Why has inflation been so low?

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Inflation in Sweden has been low for a long period of time. A great deal of the analytical work at the Riksbank has been dedicated to attempting to identify the main drivers underlying the developments. The purpose of this article is to summarise, and to a certain extent update, the findings of that analysis. We start by describing the development of inflation over the past five years, and then study potential explanatory factors, first using simple correlations and then using a model of the Swedish economy. The findings are relatively consistent in that weak international economic activity combined with low commodity prices, particularly for energy, have kept a lid on cost increases, which has been a cause of low domestic price increases in general. The fact that the Swedish krona strengthened for a time also contributed to keeping cost pressures down. In the past two years, companies have in addition squeezed their margins to a greater extent than might be expected from historical patterns.

September 2008 is remembered by many as the month in which US investment bank Lehman Brothers filed for bankruptcy – one of the most critical events of the financial crisis. What is probably less commonly remembered is that September 2008 was also the month when inflation in Sweden hit a record. CPI inflation then reached 4.4 per cent – a level not seen since 1993 when the inflation target was introduced. One reason for the upswing was increasing cost pressures and sharply rising food and energy prices.

As the effects of the financial crisis spread across the globe, and hence to Sweden, in the late autumn of 2008, the momentum of the Swedish economy changed drastically. Inflation came down quickly from its record-highs, but although production declined in 2009 and unemployment rose quickly, inflation was still relatively high. CPI inflation was indeed pushed downwards because market rates fell in line with the Riksbank's sharp cut in the repo rate, which has a direct impact on CPI, but excluding that effect, inflation was back to a level of around 2 per cent at the end of 2009. From 2011 inflation started to decline, however, and has stayed low since.

Periodically low inflation is in itself a natural consequence of the workings of the economy. The economy is constantly affected by changes and shocks, and events occur that sometimes push inflation up, and sometimes bring it down. Depending on what

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happens, and how much the economy is affected, the effect on inflation can also be relatively protracted. While the Riksbank indeed adapts monetary policy so that inflation will return to 2 per cent over time, monetary policy is not so precise that it can ensure that the inflation target will always be met.

The period from 2011 and onwards is however remarkable in many ways. To start with, it is quite simply unusual that inflation is so low for so long. It has systematically turned out lower than the expectations of practically all forecasters, including the Riksbank. Compared with previous years when inflation has been low, the past few years have also been distinctive because the dip in inflation has coincided with long-term inflation expectations trending down to a level below the inflation target. In order to break the trend and buoy inflation, the Riksbank has cut the policy rate to a negative level and has further acted to make policy even more expansionary, for instance by purchasing government bonds.

The reasons for the unexpectedly low inflation have of course been a core issue for the Riksbank in the past few years. A substantial part of the internal analytical work has been dedicated to understanding the drivers behind the developments and why forecasts have overestimated inflation outcomes. Conclusions from that work have previously been presented in, for instance, articles in Monetary Policy Reports, in Economic Commentaries and in the annual Account of Monetary Policy.[1] The purpose of this article is to summarise and update that analysis, and also to present a number of new findings.

We wish to point out that this does not mean that the final word has necessarily been said on the causes of the low inflation of the past few years. To start with, inflation is still low. While it is indeed increasing, there is still great uncertainty about its future development. Also, analytical work is still in progress regarding various aspects of the course of inflation in the past few years. There will thus probably be reason to return to this question in the future. When it comes to monetary policy, we wish to make clear from the beginning that the analysis in this article consists of a comparison of actual monetary policy with that which a simple interest rate rule would have implied in the past five years. Based on that analysis it is not possible to take a stand on whether monetary policy has been well-balanced or not.

The article consists of three core sections. In the first section we describe inflation developments in Sweden since the financial crisis from different perspectives, including an international comparison. In the two subsequent sections, we study potential explanatory factors underlying the developments. There are a number of ways to approach such an analysis. In the second core section, we basically focus on one potential factor at a time, and attempt to explain the way in which and the extent to which it has affected inflation. The statistical analysis consists mainly of simple correlations. The advantage of this approach is that the presentation is relatively simple and clear. The drawback is that it is difficult to grasp how important a certain factor has been to the low inflation compared with other factors. Moreover, correlations do not capture the complex causal links that may

1 See, for example, Apel et al. (2014), Löf (2015) and Sveriges Riksbank (2012, 2013, 2014a,b and 2015a,b).

exist at a macroeconomic level at which it is often difficult to determine underlying drivers and what caused what.

In the third and final core section of the article, we analyse inflation using a model that takes explicit account of the fact that there are interactions between different factors, and that they are determined simultaneously – a general equilibrium analysis, as it is commonly known. The drawback of this approach is that the analysis is technically complex and that the model, by necessity, gives a simplified picture of the complex links prevailing in the economy. The advantage is that this type of model can provide an indication of which factors in the economy have been of particular significance to the weak course of inflation compared to other factors.

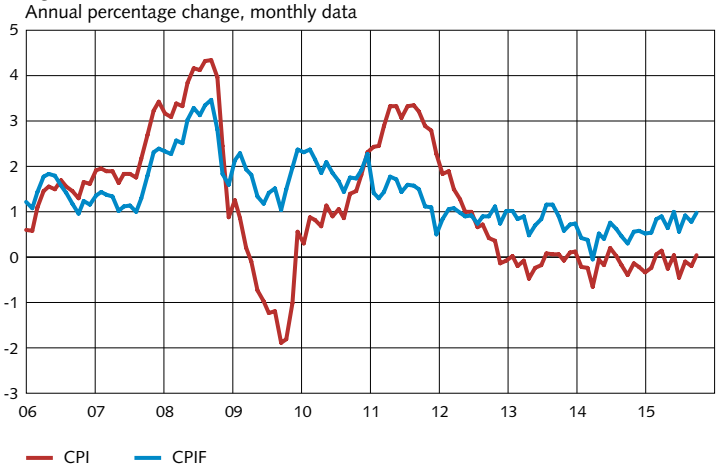
The conclusions of the analysis indicate that the weak economic activity internationally and, linked to that, subdued demand in Sweden, have been particularly important factors in explaining the low inflation of the past five years. The exchange rate has also played a part in pushing down inflation during this period. Furthermore, commodity prices, particularly for electricity and oil, have curbed inflationary pressure, partly due to a direct effect on consumer prices for electricity and oil-related products, and partly by means of an indirect effect through lower production costs for companies. In the past two years, we can also observe that companies appear to have squeezed their margins to a greater extent than might be expected from historical patterns. It is difficult, based on the ensuing analysis, to provide a precise reason for this, although according to the companies themselves it might be related to increased competition and uncertainty about future economic developments.

1. Inflation since the financial crisis

Inflation in Sweden started to drop in 2011 and, measured with CPIF, it has been at a low level ever since. In this chapter we study underlying inflation measures, various subindexes, and Swedish inflation in an international perspective in order to gain a better understanding of the developments of the past five years. The dip in the rate of price increases has generally been broad, even though the price developments in various subgroups of goods and services have affected inflation to a particularly high degree in certain years. Swedish inflation has also been low in an international comparison, particularly in 2011-2013.

In order to gain a better understanding of the causes of the low inflation in the past few years, it might be appropriate to start by taking a closer look at how CPI and its subindexes have developed. In Figure 1 we see, to start with, CPI inflation from the years immediately preceding the financial crisis, and thereafter. As mentioned in the introduction, CPI inflation was over 4 per cent in the summer of 2008. It subsequently dropped drastically and, after having fluctuated sharply, stabilised at around zero at the start of 2013.

Figure 1. CPI and CPIF
Annual percentage change, monthly data



Note. CPIF is the CPI with a fixed mortgage rate.
Source: Statistics Sweden

When studying inflation, it is important to remember the particular effect that changes to the interest rate have on the CPI measure. Changes to household mortgage rates have a direct effect on CPI via the component that measures households' interest expenses for owner-occupied housing. Therefore, when interest rates drop, for example, this will have the effect of pushing down CPI inflation.[2] From a monetary policy communication perspective, this poses quite some difficulty. For example, when the Riksbank cuts the repo rate in order to stimulate the economy and, in time, *increase* inflation, this actually has the direct effect of reducing interest expenses and hence CPI inflation *decreases*. The direct effect of monetary policy on CPI inflation thus heads in the "wrong" direction. This is particularly apparent in periods of major changes in monetary policy, such as in the financial crisis. Then, the Riksbank cut the repo rate by a total of 4.5 percentage points in 2008-2009 in order to underpin the economic recovery – a factor that led to a sharp drop in CPI inflation initially.

Because CPI inflation is affected by mortgage rates in this way, it does not provide a fair picture of inflationary pressure in periods when interest rates change a great deal, such as in the past few years. During such periods, inflation measured as the change in CPIF provides a better picture. The difference between CPI and CPIF is that in the calculation of CPIF, the mortgage rate is kept constant, that is, CPIF inflation does not include the direct effect of interest rate changes.[3] Figure 1 shows that, even excluding the interest rate effect, inflation dropped in connection with the financial crisis. However, the drop was not as drastic and towards the end of 2009 CPIF inflation was at a level of around 2 per cent. It remained

2 This effect on CPI inflation from interest expense is a peculiarity of the Swedish CPI measure. For further details about this and how interest expenses and CPI are measured, see Johansson (2015).
3 In the longer term, when the interest rate has stabilised, CPIF inflation will however coincide with CPI inflation. For further details see Hansson, Johansson and Palmqvist (2008).

there in 2010, but later dropped and stabilised at a level of around 1 per cent. CPIF inflation subsequently fell even further from mid-2013 until the spring of 2014. Since then the trend appears to have been broken and inflation has risen, albeit still being low.

BROAD DOWNTURN IN THE RATE OF PRICE INCREASES FOR GOODS AND SERVICES

A closer look at the developments shows that the low inflation is a result of a broad downturn in the rate of price increases for goods and services. That statement might perhaps seem a tad redundant. Inflation is, after all, the increase in the general price level. So, how can a drop in inflation be anything other than "broad"? The answer is that changes in prices for individual goods and services, particularly those with a high weight in the CPI basket, can temporarily impact and dominate the entire CPI aggregate. This can, at times, affect CPI inflation to a relatively high degree. Actually, we have already seen one example of this in the discussion about the impact of interest expenses on CPI inflation. As we shall see, prices for other groups of goods and services have also kept a lid on inflation to varying degrees in the past five years.

Underlying inflation has been low in the past few years

In order to get an idea of the more enduring trend, which is not affected by the "noise" induced by major price fluctuations for individual goods and services, the Riksbank follows various measures of what is known as underlying inflation. The measures differ slightly in nature and Figure 2 illustrates three of them.

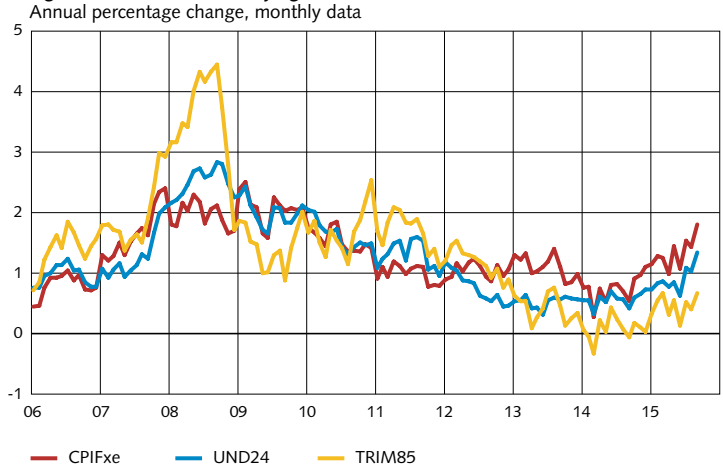
CPIFxe and TRIM85 are measures that strip away price changes that can temporarily affect the picture of the more enduring course of inflation. CPIFxe shows CPIF excluding energy prices, because electricity and oil prices have historically been a source of relatively large fluctuations in CPI(F) inflation. The TRIM85 measure excludes the 7.5 per cent of the prices that have increased the most and the 7.5 per cent of the prices that have increased the least. Then, a weighted mean of the remaining prices is calculated.[4] Finally, UND24 takes as a basis how much individual prices have varied compared to total CPI in the past two years. No prices are excluded; rather, the various prices are weighted together in such a way that greater weight is given to the prices that have remained stable. A change in the price of a product or service that previously has fluctuated a great deal therefore has less of an impact on UND24 than on CPI, in which the weight given to a certain price depends on how much households consume of the product or service.

As can be seen in Figure 2 the underlying inflation measures paint quite a consistent picture of developments since the financial crisis. In fact, inflation measured using CPIFxe and UND24 indicates that the downturn started already in 2010, which implies that energy prices pushed up CPIF inflation that year. In terms of CPIFxe inflation, it can also be noted that it was relatively stable at around 1 per cent from 2011 until the end of 2013

4 To be precise, the calculations are based on 70 CPI subgroups. The product groups that have had the highest and lowest price increases are excluded until 85 per cent of the weight total in the CPI basket remains.

when it dropped slightly. The other two measures of underlying inflation indicate more of a downward trend throughout the entire period until 2013-2014. The conclusion is thus that there has been an underlying, enduring slowdown in inflation in the past few years. This slowdown has not been mainly driven by individual products or services; rather, price increases have been smaller in general.[5]

Figure 2. Measures of underlying inflation
Annual percentage change, monthly data



Note. CPIFxe is CPI with a fixed mortgage rate and excluding energy prices. UND24 and TRIM85 are statistical measures of inflation that are based on CPI broken down into 70 price subgroups. UND24 is a measure in which prices are weighed together such that the weights reflect the historical standard deviation in the various prices. The TRIM85 excludes the 7.5 per cent of the prices that have increased the most and 7.5 per cent of the prices that have increased the least each year.
Sources: Statistics Sweden and the Riksbank

The contributions from different groups of prices have varied quite a lot over the period

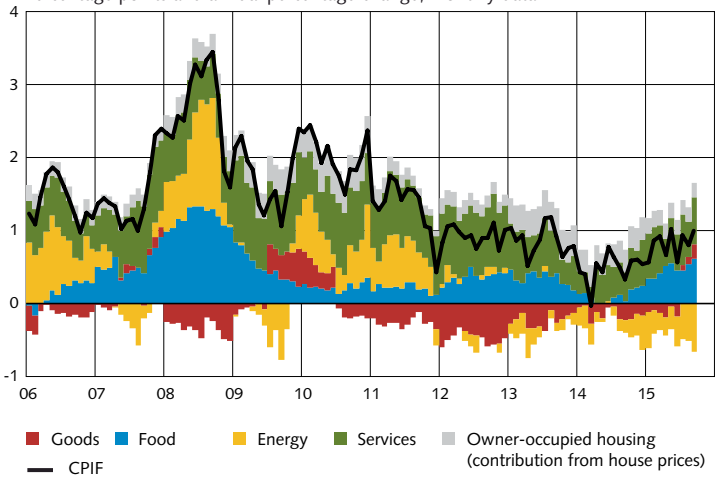
Although it can be said that the decline in the rate of price increases has been broad, the contributions to the low inflation from various groups of goods and services have varied quite a lot over the period. An analysis of various subindexes in CPI or CPIF might therefore be interesting and provide more details about the developments. Here, we have opted to take CPIF inflation as a starting point, since interest rates changed a lot in the period studied.

Exactly how the prices for individual goods and services are grouped into different subindexes can vary slightly depending on the purpose of the study, but a common breakdown is into interest expenses, energy, food, goods (excluding energy and food)

5 To a certain extent, reductions of indirect taxes have been a factor in pushing inflation down during the period. This applies mainly to the reduction in VAT on restaurant and catering services on 1 January 2012. According to calculations of the National Institute of Economic Research, it brought down CPI and CPIF inflation by just over 0.1 percentage point at the start of 2012, see *The Swedish Economy*, July 2012.

and services.[6] The breakdown into goods and services is natural, since these prices are affected differently by, among other things, competitive pressures, cost developments, and exchange rate fluctuations. There is also a point in separating energy and food prices from other goods prices since energy and food prices are highly affected by commodity prices on the global market. Note also that, here, the contribution from interest expenses only consists of the part that is due to changes in house prices, as the direct effects of mortgage rates changing over time do not affect CPIF inflation.

Figure 3. Contribution to CPIF
Percentage points and annual percentage change, monthly data



Note. The bars illustrate the contribution of each price group to the rate of change in CPIF in the past twelve months. The contributions can be interpreted as the annual rate of change in each group, multiplied by the group's weight in CPIF. In 2015 the weights are as follows, in per cent: services (45.0), goods excluding food and energy (24.2), food (17.6), energy (8.3) and owner-occupied housing (contribution from house prices) (4.8).
Sources: Statistics Sweden and own calculations

Figure 3 shows how the contributions from these subgroups to CPIF inflation have varied in the past few years. The contributions show, in simple terms, the annual rate of change in each group of prices multiplied by the group's weight in CPIF. Hence, the sum of the contributions of the different groups is equal to CPIF inflation, that is, the line in Figure 3 is equal to the sum of the bars in the figure. Bars above the zero line indicate a positive contribution to CPIF inflation, while bars beneath the zero line denote a negative contribution.

House prices have pushed up CPIF inflation

As can be seen in Figure 3, the rising prices of owner-occupied housing have contributed to increasing inflation in the period through the part of the interest expenses that is not due

6 This is the breakdown commonly used by the Riksbank. Statistics Sweden's breakdown of CPI into various main groups, available on its website, differs somewhat from this.

to interest rate changes (the grey bars).[7] Prices for owner-occupied housing have risen and households have therefore had to borrow greater amounts, which has led to an increase in interest expenses in CPIF.

Energy prices have made a negative contribution in the past few years

The contribution of energy prices (the yellow bars in Figure 3) has varied a great deal over the period. In 2010 and 2011 the contribution was positive. However, since the outset of 2012, the contribution from energy prices to CPIF inflation has been unusually low, and since 2013 it has, with the odd exception, been negative each month. In a historical perspective, it is unusual for the contribution of energy prices to be below zero several years in a row. An important factor underlying this development is that the spot price for electricity at the northern European trading facility Nord Pool has been at a low level for several years, and electricity prices have basically dropped year-on-year ever since the end of 2011. Adding to that is the fact that the price of crude oil has also been on a weak trend for a number of years, and furthermore dropped sharply in 2014, leading to the price of fuel in CPI declining almost each month on a year-on-year basis since 2013. Besides these direct effects on the prices for household electricity and fuel, the changes of the spot prices for electricity and oil also have indirect, or lagging, effects on the price of other goods and services. We discuss this further in section 2.

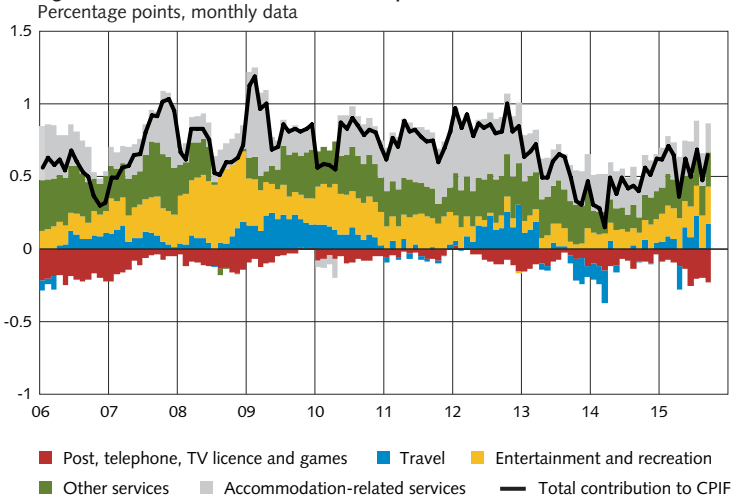
The contribution from prices for services dropped unexpectedly in 2013

Between 2008 and 2012 prices for services increased on average by just shy of 2 per cent annually, which translates to an average contribution to CPIF inflation (the green bars) of approximately 0.8 percentage points. However, as can be seen in Figure 3, the rate of increase of prices for services gradually declined in 2013, and at the outset of 2014 the contribution to CPIF inflation was just above the zero mark. It has subsequently risen again somewhat. Bearing in mind that the rate of increase in prices for services had been stable for a long time, the downturn in 2013 was unexpected. In Figure 4 we see the contribution from prices for services broken down into smaller groups. The figure shows that the downturn in 2013 mainly pertained to rents (included here in accommodation-related services) and travel (primarily air travel) for which the price increases in 2013 were lower than the year before. However, prices for other services also performed weakly in 2013-2014.[8]

7 The interest expenses included in CPI measures households' capital costs for living in an owner-occupied home and those costs are of course affected by changes to mortgage rates, but also by changes to the value of the properties financed by the mortgages. In the calculations of inflation measured with CPIF, mortgage rates are kept constant, but changes to house prices and thus the value of the properties have the same effect on CPIF as on CPI. For more information, see Johansson (2015).

8 For more information, see Nilsson (2014).

Figure 4. Contribution to CPIF from various prices for services
Percentage points, monthly data

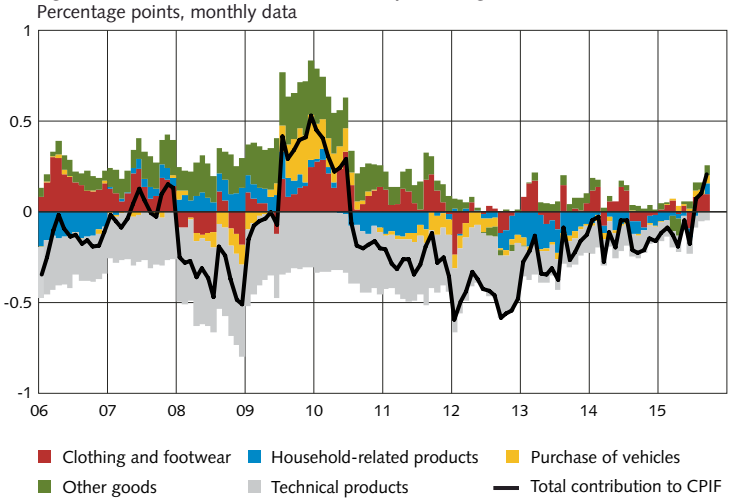


Note. The bars illustrate the contribution of each price group to the rate of change in CPIF in the past twelve months. The contributions can be interpreted as the annual rate of change in each group, multiplied by the group's weight in CPIF.
Sources: Statistics Sweden and own calculations

Goods prices have continued to decline

Goods prices (excluding energy and food) have, for a long time, made a negative contribution to CPIF inflation (the red bars in Figure 3), which reflects the fact that prices for goods have declined on average throughout the entire 2000s. Because a large proportion of the goods are imported, the Swedish krona and prices abroad are important factors for the development of goods prices. The period in 2009 and 2010 in which prices for goods actually helped push up CPI inflation coincided, for example, with a sharp weakening of the exchange rate, which thus led to more expensive imports expressed in Swedish kronor. As for the developments in various subgroups of goods, Figure 5 shows that practically all groups fared weakly after 2010, including household-related products and vehicles. The drop in the price of technical products, which had been occurring for a long time, continued to keep a lid on goods prices, but in the past two years prices for technical products have not contributed to curbing inflation by as much as they did before. The contribution from prices for clothing and footwear has on average been close to zero in the past few years. The contribution from other goods has also been low.

Figure 5. Contribution to CPIF from various prices for goods
Percentage points, monthly data



Note. The bars illustrate the contribution of each price group to the rate of change in CPIF in the past twelve months. The contributions can be interpreted as the annual rate of change in each group, multiplied by the group's weight in CPIF.
Sources: Statistics Sweden and own calculations

The contribution from food prices has been moderate

Food prices, finally, made a positive contribution to CPIF inflation over the studied period (the blue bars in Figure 3). The contribution was relatively stable at around 0.2-0.4 percentage points from mid-2009 until the end of 2013, when it dropped to zero for a couple of months. It subsequently rose relatively quickly again. The moderate development of food prices is slightly surprising considering that the price increases for commodities were relatively high from the end of 2010, pushing up price increases among producers. But this might have been counteracted by the appreciation of the Swedish krona until 2013 (see section 2).

SWEDISH INFLATION HAS ALSO BEEN LOW IN AN INTERNATIONAL COMPARISON

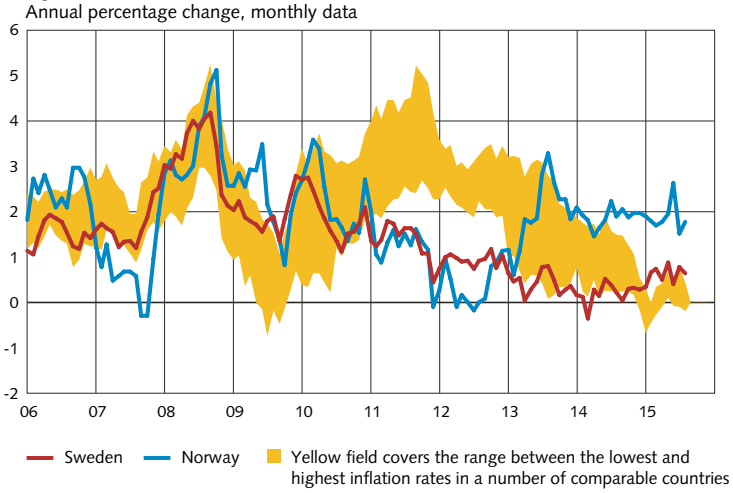
Sweden is a small, open economy and is greatly affected by events abroad. Considering that the factors that have affected Swedish inflation in the past five years have probably affected other countries too, it is interesting to look at how inflation has progressed in Sweden from an international perspective. In Figure 6 we see, to start with, inflation measured as the change in HICP in Sweden and a number of other European countries that are often used for comparisons with Swedish developments.[9] The figure contains two lines. One shows HICP

9 Unlike CPI, whose definition and calculation method may vary from country to country, HICP is a more harmonised index for consumer prices prepared by the EU to facilitate international comparisons. Inflation measured using CPI and HICP may therefore diverge somewhat. A clear difference where Sweden is concerned is that the items that measure the costs of owner-occupied housing are to the most extent not included in HICP. There are also other differences in terms of methodology in how Swedish CPI and HICP are calculated.

inflation in Sweden and the other in Norway. Other countries are included as a range that extends between the lowest and highest inflation rate in the other countries each month.

The figure clearly shows that the low inflation in the past two years is not a uniquely Swedish phenomenon; rather, inflation has been low in other countries too in 2014 and 2015. However, the development in Sweden stands out in prior years and it is clear that what has occurred in recent years is that inflation in other countries has dropped to the level at which inflation in Sweden has stayed for some time.

Figure 6. HICP inflation in different countries and in the euro area
Annual percentage change, monthly data



Note. The countries included in the comparison in the figure are Sweden, Norway, Denmark, Finland, the Netherlands, the UK and Germany. Developments in the euro area as a whole are also included in the comparison.
Sources: Eurostat and own calculations

It is interesting to compare developments in Sweden and Norway in this context. As can be seen in Figure 6, HICP inflation in Norway was similar to that in Sweden until 2013. Just like in Sweden, inflation fell from 2011 instead of rising like it did in other countries. As of 2013, it is however the Norwegian developments that differ from other countries because inflation then started to rise sharply in Norway. This comparison between Sweden, Norway and other countries illustrates, among other things, the significance of the exchange rate for the movements in inflation. After having weakened significantly in 2008-2009, the Swedish and Norwegian currencies were more or less on a strengthening trend until 2013, which coincided with the decline in inflation. The Norwegian krone subsequently started to weaken sharply once again, and inflation rose when imports became more expensive expressed in Norwegian kroner. The Swedish krona has also weakened in the past few years, but not to the same extent as the Norwegian krone. The significance of the exchange rate for inflation developments is further discussed in sections 2 and 3.[10]

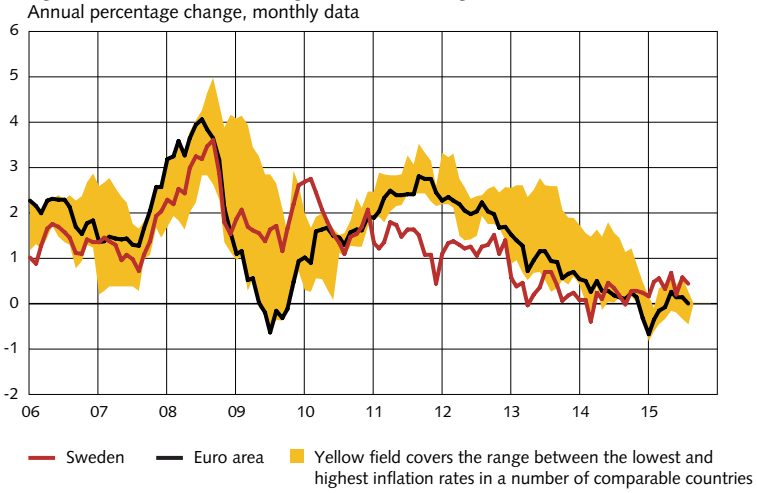
10 It is of course not only the exchange rate that explains the difference between developments in Sweden and Norway in recent years; other factors have also been of importance. See Sveriges Riksbank (2015c) for a more detailed comparison of Sweden and Norway in recent years.

Changes to indirect taxes explain part of the difference between Sweden and other countries

An important reason for the major difference between the developments of inflation in Sweden compared with other countries is the increases to indirect taxes implemented by many other European countries in order to bolster their public finances in the wake of the financial crisis. In countries such as Finland, the Netherlands and the UK, tax increases have been a factor in pushing up inflation by 0.5-0.6 percentage points. In Denmark, and particularly in Germany, this effect is however much smaller and in the euro area as a whole tax changes have on average contributed to raising HICP inflation by 0.2 percentage points.[11] In Sweden, tax cuts have, conversely, pushed inflation down somewhat (see footnote 5).

Figure 7 shows the same information as Figure 6, but with the effect of tax changes excluded (Norway is dropped due to data limitations). If tax changes are taken into account, the difference since 2011 is not entirely as drastic. However, even disregarding tax effects, inflation has clearly been much lower in Sweden in the past five-year period than in many other European countries, particularly in 2011-2013.

Figure 7. HICP inflation excluding effects of tax changes
Annual percentage change, monthly data



Note. The countries included in the comparison in the figure are Sweden, Denmark, Finland, the Netherlands, the UK and Germany. Developments in the euro area as a whole are also included in the comparison.
Sources: Eurostat and own calculations

11 The figures are based on a comparison of the average inflation in 2011-2015 measured with HICP and measured with HICP at constant tax rates.

In general, the contributions from different price groups have been low in Sweden compared to other countries

From Figure 8 we see how contributions from various price groups to HICP inflation have developed excluding effects of changed taxes. The price groups are basically the same as in the previous analysis of the contributions to CPIF inflation, that is, food, energy, goods (excluding energy and food) and services. Like in previous figures, the various ranges indicate the highest and lowest contributions each month among the other countries included in the comparison. Due to data limitations, Norway and the UK are excluded, however.

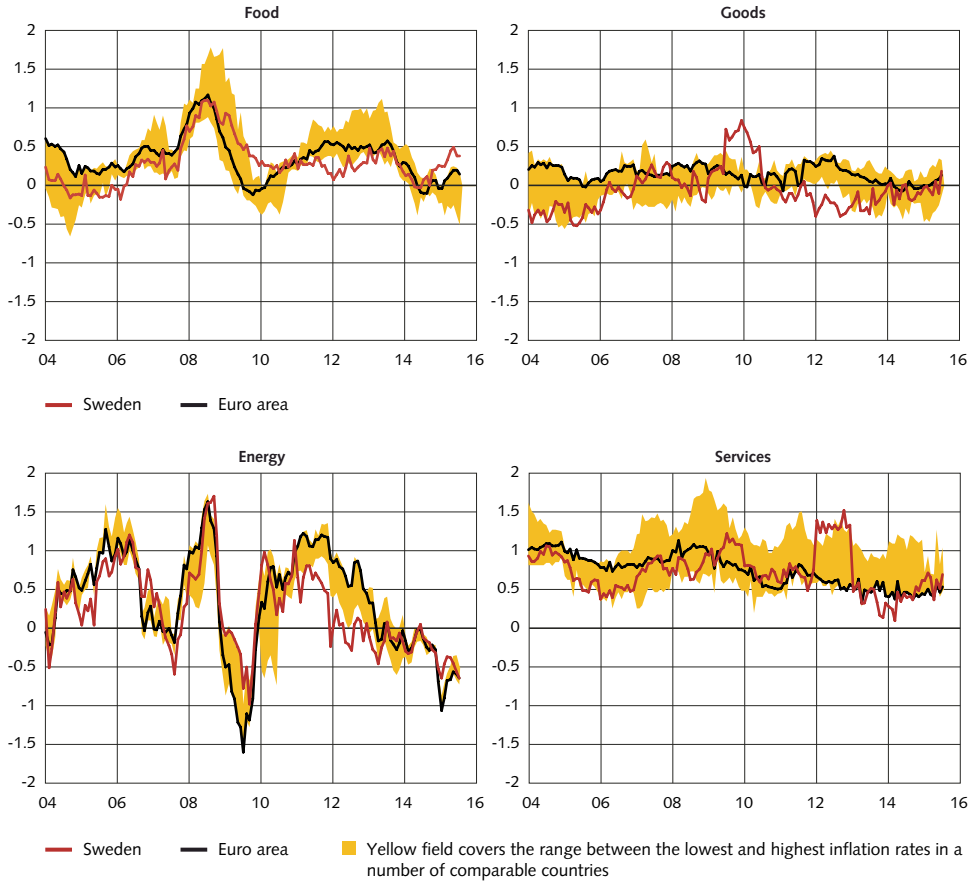
As illustrated by the different panels in Figure 8, the contributions from the various groups have generally been low in Sweden compared with other countries since 2011.[12] However, it is also clear that the price developments in different groups in Sweden have stood out more in certain years. For example, the contributions from food and goods were markedly lower in Sweden in 2011-2013, which is the opposite of the years before that, when contributions from these groups were, conversely, among the highest. It is also interesting to note that the contributions from food, and particularly goods, were comparatively low in Sweden before the crisis. However, the differences compared to other countries were lower and Sweden was not alone in having a negative contribution from goods prices for a relatively long period of time.

In terms of the contribution from energy prices too, developments in Sweden stand out primarily over the period 2011-2013. The downward trend that started in 2011 is also visible in other countries, but prices in Sweden were clearly at a lower level during that period. This differs from previous years when energy prices in Sweden, with the exception of 2005, were in line with other countries. In terms of the contribution from prices for services in Sweden, what is most striking is the drastic increase in 2012 – an effect of the reduction of VAT on restaurant and catering services that started to apply on 1 January that year.[13] Otherwise, the contribution from prices for services in Sweden has been one of the lowest in the past few years, and in 2013 and at the start of 2014, the level was considerably lower than in other countries.

12 A certain degree of caution should be exercised when interpreting the findings from this type of international comparison. To start with, they can be sensitive to which countries are included. Also, HICP statistics are not harmonised in every detail and there may be national differences in the calculations that can affect the results, particularly in the comparison of various subindexes.

13 It may perhaps seem odd that a *reduction* in restaurant VAT and hence restaurant prices leads to an *increase* in the contribution. Because the figure shows contributions excluding tax changes, a tax reduction will be "added back" onto the price, so the effect will be positive and the contribution from service prices thus increases. A partial reason for the effect in 2012 being so large is that in the calculations, a simplified assumption is made that tax changes alter prices immediately and fully.

Figure 8. Contribution to HICP inflation excluding effects of tax changes
Percentage points, monthly data

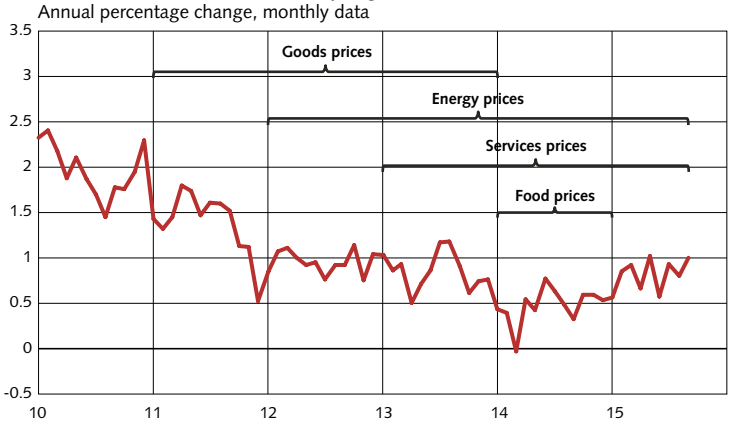


Note. The panels show the contribution of various price groups to the rate of increase in HICP excluding tax effects (HICPct) in Sweden and the euro area, and the highest and lowest contributions among a group of countries including Denmark, Finland (from 2006), the Netherlands and Germany. The euro area as a whole is also included in this group. The contributions can be interpreted as the annual rate of change in each group, multiplied by the group's weight in HICPct.
Sources: Eurostat and own calculations

SUMMARY

In this introductory section, we have described the developments of inflation in Sweden in the past five years from different perspectives. Excluding the effects of changes to interest rates, inflation has been low since 2010-2011. There has been a relatively broad decline in the rate of price increases, although prices in various groups of goods and services have affected CPIF comparatively more in some years, more or less in the way illustrated in Figure 9. The next step is to attempt to explain *why* inflation has taken this turn. Thus far, we have mentioned potential explanatory factors in passing. In the remaining sections, we go into more detail about them.

Figure 9. CPIF and periods in which the contributions from different price groups to the low inflation have been relatively large
Annual percentage change, monthly data



Sources: Statistics Sweden and own calculations

2. Reasons for the low inflation – a partial analysis

In this section we describe how a series of different explanatory factors have correlated with inflation. There are several potential driving forces which, at different points in time, might have caused the low inflation. Demand and resource utilisation have been low, which has affected companies' costs and margins. Energy prices have risen slowly or fallen since 2012, which has also contributed negatively to inflation. As a result of low commodity prices for food, consumer food prices rose very slowly in 2013 and 2014. A strengthening of the exchange rate also contributed to lower inflation, particularly in 2011-2013.

In this section we have chosen to focus on a number of explanatory factors that could be expected to be important, and attempt to describe how and to what extent these factors have affected inflation. Keeping the analysis focused on one or possibly a few factors at a time and looking at them in detail has the advantage of making it relatively simple and clear to explain. The drawback is that it is difficult to grasp how important a particular factor has been to explain the low inflation compared with other factors.

When discussing how individual factors relate to inflation, it is also important to remember that the underlying relationships may be complex – the fact that a certain factor clearly correlates with inflation does not necessarily mean that the factor has been driving inflation developments. Different factors influence each other and at a macroeconomic level it is simply difficult to establish what the underlying reason is and what has affected what.

Over the very long term, we can be relatively certain that inflation will be determined by monetary policy, that is, by the level of the inflation target in the case of Sweden.[14] But over

14 This is sometimes described as inflation being ultimately a "monetary phenomenon".

the short to medium term, the general price level – along with production, employment, unemployment and all other major macroeconomic variables – is determined by the interaction between households and companies, the central bank and government and their foreign equivalents. An overall analysis of the macroeconomy that attempts to capture the fact that all factors essentially affect each other and are determined simultaneously is usually described as a general equilibrium analysis. It is also important to gain this kind of perspective, and we therefore present the results of this type of analysis in section 3.

WHICH FACTORS SHOULD BE EXPECTED TO INFLUENCE INFLATION?

Although inflation developments are ultimately driven by complex interactions, there are a number of factors that can be expected to have a direct impact on price movements. Prices for individual goods and services are, after all, set by companies, so factors that affect companies' pricing will of course be an important factor. The price set by a firm can be broken down into two components: one component that reflects the cost of producing the product or service and a component that reflects the fact that, in addition to covering its production costs, the firm also wants a return on the capital that has been invested, that is, a price mark-up or margin.

The cost of producing a product or service will depend on the firm's costs for items such as wages, its premises and machinery.[15] In addition, there are also costs for the goods and services that the firm uses as inputs in its own production. Some of these input goods are imported, which means that prices on global markets also play a part. The exchange rate then also becomes an important factor as it affects the price in Swedish kronor that the company pays for the imported input goods. The margin, in turn, is influenced by factors such as competition in the business sector in which the firm operates.

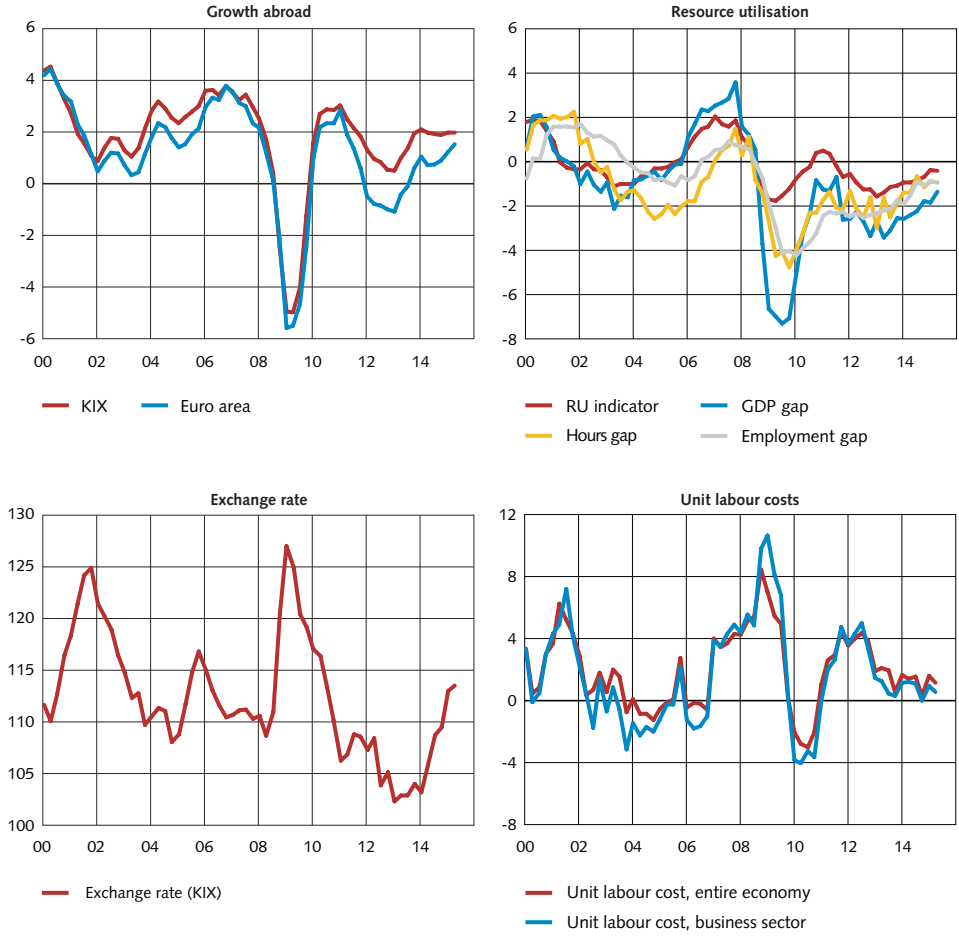
Furthermore, both the firm's costs and margins fluctuate depending on the demand in the economy, both within the country and abroad. For example, global economic conditions influence prices of commodities and other goods that are traded internationally.

Figure 10 below shows a number of factors that, at different points in time, have contributed to the low inflation. The upper-left panel illustrates foreign economic growth, while the upper-right shows various measures of resource utilisation in the Swedish economy.[16] These two figures thus reflect, to some extent, developments in demand abroad and in Sweden. The lower-left panel shows the nominal trade-weighted exchange rate, and the lower-right shows unit labour costs for the entire economy and in the business sector, which are common measures of the part of companies' production costs that are linked to the input of labour.

15 According to economic theory, it is more specifically the marginal cost of companies that is relevant to pricing, the cost of producing one additional unit of the product or service.

16 Here, we show a trade-weighted (KIX-weighted) measure of foreign economic growth. KIX refers to an aggregate of countries that are important for Sweden's international transactions. The euro area has the greatest weight, with 46 per cent.

Figure 10. Factors affecting inflation



Note. Growth abroad and unit labour costs are expressed as annual percentage changes. The GDP gap refers to the GDP devation from trend, calculated using a production function. The hours gap and the employment gap refer to the devation of the number of hours worked and the number of those employed from the Riksbank's assessed trends. The RU indicator can be interpreted as a deviation in per cent from the mean, see p.23. The trade-weighted exchange rate is shown as an index.
Sources: Macrobond, Statistics Sweden and own calculations

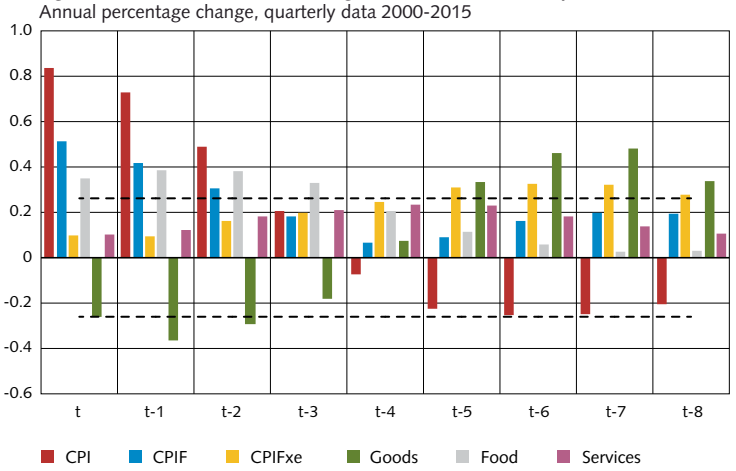
THE INTERNATIONAL ECONOMIC DOWNTURN HAS HELD BACK PRICE INCREASES IN SWEDEN

As already noted, Sweden is a small export-dependent country that is significantly affected by what happens in the rest of the world. This is also reflected in that the correlation between Swedish and foreign GDP growth is over 0.9 for the period 2000-2015. It is therefore quite evident that the weak growth internationally and particularly in the euro zone since the financial crisis has contributed to low inflation in Sweden (see Figure 10). Low demand for Sweden's export products and low price pressure on commodities and imported input goods have also affected domestic price pressure. The same factors have had a negative impact on inflation around the world.

An interesting question is the extent to which inflation in Sweden correlates with inflation abroad, and also on which horizon the correlation is highest. Swedish inflation is likely to be affected by inflation impulses from abroad with a certain lag.

Figure 11 shows correlations between foreign inflation and a number of Swedish CPI subaggregates for the period 2000-2015.[17] The bars to the far left in the figure show the degree of contemporaneous correlation, that is, when Swedish consumer prices in a certain quarter, t, are matched with foreign inflation in the same quarter, t. The bars to the right of them show the co-variation when Swedish consumer prices in quarter t are instead matched with foreign inflation in the previous quarter, t-1, with foreign inflation two quarters ago, t-2, and so on. If the correlation is highest in for example t-4, this means that the co-variation between Swedish consumer prices and foreign inflation is at its highest if foreign inflation lags four quarters. The dotted horizontal line indicates whether the correlation is statistically significant at the 5 per cent level. The positive correlation between CPI in Sweden and foreign inflation (the red bars) is clearest. The relationship is strongest if one compares CPI inflation for a particular quarter with foreign inflation for the same quarter. The contemporaneous correlation between CPIF inflation and foreign inflation is also clear. The fact that the co-variation is highest between these measures and foreign inflation is largely due to the clear link between energy prices in Sweden and the rest of the world.[18] When energy prices are excluded, as in CPIF excluding energy (yellow bars), the contemporaneous correlation between Swedish and foreign inflation disappears and is instead at its strongest six quarters earlier. We also see that this is mainly explained by goods prices (green bars).

Figure 11. Correlations between foreign and Swedish consumer prices
Annual percentage change, quarterly data 2000-2015



Note. Foreign (KIX-weighted) inflation has been lagged 1 to 8 quarters. The dotted black lines in the figure indicate statistical significance at the 5 per cent level.
Sources: Macrobond, Statistics Sweden and own calculations

17 Here, we use a KIX-weighted measure of international inflation.
18 The fact that the contemporaneous correlation is strongest between CPI and international inflation is explained by a clear co-variation between interest expense in CPI and international inflation.

WEAK RESOURCE UTILISATION INDICATES THAT INFLATIONARY PRESSURE HAS BEEN LOW

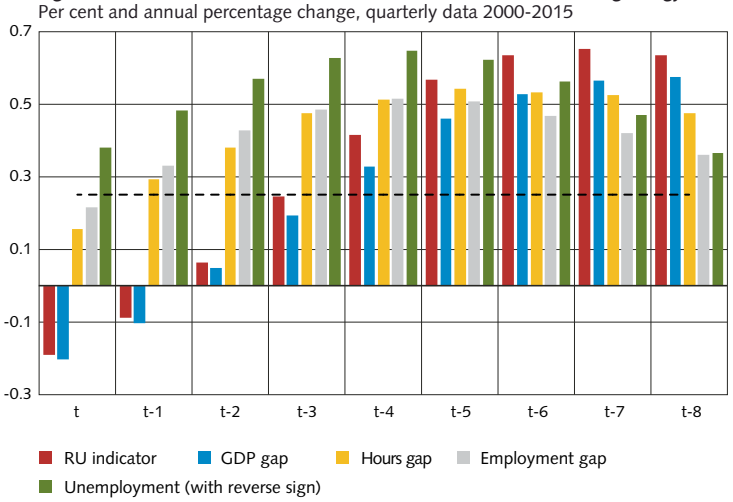
Different measures of resource utilisation are often used to provide an overall view of real economic activity. Resource utilisation is used to try to measure the extent to which the economy's productive resources, that is, labour force and capital, are being used in relation to what is sustainable in the long term. Resource utilisation is of great significance to monetary policy. First, resource utilisation is linked to important economic policy targets such as high GDP growth, high employment and low unemployment. Second, resource utilisation is also a commonly used indicator for how high underlying inflationary pressure is and how high it will be in the future. In somewhat simplified terms, one could say that it reflects economic conditions. One problem is that it is not possible to directly observe actual resource utilisation, unlike other factors such as the unemployment rate. Neither does economic theory offer any obvious definition of resource utilisation. A number of indicators of resource utilisation are therefore usually used to obtain a clearer picture of it. Another difficulty is that the relationship between resource utilisation and inflation is not stable over time. There may be deviations from the average correlation depending on what type of shock the economy is experiencing, and the different indicators of resource utilisation do not always provide a consistent picture as they show different strengths of co-variation with inflation.

GDP in Sweden and many other countries fell rapidly in the 2008-2009 crisis and, based on a number of different indicators, resource utilisation is still lower than normal. This extended period of weak global demand may therefore be viewed as an overarching reason why inflation has been low for a long time, as this has resulted in low domestic resource utilisation (see Figure 10).

Figure 12 shows the correlations between different measures of resource utilisation and the annual percentage change in CPIF, excluding energy for the period 2000-2015. Just as in the previous analysis of inflation abroad, we calculate correlations between Swedish inflation in quarter t and resource utilisation lagged up to eight quarters, that is, t-8. The contemporaneous correlation between inflation and unemployment is statistically significantly different from zero on a quarterly basis, but the relationship is stronger if one compares inflation as it was for a particular quarter with unemployment a few quarters earlier. Compared with unemployment, the hours gap and the employment gap, the GDP gap and the Riksbank's RU indicator seem to be early indicators of inflationary pressure.[19] We get the highest correlation with inflation if we lag these measures seven to eight months. In other words, it seems that for example slowdowns in real economic activity appear to be associated with downturns in inflation around two years later.

19 The RU indicator summarises the information in survey data and labour market data using principal component analysis. In principal component analysis, latent variables (principal components) are used, which explain as much as possible of the total variation of the original variables. The first principal component captures the greatest share of the variation in the dataset, while the second principal component, which is independent of the first, explains the second-largest share of the variation, and so on. The indicator has the advantage of being revised very little when new information arrives, and that it can be updated relatively quickly.

Figure 12. Correlations between resource utilisation and CPIF excluding energy
Per cent and annual percentage change, quarterly data 2000-2015



Note. The different measures of resource utilisation have been lagged 1 to 8 quarters. The dotted black line in the figure indicates statistical significance at the 5 per cent level.
Sources: Statistics Sweden and own calculations

THE TREND IN ENERGY PRICES HAS CONTRIBUTED TO LOWER INFLATION

On average, the market price of electricity was lower between 2012 and 2015 than between 2008 and 2011. There a lots of reasons for the lower electricity price, such as increased subsidies for renewable energy in Europe and the growing use of shale oil in the US. This has led to demand for coal decreasing, which in turn has resulted in the price of emission rights falling and the price of electricity being pushed down. Another reason is the weaker economy globally and in Sweden. This has had a direct effect on the price via lower demand for electricity. In Sweden, electricity prices also fell to a particularly large extent in the spring and summer of 2015. But the trend has been mainly driven by supply-side factors, such as heavy rainfall and high water storage reservoir levels.

From 2011 through the first six months of 2014, the global price of oil was relatively stable, despite the weak global economy. With the exception of a few months, Brent Crude oil continually traded within a narrow price band of between USD 100 and USD 120 per barrel. This price stability was broken in the second half of 2014 when the oil price collapsed. At the start of 2014, the price of oil was around USD 110 per barrel, but then sank to around USD 50 per barrel in early 2015. However, the decrease has not been as severe measured in Swedish kronor because the US dollar has strengthened over this period. Expressed in Swedish kronor, the oil price has fallen by around 30 per cent.

Factors on both the demand and the supply side have contributed to the fall in oil prices. Production of North American shale oil has increased sharply in recent years, and Russia, Iraq and Libya have increased their oil production. Moreover, OPEC has not cut its oil production, as it has done when prices have dropped in the past, in order to buoy prices

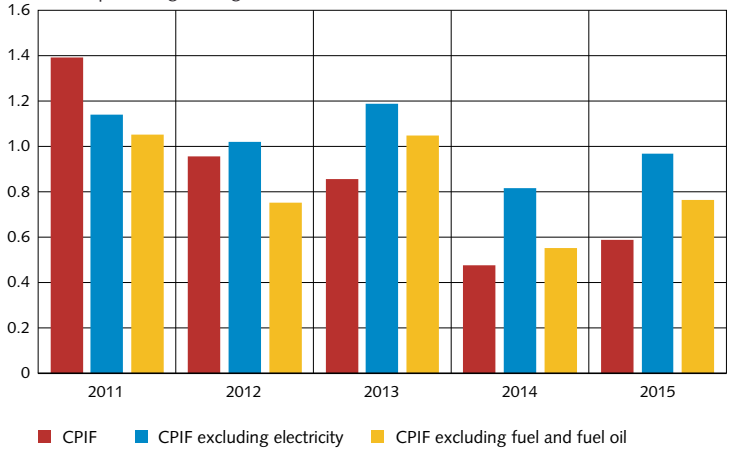
and has instead increased production. Another reason for the fall in prices is that demand for oil has been suppressed by lower expectations regarding global GDP growth.

Both direct and indirect effects of changed energy prices may have affected inflation

A change in energy prices affects inflation in different ways, both directly and indirectly. By direct effects we mean movements in consumer prices for electricity and oil-related products. An example of a direct effect is that the prices of fuel in the consumer price index tend to decline when the oil price drops. The direct effect of lower oil prices is relatively simple to estimate. The direct effect of an altered market price of electricity is often more difficult to forecast, because the link to consumer prices for electricity is not as straight.[20] The measured direct effect from energy prices is shown in Figure 3 in section 1. It can be noted that the contribution of energy prices to inflation has mostly been negative since 2013.

Figure 13 below shows the extent to which CPIF has been affected directly by changes in electricity and oil prices. The red bars show the annual percentage change in CPIF since 2011. The blue bars show developments in CPIF if consumer prices for electricity are excluded, while the yellow bars show the change to CPIF if prices for oil-related products such as fuel and fuel oil are excluded. When the blue or the yellow bar is higher than the red one, electricity and oil-related prices, respectively, contribute to pushing inflation down. As seen in the figure, electricity prices have been a reason for lower inflation since 2012, and oil-related prices since 2013. However, the effect from electricity prices has been greater in the past three-year period.[21]

Figure 13. CPIF excluding energy prices[22]
Annual percentage change, annual data, 2011-2015



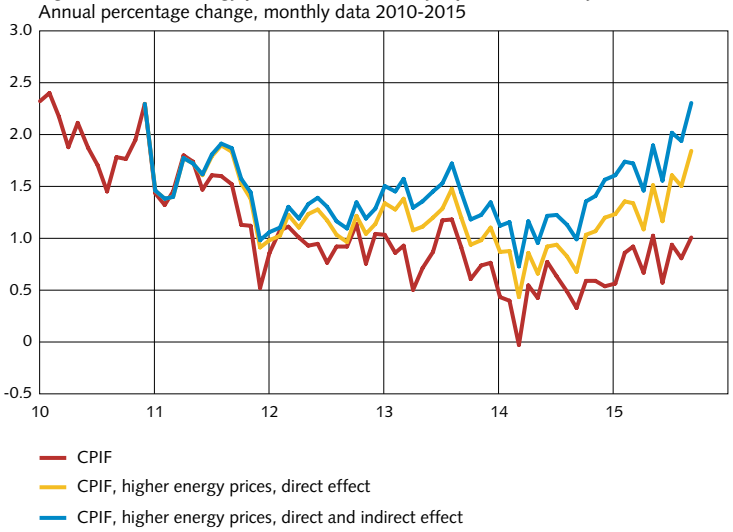
Sources: Statistics Sweden and own calculations

20 The electricity price index in CPI consists of grid fees, continuous prices and contracts with a fixed electricity price for one or several years, which makes the link to the market price of electricity less obvious than to the market price of oil.
21 The figures for 2015 are based on an average until the end of August.
22 In the measure that excludes fuel and oil, prices for district heating and pellets are also excluded.

Changes to energy prices also have indirect effects on the inflation rate in that they affect companies' costs. The indirect effect is much more difficult to estimate than the direct effect because it depends on, for instance, company behaviour. One example is lower fuel costs, which lead to less expensive transport and hence to lower costs for all goods. Declining energy prices can also affect inflation expectations, which can in turn affect inflation through, for example, lower wage demands.

The Riksbank has, on various occasions, attempted to estimate the extent of the indirect effects of changed energy prices using econometric analytical tools. Based on such estimations, Figure 14 shows the development of CPIF inflation if energy prices had risen by 2 per cent on an annual basis on average since 2011, instead of dropping by close to 2 per cent. The total effect is broken down into direct and indirect effects of higher energy prices. The outcomes are highly uncertain but the calculation nevertheless suggests that energy prices and their indirect effects play an important part in explaining the low inflation, since it is shown that inflation would have been between 0.3 and 0.4 percentage points higher on average in 2014 and 2015 if energy prices had risen by 2 per cent annually in the past five years.

Figure 14. CPIF if energy prices had increased by 2 per cent annually
Annual percentage change, monthly data 2010-2015

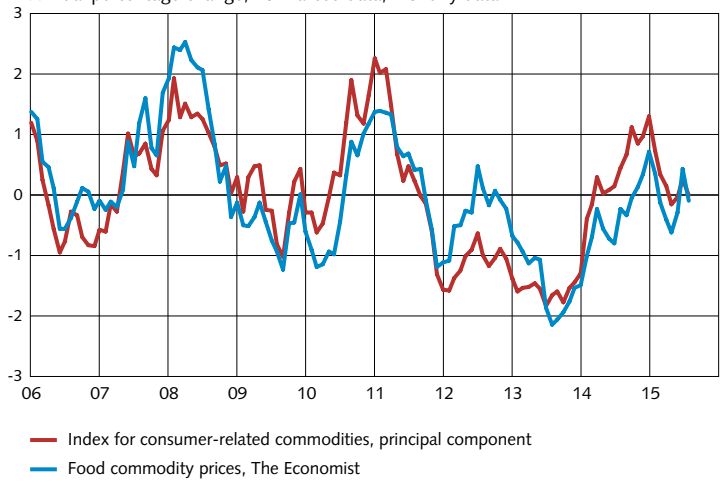


Note. In the above exercise, it is assumed that the energy component in CPIF has risen by a constant monthly percentage change as of January 2011 (see the yellow and blue lines), such that energy prices increase by 2 per cent annually over the period December 2011-September 2015.

LOW PRICE INCREASES FOR OTHER COMMODITIES IN RECENT YEARS

Figure 15 shows the annual percentage change in the Economist's commodity price index for food (the blue line) and a summary index for the development of 29 different commodity prices, mainly in the food category (the red line).[23] Both series show more or less the same progression. The rate of price increase for food commodities was low in 2012 and 2013. Prices subsequently increased, expressed in kronor, in 2014.

Figure 15. Commodity prices, mainly for food, expressed in SEK
Annual percentage change, normalised data, monthly data

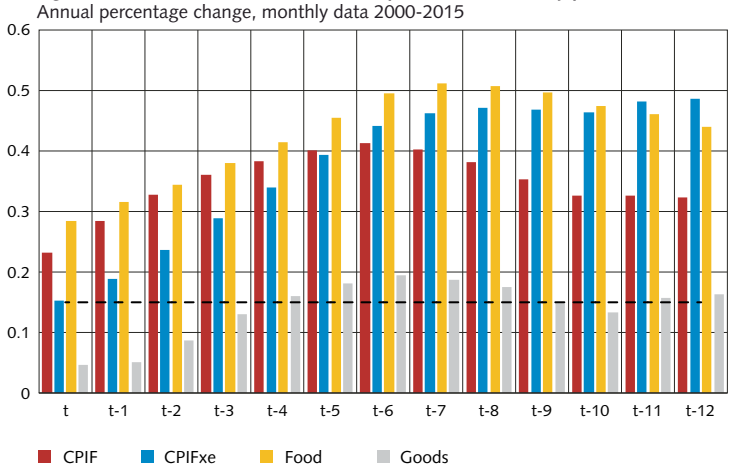


Note. The summary index is calculated based on annual percentage changes. Both series are normalised so that the mean is 0 and the standard deviation is 1.
Sources: Macrobond and own calculations

Figure 16 shows correlations between the summary index and a number of CPI subaggregates for the period 2000-2015. As expected, the correlation is highest between the commodity prices and food prices (the yellow bars). The link is strongest when comparing consumer food prices in a certain month with the commodity price index around seven months earlier. The correlation between CPIF and the commodity index is also statistically significant, as is the correlation between CPIF excluding energy and the summary index. The low commodity prices in 2012-2013 might thus have contributed to curbing consumer food prices in 2013-2014, which also curbed CPIF inflation.

23 In order to calculate the summary index, a principal component analysis has been used.

Figure 16. Correlations between consumer prices and commodity prices
Annual percentage change, monthly data 2000-2015



Note. The commodity price index has been lagged 1 to 12 months. The dotted black line in the figure indicates statistical significance at the 5 per cent level.
Sources: Statistics Sweden, Macrobond and own calculations

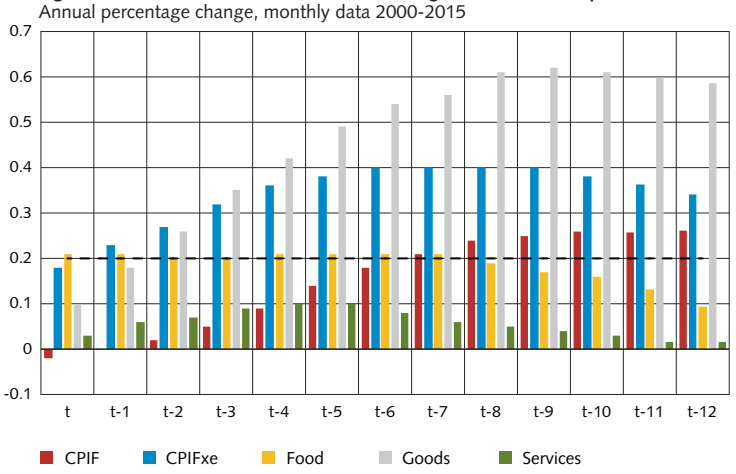
A STRENGTHENING OF THE EXCHANGE RATE KEPT A LID ON INFLATION IN 2011-2013

Another important explanatory factor for inflation developments is the exchange rate, which we touched on already in the first section. The exchange rate is affected by a number of factors, and not least by monetary policy. However, it is often difficult to identify which effect(s) explain most of the exchange rate fluctuations at a certain point in time. In a partial analysis such as this, it is therefore difficult to establish what drives developments and hence pinpoint the underlying factor behind the changes to the exchange rate.

Figure 17 below shows correlations between the trade-weighted exchange rate, KIX, and a number of price indexes for the period 2000-2015. It can be noted that annual price changes for goods are clearly tied to the exchange rate, and that the link is strongest when comparing the change in prices for goods in a certain month with exchange rate fluctuations nine months earlier. The correlation between exchange rate fluctuations and food prices is weaker and barely significantly different from zero, while the correlation with prices for services is never statistically significant.

The Swedish krona depreciated rapidly in 2009-2010, which contributed to a higher level of inflation. After that, a gradually stronger exchange rate probably restrained inflation, particularly in 2011-2013. Since 2014, the exchange rate has weakened again (see Figure 10).

Figure 17. Correlations between the SEK exchange rate and various price indexes
Annual percentage change, monthly data 2000-2015



Note. Nominal competitiveness-weighted exchange rate (KIX). The exchange rate has been lagged 1 to 12 months. The dotted black line in the figure indicates statistical significance at the 5 per cent level.
Sources: Statistics Sweden and own calculations

SUBDUED COST DEVELOPMENTS ARE ANOTHER PIECE OF THE PUZZLE

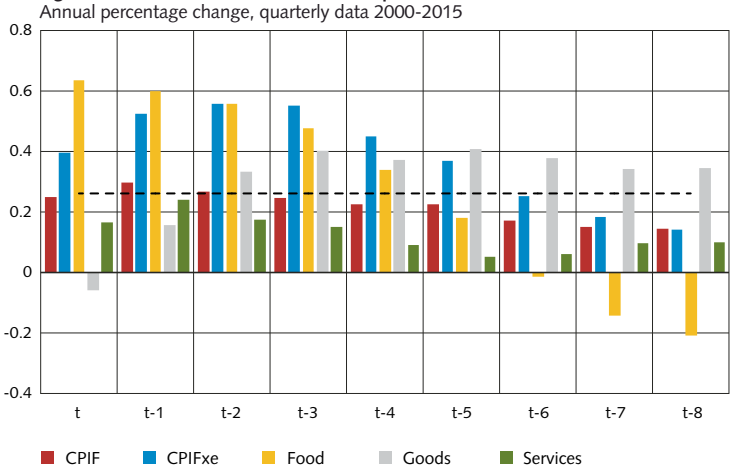
Companies' prices are highly dependent on their costs. At the aggregate level, inflation thus depends on production costs in the economy. A common measure of aggregate costs is unit labour costs. These are determined by both productivity and wages.

Figure 18 shows correlations between the annual percentage changes in unit labour costs and various consumer price indexes.[24] The high contemporaneous correlation between the cost measure and food prices is most evident (the yellow bars).[25] The link is also strong between goods prices met by consumers (the grey bars) in a certain quarter, and labour costs three to five quarters earlier.

After the trough in 2010, costs rose according to this measure for a few years, then fell back again in 2013 (see Figure 10). The average annual percentage change since the first quarter of 2013 is 1.4 per cent for the entire economy. The equivalent figure for unit labour costs in the business sector is 0.8 per cent. These figures are lower than the percentage average rate of increase over the period 2000-2012, which has probably restrained inflation. Interestingly, the figure also shows a strong relationship between unit labour costs and inflation measured with CPIF excluding energy, but not measured with CPIF. Energy prices thus appear to have a pattern that counteracts the positive correlation between inflation and unit labour costs.

24 Here, unit labour costs are used for the entire economy.
25 If the period is extended back in time to 1995, the positive correlation between costs and consumer food prices becomes much weaker.

Figure 18. Correlations between consumer prices and unit labour costs
Annual percentage change, quarterly data 2000-2015



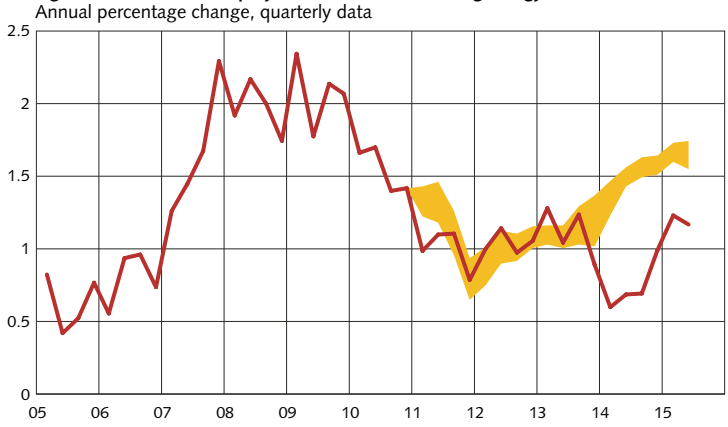
Note. Unit labour costs have been lagged 1 to 8 quarters. The dotted black line in the figure indicates significance at the 5 per cent level.
Sources: Statistics Sweden, Macrobond and own calculations

HISTORICAL PATTERNS DO NOT APPEAR TO FULLY EXPLAIN DEVELOPMENTS

One way of studying more formally whether the inflation developments can be explained by the factors at which we have looked more closely in this section is to estimate an econometric model. This way, we study how large a proportion of the historical inflation variations can be explained using exchange rate fluctuations, unit labour costs, resource utilisation and commodity prices. The inflation measure and the explanatory variables are in this exercise expressed as quarterly percentage changes.[26] Figure 19 shows outcomes and projections for CPIF excluding energy, that is, what inflation according to this measure would have been had it progressed according to the model. Here, quarterly data from 1995 to 2015 is used, and five models are estimated. All specifications include the exchange rate and unit labour costs as explanatory variables. One of these five models only includes these two variables. The other models have one more explanatory variable – unemployment, unemployment gap, employment gap and commodity prices for food, respectively. The models are estimated using data through the fourth quarter of 2010. After that, data for the explanatory variables is used to project inflation through the end of the second quarter of 2015. The projections thus show what inflation would have been if it had followed the historical relationship with the exchange rate, unit labour costs and other variables. The yellow field in Figure 19 indicates the range between the highest and the lowest projection.

26 The exchange rate is the trade-weighted exchange rate, KIX, expressed as four periods' moving average of the quarterly percentage change. For unit labour costs, 12 quarters' moving average of the percentage change is used. For commodity prices, food prices according to The Economist are used.

Figure 19. Outcome and projections for CPIF excluding energy
Annual percentage change, quarterly data



Note. The yellow field refers to projections from the five different models
Sources: Statistics Sweden and own calculations

Developments through the end of the second half of 2013 appear to follow historical patterns relatively well, but in the subsequent period inflation was lower than what it should have been based solely on the historical average relationship.[27] The fact that the explanatory variables do not manage to capture developments since the autumn of 2013 suggests that it is other factors that have kept a lid on companies' price hikes in the past few years.

In order to gain a better understanding of companies' pricing recently, the Riksbank commissioned the Swedish National Institute of Economic Research to conduct a specific survey in the spring and summer of 2014. Many of the companies responded that the price increase rate for their goods and services has been lower than normal recently. The results also showed that companies' margins have been lower than normal. One reason for this is that demand has been weak, and its future development has been uncertain. However, the companies also stated that competition has increased a great deal in recent years, which might be due to the weak demand, but could also indicate that the explanations for the low margins might to some extent be structural. In the climate of weak demand, it thus appears that companies, to a lesser degree than usual, have been able to transfer their cost increases onto customers by increasing their prices and their margins have thus contracted.

In connection with conducting the survey, the Riksbank's own business survey was also extended with more companies in the trade and service industries. Moreover, the questions focused to a greater extent on the companies' prices, costs and margins. That survey showed that cost increases had been lower than normal, which was in turn due to purchasing costs and wages being low. However, this applied mainly to the largest

27 A similar exercise has been performed using an error-correction model, which is used, for example in the Riksbank's forecasting process. In that equation, the quarterly percentage change in CPIF is explained by the unemployment gap and energy prices as explanatory variables in the short-term dynamics. In the long-term dynamics, producer import prices and unit labour costs are included together with CPIF. In this case too, the model has difficulties capturing the low inflation figures in 2013 and 2014.

companies in Sweden, and to a lesser extent to smaller ones. On the whole, the results of the surveys suggest that many companies have been forced to accept a lower margin when demand has been weak and competition fierce.

E-COMMERCE AND INCREASED COMPETITION

One reason for the increased competition that companies state they experience could be growing e-commerce, which has increased its share of the total turnover of retail trade from 1.2 per cent in 2013 to 6.2 per cent in 2014. In many cases, companies are thus now competing not only with other companies in their geographic proximity, but also with companies elsewhere in the world through e-commerce. Compared with regular distribution channels, online stores ought to provide scope for cost cutting, which in turn might increase competition.

New online services have also furthered the possibility of consumers to compare the price and quality of a product. As consumers become more price- and quality-aware, companies might perceive that competition has increased, and that their market power has diminished. In turn, this leads to companies finding it more difficult to increase their prices, but it can also cause them to increase productivity in order to squeeze costs and increase margins that way instead.

However, it is difficult to establish a direct link between such changes, which are more long-term in nature, and the low inflation of very recent years. Increased competition can indeed lead to lower prices in a transitional period, which might be more or less protracted, but the inflation rate should not be affected in the longer term.

THE IMPORTANCE OF INFLATION EXPECTATIONS

A potentially important explanatory factor for the low inflation, perhaps mainly in the past two-year period, is the inflation expectations of households and firms. Short-term inflation expectations have gradually dropped since 2011. The more long-term expectations also show a declining trend, but not at all as steep.

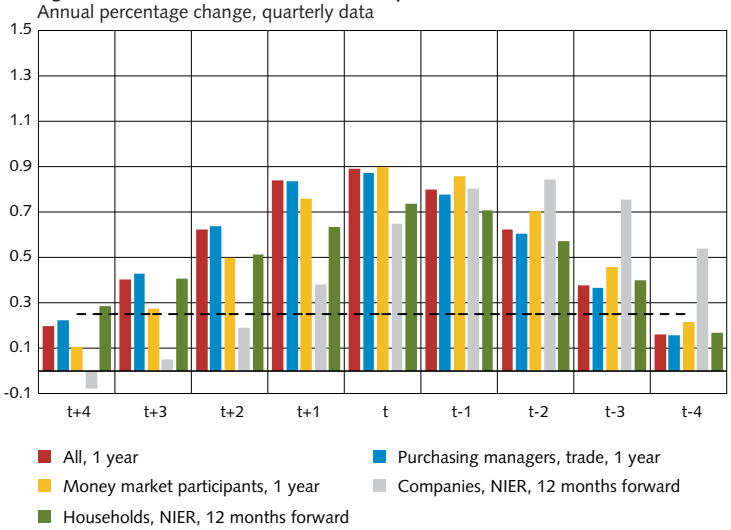
There is a clear link between actual inflation and short-term inflation expectations. In line with inflation falling in the past few years, inflation expectations have also come down. The drop in inflation expectations might have contributed to lower inflation. For example, it might be difficult for companies to hike prices if the general perception of households and other agents in the economy is that the price increase rate will be low ahead. Assessing the extent of the potential impact of lower inflation expectations on inflation is very difficult, however.

As shown in Figure 20, the co-variation is clear between the short-term inflation expectations and the actual inflation according to CPI in the period 2000-2015. With the exception of the inflation expectations of companies, the relationship is strongest when comparing the change to inflation in a certain quarter with expectations in the same quarter. The degree of co-variation then drops. In terms of companies' inflation

expectations (see grey bars), the link is instead strongest when comparing actual inflation in a certain quarter with expectations two quarters ago. The results thus imply that changes in companies' expectations precede changes to actual inflation.[28]

Unlike in previous figures with correlations, we also show in Figure 20 bars to the left of those that indicate contemporaneous correlation. They thus show how expectations in a certain quarter correlate with the measured inflation rate 1 to 4 quarters ago. Here too, the degree of co-variation is relatively high to start with but then gradually drops the further inflation is lagged. The correlations thus show that high inflation expectations in a certain quarter are followed by high inflation a quarter or so later, but also that high inflation in a certain quarter is followed by high expectations a quarter or so later. Hence, both variables tend to move in the same direction at the same time. The same pattern can be observed when studying more long-term inflation expectations.[29] This indicates that inflation expectations, according to all measures except companies' expectations, actually do not precede the movements in inflation. If the movements in inflation were clearly driven by expectations, we ought to observe stronger correlations to the right than to the left of the point in time t, which for most measures does not appear to be the case.

Figure 20. Correlations between inflation expectations and actual inflation (CPI)[30]
Annual percentage change, quarterly data



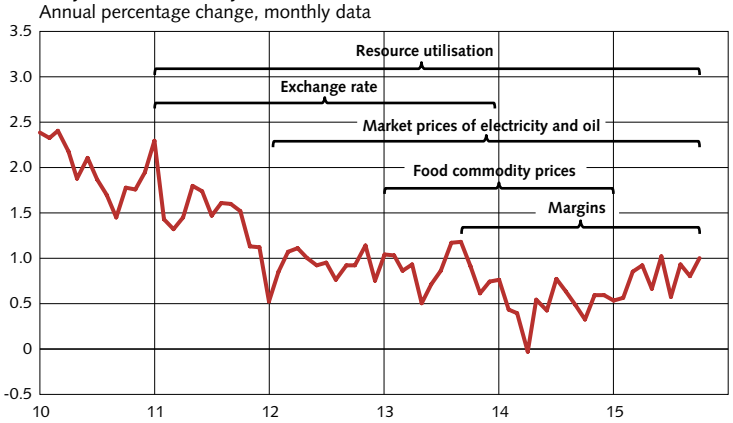
Note. The expectations are lagged 4 quarters back and led 4 quarters forward in time. The dotted black line in the figure indicates statistical significance at the 5 per cent level.
Sources: Statistics Sweden, the National Institute of Economic Research, Prospera and own calculations

28 A simple causality test gives the same conclusion. The test is used to study whether the direction of one variable tends to affect the direction of another variable, or vice versa.
29 This applies to inflation expectations with a two- and five-year horizon.
30 Inflation expectations are usually compared with the CPI inflation, since that is the inflation measure that many of the surveys explicitly take as their basis.

SUMMARY

The low level of inflation over the last few years appears to be due to a series of different factors which we summarise in Figure 21. Demand and resource utilisation have been low, both in Sweden and abroad, which has led to subdued growth in companies' costs and margins. Due to both supply and demand factors, energy prices have risen slowly or dropped since 2012, which has curbed inflation through both direct and indirect effects. The low electricity prices have had the greatest negative direct effect. On top of this, consumer food prices have also been weak, mainly in 2013 and 2014, due to low commodity prices. Finally, a strong exchange rate also contributed to lower inflation in 2011-2013.

Figure 21. CPIF and its most important explanatory factors according to partial analyses of the economy
Annual percentage change, monthly data



Sources: Statistics Sweden and own calculations

3. Reasons for the low inflation – a model explanation

In a general equilibrium model, the economy is driven by exogenous shocks to the model, that is, events both in Sweden and other countries that lead the path of the economy to diverge from historical economic relationships. One way of investigating why inflation has been so low is to study which such shocks, according to the model, have caused the recent course of inflation. Using this type of analysis, we can also compare the extent of the significance the shocks have had in relation to each other. The analysis indicates that it is foreign economic developments and subsequent contagion effects, combined with subdued demand in Sweden, that have had the overall greatest significance in explaining the low inflation since 2011. However, in the past one-and-a-half years, another explanation for the low inflation has gained increasing importance in the model, namely that price mark-ups, and hence the margins, of companies have contracted.

In previous sections, we have discussed the reasons for the development of inflation using partial analyses of the economy. In other words, we have studied how inflation might have been affected by a number of explanatory factors, but without taking account of all factors and their interactions at the same time. In this section, we look instead at the reasons underlying the development of inflation from a macroeconomic perspective, that is, in light of the course of the economy as a whole in the past few years, using the Riksbank's macroeconomic model, Ramses.

THE WORKINGS OF THE GENERAL EQUILIBRIUM MODEL

Ramses is what has been termed as a "dynamic stochastic general equilibrium model".[31] The model being a general equilibrium model means that it is intended to describe how the economy works as a whole – the links between different sectors in the economy are modelled under some specific assumptions about the behaviour of individuals and organisations. The model being dynamic enables us to study the course of the economy over time. The model being stochastic means that we take account of the fact that the economy is affected by random exogenous shocks, in other words events outside of the model that lead the course of the economy to deviate from the historical economic relationships.[32]

The exogenous shocks can reflect events that are uncommon on one hand, such as a decline in production because of an economic crisis. On the other hand, they can also capture more normal variations in, for example, preferences or technology. Such variations can be a case of technology having developed faster or slower than the historical average, making it less or more expensive to produce goods and services, or of household and companies becoming more or less optimistic about future economic developments. It can also be a matter of an increase in competition and a change in companies' pricing behaviour, or monetary policy being conducted in a way that deviates from its historical pattern. Shocks can come both from abroad and from the Swedish economy, as well as from exchange rate fluctuations. Studying the exogenous shocks thus tells us something about why the economy does not fare in line with historical patterns, but also how important each individual explanatory factor has been compared with others, as all the factors are studied within the same model.

All economic models are simplifications of reality. Even the most complex models can only take account of the factors that are considered to be of outmost importance to the questions under study. However, factors that do not fall within the scope of the model of course nevertheless affect the variables included in the model. An example of this is that inflation, which is an important variable in the model, is in practice affected by energy

31 For a more detailed description of the model, see Adolfson et al. (2013).

32 In this context, the historical economic relationships refer to the average patterns over the period covered by the data on which the model is estimated, in Ramses' case Q2 1995 through Q2 2014. We can then analyse also later (or earlier) data, assuming that the parameters governing the model relationships are constant. The assumption is not unreasonable, as most parameters in a DSGE model such as Ramses are intended to capture the underlying preferences and financial motives of the agents in the economy which change very slowly over time.

prices, which are in turn not modelled in Ramses. Because the model does not take explicit account of energy prices, it will instead perceive changes to them as an exogenous shock of some kind, depending on which effects the change to energy prices has on the economy as a whole.

Practically all variables in the model are affected by all the various shocks in the model.[33] Some shocks can be more closely attributed to movements in certain variables, but over time the movements of each variable tend to be explained by a series of different shocks combined. Each shock has a unique general effect on the economy in the model. The precise extent of the contribution of a certain shock is thus determined by how the variables have developed in relation to each other. In a very simple macroeconomic model, a shock that brings down inflation and simultaneously boosts production, for example, is commonly attributed to technological progress, since better technology enables producing more goods at a lower price. However, a shock that increases inflation while boosting production at the same time is instead attributed to increased demand. Production possibilities have not changed, so higher production than normal is due to demand having risen, and prices thus increase. In Ramses the principle is the same, although the variables and shocks are more numerous, and the relationships are therefore far more complex.

THE DEVIATION OF INFLATION FROM THE TARGET CAN BE BROKEN DOWN INTO EXOGENOUS SHOCKS TO THE MODEL

In a way similar to how we broke down inflation developments into contributions from the various subindexes above, we can explain inflation using the various shocks in the model. The number of shocks in the model is too great for all to be shown in one figure, so in order to facilitate the analysis, we present them in different groups. As with the subindexes in CPIF, the grouping can vary depending on what we are interested in studying. Here, we have chosen to form groups of shocks to domestic demand, domestic cost pressure, international factors and price mark-ups (the difference between the prices set by companies and their production costs for a certain product or service). We also look individually at the shocks to monetary policy and to the exchange rate.[34]

Monetary policy in the model is illustrated by a simple interest rate rule, where we assume that the monetary policy authority lets the repo rate respond to movements in inflation and resource utilisation in the Swedish economy.[35] The movements seen by the model on top of that, for example, a lower repo rate than would have been implied by the

33 The exception is international variables, which are not assumed to be affected by shocks to the Swedish economy. Sweden is a small, open economy which, albeit highly reliant on foreign trade, is assumed to be sufficiently small to not appreciably affect the course of the international economy as a whole. Even though individual countries are affected by the state of the Swedish economy, the assumption is reasonable for Sweden's international environment as a whole, and allows a considerable simplification of the model's structure.

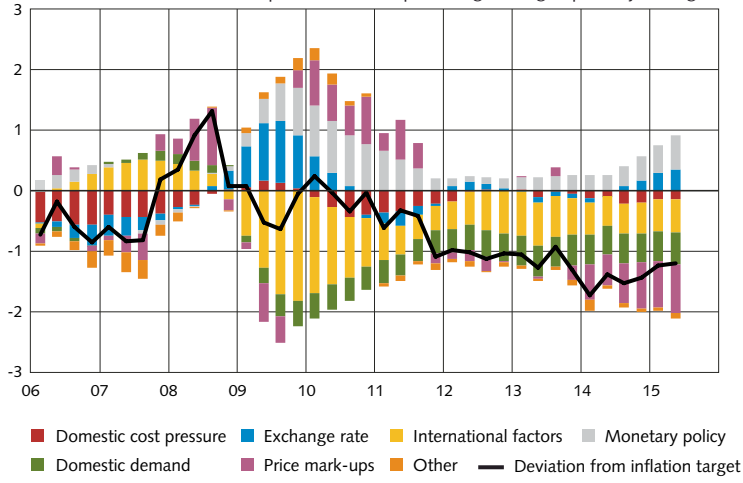
34 The group "Other" contains what the model interprets as measurement errors, that is, inflation movements which are difficult for the model to reconcile with the developments in other model variables. Such contributions are commonly small.

35 More specifically, we assume that the interest rate responds to the deviation of CPIF inflation from 2 per cent in the previous quarter, and the hours gap in the previous quarter. The policy rule of conduct also allows for interest-rate smoothing.

rule, are perceived as exogenous shocks to monetary policy. It is thus only in cases in which monetary policy has been unusually expansionary or contractionary that contributions from it will show up in the analysis. The same reasoning applies to exchange rate movements, which are, in the model, assumed to be determined by an interest rate parity condition. This condition implies, somewhat simplified, that the expected return on an investment in an interest-bearing asset in Sweden and abroad shall be the same after account has been taken of risks, and that this is ensured by the due adaptation of the exchange rate. Exchange rate movements are not in themselves uncommon. The movements often reflect developments in the domestic and foreign economies according to the economic relationships on which the model is based. However, in cases where exchange rate fluctuations deviate from these relationships, this is viewed by the model as the perceived uncertainty on foreign exchange markets having changed. Such deviations are usually called external risk premiums, and these are what we refer to when we speak of shocks to the exchange rate in the breakdown above.

Figure 22 shows how the six shock subgroups' contribution to CPIF inflation has varied in the past few years. The bars show, in simplified terms, the extent to which each shock group has caused inflation to deviate from 2 per cent. A positive bar means that the shock group has helped buoy inflation, while a negative bar means that the shock group has instead contributed to pushing inflation down below 2 per cent.

Figure 22. Contribution to CPIF from exogenous shocks
Deviation of outcome from 2 per cent, annual percentage change, quarterly average



Note. The bars illustrate the contribution of each shock group to the deviation from 2 per cent of CPIF in the past twelve months. The model relationships are estimated on quarterly data for CPIF inflation as well as fourteen other domestic variables and three foreign-economy variables.
Sources: Statistics Sweden and own calculations

FOREIGN ECONOMIC DEVELOPMENTS ARE AN IMPORTANT EXPLANATORY FACTOR

We can see that many of the shock groups have contributed to the developments of CPIF inflation. We can also observe from the figure that some of the patterns that emerge with the outbreak of the financial crisis at the end of 2008 and beginning of 2009 – particularly the factors that keep inflation down – still persist to some extent today.

The overall largest factor since the onset of the financial crisis appears to have been the foreign economic developments, as shown by the yellow bars in the figure. The financial crisis that commenced at the end of 2008 was an internationally triggered crisis from Sweden's point of view. It is thus not unexpected that international factors in the model have been a strong cause in keeping inflation down, particularly in 2009 and 2010. While the contribution from international factors indeed started to shrink after 2009 and was considerably smaller in 2011 in particular, it subsequently rose again in line with the slowdown in the economic recovery in Europe. Along with domestic demand, foreign economic developments are still one of the most important explanatory factors for the low inflation, more than six years after the outbreak of the financial crisis.

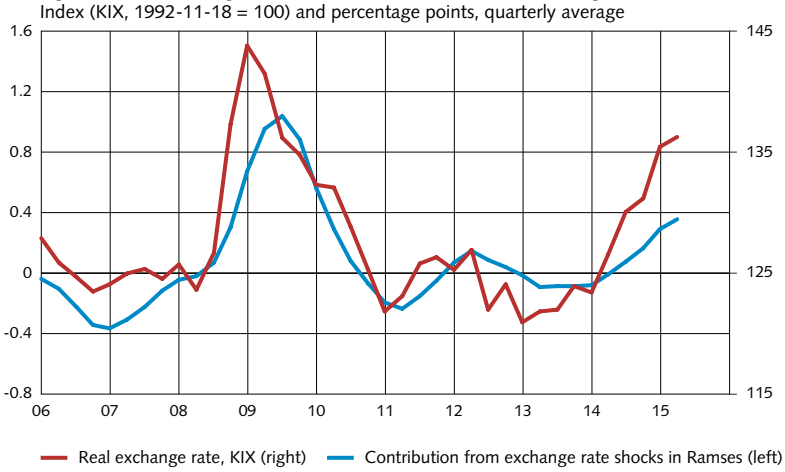
Even though the contributions from international factors were greatest during the early stages of the financial crisis, that was not when inflation in Sweden was at its lowest. According to the model, this is partially explained by the sharp weakening of the Swedish krona in the second half of 2008. The contributions from shocks to the exchange rate, shown as blue bars in Figure 22, play an important role in the developments of inflation from the final quarter of 2008 and about two years onwards. The fluctuations of the Swedish krona are thus not explained particularly well by the interest rate parity condition in this period. Rather, they are perceived by the model as changes in external risk premiums. The model view is thus consistent with the interpretation that investors have tended to prefer large and less volatile currencies in times of economic unease. Swedish assets have thus been perceived as riskier in times of economic crisis, as the market for the Swedish krona is relatively small.[36]

The Swedish krona then strengthened gradually over a long period of time towards levels that are more consistent with the interest parity condition, and so the positive contributions to inflation from the external risk premium shocks also diminished. When the Swedish krona was at its strongest in 2011 and 2013, we could even observe negative contributions to inflation from shocks to the exchange rate. This co-variation can clearly be seen in Figure 23, which shows how the contribution to CPIF inflation from risk premium

36 In 2008-2009, Swedish banks also had substantial exposure to the Baltics, which were associated with high risk. A deepened crisis in the Baltics, with higher credit losses for the Swedish banks, was seen as a risk to Swedish financial markets, which was a factor in the depreciation of the krona. Credit losses subsequently turned out lower than feared, since the recovery of the Baltics was stronger than expected. See, for example, Sveriges Riksbank (2008, 2010).

shocks has evolved in relation to the exchange rate.[37] Not until in the past year has the contribution from shocks to the exchange rate turned positive again. However, while the Swedish krona has indeed weakened relatively sharply since the beginning of 2014, this is only due to a certain extent to developments in external risk premiums. The exchange rate fluctuates, precisely as we have discussed above, also in accordance with the interest rate parity condition. Part of the weakening of the Swedish krona can thus be seen as rather normal given the macroeconomic developments in Sweden compared with those abroad, not least in terms of monetary policy.

Figure 23. Real exchange rate and contribution to CPIF from exchange rate shocks
Index (KIX, 1992-11-18 = 100) and percentage points, quarterly average



Note. The red line illustrates the real exchange rate. KIX refers to an aggregate of countries that are important for Sweden's international transactions. The blue line illustrates the shock group's contribution to CPIF inflation in the past twelve months.
Sources: The Riksbank and own calculations

RESTRAINING EFFECT ON INFLATION FROM DEMAND IN SWEDEN

Domestic demand, shown as green bars in Figure 22, emerges as a negative contributor more or less at the same time as the negative contributions from international factors. The negative green bars are due to consumption and, particularly, investment in Sweden having had a more restraining effect on inflation since the financial crisis than they have historically. In the group of factors that pertain to domestic demand, there are for example confidence factors, such as households' willingness to consume and companies' willingness to invest. The group also encompasses conditions on the Swedish financial market, which

37 The variable that the model takes into account is the real exchange rate gap, which is given by the deviation of the real exchange rate from its long-term level in per cent. Because the long-term level of the exchange rate fluctuates slowly and has changed relatively little during the period studied, the conclusions are more or less the same even if we look at the exchange rate in levels. Furthermore, the real and nominal exchange rates in the studied period have also displayed a high degree of co-variation, such that the same conclusions largely apply for the nominal exchange rate as well.

are reflected in the model by increased financing costs for companies and subdued investment growth ever since the financial crisis.

Weak demand abroad usually subdues demand in Sweden too. We also see from Figure 22 that the negative contributions from shocks to domestic demand, just as the contributions from international factors, never entirely disappeared, but still continue to weigh down inflation today. Part of the explanation for this lies in the fact that there are several different types of contagion effects from the international economy to Swedish markets. A small economy that is dependent on the rest of the world like Sweden is affected by foreign economic developments through more channels than those captured by the foreign-economy shocks in the model.[38] Contagion effects through the channels that are not explicitly modelled will not be perceived as contributions from the international factors by the model; instead they will be attributed to some of the domestic shocks. For example, the model will perceive weaker confidence from households and companies in the economy as a shock to domestic demand, even if it originates from a slowdown in foreign economic activity. The same applies if financing costs for companies deteriorate due to the developments in global financial markets. In light of this, it is not surprising that the shocks to domestic demand have weighed inflation down in the same period as foreign economic developments have been weak.

LOW COST PRESSURE CONTRIBUTES NEGATIVELY AT TIMES

Domestic cost pressure, shown as red bars in Figure 22, has also contributed negatively to the inflation developments at times. If we focus on the period during and after the financial crisis, it is primarily 2010 and 2011 in which shocks to cost pressure have been of significance to Swedish inflation. As of 2014, cost pressure has become unusually weak once more compared to its historical patterns, although the contributions are less pronounced now than they were in previous periods.

The domestic costs group comprises shocks to technological development in Sweden, as well as certain labour market factors. In the model, technology is assumed to constantly improve, both in Sweden and abroad, and this progression is captured as a part of foreign economic developments in our group breakdown insofar that developments in Sweden do not deviate from those of its trading partners. If, however, technological development in Sweden occurs faster or slower than in the rest of the world, this will demonstrate itself as shocks to the Sweden-specific technology and affect cost pressure in Sweden. The economy in Sweden recovered relatively quickly following the deep slump caused by the financial crisis, and in 2010 and 2011 economic growth in Sweden was higher than in its trade-weighted international environment. The model perceives this as technological development having been unusually good, and that Sweden could therefore produce

38 The foreign economic variables included in the model are GDP, inflation and the policy rate, all as aggregates of countries that are important to Sweden's international transactions. It is thus only shocks to these that are included in the yellow bars in Figure 22. The model will attribute other international effects to some of the domestic shocks.

goods and services at a lower cost than usual. Inflation was hence lower too. In addition, in that same period, and also in 2014 and 2015, the labour market situation had a partially restraining effect on inflation. The model perceives that shocks also occurred then to labour supply, which has kept a lid on company costs and ultimately also on inflation.

THE CONTRIBUTION FROM MONETARY POLICY

Ever since the financial crisis, monetary policy has been more expansionary than it would have been had it followed historical behaviour. This can be seen in that the grey bars in Figure 22 have, since 2009, constantly helped buoy inflation. The contributions are high in the initial period following the crisis, before declining from the end of 2011. As of mid-2014 and onwards, the positive contributions from monetary policy shocks increase again. At the same time, inflation turns upwards, after having troughed in the first quarter of 2014.[39]

As discussed above, monetary policy in the model is determined by an interest rate rule based on developments in inflation and resource utilisation. The extent to which monetary policy reacts to changes to inflation and resource utilisation reflects how the Riksbank has actually acted in the past. However, the rule is merely an approximation and does not provide a precise representation of how monetary policy is conducted. The deviations we observe between the actual interest-rate decisions and the interest rate that would have applied had the Riksbank followed the model's interest rate rule exactly is interpreted by the model as a measure of monetary policy shocks – unusually expansionary or contractionary monetary policy. The contributions to the inflation developments that we can observe in Figure 22 thus only reflect the effect of these specific shocks, and not the aggregate effect that monetary policy has on inflation.

UNUSUALLY LOW PRICE MARK-UPS IN 2014 AND 2015

Despite the negative contribution from developments abroad having decreased somewhat and monetary policy having become more expansionary in the past year, this has not been reflected in inflation developments to the extent one might expect. The model explains this by companies' price mark-ups, shown as purple bars in Figure 22, having been unusually low from the beginning of 2014 and onwards.

In the model, the price mark-ups of companies are changed in line with changes to their costs and prices. The price mark-ups reflect the link between demand and the costs of companies on the one hand, and price increases in the economy on the other. The model assumes that the companies set the price of a certain product at the cost of producing it, plus a mark-up.[40] The mark-up is determined by the competition on the

39 It is important to note in this context that the model only takes account of the traditional monetary policy measures or, in other words, the cuts (and previous hikes) to the repo rate that have been made. The additional monetary policy measures carried out since February 2015 in the form of government bond purchases are not given explicit consideration in the model. The contributions made by these to inflation developments will thus be captured by other shocks in the model.

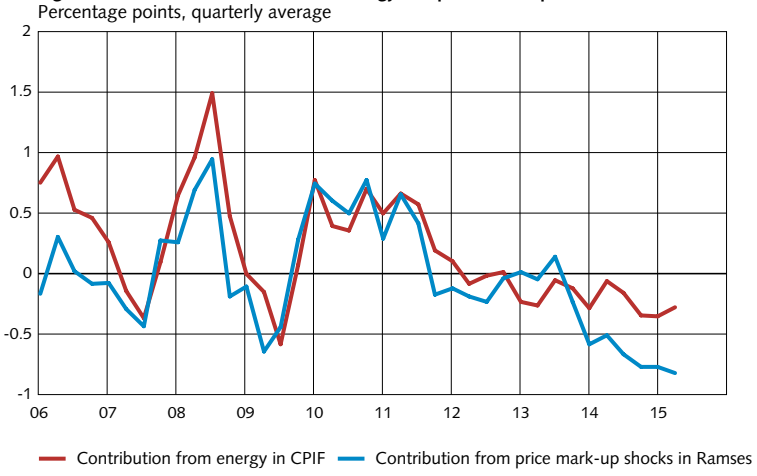
40 The producing companies in the model are assumed to act under monopolistic competition, and are hence able to take out a certain margin on the goods and services they produce.

market in which the company operates, but can also be temporarily affected by demand developments, which make it more or less difficult to transfer the company's cost increases onto consumers. The temporary changes in the price mark-ups that deviate in one way or another from the historical pattern will be perceived by the model as price mark-up shocks, which will affect inflation and many other variables in the model. We note, however, that the model might also perceive a large share of inflation fluctuations that come from variables other than those explicitly modelled in Ramses as shocks to the price mark-ups. This is because the price mark-ups affect pricing directly, while they only affect production indirectly.

One example of inflation fluctuations caused by variables outside of the model, and captured in the price mark-ups, is the direct effects of changes to energy prices, which we have discussed earlier. Energy is indeed used in the production of goods and services, and hence affects production costs. However, energy prices also have a direct impact on CPIF inflation, as seen in sections 1 and 2. It turns out that the contribution to CPIF from the energy component (the yellow bars in Figure 3) correlates closely with the contribution to CPIF that comes from the price mark-ups in Ramses (the purple bars in Figure 22). Figure 24 shows these two contributions in relation to each other. We can, for example, see in the figure that the strong positive contributions from price mark-ups in 2008 and 2010-2011 coincided with high increase rates in energy prices.

Part of the negative contributions from the price mark-ups in the model recently can also be linked to recent falling energy prices. However, this does not appear to be the whole story. The figure below shows that the contribution from price mark-ups in the model in the past year and a half has taken a much more negative direction than the contribution from energy prices. As we discussed in section 2, companies' margins appear to have been under an unusual amount of pressure, and companies appear to have found it difficult to transfer cost increases onto consumer prices. A reason for this could be that international economic unease, with its contagion effects to Sweden, has proven very protracted indeed. As we saw in section 1, inflation has in 2014 and 2015 been suppressed in many countries, which also suggests that the recent very low price mark-up is a broad international phenomenon. However, it is currently difficult to establish with certainty what the underlying driving forces are.

Figure 24. Contribution to CPIF from energy and price mark-up shocks
Percentage points, quarterly average

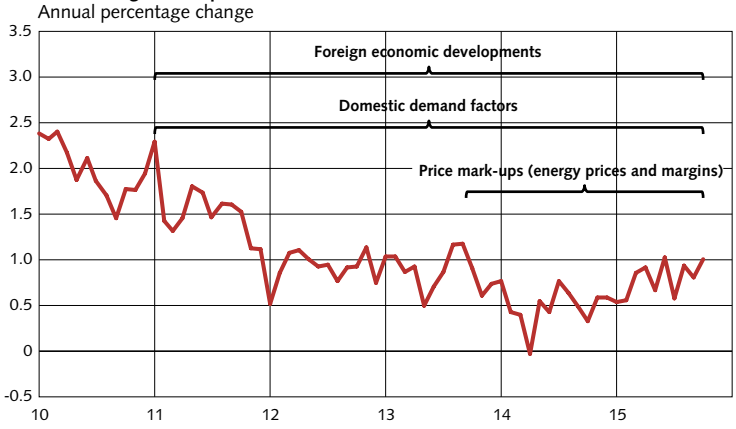


Note. The lines illustrate the contribution of the price and shock groups to CPIF inflation in the past twelve months.
Sources: Statistics Sweden and own calculations

RAMSES' INTERPRETATION OF THE INFLATION DEVELOPMENTS IN BRIEF

Figure 25 largely illustrates what the most important explanatory factors have been behind the progression of CPIF inflation in the past few years, in terms of exogenous shocks to the general equilibrium model. In summary, the model analysis indicates that it is foreign economic developments and contagion effects from those that have been of the greatest significance to the low inflation since 2011, but demand in Sweden has also been low during this period. Furthermore, it appears that inflation in the past year and a half has also been weighed down by squeezed company margins. This might, in turn, have a number of potential explanations that the model unfortunately does not allow us to distinguish, and is a question that deserves further attention.

Figure 25. CPIF and its most important explanatory factors according to the Riksbank's general equilibrium model
Annual percentage change



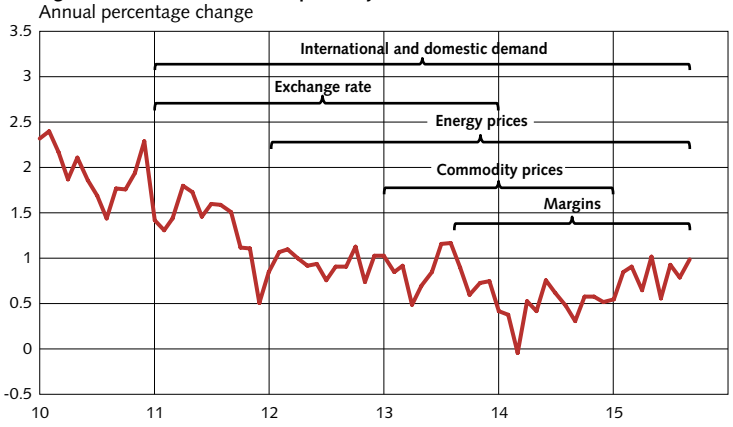
Sources: Statistics Sweden and own calculations

Summary and concluding remarks

The purpose of this article has been to highlight the low inflation and summarise the underlying driving forces. We started by describing how inflation in Sweden has progressed in the past five years, and concluded that there has been a broad downturn in the price increase rate in general, but that prices for different groups of goods and services have contributed to varying degrees to the low inflation in different years. This also becomes obvious when we compare the developments in Sweden with those in other countries.

We then looked more closely at the driving forces underlying the developments. We started by describing how various potential explanatory factors have correlated with inflation, and the extent to which the low inflation can be explained with historical patterns in these correlations. We then analysed the course of events using a general equilibrium model, in which we could identify how much of a certain factor has contributed to keeping inflation down compared with other factors in the model.

Figure 26. CPIF and the main explanatory factors for the low inflation
Annual percentage change



Sources: Statistics Sweden and own calculations

The findings from the various analytical sections are relatively consistent. In Figure 26 we summarise the main explanatory factors and the periods during which they have contributed the most to keeping a lid on inflation. This is of course not an exact illustration of the underlying causes and the time periods in which they have been of significance, but it does provide us with an overarching view of the analysis presented above. The findings indicate that factors that normally affect the rate of price increase, such as demand and the exchange rate, have also contributed to pushing inflation down in the past five years. Not very surprisingly, it appears that the weak economic developments abroad and, linked thereto, subdued demand in Sweden, have been of particular importance. Adding to that, low commodity prices – particularly for electricity and oil, but also for food for a shorter period of time – have suppressed the cost increases of companies and curbed inflationary pressure.

At the same time, it is clear that these factors do not tell the whole story. In the past two years, companies appear to have squeezed their margins to a greater extent than might be expected from historical patterns. The precise cause of this is difficult to pinpoint, but in surveys companies themselves have emphasised perceived uncertainty about the future direction of the economy and increased competition.

We commenced the article by observing that the period from 2011 and onwards is remarkable in many ways. At the same time as inflation has been on a declining trend to a low level, monetary policy has gradually become increasingly expansionary, with the Riksbank's repo rate even coming down to negative levels. Thus far, we have not said much about the role that monetary policy has played in inflation developments in the past five years, but it has of course been of significance.

Monetary policy has little possibility of influencing some of the driving forces behind the low inflation, such as low energy prices – at least their direct effects. However, monetary policy can influence many of the other factors, such as demand and the exchange rate,

in the short term, and through them contribute to inflation rising or falling. Inflation expectations can also be influenced by monetary policy. In the past few years, the policy conducted by the Riksbank has helped buoy inflation. Without it, inflation would have been even lower, as shown by the model analysis presented here. It is important to note in this context that the findings only indicate that monetary policy has been more expansionary than what a historical interest rate rule would imply.[41] The analysis we have presented in this article thus does not take a firm stand on how well-balanced the pursued monetary policy has been.

Monetary policy is based on the forecasts available at the time decisions were made. Inflation has, for a long period of time, been below the target and the Riksbank has, like most other forecasters, overestimated how high inflation will be in its projections. It is possible that the low inflation in the past few years might have been amplified by the fact that inflation expectations have dropped after a long period of low inflation. If the forecasts had been more accurate, the repo rate would probably have been cut down to the current low levels somewhat faster. What is more open to discussion, and what has also been subject to lively debate during the period, is *how much* faster the interest rate might have been cut, the effect that would have had on inflation, and what the implications would have been for the economy at large. These questions are, however, beyond the scope of the analysis in this article.

41 It should also be noted that the parameters in the historical interest rate rule on which the model analysis is based are assumed to be constant over time. If, in actual fact, a downward shift has occurred in the neutral interest rate, while at the same time the model assumes it is constant, the model might perceive monetary policy to be more expansionary than it actually is. There is an ongoing discussion about the extent to which current low interest rates in Sweden and internationally reflect the fact that the neutral interest rate has fallen, or whether the low interest rates are rather due to more temporary effects linked to the weak economic activity. See, for example, Armelius et al. (2014).

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