to trust adjustments in the exchange rate to compensate for higher wage increases in Sweden than in other countries and hence to preserve the competitiveness. According to this view, wage and cost developments in Sweden relative to other countries are therefore still just as important as they were when we had a fixed exchange rate. One consequence could be that the social partners conclude agreements that are more in line with price and wage increases in the euro area than with the economic situation and inflation target in Sweden. It will then be more difficult for the Riksbank to achieve the higher target.[28]

Of course, raising the target is not made easier by the fact that opinion is divided as to whether a higher target is a good idea or not. For an increase to be as smooth as possible, it would therefore be desirable for it to be preceded by a reasonable amount of consensus among central banks and in the research community and, moreover, was coordinated so that several central banks decided to raise their targets simultaneously. None of this is, of course, particularly easy to achieve. Even if there is a great deal to suggest that a higher inflation target would be beneficial in the long run, the threshold for actually implementing an increase is nevertheless very high.

27 See, for instance, Enegren (2011), for a more detailed discussion.

28 Such a discrepancy between the domestic economic situation and wage formation – and between the inflation target and wage formation – can probably arise even when the inflation target in Sweden and the euro area is the same, if price and wage increases in the euro area have been unusually low for a long time. It is possible that the development we are currently observing, with low Swedish wage agreements despite strong domestic economic activity, is an example of this.

6 Challenges in the short term with the current inflation target

There are other problems to deal with in the short term. As we noted above, many central banks are finding it difficult to reach even their current targets. The reasons for this are not entirely clear. Despite a general improvement in the labour market, price increases and wage growth are only modest. The relationship between economic activity and inflation, sometimes illustrated by the Philips curve, may have become weaker. High resource utilisation may induce less inflation than it usually does. Underlying structural trends, such as digitalisation and globalisation may also have contributed to subduing inflation.

6.1 Difficult to stimulate more and inappropriate to lower the target

There are basically three ways to act if inflation is expected to be below the central bank's inflation target for a relatively long time in the event of an unchanged monetary policy. The first, and often most natural, is for the central bank to try to conduct an even more expansionary policy to get inflation to rise. But bearing in mind that the policy rate in many countries is already close to or at its lower bound, and that there are still question marks as regards how well inflation can be controlled with the help of quantitative easing, this is not particularly easy.

Another and significantly more drastic way of dealing with the problem of persistently below-target inflation is to simply reduce the target. Even though this has not been a major issue internationally, it has been discussed here and there, perhaps in particular in Sweden. An obvious drawback with such a measure is that the difficulties that an increase in the inflation target would alleviate would of course be even greater if the target was instead *lowered*. One of the biggest problems would be that the leeway for lowering the policy rate in future economic downturns would be *less* than it is with the current inflation target. The whole point of raising the target is, as we have just observed, to increase this leeway.

Lowering the target because it seems difficult to reach would also be interpreted as the central bank 'moving the goal-posts'. This could, in turn, fuel suspicions that the target will be adjusted again in the future as a way of improving goal fulfilment. As we have argued above, this may result in weaker confidence in the inflation target and greater uncertainty as to what the nominal anchor in the economy actually is. From a more practical perspective and in the same way as if the target were to be raised, it would probably be difficult for an individual central bank to change the target in a direction away from the international norm of 2 per cent.

6.2 Allowing more time to reach the inflation target is an option

The third way of dealing with the problem of persistently low inflation is to keep to the inflation target but accept that it will take longer than usual to reach it. The central bank thus continues its expansionary monetary policy but does not make it more expansionary (which may be difficult to do). Using the useful metaphor of driving a car, the central bank continues to keep its foot steadily on the gas, but does not step on it further. The car, that is to say inflation, reaches its goal, but slightly later than it would otherwise have done.

One condition for this to be a feasible strategy is that inflation will actually be able to reach the target. In the Swedish debate in particular, arguments have been put forward stating that underlying structural trends such as digitalisation and globalisation are such strong 'headwinds' as regards inflation that it has become virtually impossible to reach 2 per cent.[29]

29 This has been one of the arguments of debaters who advocate a lower inflation target in Sweden, see for example Mittelman (2013).

Digitalisation and globalisation are probably exerting downward pressure on inflation, see for instance Borio (2017). But this does not mean that actual inflation will be *permanently* lower than the state intends it to be on average. First, the effect of this type of structural trend is basically temporary even if it can be persistent. Second, the central bank can try to estimate how much digitalisation and globalisation will dampen inflation and to compensate for this. This is also what central banks with an inflation target are in practice trying to do. In Sweden, for instance, prices of imported goods have been low since the early 2000's. However, digitalisation and globalisation are not different in this aspect from other factors that affect the economy and that the central bank must try to take into account.

It is also important to realise that if one claims that digitalisation and globalisation lead to *permanently* lower inflation, one also implies that there is no point in central banks and governments setting targets for inflation, as it is determined even in the long term by factors beyond the remit of monetary policy. This claim has a rather heavy burden of proof attached to it, however, as such a view contradicts what at least so far is considered to be established knowledge within economic science.[30]

6.3 … but puts a heavy onus on monetary policy communication

But even if we assume that the central bank has sufficiently effective means for it to be worth setting an inflation target, a strategy whereby it takes longer to reach the target may be problematic, as it is not just central banks but also economic agents who must accept that it takes longer. It is therefore important that these agents do not think that the central bank has abandoned the inflation target simply because it is taking longer to reach. Expectations among economic agents thus play a key role. To maintain the credibility of an inflation target, inflation cannot be allowed to deviate from the target indefinitely. Long-term expectations will then, sooner or later, start to fall, and if price and wage formation starts to adapt to these lower inflation expectations, it will be more difficult for the central bank to achieve the target – it becomes a self-perpetuating vicious circle.

There is no clear answer to how long and how much inflation can deviate from the target without economic agents beginning to lose confidence in the central bank's ability and ambition to reach it. This depends on a number of different circumstances, such as the central bank's general track record and how long the most recent period of target deviation lasted.

The central bank's communication is particularly important in this context. The central bank needs to explain clearly why inflation will continue to deviate from the target for some time to come and why it nonetheless cannot make monetary policy more expansionary, or deems it inappropriate to do so. It also needs to make clear that this does not mean that the target has been abandoned and describe when and how inflation will return to the target.

The strategy of allowing more time than normal to reach the target thereby constitutes a considerable communicative challenge. However, it should not be exaggerated. If flexible inflation targeting is being conducted, it is a natural consequence that the time at which the target is reached will vary. There are examples of central banks, whose inflation forecasts have been quite far from the target at the end of the forecast horizon, without confidence in the inflation target decreasing. In its latest reports, for example, Norges Bank has forecast that inflation will be below target fairly significantly during the forecast period and amount to around 1.5 per cent at the end of 2020, a whole one percentage point under the target of 2.5 per cent.

30 It should be mentioned that, according to the so-called 'fiscal theory of the price level', fiscal policy has crucial influence over inflation in the long term, see for example Christiano and Fitzgerald (2000). To achieve low and stable inflation, a well-balanced monetary policy is therefore insufficient. It also requires fiscal policy to be conducted in a way that is compatible with the inflation target.

As there are no clear answers, it is up to each central bank to make an assessment of how much scope there is. Given that the possibilities for making monetary policy more expansionary are limited and given that one do not want to reduce the target, there may not be any other viable options than to apply such a strategy.

7 Summary

Recently, there has been an international debate on whether the inflation target in developed countries should be increased from 2 per cent, which is currently somewhat of an international standard. The reason is that many central banks have found the policy rate's lower bound to be a binding restriction under surprisingly long periods. They were therefore unable to lower the interest rate as much as they would have preferred. A higher inflation target would help to reduce the risk of this ocurring again in the future. In this article, we have reviewed both the arguments in the more policy-oriented debate on the level of the inflation target and what academic research says about the optimal rate of inflation. Among other observations, we have noted that there has been a gap between theory and practice insofar as the model-based academic literature has resulted in lower optimal inflation rates than the actual targets used by central banks. This gap seems to have decreased in recent years in that models have started to take into account, for instance, that the policy rate can reach its lower bound. This tends to generate a higher optimal level of inflation. One conclusion in the article is that perhaps the greatest difficulty in raising the inflation target is that there are significant practical problems attached to abandoning an already established target and changing to another. We have also discussed the challenges that central banks can face in the near term as regards achieving their current targets.

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Households' mortgage-rate expectations – more realistic than at first glance?

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Household expectations of future mortgage rates elicited over the last few years might appear unrealistically low. However, taking explicit account of the high persistence in interest rates, we find that Swedish households' implied long-term expectation of mortgage rates is around 4.7 per cent. This number lines up well with the long-term expectation that can be deduced from the Riksbank's assessment of the repo rate in the long run and the typical spread between the mortgage rate and the repo rate. Our analysis makes use of household mortgage-rate expectations at three different horizons, which enables an explicit modelling of the 'term-structure' of household forecasts.

1 Introduction

Expectations of future mortgage rates are arguably an important factor for many households when they decide how much they are willing to pay for owner-occupied housing. Whether (irrationally) low household expectations of future mortgage rates might contribute to general housing price increases is an open question, but many policy makers clearly see it as a real concern in this era of unprecedentedly low interest rates. In Sweden, for instance, housing prices rose by more than 50 per cent between 2010 and 2016, from a level that was already considered 'high' and which was barely dented by the financial crisis.[1] Sveriges Riksbank (2013b, p.9) suggested that 'Low mortgage rate-expectations could lead to a stronger upward trend in both housing prices and debts'. As a large share of mortgages in Sweden – typically well in excess of 50 per cent during the period 2010 to 2016 – have fully adjustable rates, subject to change every three months, the household exposure to interest rate changes is large by international standards,[2] and currently low rates might have an undue effect on house prices if households have unrealistic expectations of continuing low rates.

From a historical perspective, recent Swedish mortgage rates have been extremely low, which may have affected households' long-term mortgage-rate expectations. However, there has been little analysis conducted to establish the validity of the claim that households' long-term mortgage-rate expectations may be unrealistically low.[3] In this paper, we conduct an empirical analysis of household mortgage-rate expectations from the *Economic Tendency Survey* of the National Institute of Economic Research (NIER). This monthly survey – which is generally considered to be Sweden's most important source of data concerning household

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1 See, for example, Sveriges Riksbank (2009, p.56): 'There are signs that house prices are currently slightly above the level that can be considered sustainable in the long term'.

2 The remaining fraction of mortgages have rates that are fixed for horizons between one and ten years. At the end of a fixed-rate period (for example, after five years), a new rate is determined subject to the then prevailing interest-rate levels. Thus, virtually all mortgage takers will be subject to a significant interest-rate exposure at some future date, unless they pay off their debt extremely quickly.

3 The study by Österholm (2017) is a recent exception.

expectations – provides us with monthly observations on average household mortgage-rate expectations from February 2010 until March 2017.

Specifically, for each month, we observe a forecast of the (adjustable) three-month mortgage rate for one, two, and five years into the future. We make explicit use of this 'term-structure' of forecasts to recover the implied long-term mortgage-rate expectation of households. Under an assumption that mortgage rates follow a first order autoregressive (*AR*(1)) process, the elicited survey expectations can be modelled as conditional forecasts obtained from such a process. This enables us to recover estimates of both the long-term (or unconditional) mortgage-rate expectation of Swedish households and the speed with which this long-term forecast should be reached. Our study accordingly contributes to the ongoing debate regarding the potential risks of inflated housing prices as a result of historically low interest rates in many countries.[4] In addition, we contribute to the general literature on expectations and price-formation in housing markets; see, for instance, Case and Shiller (2003); Case, Shiller and Thompson (2012); Lambertini, Mendicino and Punzi (2013); and Gelain and Lansing (2014).

2 Data

The NIER's *Economic Tendency Survey* is a large monthly survey in which Swedish households and businesses are asked questions regarding both their own economic situation as well as the overall Swedish economy. In this paper, we use data from the part of the survey that concerns households.[5] In February 2010, three questions regarding the future value of the (adjustable) three-month mortgage rate – which in Sweden is also commonly denoted the 'variable' mortgage rate – were added to the survey. The specific questions that the households are asked are as follows.

Question 18. Today the variable home loan rate is *x* %. State how high you expect the variable home loan rate to be in:

(a) 1 year's time

(b) 2 years' time

(c) 5 years' time

The individual survey responses are aggregated by the NIER to create time series of average household responses for each question.[6] These time series thus represent the average household forecasts of the three-month mortgage rate for one year, two years and five years into the future.[7] These forecasts are lined up with the current three-month mortgage rate at the time of each survey – the reference rate – which is stated to the respondents as the questions are read out to them. We use the full available time series, from February 2010 to March 2017, on each of these three questions as well as the reference rate. Data are plotted in Figure 1.

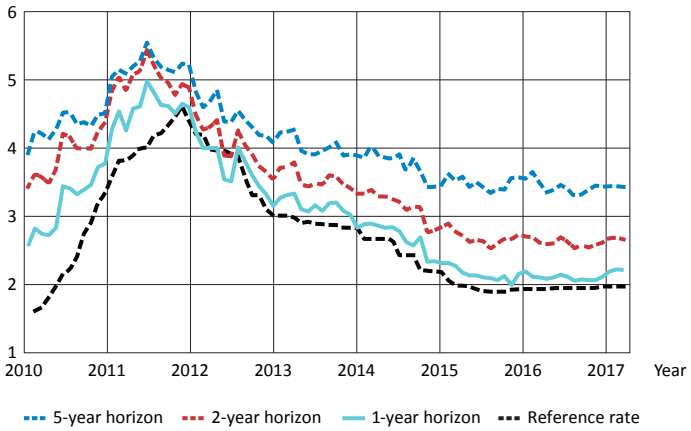
4 See, for example, Sveriges Riksbank (2011), Dermani, Lindé and Walentin (2016), European Commission (2016) and International Monetary Fund [IMF] (2016) for a discussion concerning Sweden.

5 See www.konj.se/english/publications/economic-tendency-survey.html for details.

6 On average, in each survey round, approximately 75, 65, and 55 per cent of the 1500 respondents answer the questions concerning the future mortgage rate at the one-year, two-year, and five-year horizons, respectively.

7 The NIER has a pre-determined formula for classifying outliers in the individual responses and removes such outliers prior to calculating average responses.

Figure 1. Mortgage-rate expectations and reference rate
Per cent



Note. Dates correspond to when the expectations were collected and the reference rate stated to the respondents.
Source: National Institute of Economic Research

3 Empirical analysis

The econometric analysis is based on the assumption that households view the mortgage rate as an $AR(1)$ process,

$$(1) \qquad i_t-\mu=\rho(i_{t-1}-\mu)+e_t,$$

where i_t is the three-month mortgage rate, μ is its unconditional mean, and e_t is a disturbance term that is independently distributed (*iid*) across time. Assuming a mean reverting mortgage rate ($-1<\rho<1$), μ thus represents the long-term forecast, or unconditional expectation, of mortgage rates. The parameter ρ determines the degree of persistence in the process or, put differently, determines how quickly the process reverts to the long-term mean μ. The closer ρ is to zero, the quicker the mean reversion.

The $AR(1)$ model assumption is clearly an approximation to the households' perception of the mortgage rate. Though extremely simple in its formulation, the $AR(1)$ model is generally viewed as a good approximation of the time-series properties of many economic variables, and forecasts from this model are easily understood in intuitive terms. Specifically, as shown in detail below, an $AR(1)$ forecast is easily seen to equal a weighted average between today's value and the long-run mean of the process, where the weight on today's value declines with the forecasting horizon. The $AR(1)$ model is frequently used in empirical macroeconomic work related to forecasting, providing a simple benchmark model that performs well in many settings; see, for example, Pesaran, Smith and Schuermann (2009).[8] Our model choice is also in line with, for instance, Orphanides and Williams' (2004) model for monetary policy analysis, in which the private sector uses an $AR(1)$ model in order to form inflation expectations.

Forecasts from the model are conveniently generated due to its simple, recursive structure. Standing at time t, households form conditional expectations h years ahead, which we denote i^e_{t+h}. Since the best forecast of all future disturbances (e_{t+h}, where $h>0$) is zero, the one-step-ahead forecast is given as

$$i^e_{t+1}=\mu+\rho(i_t-\mu),$$

8 It can also be noted that an $AR(1)$ model performed well relative to judgemental forecasts when survey expectations of Swedish inflation were evaluated by Jonsson and Österholm (2012).

where i_t is the current rate at time t (that is, the reference rate stated to the respondents at each round of the survey). Rearranging, the one-step-ahead forecast can equivalently be expressed as

$$i^e_{t+1}=\mu(1-\rho)+\rho i_t,$$

which is now easily seen to equal a weighted average between today's value (i_t) and the unconditional, or long-run, mean (μ). In the one-step-ahead forecast, the weight on today's value is given by ρ, such that a greater ρ gives more weight to current conditions and less weight to the long-run mean. The two-step-ahead forecast is given recursively as

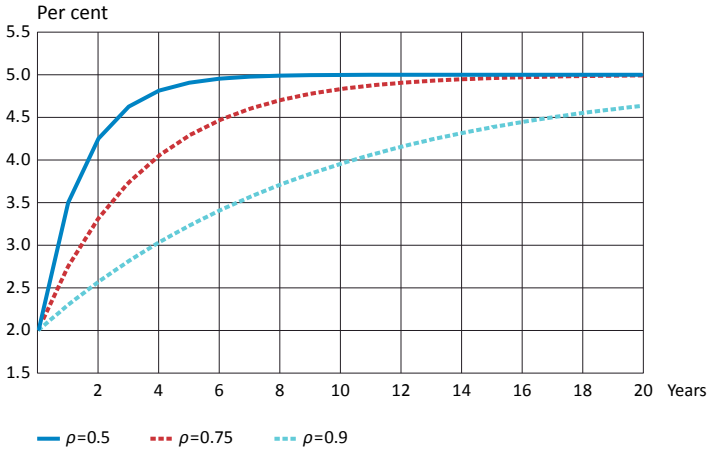
$$i^e_{t+2}=\mu(1-\rho)+\rho i^e_{t+1}=\mu(1-\rho)+\rho[\mu(1-\rho)+\rho i_t]=\mu(1-\rho^2)+\rho^2 i_t,$$

and, in a similar manner, the h-step-ahead forecast is given as

$$i^e_{t+h}=\mu(1-\rho^h)+\rho^h i_t. \quad (2)$$

In order to illustrate the properties of this model, Figure 2 plots the forecasts for three different $AR(1)$ models, all with an unconditional mean (μ) equal to 5 per cent, but with the autoregressive parameter ρ taking on values of 0.5, 0.75, and 0.9, respectively. Today's value is set equal to two per cent. With $\rho=0.5$, it then takes six years to reach the unconditional mean (measuring at the first decimal place). Increasing ρ to 0.75 it instead takes 15 years, and finally setting $\rho=0.9$, the unconditional mean has not been reached in the 20 years that we show in the graph. After 20 years, the value is in fact only 4.6 in this case.[9]

Figure 2. Illustration of forecasts for processes with different persistence



Note. The persistence (0.5, 0.75 and 0.9) is the autoregressive parameter, ρ, of the $AR(1)$ model in Equation (1). The forecasts at different horizons are generated according to Equation (2).
Source: Authors' calculations

9 It takes 39 years to reach the unconditional mean in this case (measuring at the first decimal place). As seen from the general forecast formula in Equation (2), the forecast of any $AR(1)$ model, with $\rho\neq0$, never fully reaches the unconditional mean, since some weight is always placed on today's value. However, from a practical perspective, the forecast eventually gets close enough to the unconditional mean that the two are essentially indistinguishable.

Based on the model specification in Equation (1), we formulate the following three moment conditions, corresponding to the three different forecast horizons in the survey:

$$E[i^e_{t+1}-\mu(1-\rho)-\rho i_t]=0$$

$$E[i^e_{t+2}-\mu(1-\rho^2)-\rho^2 i_t]=0$$

$$E[i^e_{t+5}-\mu(1-\rho^5)-\rho^5 i_t]=0.$$

The model parameters μ and ρ are estimated through the Generalized Method of Moments (GMM) procedure, using the full set of 86 monthly observations.[10] Results are given in Table 1. As can be seen, the long-term expectation of the mortgage rate is approximately 4.7 per cent. Is this a reasonable value to which the households let their forecasts converge? One way to assess this question is to relate the estimated unconditional expectation to the average of the actual mortgage rate over a longer period. Calculating the average over the period February 1997 to March 2017 – a period chosen due to a combination of data availability and the fact that Sveriges Riksbank's inflation target had been made credible by 1997 – we find that it is 3.8 per cent.[11,12] From this perspective, the estimated unconditional mean is actually on the high side. However, during the last two decades, inflation in Sweden – and in many other countries – has been lower than expected and on average below the target. This is to some extent explained by the fact that resource utilisation on average has been lower than neutral, which is not surprising given that the recent global financial crisis is included in the sample. This low inflation helps explain why the Swedish repo rate during this period in general was kept below what can be considered a steady-state value.[13] A long-run repo rate has been suggested by Sveriges Riksbank (2017) to be in the range of 2.5 to 4 per cent. The spread between the three-month mortgage rate and the repo rate might be approximately 1.5 percentage points, as it typically has varied between 1 and 2 percentage points; see, for example, Sveriges Riksbank (2012) and Turk (2016). Taken together, a reasonable range for the three-month mortgage rate could accordingly be 4 to 5.5 per cent.[14] From this perspective, the estimated unconditional mean seems very reasonable.

Table 1. Estimation results

Parameter	Point estimate	Standard error
μ	4.74	0.13
ρ	0.80	0.03

Note. The sample is February 2010 to March 2017. μ is expressed in per cent. ρ is the persistence at an annual basis.

Turning to the estimated autoregressive parameter, ρ, Table 1 shows that it is equal to 0.8 (on an annual basis). This value indicates a fairly slow speed of mean reversion – a finding well in line with the empirical literature on nominal interest rates, which typically finds that they are highly persistent; see, for example, Lanne (2000) and Beechey, Hjalmarsson and

10 The first- and second-stage GMM estimates are very similar. Here we simply report the first-stage results, which have the appealing property of giving equal weight to each of the three forecast horizons. The parameter values are obtained through a grid-search, allowing for values of ρ between 0 and 0.999 and values of μ between 0 and 15.

11 This value was calculated by taking the mean over the adjustable three-month mortgage rates of three of Sweden's largest actors in the mortgage market, namely Nordea, SBAB and Swedbank.

12 In January 1993, it was declared that inflation targeting was the new monetary-policy regime in Sweden. However, due to a lack of credibility for Swedish monetary policy, interest rates in Sweden were fairly high for the first few years after the introduction. The assessment that the Swedish inflation-targeting regime had been thoroughly established by 1997 is shared by, for example, Svensson (2015).

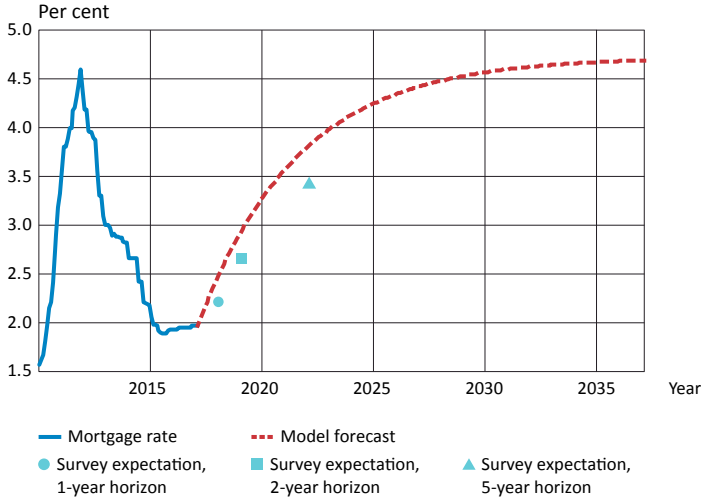
13 For a further discussion of why inflation in Sweden has been low in recent years, see Andersson, Corbo and Löf (2015) and the references therein.

14 It can be noted that until quite recently, the Riksbank assumed that a long-run value for the mortgage rate should be in the interval 5.2 to 6.5 per cent. This was also based on a combination of long-run values for the repo rate and the mortgage spread; see, for example, Sveriges Riksbank (2013a).

Österholm (2009). To get a clearer understanding of the implications of this value for ρ, it is instructive to calculate the implied model forecasts for various horizons, starting at the last observed reference rate in our sample, which is equal to about 2 per cent for March 2017. The five-year ahead conditional forecast – based on the *AR*(1) forecasting function and the estimated parameter values – is equal to 3.8 per cent; the ten-year ahead forecast is 4.4 per cent, the fifteen-year ahead forecast is 4.6 per cent and the twenty-year ahead forecast is 4.7 per cent. Thus, under this level of persistence (ρ=0.8), it takes about ten to fifteen years before the conditional forecast gets close to the unconditional mean of the process.

Figure 3 graphically illustrates these findings, showing the model-implied forecast over the next 20 years, until March 2037. In the figure, the forecasts of the model are also compared to the survey expectations from the *Economic Tendency Survey* of March 2017, in order to give an illustration of the fit of the model. As is seen, the forecasts from the model at the end of the sample are somewhat higher than the corresponding survey expectations. This result could possibly signal a decrease in the perceived unconditional mean, which might have occurred if households' expectations are eventually affected by the fact that the mortgage rate has been low for a long time. However, some deviations between the model and the actual elicited survey expectations should clearly be expected, and one should certainly be cautious not to over-interpret the fact that the fit of the model is not perfect for a given sample point.

Figure 3. Forecasts from the estimated model, standing at March 2017



Note. The survey expectations are from the Economic Tendency Survey of March 2017.
Sources: National Institute of Economic Research and authors' calculations

Overall, we believe that our results indicate that the households' expectations concerning the future mortgage rate appear reasonable. That said, some caveats with our analysis should be noted. In particular, by using aggregated data – that is, average responses across survey respondents – we ignore the inherent dispersion in the forecasts. Since our results suggest that on average households have sensible expectations about future mortgage rates, there must be households who have expectations that are too low. For the individual household, such biases might lead to unfortunate decisions in terms of taking on too much debt or relying overly much on adjustable rate loans that offer less protection against adverse future interest rate movements. The extent of these concerns depends on which parts of the population form forecasts that are too low.

For instance, suppose expectations of future mortgage rates are systematically lower for people who have recently bought a house or an apartment, than for people who rent or have owned their homes for a long time. The former group would generally have new

and relatively large mortgages, whereas the latter group would likely have smaller or no mortgages. In such a case, the average mortgage-rate expectations might look reasonable, but for the group for whom these expectations really matter (the recent home buyers) the expectations might be too low. Such a bias could occur if the group of recent home buyers decided to buy because they have, at least from their perspective, a relatively more optimistic view of the future in the sense of continuing low mortgage rates (and perhaps more rapidly increasing house prices). Alternatively, it could also be the case that less educated and poorer households are less capable of forming realistic forecasts for future mortgage rates. Such concerns are well supported by research on household finance and financial literacy; see, for instance, Campbell (2006). If these households systematically put too much weight on today's low rates in their forecasts, this would clearly be worrying since these households are likely the ones that would be most exposed if rates increase faster and/or more than they expect.

However, while these types of caveats should certainly be kept in mind, it should be stressed that sensible average expectations among households must still be viewed as encouraging, and as positive a result as one could hope for in any study using aggregate data.

4 Conclusion

In this paper, we have introduced a novel approach to using survey data to estimate the long-term, or unconditional, expectation of the mortgage rate. The results suggest that Swedish households seem to have realistic expectations of the future mortgage rate. Specifically, the implied long-term expectation appears well in line with reasonable values of the long-run repo rate and the mortgage spread.

Our analysis also points to an important principle: While five years might seem like a long forecasting horizon, one should not necessarily interpret five-year forecasts as proxying for truly long-term (or unconditional) expectations. This is particularly true when data – as in the case of interest rates – are highly persistent.

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Norwegian monetary policy seen from abroad

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'Who wants transparency when you can have magic? Who wants prose when you can have poetry?' – Duke of Windsor, in the TV series 'The Crown'.

1 Introduction

The Nordic countries in Europe have many things in common, but have for various reasons chosen different strategies for their monetary policies. Finland is a member of the European Union (EU) and the euro area. Denmark and Sweden are members of the EU, but not of the euro area. Denmark has, however, chosen to peg the value of its currency to the euro, whereas Sweden has a flexible exchange rate and instead focuses on stabilizing the domestic value of its currency through an explicit inflation target. Norway and Iceland also have flexible exchange rates and inflation targets, but unlike Sweden they are not part of the EU. Being outside the EU, at least formally, these two countries have somewhat larger degrees of freedom when it comes to central bank governance.

This paper has been written on the suggestion of the Ministry of Finance in Norway and is based on a presentation made at a conference on experiences of inflation targeting organized in Oslo on 16 January 2017. The task given was to comment on monetary policy in Norway from a Swedish perspective. For obvious reasons, being a central bank official, I have chosen not to comment on the current implementation of monetary policy in Norway and Sweden. Instead, I will take a more general and long term perspective and highlight some similarities and differences between the two countries' strategies for monetary policy.

In summary, the presentation and the paper contain the following main messages. First, the facts that there have historically been small differences in nominal and real interest rates in Norway and Sweden, and, in particular, that the nominal exchange rate has been very stable, suggest that there have been small differences in monetary policies between Norway and Sweden. Second, the similarities in monetary policies can be observed despite differences in institutional frameworks, as reflected for example in central bank laws. Taken together, these first two observations probably reflect that both Norway and Sweden are highly dependent on the development in the rest of the world. Third, monetary policy in Norway and Sweden face similar challenges in the near future. The experiences during the last decade, that is, since the global financial crisis, have raised questions about the inflation targeting strategy, for example as regards the proper definition of the inflation target and the links between monetary policy, fiscal policy and financial stability.

2 How different are the frameworks for monetary policy in Norway and Sweden?

Some similarities and differences between Norwegian and Swedish frameworks are summarized in Table 1. An important similarity is that Sweden and Norway both follow the strategy called 'flexible inflation targeting'. An explicit inflation target was announced

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in Sweden in 1993 and in Norway in 2001, but the details of this strategy have developed over time. For instance, Norges Bank started to publish forecasts for their own interest rate in 2005 and Sveriges Riksbank started with this in 2007. Both central banks are considered to be among the most transparent central banks in the world, although there are some differences in their practices, and of course still room for further improvement.[1]

Table 1. Comparison of the frameworks for monetary policy in Norway and Sweden

Similarities	Differences
Explicit, but flexible, inflation targets	EU
Transparency	The degree of independence
Interest rate forecasts	Governance
Small, efficient central banks	NB has broader mandate
Separate Financial Supervisory Authorities	2.5 per cent vs 2 per cent
Fiscal rules	Communication about leaning
Small open economies	Oil

Some of the common characteristics of Norges Bank and Sveriges Riksbank may not seem directly related to the monetary policy strategy, but can arguably affect the credibility of the inflation targets. Both central banks are relatively small by international standards, and since they still perform similar tasks to other central banks, they should therefore be considered relatively efficient. A high degree of transparency and openness is also conducive to efficiency. Efficiency – and transparency – in turn should promote legitimacy for the institution and thereby credibility for the target and strategy the central bank chooses to formulate (if the target and the strategy are consistent).

Both Norway and Sweden have separate Financial Supervisory Authorities that are not part of the central bank (unlike the situation in some other countries, for example Finland and the UK). The advantages and disadvantages of such separation are subject to an international discussion among policy makers and researchers. There are arguments suggesting that coordination would lead to better outcomes for both monetary policy and supervision, but there are also arguments why separation may be beneficial (see, for example, Acharya, 2015, and Schnabel, 2016).

In both Norway and Sweden, fiscal policy is restricted by some explicit rules. In Sweden, there is a surplus target for net government lending over the business cycle. In Norway, there is instead a limit for the deficit, more precisely a limit on how much of the government pension fund, based on revenue from oil production, that can be used each year. Some macro economists have emphasized that inflation targets can be credible only in so far as the strategies for monetary and fiscal policy fulfil certain consistency requirements (see, for example, Leeper, 2016, and Sims, 2016).

The most important similarity may well be that both Norway and Sweden are small and trade-dependent economies that are heavily influenced by economic developments in the rest of the world. This puts some limits on how monetary policy can be designed, and on what it can achieve. But there are also differences in this regard. As a member of the EU, Sweden has agreed to comply with the principles of the Maastricht Treaty. This is one reason why Sveriges Riksbank has a higher degree of independence from the political system than Norges Bank. According to Swedish law, no public authority may determine how the Riksbank shall decide in matters of monetary policy, and the Riksbank's Executive Board may

1 According to Dincer and Eichengreen (2014), Norges Bank's 'transparency index' is 10.0 and Sveriges Riksbank's 14.5, whereas the average for central banks in Europe is 8.4. For suggestions as to how communication can be improved, see for example Norges Bank Watch 2016 (Lommerud et al., 2016) and Goodfriend and King (2016).

neither seek nor take instructions. In Norway, in contrast, the Government has the right to give instructions to Norges Bank.[2]

There are also other differences in the institutional frameworks for the two central banks that may have implications for how monetary policy is conducted. There are, for example, differences regarding the composition of the central banks' Boards and the roles of the Governor. The Riksbank is governed by an Executive Board consisting of six full-time employed members, the Governor and five Deputy Governors. Norges Bank has an Executive Board consisting of three internal members, the Governor and two Deputy Governors, and five external members. Norges Bank's governance model resembles that of the Reserve Bank of Australia, while the Swedish model is more similar to those in Chile, Brazil and Switzerland.

Norges Bank clearly has a much broader mandate than Sveriges Riksbank. The single largest difference between the two institutions is probably that Norges Bank manages the government pension fund based on revenues from oil production, especially considering the size of the fund (around three times the size of Norway's gross domestic product (GDP)). Norges Bank is also requested by the government to give recommendations regarding commercial banks' counter-cyclical capital buffers, in contrast to the situation in Sweden where the Financial Supervisory Authority has this role. Another example of differences in mandates is that the Norges Bank Act includes a general clause saying that 'The Bank may implement any measures customarily or ordinarily taken by a central bank'. The Sveriges Riksbank Act, in contrast, says that the Riksbank 'may only conduct, or participate in, such activities for which it has been authorised by Swedish law'.

Although central bank legislation and practices develop over time and are affected by many and time-varying circumstances, the facts that Sveriges Riksbank has both a higher degree of independence and also a more narrow mandate are probably not coincidental. Politicians and the general public may be more willing to give a higher degree of independence to a central bank (and other public authorities) as long as the mandate is not too vague or broad. For some arguments along these lines – mainly positive, not normative – see Acharya (2015) and Archer (2016).

There are also some noteworthy differences between the designs of the flexible inflation targeting regimes in Norway and Sweden. Norges Bank has a higher inflation target (2.5 per cent) than the Riksbank (2 per cent). Norges Bank has also been quite explicit, since 2012, about the fact that it, to some degree, is 'leaning against the wind' in monetary policy. This expression is used by macro economists to describe a monetary policy that not only strives to stabilize inflation and economic activity but also has the ambition to dampen risks to financial stability.[3] In Sweden, there has been a discussion about whether the Riksbank practised 'leaning' during 2010–2012 and, if so, what the effects might have been.[4] But at least since 2014, the Riksbank's monetary policy has been focused on achieving the inflation target, despite the financial instability risks identified by the Riksbank itself and, for example, the International Monetary Fund (IMF). In Table 1, the difference between Norway and Sweden in this regard has been deliberately described as 'communication about leaning'; how much of the easily identified difference in communication that is also reflected in actual policy and outcomes for for example inflation and economic activity remains an open issue.

Finally, a very important difference between Norway and Sweden is the Norwegian oil production. This difference does not only mean that the central banks face different

2 According to a certain independence index presented by Dincer and Eichengreen (2014), Sveriges Riksbank is almost as independent (0.77) as the ECB (0.81), and these central banks are much more independent than for example Norges Bank (0.47) and Bank of England (0.23). Of course, formal differences in legislation may overstate the actual differences in policy implementation. My colleagues in Norway have emphasized that the government's right to instruct Norges Bank has only been used twice since 1985. First, when the inflation target was announced in 2001, and, second, when Norges Bank received the task to give recommendations on the counter-cyclical capital buffer in 2013.

3 Woodford (2012) offers a theoretical argument for such a strategy. The literature with arguments for and against 'leaning against the wind' is too large to be described here, but recent and short summaries have been presented by Mester (2016) and Schnabel (2016).

4 See Jansson (2014) and Goodfriend and King (2016).

challenges regarding governance (because Norges Bank manages the government pension fund) and that monetary policy has to consider the effects of quite different terms-of-trade shocks – the revenues from oil production also imply quite different challenges for fiscal policy and financial stability, challenges which may also have repercussions on monetary policy.

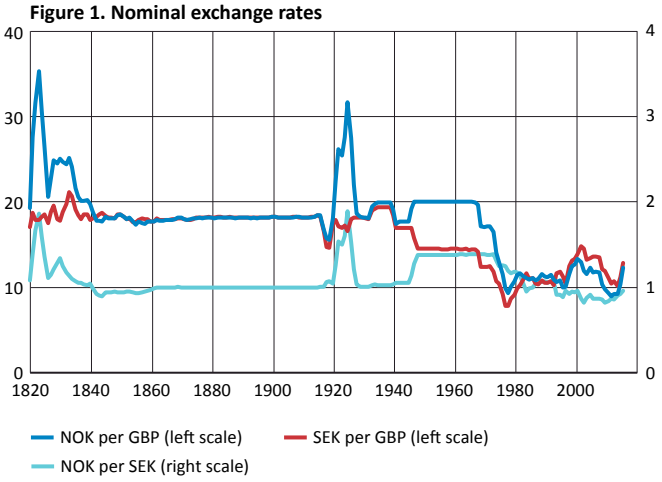
In the rest of this paper, I will come back to the differences regarding the inflation targets and oil, and to the similarity of being small open economies, but I do not have much more to say about the other similarities and differences listed in Table 1.

3 Long-term developments of nominal and real exchange rates

3.1 Exchange rates and GDP

Given that one important, and perhaps the primary, objective of monetary policy is to stabilize the value of domestic money, a natural way to measure differences in monetary policies should be to look at changes in nominal exchange rates between different currencies.[5] The countries in the euro area have the same currency and therefore a common monetary policy. But Denmark's monetary policy cannot be very different either, since Denmark has chosen to peg the value of its currency to the euro. From this perspective, it is very interesting to note that the value of the Norwegian currency (NOK) in terms of the Swedish currency (SEK) has been very close to 1 most of the time for the last two hundred years – see Figure 1. For example, the current exchange rate is very close to the level of the exchange rate in 1850. Between 1875 and 1914, Norway and Sweden were part of the Scandinavian Currency Union, so the exchange rate was fixed at exactly 1. But even during other monetary policy regimes the exchange rate has not deviated much from 1 – compared with how much nominal exchange rates between other countries with different central banks and monetary policies normally fluctuate. As can be seen from Figure 1, the values of both the NOK and the SEK have fluctuated much more vis-à-vis sterling (GBP). While the NOK/SEK exchange rate now has about the same level as during the Scandinavian Currency Union and the gold standard, both currencies have appreciated around 40 per cent since then vis-à-vis the GBP.

Figure 1. Nominal exchange rates



Sources: Bohlin (2010), Klovland (2004), Lobell (2010), Norges Bank and the Riksbank

5 To say that stability of the value of domestic money is a primary objective of monetary policy does not, of course, imply that this should be the central bank's only objective.

A common view of the development of nominal exchange rates, at least in the short run and as long as they are not deliberately fixed through a currency union or similar arrangement, is that they are unpredictable. Nominal exchange rates are often characterized as random walks. The NOK/SEK exchange rate is clearly not a random walk. It is not a coincidence that the current level is about the same as in 1850. The stability of the NOK/SEK exchange rate reflects that monetary policies in Norway and Sweden have been very similar and that differences in structure and shocks hitting the two economies have evened out over this longer period.[6]

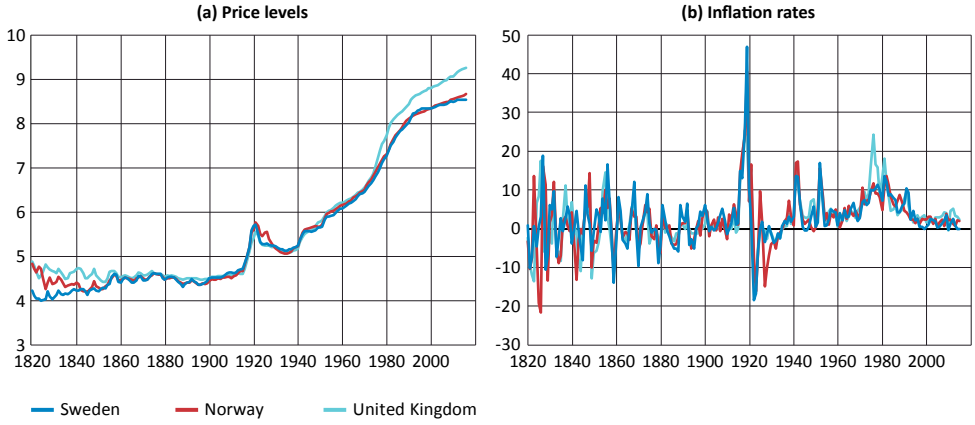
If we take a somewhat shorter perspective and focus on the development during the last fifty years, things look a bit different. Both the NOK and the SEK appreciated strongly against the GBP after the break-down of the Bretton Woods system of pegged exchange rates. But since the mid-1970s, there has been no clear trend in the NOK/GBP rate (although it has been quite volatile), while the SEK has experienced a depreciating trend vis-à-vis the GBP. This of course also means that the NOK has appreciated vis-à-vis the SEK, by around 1/3, since the early 1970s. This trend however came to a halt about twenty years ago. During the last two decades, the NOK/SEK rate again has been quite stable.

Changes in nominal exchange rates do not necessarily reflect changes in the real value, that is the purchasing power, of the currencies in question. It is a commonly held view that changes in nominal exchange rates at least partly reflect differences in inflation (that is changes in the domestic purchasing power) between the countries in question. If 'purchasing power parity' holds, nominal exchange rates adjust exactly one-for-one with changes in the domestic price level so that the real exchange rate is constant. The real exchange rate is here defined as $Q = EP^*/P$, where E is the nominal exchange rate (for example, NOK/SEK, so that higher E means a weaker NOK), P is the price level at home (for example Norway) and P^* the price level abroad (for example Sweden).

Figure 2a shows the long-run price levels in Norway, Sweden and the UK, and Figure 2b shows the corresponding inflation rates (percentage changes of the price levels). It can be seen that inflation in the UK has been higher than inflation in Norway and Sweden since the early 1970s, so against this background the depreciation in the nominal value of the GBP vis-à-vis the NOK and the SEK is understandable. But apparently differences in inflation do not tell the whole story behind changes in nominal exchange rates. The SEK has depreciated vis-à-vis both the NOK and the GBP during the last two decades, despite the fact that inflation has been lower in Sweden than in Norway and the UK.

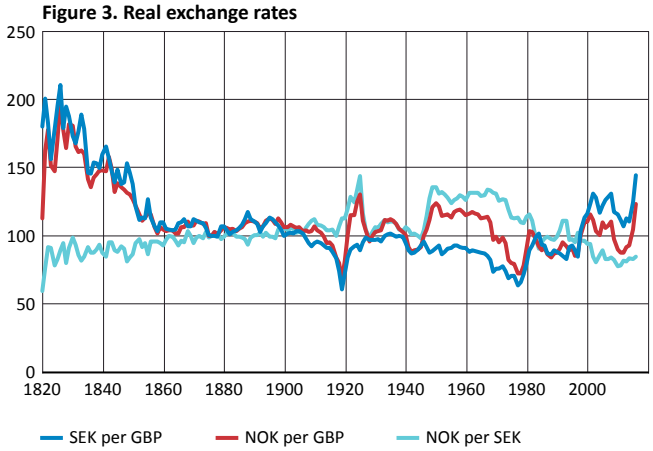
6 It should be noted that having similar inflation targets does not imply a stable level of the nominal exchange rate. With an inflation target the deviations from the target are accumulated in the price level over time, so the price level becomes a non-stationary process. This will be reflected in the nominal exchange rate between two inflation-targeting countries also being non-stationary.

Figure 2. Price levels and inflation rates



Note. The natural logarithm of index, 1875 = 100 and annual percentage change.
Sources: Edvinsson and Söderberg (2010), Grytten (2004a), Klovland (2013), Office for National Statistics, Norges Bank and the Riksbank

Figure 3. Real exchange rates



Note. Nominal exchange rates and price level indicies are indexed, 1875 = 100.
Sources: As in Figures 1 and 2

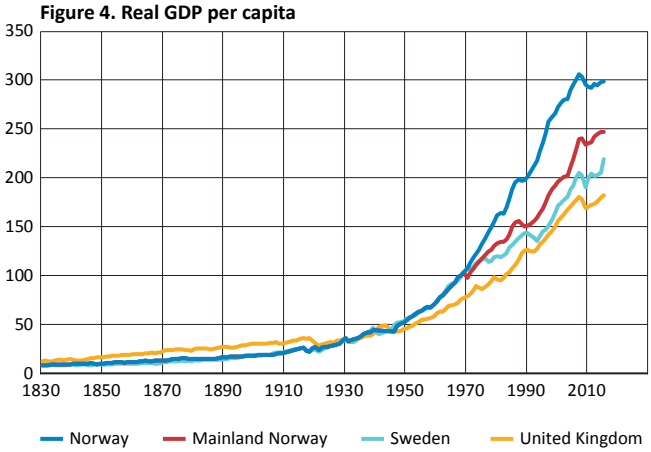
Deviations from purchasing power parity, or, equivalently, levels of real exchange rates, are shown in Figure 3.[7] It can be seen that the purchasing power, the real value, of the GBP was quite high in the early 1800s; that the real value of the SEK was quite high after the Second World War; and that the real value of the NOK has appreciated versus the SEK since the mid-1960s. In broad terms, these patterns should not be surprising. The prices of goods and services should typically be relatively high in rich countries where consumers have high incomes to spend. Industrialization occurred earlier in the UK than in Norway and Sweden, which is one reason why income, spending and prices were relatively high in the UK in the 1800s. Sweden was not directly involved in the Second World War and could therefore maintain a relatively high level of production and spending in the 1950s and 1960s. Oil discoveries in Norway have made relatively high production and spending possible during the last forty years.[8]

7 The real exchange rates in Figure 3 (Q) are just the products of the nominal exchange rates in Figure 1 (E) and the ratios of the price levels (P/P^*) in Figure 2a. In contrast to Figure 1, where the numbers on the vertical axis reflect actual prices used on currency markets, the numbers on the vertical axis in Figure 3 have no economic interpretation, because the price levels (in Figure 2a) are just indices of consumer prices measured in different ways in different countries.

8 The use of the word 'relatively' is deliberately somewhat sloppy here, in order to simplify the presentation. Sometimes it relates to a historical perspective, sometimes to a comparison across countries, or both.

The development of GDP per capita in Norway, Sweden and the UK is shown in Figure 4. Real GDP per capita is now around 35 per cent higher in Norway than in Sweden.[9] If we exclude oil production and compare the GDP level in just mainland Norway with GDP in Sweden, real GDP per capita in Norway is around 12 per cent higher. Between the first and second world wars, real GDP per capita was at about the same levels in Norway, Sweden and the UK. After the Second World War, production and income grew faster in Norway and Sweden, but the levels in these countries have grown apart since around 1970.

Figure 4. Real GDP per capita



Note. Index series, Norway 1968 = 100, levels of Sweden and UK adjusted to match Purchasing Power Parity-adjusted GDP (according to the Organisation for Economic Cooperation and Development (OECD)) 2010.
Sources: Edvinsson (2014), Grytten (2004b), Thomas and Dimsdale (2016), Bank of England, IMF, Norges Bank, Macrobond, Statistics Norway and the Riksbank

Using data that have been used in Figures 3 and 4, it is possible to establish a systematic relation between real exchange rates ($Q = EP^*/P$) and relative GDP levels (Y/Y^*) – see Figures 5a and 5b.[10] When GDP in Norway has been relatively high in relation to Sweden and the UK (*Y*/*Y** *high*), Norway's real exchange rate has been relatively strong, or, equivalently, the prices of goods and services in Norway, measured in common currency, high (that is, $Q = EP^*/P$ *low*).[11] The correlation between real exchange rates and relative GDP levels is not perfect, of course. There are many different factors that influence the developments of both real exchange rates and GDP. Yet, the relation between relative spending and relative price levels – measured in common currency – has implications for monetary policy. I will return to this issue below, after a short digression on the role of the current account.

3.2 The development of the current account in Norway and Sweden

One variable that is commonly used in analyses of 'competitiveness' and 'equilibrium' or 'sustainable' real exchange rates is the level of the current account. Sometimes a persistent current account surplus is interpreted as a sign of an 'undervalued' currency (often in both real and nominal terms). Since both Sweden and Norway have had persistent surpluses in our current accounts during the last twenty years, while the UK has experienced persistent

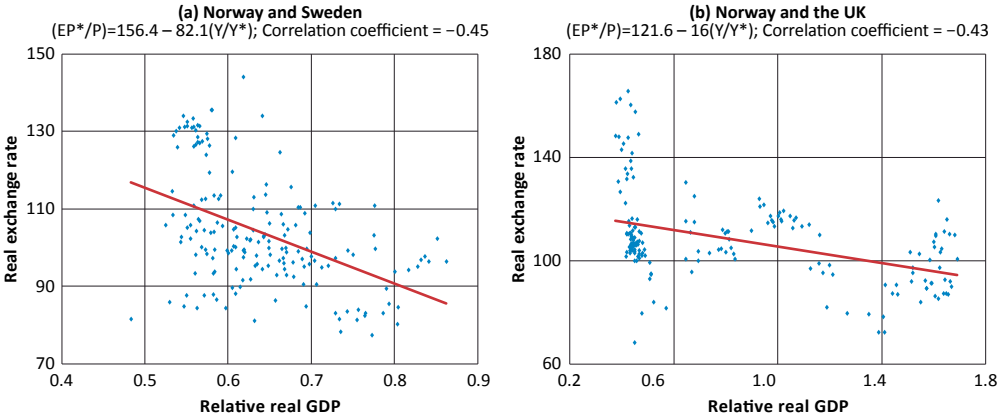
9 The GDP per capita levels in Figure 4 are based on real GDP (and population) data from each country, which means that they are also based on the use of different price indices (to compute real GDP). This makes it difficult to compare real GDP levels in different countries. The data in Figure 4 have however been scaled to match differences in purchasing power-adjusted real GDP per capita by 2010, according to estimates of such differences from the OECD. The vertical axis in Figure 4 (or, rather, the relation between the levels of series) can thus be given an economic interpretation.

10 The data in Figure 4 are GDP per capita, while the data on Y and Y* in Figures 5 a–b are based only on GDP series without any adjustments for population size.

11 The relation between the real exchange rate and the relative GDP level in Sweden and the UK (not shown) is marginally weaker than the corresponding relation between Norway and the UK.

deficits (during the last thirty years) – see Figure 6a – one may wonder why the SEK has depreciated vis-à-vis the GBP in real terms, while the real NOK/GBP rate has been relatively stable.

Figure 5. Real exchange rate and relative GDP in Norway 1830–2015

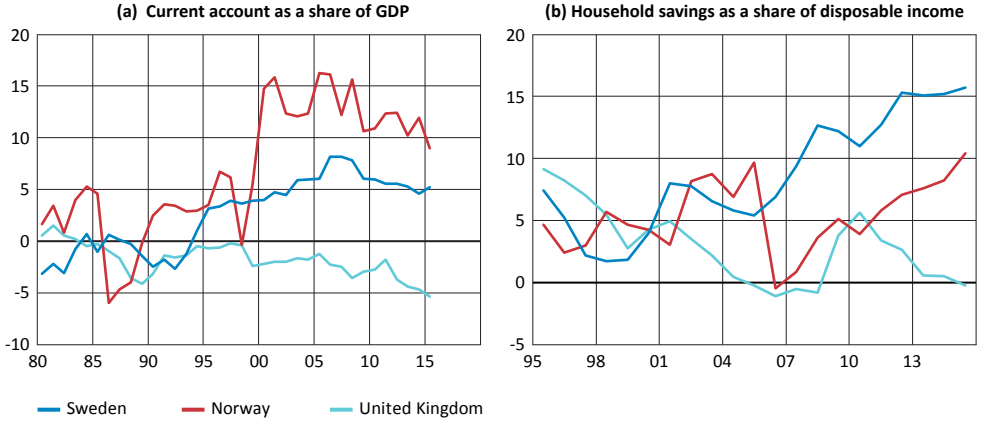


Sources: See Figures 1, 2 and 4, where Norway's GDP includes oil income

This becomes less puzzling once one considers the different factors behind the current account surpluses in Norway and Sweden. Norway's current account surpluses are mainly driven by production and exports of oil. Oil revenue enables a current account surplus and a capital outflow from Norway to the rest of the world. At the same time, this enables a current account deficit for mainland Norway, that is a capital inflow not from the rest of the world but from the Norwegian oil fields. This permits spending to be higher than income in mainland Norway and puts upward pressure on prices in Norway vis-à-vis the rest of the world, which tends to appreciate the real exchange rate.

In Sweden, by contrast, the current account surplus rather reflects a relatively low level of spending (in relation to income), both in the private and the public sector. The economic crisis in the early 1990s led to large changes in economic policy and households' behaviour in Sweden. Household savings as a share of disposable income are shown in Figure 6b. As mentioned above, fiscal policy has also aimed for positive net savings in the public sector. Hence, in contrast to mainland Norway, Sweden has thus generated a current account surplus through low spending. This is one reason why prices of goods and services have been

Figure 6. Current account and household savings



Note. Per cent of GDP and percentage of households net disposable income. Net household saving is defined as the subtraction of household consumption expenditure from household disposable income, plus the change in net equity of households in pension funds. Norway's GDP includes oil income.
Sources: IMF and OECD

relatively low (that is a depreciated real exchange) compared to both Norway and the UK.

In summary: the real appreciation of the NOK vis-à-vis the SEK during the last forty years reflects the fact that income and spending has grown faster in Norway than in Sweden, putting stronger upward pressure on prices in Norway. The main reason for the higher income and spending is the revenue from oil production, which also explains why Norway has experienced a current account surplus despite a relatively strong real exchange rate. In Sweden, both private and public savings have been high, and spending relatively low. This has resulted in a weak real exchange rate and a current account surplus.

3.3 Lessons for policy, part I

Structural factors have generated a real appreciation of the NOK vis-à-vis the SEK since the break-down of the Bretton Woods system. The NOK/SEK rate has appreciated by around 1/3, in both in real and nominal terms. In contrast, the SEK was strong in real terms during the first twenty years after the Second World War.

Monetary policy cannot do much about the need for long-term adjustments in real exchange rates (Q). Even so, monetary policy determines how much of the changes in real exchange rates that occur through changes in the nominal exchange rate (E) or through changes in relative price levels (P/P^*). Interestingly, and somewhat paradoxically, the real appreciation of the NOK/SEK rate during the first twenty years after the break-down of the Bretton Woods system, when both Sweden and Norway had the ambition to stabilize the nominal values of their currencies, took the form of a nominal appreciation of the NOK. (Inflation was higher in Sweden than in Norway, so the nominal NOK/SEK rate had to appreciate even more for the real exchange rate to appreciate.) During the recent twenty years, when both countries have had the ambition to stabilize inflation and let their currencies float, the nominal NOK/SEK rate has actually been quite stable and the real NOK/SEK appreciation has instead occurred through differences in inflation (higher inflation in Norway).

This means that the pattern of relative price adjustments between Norway and Sweden during the last twenty years largely resemble those that would have to take place in a currency union. A common view is that a disadvantage of a currency union is that changes in real exchange rates cannot take place through nominal exchange rate adjustments but instead have to occur through changes in nominal prices. The latter are assumed to be more painful. But the necessary adjustment of the real exchange rate between Norway and Sweden during the last twenty years has apparently been possible without any significant change in the nominal exchange rate. This, in turn, implies that differences in monetary policy between Norway and Sweden may not have been very important.

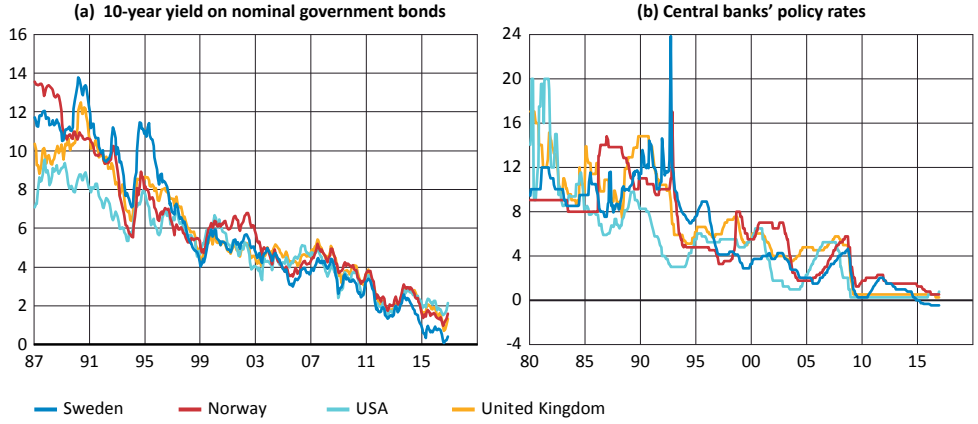
Norges Bank Watch 2016 (Lommerud et al., 2016) has raised the question whether Norges Bank's inflation target of 2.5 per cent should be lowered to the same level as in Norway's 'neighbours'. This is a question of how important it is for Norway to have a stable nominal exchange rate. With lower inflation in Norway (or higher inflation in Norway's trading partners) the real exchange rate adjustment that has been necessary would have required a larger change of the nominal value of the NOK. From this perspective, the difference between Norway's and Sweden's inflation targets – 2.5 per cent vs 2 per cent – is understandable. Higher inflation in Norway than in Sweden allows more stability in the nominal NOK/SEK exchange rate. Looking forward, it is quite possible that both Norway's and Sweden's real exchange rates will have to appreciate – given the current account surpluses in these countries. If so, stability of the NOK/SEK exchange rate could be consistent with more similar inflation targets.

4 Long-term developments of nominal and real interest rates

So far, the discussion has been mostly cast in terms of a two-country world (Norway and Sweden) with occasional references to the development in the 'rest of the world' (represented by the UK). But it is of course misleading to analyse the economic development – and monetary policy – in any small open economy as being influenced by the development in only one foreign country (or two countries). The current low levels of nominal interest rates in Norway and Sweden are not primarily the results of monetary policies in these two countries, but reflections of a long-term, global, downward trend in interest rates – see Figures 7a and 7b.

The downward trend in nominal interest rates has apparently been more persistent than central banks have expected. Figures 8a–8d show the developments of the policy rates in Sweden, Norway, the Czech Republic and New Zealand together with the forecasts of the policy rates published by the unusually transparent central banks in these countries.

Figure 7. Government bond yields and central banks' policy rates



Note. Per cent. For Norway the discount rate is used 1980–1986/02, the D-loan rate 1986/03–1993/05, and Sight deposit afterwards. For Sweden the discount rate is used 1980–1986, the marginal rate 1987–1994/05 and the repo rate afterwards.
Sources: Bank of England, Federal Reserve, Norges Bank and the Riksbank

4.1 Why have central banks made systematic forecast errors?

Data like the ones described in Figures 8a–8d of course give rise to criticism of central banks. How come the central banks make such bad forecasts even for the policy rates that they set themselves?

One possibility is of course that the data in Figures 8a–8d are not representative of central banks in general, and that the central banks that are unusually transparent have also been unusually bad forecasters. It is, however, hard to believe that central banks who have been unwilling to publish interest-rate forecasts have systematically made better forecasts. Unfortunately, such hypotheses cannot be tested.

Another possibility is that the central banks in question – and perhaps all central banks – rely too heavily on obsolete models. This has been a common critique against central banks during the last decade. Goodfriend and King (2016) have, for instance, criticized the Riksbank's use of models. That particular critique does not seem to be justified. Iversen et al. (2016), using real time data, show that forecasts from the Riksbank's models are not systematically worse than the forecasts that have been published, and that are influenced by both models and judgements. Lindé and Reslow (2017) also show that the Riksbank's forecast errors have not been mainly driven by the use of deficient models. On the other hand, it is clear that there are many weaknesses in the dominating macro models more generally – see for example Faust and Leeper (2015) and Lindé, Smets and Wouters (2016).

Figures 8a–8d should lead us to search for explanations behind the forecast errors not in peculiar models or other conditions in individual countries, but for some factors that are common to small open economies – and perhaps also larger economies – within the entire world economy. Figures 7a and 7b show that both short-term and long-term interest rates in the world economy have not only gone down but also converged. One explanation for this is that differences in monetary policies have become smaller. Most countries have had the ambition to stabilize inflation at a low level, irrespective of whether their central banks have explicit inflation targets. The downward trend in nominal interest rates partly reflects a downward trend in inflation, and the convergence partly reflects similarities in explicit or implicit inflation targets.

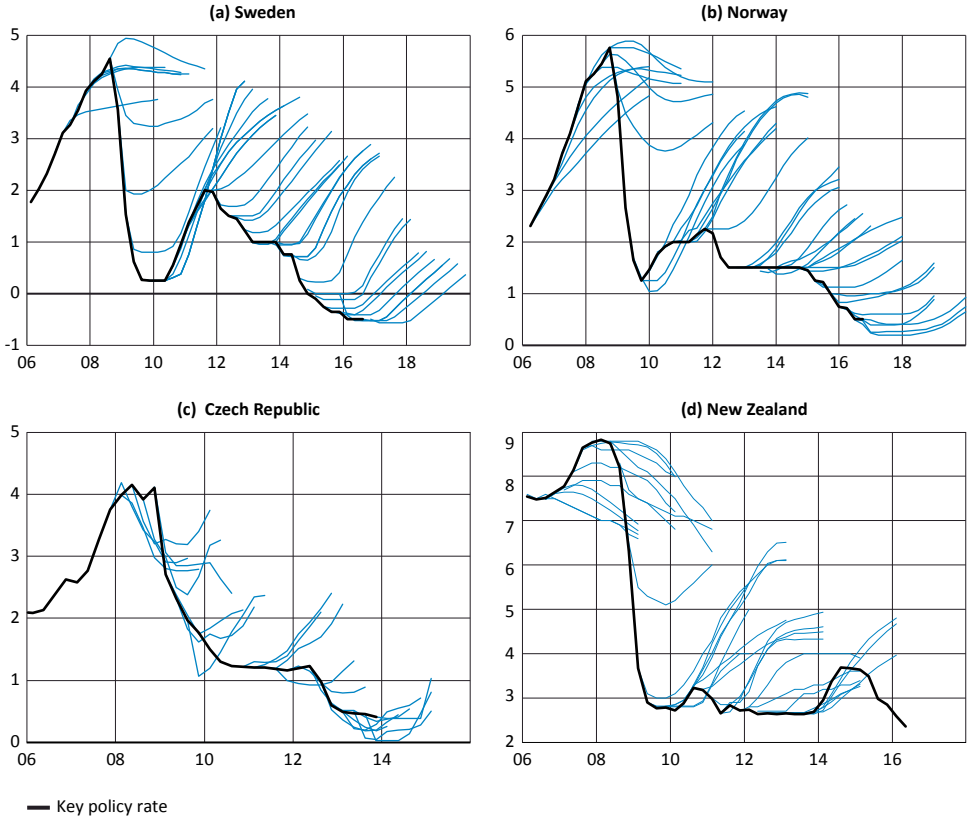
But interest rates have been trending downwards even when the development of inflation is taken into account – see the development of real interest rates in Figure 9.[12] There also seems to have been a convergence in real interest rates, although this is less obvious. The world economy has no doubt become more open, both financially and through trade of goods and services. Trade has increased faster than GDP and labour and capital mobility has also increased. This should indeed be expected to lead to a convergence of real interest rates.

The global downward trend in real interest rates has received increased attention from researchers and policy makers, see for example Rachel and Smith (2015) and Fischer (2016) for two recent summaries. Demographic changes, fiscal policies, higher inequality and higher uncertainty are factors that have all contributed to persistently lower real interest rates. There also seems to have been a slowdown in the rates of technical progress and productivity growth. These factors are partly related and often common across countries. Through trade in goods and services and mobility of production factors they are also transmitted across countries.

It is, of course, fair to ask why the downward global trend in real interest rates has come as a surprise to central banks. But the fact that Alan Greenspan talked about a 'conundrum' back in 2005 (that is before the financial crisis; see Greenspan, 2005) together with the fact that the normal level of the real interest rate is still being debated (see Rachel and Smith, 2015, and Fischer, 2016) suggests that central banks, in general, have been genuinely surprised by the low level of real interest rates, and therefore of nominal policy rates, not only in their home countries but globally.

12 There is no obvious and simple way to calculate and compare real interest rates in different countries. The data in Figure 9 are based on observed interest and inflation rates. Ideally one would like to compute real interest rates using expectations of inflation rather than outcomes.

Figure 8. Central banks' policy rates together with their forecasts



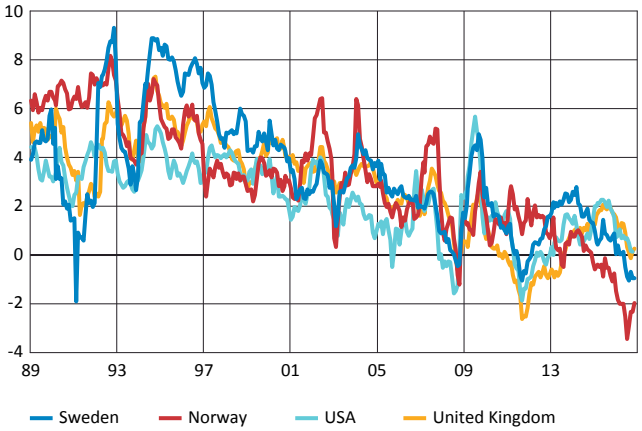
Source: Filardo and Hofmann (2014), Bank for International Settlements (BIS)

4.2 Lessons for policy, part II

When comparing policy rates and other interest rates in Norway and Sweden, it is not the differences that are striking, but the similarities. And not only the similarities between these two countries, but also the strong correlations with interest rates in the rest of the world. The currently low levels of the policy rates in Norway and Sweden are reflections of globally low interest rates. It is not surprising that the long run trends in nominal and real interest rates are strongly related across countries. The common trend in real interest rates reflects a high degree of integration of the world economy. The common trend in nominal interest rates in addition reflects a high degree of similarity in inflation targets and monetary policy strategies.

Taken together, these 'stylized facts' seem to suggest that differences in monetary policies between countries, including Norway and Sweden, have become less important over time. One reason is that the differences in monetary policy itself have become smaller. The application of some version of (explicit or implicit) inflation targeting has increased over time. Another reason is that the world economy has become more integrated. This leads to smaller differences in real interest rates and possibly less scope for monetary policy to affect the economic cycles in different countries. As all readers can observe, these conclusions are not based on very deep theoretical or empirical studies but rather speculative. More careful studies are needed.

Figure 9. Real interest rates
Per cent



Note. Difference between 10-year yield on nominal government bonds and the CPI for all countries.
Sources: Bureau of Labor Statistics, Macrobond, Office for National Statistics, Statistics Norway and Statistics Sweden

5 Challenges for monetary policy in both Norway and Sweden

In the previous sections I have argued that there are many similarities between the monetary policies in Norway and Sweden. Differences in the degree of central bank independence, governance models, levels of inflation targets, etcetera do not seem to have led to large differences in interest rates or exchange rates. One reason for this may be that both economies are small and open and highly integrated. One important difference, though, is that Norway's production of oil has led to an increasing difference between the levels of income in the two countries. Capital mobility may imply that different income levels are consistent with small differences in real interest rates, but adjustments in real exchange rates are needed in the short term since parts of the consumption baskets consist of non-traded goods.

Against this background, Norway and Sweden face similar challenges for their strategies for monetary policy – despite the higher income due to oil production in Norway.

One set of strategic questions that has received increased attention in recent years concerns the definition of the inflation target. The Bank of Canada have in their last two reviews of their inflation-targeting strategy asked whether the inflation target should be lowered or raised. Norges Bank and Sveriges Riksbank have reason to consider the same questions. These questions cannot, of course, be answered independently of the definition of the inflation target. There is an on-going discussion in both Norway and Sweden of the implications of different definitions of the inflation targets; for example about whether the targets should be expressed in terms of headline CPI or some measure of 'core' inflation (see Goodfriend and King, 2016, Lommerud et al., 2016, and Sveriges Riksbank, 2016).[13] In Sweden there is also a discussion about whether the inflation target should be combined with some interval indicating the central bank's tolerance for deviations or the general uncertainty in inflation forecasts etcetera (see Sveriges Riksbank, 2016).

Another question concerns, as we have seen, estimates of the policy rate in a steady state, that is when the effects of temporary disturbances have disappeared. If one reason for the central banks' forecast errors, shown in Figures 8a–8d is that the steady state level of the policy rate has been overestimated, the result has probably been that the policy rate

13 After this paper was written, Sveriges Riksbank reformulated its inflation target in terms of CPIF instead of CPI, which was announced on 6 September 2017.

has been higher than desirable. Finding better ways to estimate the (possibly time-varying) steady state level is thus important for a proper implementation of monetary policy.

Risks to financial stability involve further challenges. First, the risks have to be identified. Second, the implications for monetary policy have to be decided. There are no simple answers to these questions. As shown above, both Norway and Sweden have had persistent current account surpluses during recent decades. This means that the countries' net indebtedness vis-à-vis the rest of the world is not increasing but rather decreasing. The private sectors' gross debt has nevertheless been increasing. And high levels of gross debt and rapid increases in residential prices, as in Norway and Sweden, are known to be leading indicators of the risks of financial crises.

The high levels of gross private debt may be partly explained by the high levels of collective savings – accumulated in the government pension fund based on oil revenues in Norway and in the pension funds based on agreements between employers and unions in Sweden (see Nilsson et al., 2014, for a discussion of the Swedish case). These pension funds contribute positively to financial stability in Norway and Sweden by providing buffers against unfavourable developments of for example demographics or productivity. But the high degree of collective savings also, by construction, means that the private sector is more liquidity constrained compared to a situation with a larger share of individual savings. The net effect on financial stability risks, and the implications for central bank policy, should be subject to more careful analyses.

Even if high levels of private debt and rapid increases in residential prices are associated with risks to financial stability, it is not obvious that this should be the central bank's responsibility, and even if the central bank has a responsibility in this field, it is not obvious that it should have any implications for monetary policy (see for example Mester, 2016, and Schnabel, 2016 for recent reviews). New measures in the area of macro-prudential policy are often said to be the 'first line of defence' against financial instability risks. But even so, some coordination of monetary and macro-prudential policy may be beneficial. Coordination is of course simpler if these tools are handled by the same authority, as in the case of the UK and the Bank of England. In Norway and Sweden and other countries where the Financial Supervisory Authorities are not part of the central bank, other forms of coordination have to be found. In Norway, the central bank has been given the task to give recommendations on the counter-cyclical capital buffer. This has led to regular publications of assessments of financial stability in Norges Bank's reports on monetary policy. Sveriges Riksbank has no formal responsibility for macro- or micro-prudential policy but still publishes Financial Stability Reports with analyses and recommendations. There is a Financial Stability Council where representatives of the Government, the Swedish Financial Supervisory Authority, the Swedish National Debt Office and Sveriges Riksbank regularly meet to discuss issues of financial stability. In both Norway and Sweden, the interactions between the government, the central bank and the Financial Supervisory Authority will presumably be further developed in the near future.

Regarding the coordination or 'policy mix' of monetary and fiscal policy, both Norway and Sweden have made reforms during the last 15–25 years that have been focused on creating clear rules for the different policies separately, with no ambitions of coordination. Monetary policy has been reformed to establish credibility for the inflation targets and fiscal policy has been reformed to ensure a sustainable long term development of government debt. Leeper (2016) and Sims (2016), among others, have stressed the importance of formulating consistent rules for monetary and fiscal policy. Their arguments suggest that fiscal policies in Europe and elsewhere may have been too much focused on 'austerity' in recent years and that this may be part of the explanation for persistently low inflation. The implications of these analyses and arguments for monetary and fiscal policy in Norway and Sweden remain open issues. But economists at Norges Bank and Sveriges Riksbank should be able to make constructive contributions to a discussion of such issues.

An ambition to preserve a certain level of central bank independence may pose restrictions on the coordination of monetary policy with macro-prudential policy or fiscal policy. The future degree and design of central bank independence in Norway and Sweden will be thoroughly discussed in the near future, as the central bank laws in both countries are being reviewed. But even with a high degree of independence from the political system, the possibilities for both Norges Bank and Sveriges Riksbank to pursue very independent monetary policies are limited by the openness of these small economies. The implications of for example capital mobility for the effectiveness of monetary policy in Norway and Sweden deserve further theoretical and empirical studies.

Finally, both Norges Bank and Sveriges Riksbank need to evaluate their experiences from being among the most transparent central banks in the world. Publications of interest-rate forecasts (in both countries) and of detailed minutes from the Board's discussions about monetary policy (Sveriges Riksbank being more detailed than Norges Bank in this regard) should have had positive effects on the central banks' legitimacy, through improved accountability and efficiency. But the high level of precision in the communication may also have contributed to an overly optimistic view – perhaps more outside than inside the central bank – of what the 'science of monetary policy' can achieve; see Goodfriend and King's (2016) review of the case of Sweden for some critical comments. The message in the introductory quotation from the TV series 'The Crown' suggests that people often want to be 'fooled', perhaps because realism is not always pleasant, and perhaps this is true also of monetary policy. Documenting and analysing forecast errors such as those shown in Figures 8a–8d is not always pleasant. Still, being as transparent as possible about what policy, and forecasting models, can and cannot achieve is a good starting point for improving policy making and analyses. How to combine transparency with rigorous analyses while still emphasizing that both policy and analyses are associated with considerable uncertainty remains an important challenge.

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