

An analysis of the driving forces behind inflation 1995-2015

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The purpose of this article is to contribute to the discussion on the Riksbank's attainment of the inflation target by describing the driving forces behind inflation during the period 1995-2015. An analysis using a model of the Swedish economy is presented in the first section. These results are then compared with the descriptions of the causes for the development in inflation made by the Riksbank in real time. One recurring factor of those that have contributed to holding back inflation is low price increases on imported goods. Another important explanation is strong productivity. A third section of the article examines to what extent developments in these two factors have surprised the Riksbank. The analysis shows that productivity was much higher than the Riksbank had forecast, while forecasts for import prices, according to the measure used during the period, partly overestimated developments.

Introduction

In January 1993, the Riksbank announced that monetary policy would, with effect from 1995, be aimed at attaining a target for CPI inflation of 2 per cent. Although the Riksbank has changed a number of details in its strategy along the way, during these two decades monetary policy has been governed by this inflation target.

Monetary policy has often been a subject for economic debate during this period. The discussion has largely centred on what level is most appropriate for the Riksbank's policy rate, the repo rate, given the outlook for the Swedish economy at a particular point in time. But at times the debate has also focused on more fundamental issues, and on whether the inflation-targeting policy should be reformed in some way. In recent years, this discussion has intensified as a result of inflation targeting, as conducted in Sweden and abroad, being questioned as a result of the experiences from the financial crisis in 2008 and the ensuing economic recession.

Judging from the debate in Sweden, the majority agrees that inflation-targeting has functioned well on an overall level. It has served Sweden well, as the expression goes. One therefore should not make any overall changes to the monetary policy strategy too hastily. But of course, they should not be ruled out altogether. It is important that there is a

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constructive and well-informed debate on possible changes that can contribute to a better monetary policy and better economic developments in general.

Naturally, a central role in this debate is the extent to which the Riksbank has attained its inflation target. Discussions on target attainment often start with what inflation has been on average over a certain period of time. Monetary policy cannot guarantee that inflation is exactly on target all of the time. But, the argument goes, although the target does not explicitly apply to the average inflation rate, the average over time should nevertheless be close to 2 per cent – if it is not, this indicates that monetary policy could have been conducted in a better way. If, for instance, the average inflation rate has been below 2 per cent, as has been the case with CPI inflation, monetary policy could have been more expansionary, which could probably have contributed to a stronger development in, for instance, growth and employment.

However, it is difficult to discuss changes to the framework for implementing monetary policy to improve target attainment without first analysing *why* inflation has deviated from the target and to what extent the Riksbank has *predicted* the factors that have led to the deviation. Without this kind of analysis it is difficult to gain an impression of which changes to the framework might be justified and how target attainment could be improved if they were made.

The purpose of this article is to contribute to the discussion on target attainment by, to begin with, presenting an analysis of the driving forces behind inflation outcomes during the period 1995-2015. This analysis is divided into two sections. The first uses the Riksbank's macroeconomic model, Ramses, to identify factors that have pushed down inflation during the period. The second section presents the explanations for the weak development of inflation highlighted by the Riksbank in the Inflation Reports and Monetary Policy Reports. This analysis is interesting in itself, as it provides a more detailed picture of developments. Although Ramses is a relatively complex model, it is of course a stylised representation of the Swedish economy. Moreover, it is interesting to see how the Ramses analysis concurs with the Riksbank's analysis of economic developments made in real time.

The conclusions from these sections are, in brief, that different factors have been particularly important for the development of inflation during different periods. Although the model results are in some cases open to interpretation, they largely concur with the descriptions of the driving forces behind inflation contained in the reports. Among the various factors low price increases on imported goods and services have recurred in the reports as an explanation for the low inflation. Periodically this has been linked to weak international economic activity and/or a strong krona, but sometimes the reasons have not been as clear and the reports have also highlighted more structural explanations, such as the shift in the Swedish import patterns to countries with lower prices. Another important factor holding back inflation, according to the Riksbank's reports, has been the strong development in productivity. However, here too the causes have been difficult to identify with any degree of certainty.

The review of the Riksbank's analysis of the driving forces behind low inflation provides a background to the second part of the article, which focuses on the Riksbank's actions. The Riksbank's forecasts for inflation during this period generally overestimated inflation – this is for example documented in the material the Riksbank compiles every year for the Riksdag Committee on Finance's assessments of monetary policy.¹ If the forecasts had been more accurate, monetary policy would probably have been more expansionary during this period.² This would in turn probably have contributed to average CPI inflation being closer to 2 per cent.³

So why was inflation overestimated? The main explanation, according to the material provided for the Committee on Finance's assessment, is that the Riksbank was surprised by factors that caused inflation to be lower than expected. These include, of course, several of the factors behind the low inflation discussed in the first part of the article. However, two factors that have been emphasised as particularly important among these are low import prices and strong productivity. The second part of the article therefore focuses on these two factors and to what extent they have surprised the Riksbank.

The conclusions from this analysis are that the Riksbank's forecasts for import prices excluding oil products overestimated the size of the price increases round the middle of the 2000s. This was partly counteracted by the increases in oil prices being underestimated. But much suggests that surprisingly low import prices were an important explanation for inflationary pressures at longer horizons being overestimated by the Riksbank. However, this conclusion is based on what turned out to be an uncertain assumption that the measure of import prices on which the Riksbank based its forecasts actually reflected developments in import prices satisfactorily. With regard to productivity, the analysis shows that it was much stronger in the 2000s than the Riksbank had predicted, which probably contributed to the overestimation of inflationary pressures in the economy. Later revisions to the National Accounts also indicate that inflationary pressures were even lower than there was reason to believe in real time.

1 Previously, this material was included as an in-depth article in the first Inflation Report published every year. From 2008 onwards, the material is published in a separate series of reports known as *Account of Monetary Policy* (prior to 2013, *Material for Assessing Monetary Policy*).

2 It is probable, but not definite. Possibly, the forecasts would then have indicated lower inflationary pressures in the economy and scope for lower interest rates, all else being equal. However, monetary policy is not only governed by inflation prospects. The outlook for the real economy also plays a role, for instance, and this outlook would also have been different.

3 This conclusion is consistent with how one normally imagines the correlation between a central bank's policy rate and inflation, that is, when the central bank cuts the policy rate, this contributes through various channels to an increase in inflation. One complication in the case of Sweden is that this is not self-evident in the shorter term for CPI inflation, as interest rate adjustments also have a counteracting effect on the CPI via household mortgage costs. This singularity of the Swedish CPI is discussed in more detail in the text.

The driving forces behind inflation 1995-2015

As Table 1 indicates, inflation has on average been lower than the target level since 1995.⁴ Exactly how much lower depends on whether or not one uses real-time data. In 2005, Statistics Sweden changed its method for calculating CPI inflation and at the same time recalculated earlier inflation outcomes in line with the new method. However, when analysing and evaluating monetary policy, it is more accurate to use the earlier definition of CPI inflation for the years prior to 2005, as it was inflation according to this definition that the Riksbank used as a basis for its analysis and that the Riksbank was evaluated by in real time.

Given that, the CPI increased on average by 1.2 per cent a year during the period 1995-2015 (1.1 per cent if one ignores the method change in 2005). As a comparison, Table 1 also includes the average inflation rate according to two other measures often used. The CPIF is the CPI where interest expenditure is calculated using a fixed mortgage rate, while the HICP is the harmonised index for consumer prices prepared by the EU. Inflation according to these two measures was on average 0.4 and 0.3 percentage points higher per year, respectively, during the period 1995-2015 in relation to CPI inflation.

Table 1. Average inflation

Per cent	1995-2001	2002-2008	2009-2015	1995-2015
CPI, real time	1.3	1.8	0.6	1.2
CPIF, real time	1.9	1.8	1.2	1.6
CPI	1.0	1.7	0.6	1.1
CPIF	1.6	1.8	1.2	1.5
HICP	1.4	1.8	1.1	1.4

Note. The table shows the average value of the monthly outcomes for the annual percentage change in the CPI, the CPIF and the HICP in different periods. "Real time" here means that CPI inflation in 1995-2004 is calculated according to the definition that applied during those years. Calculation of the CPIF began in June 2008, that is, the series for CPIF real time is the one that would have applied if the CPIF had been available in real time during the period. Data for the HICP is available from 1995, which means that the average values for HICP inflation are calculated with effect from 1996.

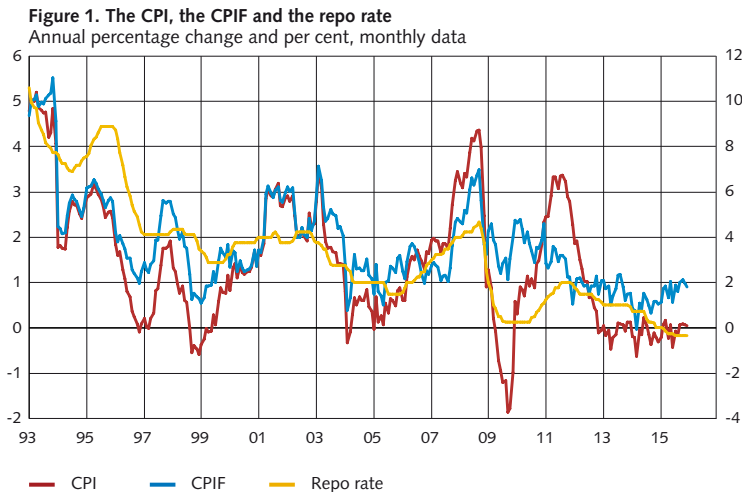
Sources: Statistics Sweden, Eurostat and own calculations

Given that the CPI increased by almost 9 per cent a year on average during the period 1975-1990, there was thus a clear slowdown in inflation in the middle of the 1990s. Why did inflation slow down like this? A preliminary observation is that Swedish is not alone in having experienced such a change; it was an international trend. The starting point varies a little between countries, but generally speaking there was a period from the mid-1980s when inflation levels and fluctuations in many industrial nations' economies were dampened substantially in relation to earlier decades. The reasons for this development, "the Great Moderation" as it came to be called, have been the object of considerable

⁴ In January 1993, the Riksbank announced that monetary policy would, with effect from 1995, be aimed at attaining an inflation target of 2 per cent, with a tolerance interval of +/- 1 percentage point, with inflation being measured as the change in the CPI. Over the two years leading up to 1995, monetary policy was to be aimed at preventing the underlying rate of inflation, which had decreased to a level around two per cent, from increasing again.

analysis and debate.⁵ Most likely, it was the result of several interacting factors. However, there are many indications that the changes in the monetary policy area that took place on a broad front during this period, not least the introduction of an inflation target in many countries, was an important factor behind the slowdown in inflation.⁶

Figure 1 illustrates the monthly developments of inflation according to the CPI and the CPIF and the Riksbank's repo rate from the introduction of the inflation target in 1993 and onwards. As shown in the figure, there was a clear and relatively sudden slowdown in inflation at the beginning of the period, when confidence in the inflation target was established in Sweden. As a natural consequence of this, interest rates also declined, and the Riksbank gradually cut the repo rate from an average of more than 10 per cent at the end of the 1980s and early 1990s to around 2 per cent.



Note. CPI and CPIF inflation are measured on the scale on the left-hand vertical axis, while the repo rate is measured on the scale on the right. Both inflation rates are real-time series, that is, the values 1995-2004 are calculated according to the definitions of the CPI applying in these years. Calculation of the CPIF began in June 2008, which means that the real-time series for the CPIF is the one that would have applied if it had been available in real time during the period.
Sources: Statistics Sweden and the Riksbank

THE SIGNIFICANCE OF THE INTEREST RATE FOR CPI INFLATION

So Sweden was not alone in experiencing a sequence of events whereby interest rates slowed down in this way. But a period with a falling interest-rate trend has a direct and relatively large effect on CPI inflation in Sweden via the component that measures housing costs, unlike the way inflation was affected in other comparable countries. This component can be calculated in different ways. Sweden uses an approach where mortgage interest expenditure plays an important part. The same approach is also used in Canada, but the

5 For a survey of the discussion of the “the Great Moderation”, see Bernanke (2004).

6 See, for instance, Summers (2005) and Giannone, Reichlin and Lenza (2008).

properties in the method of calculation differ somewhat and the effects on the CPI become relatively larger in Sweden.⁷ The effects are also long-lasting. So when mortgage rates fluctuate, this component provides a relatively large contribution to the fluctuations in CPI inflation in Sweden.

The fact that the fall in interest rates is an important explanation for the low CPI inflation becomes clear if one compares CPI inflation in Figure 1 (the red line) with inflation measured as the change in the CPIF (the blue line) since the difference between those lines represents the effects of interest expenditure on CPI inflation. The figure shows that interest rate increases in certain periods have contributed to pushing up CPI inflation (the red line is above the blue one). But for the period as a whole, the relationship has mostly been the reverse. Interest rates in general have shown a downward trend that has contributed to holding down CPI inflation around 0.4 percentage points on average (see Table 1). Measured in terms of the CPIF, inflation was on average 1.6 per cent per year for the period 1995-2015, according to real-time data (1.5 per cent without real-time adjustment).

As also illustrated in Figure 1 and Table 1, the downward trend in interest rates can largely be attributed to two specific episodes. Firstly, interest rates fell substantially at the beginning of the period in connection with the introduction of the inflation target, the implementation of reforms in the fiscal-policy framework and the strengthening of confidence in Swedish economic policy after the 1990s crisis. This contributed to pushing down the CPI during the second half of the 1990s. Secondly, the Riksbank cut the repo rate heavily from the end of 2008 in connection with the financial crisis, which had a considerable effect on CPI inflation. During these periods of falling interest rates, the average CPI inflation is clearly lower than the average CPIF inflation. During a period without a clear trend in interest rates, for instance 2002-2008, the average for the two inflation measures is in principle the same.⁸

FACTORS THAT HAVE AFFECTED INFLATION ACCORDING TO THE RIKSBANK'S MACROECONOMIC MODEL OF SWEDEN'S ECONOMY

Which factors have been the main driving forces and contributed to the relatively low average inflation rate during the inflation-targeting period? One tool that can be used to try to answer this question is the Riksbank's macroeconomic model of the Swedish economy, Ramses.⁹ This model is used mainly in the Riksbank's forecasting process and in calculations of the effects of different monetary policy alternatives. However, it can also be used to try to determine why, for instance, inflation has developed in a certain way.

7 Further details of how mortgage interest expenditure is calculated in the Swedish CPI can be found in Johansson (2015). The differences between Swedish and Canadian CPI with regard to calculations of interest expenditure are described by Palmqvist (2013).

8 For a more in-depth description of the downward trend in interest rates and the average development of inflation, see Andersson, Palmqvist and Österholm (2012).

9 The model is described in Adolfson, Laséen, Christiano, Trabandt and Walentin (2013). The official name of the model is Ramses II, to mark that the current version of Ramses is a revised and further-developed version of the original model.

Ramses is a so-called dynamic stochastic general equilibrium model, which tries to explain the development in the Swedish macroeconomy as a result of an interplay between households, companies, the government and central banks, as well as supply and demand on many different markets at the same time. That the model is dynamic means that it is possible to study the development of the economy over time. That it is stochastic means that it includes events outside of the model – random shocks – which can make developments deviate from how the modelled relationships have developed historically.

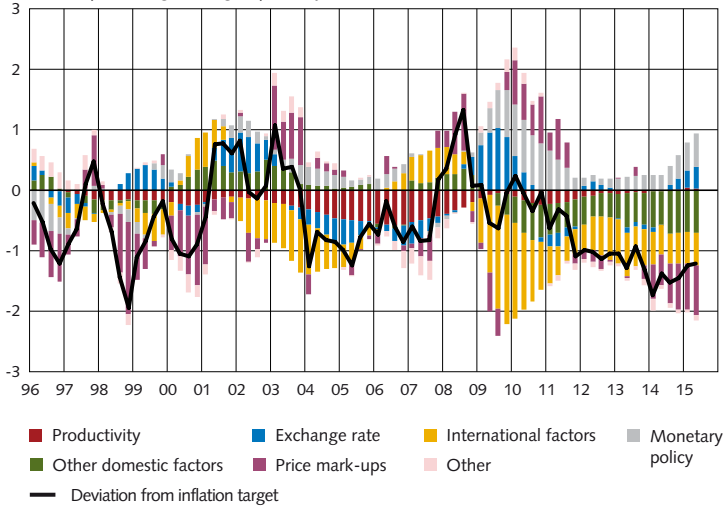
The shocks thus say something about why the economy did not develop in accordance with historical correlations. Ramses contains a large number of shocks, each of which has a unique effect on the economy. Although some of the shocks are more closely linked to fluctuations in some of the variables included in the model, usually each variable – interest rate, exchange rate, growth, inflation and so on – will be explained by a number of different shocks acting together.

Figure 2 shows one such analysis of the quarterly, annual percentage change in CPIF inflation, that is, inflation excluding the effects of interest rate changes as discussed above. More precisely, it is the reasons for CPIF inflation deviating from 2 per cent, according to Ramses, that are illustrated in the figure. An account of all of the individual shocks would be difficult to overview, so to make the analysis easier, the shocks have been grouped and each group has been allocated a particular colour. In a particular quarter (groups of) shocks have contributed to different extents to pushing up inflation – those above the zero mark – while other have contributed to pushing down inflation – those below. The net outcome of the different shocks, which is then CPIF inflation's deviation from 2 per cent, is illustrated by the black line in the figure.¹⁰

¹⁰ See Adolfson, Laséen, Christiano, Trabandt and Walentin (2013) for details regarding the different shocks. A more intuitive description and deeper analysis of the shocks that, according to Ramses, were important for the developments of inflation in 2010-2015 can be found in Andersson, Corbo and Löff (2015).

Figure 2. Contribution to the CPIF from different shocks in the Riksbank's macro model Ramses

Annual percentage change, quarterly data



Note. The figure illustrates developments in terms of CPIF inflation's deviation from two per cent. CPIF inflation is not a real-time series in this case, which means that developments here differ somewhat from Figure 1 for the period 1996-2004. Sources: Statistics Sweden and own calculations

The period 1996-2000: price mark-ups, monetary policy, international developments and productivity

Figure 1 showed that inflation excluding the effects of interest rate changes was at a level just below 3 per cent in 1994-1995. In 1996, inflation then fell to below 2 per cent and apart from a temporary peak during the second half of 1997, inflation was low until the start of 2001. The model analysis in Figure 2 indicates that the explanation for the weak inflation up to 1998 can mainly be attributed to shocks to *monetary policy* (grey columns) and companies' *price mark-ups* (purple columns). However, *international developments* (yellow columns) and, during a short period, shocks to the *exchange rate* (blue columns) contributed to holding back inflation. From 1998, the shocks to price mark-ups continued to be an important factor and weaker international developments than normal took on a larger role. At the same time, *productivity* shocks (red columns) become a minor but persistent factor behind the low inflation.¹¹

It is important to note that the columns in Figure 2 capture changes that cannot be explained by the relationships that normally govern how different variable move according to the model. Monetary policy, for example, is explained in Ramses by a simple policy rule,

¹¹ The group "other" (pink columns) largely consists of what the model interprets as measurement errors, which are changes in inflation that are difficult to combine with the developments in other variables according to the correlations in the model. As shown in Figure 2, the contribution from this group may be relatively large in some quarters, but the contributions are usually small.

where the interest rate is basically determined by inflation and resource utilisation in the economy. If the interest rate has been lower or higher than implied by the policy rule, that is, if it has been more expansionary or tighter than normal, the model interprets this to be a shock to monetary policy. During 1996, and to some extent also 1998/1999, a tighter monetary policy than normal thus contributed to holding back inflation, according to Ramses.

As Figure 2 also shows, the shocks to company price mark-ups (purple columns) were the single most important explanation for inflation being pushed down during the second half of the 1990s. In the model, the price of a product is set at the cost of producing an additional unit of the product plus a mark-up. The size of the mark-up is determined by, for instance, how much competition there is on the market in which the company is active as well as by demand. The mark-ups will vary over time, depending on changes in the companies' costs and in demand for their products. During the second half of the 1990s, prices thus increased unusually slowly given cost developments, which Ramses captures as shocks to the price mark-ups. In this context it is important to point out that shocks to the price mark-ups can also capture changes in inflation that are due to factors that are not explicitly included in the model (more on this later).

The period 2001-2003: exchange rate, monetary policy, price mark-ups and other domestic factors

During 2001, inflation rose to a relatively high level. It did fall temporarily in 2002, but over the period 2001-2003 as whole CPIF inflation was on average above 2 per cent. As Figure 2 shows, the turn to high inflation is initially due to a large positive contribution from *international developments*, but this soon turns into a large negative contribution. Instead, it is primarily shocks to the *exchange rate, monetary policy* and other *domestic factors* (green columns) that contribute to keeping up inflation 2001-2002, while major effects of shocks to *price mark-ups* push up inflation in 2003. During this period, an increasingly expansionary monetary policy (according to the simple policy rule) contributed to pushing up inflation, while disruptions to other domestic factors that affect companies' cost pressures and demand for their products also contributed to pushing up prices. At the same time, the krona weakened relatively substantially compared to how it normally changes according to the model, and this contributed to higher inflation.

The large positive effect of the shocks to price mark-ups in 2003 might be an example of a change in inflation that is driven by a factor that is not included in the model. In 2003, energy prices rose considerably and they are not modelled explicitly in Ramses. Changes in energy prices affect companies' production costs and these costs are included in the model. However, changes in energy prices also have a direct effect on consumer prices through prices on fuel and heating, and this effect on inflation may instead be interpreted by the

model as a shock to the price mark-ups. It has been shown that the direct contribution from energy prices to CPIF inflation periodically covaries closely with the contribution to inflation from the price mark-ups in Ramses.¹²

The period 2004-2007: productivity, international developments and the exchange rate

At the beginning of 2004, inflation fell substantially and remained at a low level until the end of 2007. As Figure 2 shows, Ramses mainly links this to an unusually strong growth in *productivity*. Productivity shocks did contribute to dampening inflation in previous years, but during a period in the mid-2000s, this contribution increased and became considerably larger than before. Shocks to the *exchange rate* and, at the beginning of the period, *international developments*, contributed to the low inflation from 2004 and onwards. In individual quarters there are also negative contributions from shocks to the *price mark-ups*.

Productivity can be measured in different ways. Labour productivity measures production per work input, that is, the number of working hours or the number of people employed. The fact that labour productivity has risen can be due to an increase in the efficiency of the employees, or to investments in more or better machinery. Total factor productivity (TFP) is a measure of production in relation to the input of *all* production factors, not just labour. TFP increases are often associated with technological development or organisational improvements which mean that more can be produced with the same quantity of production factors. It is shocks to the TFP that are illustrated in the red columns in Figure 2. In other words, unusually large increases in production given the input of labour and capital contributed to holding back production costs and thereby price increases in the mid-2000s.

*The period 2008-2015: international developments, domestic demand and price mark-ups*¹³

From the end of 2007, inflation rose markedly and in autumn 2008 it was at a record-high level, seen over the entire inflation-targeting period. Ramses explains the upturn primarily with contributions from *international developments*, unusually high *price mark-ups* and also other shocks that pushed up *domestic demand* and *cost pressures*, despite productivity still being unusually high and holding back cost increases.

When Sweden then was hit for real by the financial crisis from autumn 2008, this rapidly turned around and both international developments and domestic demand contributed substantially to subduing inflation. However, according to the model this was counteracted by an unusually weak exchange rate, expansionary monetary policy and high price

¹² See Andersson, Corbo and Löf (2015).

¹³ A more detailed Ramses analysis of inflation over the past five years can be found in Andersson, Corbo and Löf (2015). Note that the grouping of the different shocks is slightly different there. The groups called "domestic cost pressures" and "domestic demand" in that article have been combined into one single group called "other domestic factors" in this article. However, the shocks to productivity have been removed from the group "domestic cost pressures" and are reported separately here.

mark-ups, which in principle balanced the large negative shocks. CPIF inflation therefore remained close to 2 per cent.

Towards the end of 2011, CPIF inflation fell to around 1 per cent and remained there until the end of 2013, when it declined somewhat further. After that, inflation rose towards 1 per cent again. As shown in Figure 2, the explanation for this given by the model is that negative contributions from the weak *international developments* and *domestic demand* have continued to dampen inflation, while the positive contributions from, for instance, the exchange rate, monetary policy and price mark-ups have not been as large as before. On the contrary, unusually low *price mark-ups* have pushed down inflation to a relatively large degree the past two years.

FACTORS THAT HAVE AFFECTED INFLATION ACCORDING TO THE RIKSBANK'S REPORTS

After the review of Ramses' explanation of the forces driving inflation over the past two decades, follows a description of the main explanations highlighted by the Riksbank in its Inflation Reports and Monetary Policy Reports. There are several reasons why such a description may be interesting. To begin with, it gives a more detailed picture of developments during this period than the model analysis. It is also interesting to compare how well this picture coincides with Ramses' interpretation.¹⁴ The model analysis is made with "the benefit of hindsight", that is, with the information on developments during the period that we have available now (including revised statistics). The Riksbank's reports during this period, on the other hand, provide a real-time description of developments, where the driving forces behind the low inflation rate are identified as new statistics and results from new analyses become available.

It is important to note that the description of the driving forces behind the low inflation described in this section is the Riksbank's *interpretation* of developments in the economy – an interpretation that is not necessarily entirely correct. It is not always easy in real time to identify with certainty the underlying trends and driving forces in the economy.¹⁵ The fact is that uncertainty regarding changes in trends and long-term connections is something that often recurs in the reports during the period. The aim has been that the description below, in addition to summarising the underlying driving forces, should also to some extent reflect this.

¹⁴ The Riksbank's explanation of developments in real time has of course been influenced by the Ramses analysis made during the period, that is, from around 2004/2005 when the model was first used in policy work. However, the early version of Ramses differs considerably from the current version.

¹⁵ However, the Riksbank's interpretation probably does not differ very much from those made by other institutions during the period.

The period 1996-1997: increased confidence in economic policy and lower “inflation propensity”

The Riksbank's Inflation Reports from 1996 explain the low inflationary pressures in the economy as being partly due to economic activity. During 1995, economic activity weakened in Sweden and abroad. Although it began to rise again in 1996, it was noted that household demand was still relatively subdued and that there was spare capacity in the economy. However, the main explanation given for the low inflationary pressures was falling interest expenditure and falling import prices as a result of the krona appreciation since the end of 1995. According to the Riksbank these two factors, falling interest rates and a stronger exchange rate, were essentially a positive development since it interpreted this as an expression of greater confidence in Swedish economy policy, which had been very low following the crisis in the early 1990s.

It was also noted that there was a more underlying trend, where companies' behaviour appeared to have changed in relation to the situation before the 1990s crisis. The inflation propensity, as it was called, appeared to have declined in the economy, which held back price increases. This was a recurring theme in the Inflation Reports published in 1996-1997 and there were discussions of the possible explanations for the decline in inflation propensity as well as how long this phenomenon might last.¹⁶

Given that the Riksbank cut the repo rate by almost 5 percentage points in 1996 (see Figure 1) and that market rates fell at the same time, it is not so strange that CPI inflation was pushed down by interest expenditure. What may appear odd, however, is that Ramses finds that monetary policy also contributed to holding back inflation *excluding* the effect on interest expenditure in 1996-1997. The large cuts in the repo rate were made with the opposite intention, that is, to counteract the slowdown in the economy and increase economic activity and thereby inflation.¹⁷ But Ramses' interpretation of developments is not so strange if one considers that the interest rate was still above 4 per cent at the end of 1996, despite the large cuts. Compared with the period on which the analysis in Ramses is based, that is, 1995-2014, this is a relatively high level given that underlying inflation was around 1 per cent. As inflation expectations had begun to stabilise around 2 per cent in 1996, the real repo rate was also relatively high.

The fact that the large cuts in the repo rate in 1996 began from just below 9 per cent – a high level compared to the rest of the period – was partly due to the Riksbank *raising* the repo rate in 1994-1995. This tightening and the fact that the cuts did not begin until 1996 was criticised in the monetary policy debate, partly because demand and inflationary

16 See, for instance, the article “Has the inflation process changed?” in *Inflation Report* 1997:2. This article is based on the analysis in Berg and Lundkvist (1997).

17 It was noted in Inflation Report 1996:3 that confidence in Sweden as a country with low inflation was being established in 1996, which contributed to creating the scope for monetary policy easing that was used over the year. “For the first time in recent decades a more expansionary monetary stance could accordingly be used to counter an international slowdown” (p. 25).

pressures were already held back by the consolidation in public finances.¹⁸ Moreover, the appreciation of the krona from the middle of 1995 together with weaker economic activity contributed to further dampening inflationary pressures. The Riksbank's view was that in autumn 1995 there were signs that inflation would overshoot the target and, additionally, inflation expectations and outcomes of wage negotiations in spring 1995 indicated that the credibility for the inflation target had not been fully established. The strengthening of confidence that did appear to have taken place made an impression in the sense that the repo rate was not raised further in autumn 1995, despite the assessment that the inflation target would be overshoot in a couple of years' time.¹⁹

The period 1998-2001: Asian financial crisis, low resource utilisation and deregulations

Towards the end of 1997, underlying inflation rose, which was largely explained by increases in indirect taxes and some administratively determined prices, such as apartment rents. In the middle of 1997, the so-called Asian financial crisis broke out, when a number of countries in South East Asia suffered problems with depreciating currencies and large capital outflows. The crisis deepened in 1998 and its consequences contributed to turbulence on the financial markets and weaker economic developments for a couple of years.

The Riksbank explained the relatively large fall in Swedish inflation in 1998 in its Inflation Reports as largely due to the effects of the Asian crisis. Prices of imported goods fell in 1998 as a result of weaker international demand in general and a decline in the oil price in the wake of the crisis in particular. The Inflation Reports show that CPI inflation in 1998-2000 was also held back by what were called "temporary effects", first of changes in indirect taxes and subsidies and then price changes linked to deregulation on various services markets.²⁰

During 1999, international economic activity began to improve somewhat and the price of crude oil rose substantially up to the end of 2000. This pushed up import prices through prices of petrol and domestic heating oil. However, the development of import prices on more processed goods remained subdued, which the Riksbank said could be partly due to tougher international competition than before. Resource utilisation in Sweden was still low. Moreover, the relationship between resource utilisation and inflation seemed to have changed, both in Sweden and abroad. The strong productivity growth in Sweden since the mid-1990s was also beginning to gain scope in the Inflation Reports and there were discussions of possible reasons for this.

18 The Riksdag Committee on Finance and the Government later stated that these cuts should have been made earlier and at a faster pace. See the Committee on Finance report 1998/99:FiU23 and appendix 5 to the 2001 Spring Budget Bill.

19 See Bäckström (2003), who also comments on the criticism levelled at the Riksbank.

20 For instance, there was a cut in tobacco tax in the middle of 1998, which had a dampening effect on CPI inflation up to the end of 1999 (as inflation measures the change in prices over 12 months). From the middle of 1999 onwards, prices of electricity and telecommunications services were held back, probably due to deregulation.

The period 2004-2007: strong productivity and low increases on prices of import goods

From 2001, inflation rose sharply. Supply shocks in the form of large price increases on oil, electricity, meat as well as fruit and vegetables contributed in various periods to pushing up CPI inflation. However, inflation rose even when these effects were excluded. From the Inflation Reports during the period it appears that the Riksbank was not completely sure why, but one hypothesis was that a relatively high level of resource utilisation in Sweden had led to companies being able to pass on their increased production costs to higher prices to a greater extent than before. Questions were also raised about the earlier view of the relationship between growth and inflation and how much it had actually changed.

At the beginning of 2004, inflation fell substantially and remained at a low level until the end of 2007. This rapid fall in inflation was partly due to prices being pushed up temporarily at the beginning of 2003 due to a spike in energy prices. The large upturn in energy prices in 2003 was also the reason why the Riksbank based its monetary policy that year on a measure of underlying inflation that excluded energy prices.

From the Inflation Reports published in the period 2004-2007 it is otherwise clear that strong productivity growth is one of the main explanations for the low inflation. Productivity, together with moderate wage increases, contributed to combining strong growth with low wage pressure. The Riksbank observed that the reasons for the rising trend in productivity since the mid-1990s were not entirely clear, which made it difficult, for instance, to determine how long this development would last. One sector that also aroused particular interest in the Inflation Reports was the retail trade, where food prices fell 2004-2005, something that was partly explained with reference to low-price supermarket chains establishing in Sweden leading to tougher competition.

The second main explanation for the low underlying inflation highlighted by the Riksbank during this period was the low increases in prices of imported goods. The oil price rose quickly at times, and contributed to pushing up import prices. But this was counteracted by a very subdued development in prices of other import goods. The Riksbank attributed this partly to increased international competition probably holding back price impulses more than previously in comparable economic conditions. Another possible explanation mentioned was that there may have been changes in the Swedish import pattern where imports from countries with relatively high prices were increasingly being replaced by imports from countries where prices were relatively low. This shift in import patterns would then contribute to reducing the prices paid by Swedish importers.

The krona exchange rate was also suggested as an explanation for the low import prices. The krona appreciated more or less constantly from 2002 and until the end of 2004, but during 2005 there was a turnaround, and the krona depreciated. However, it was pointed out in the Inflation Reports that it normally takes time before exchange rate changes affect domestic pricing. This indicated that the earlier strengthening of the exchange rate probably played a role in the lower increases in import prices in the years following 2004. Finally, it was also noted that the strong productivity and the low domestic cost pressures

not only held back price increases on domestic production, but also prices of import goods, as these are also affected by domestic costs for processing, distribution and so on.

The period 2008-2015: financial crisis, international recession and considerable uncertainty

From the end of 2007, inflation rose sharply and in summer 2008 it was at its highest level since 1993. Resource utilisation in the economy rose and the labour market became tighter, which was reflected in higher wage agreements than before. Altogether, this meant that cost pressures increased. The Riksbank's reports also show that another important reason for inflation rising was that food and energy prices increased substantially.

The situation changed in autumn 2008, when the problems on the financial markets, which had spread from the US mortgage market, worsened drastically. The international economic downturn deepened and world trade ground to a halt. This had a dramatic impact on the Swedish economy and GDP fell heavily in 2009, at the same time as unemployment rose. Inflation fell rapidly from the record levels, but despite the economic downturn, it remained relatively high and CPIF inflation was back above 2 per cent at the end of 2009.

Economic activity began to recover from summer 2009, albeit from a low level. During 2010, there was a strong recovery in Sweden and the positive development continued during the first half of 2011. However, over the summer and autumn the international financial markets were increasingly affected by uncertainty linked to the public finances situation in some euro area countries and the United States. This contributed to breaking off the international recovery and as a result the Swedish economy slowed down sharply at the end of the year. Economic activity was still weak in 2012 and the Swedish economy was increasingly affected by the low demand in the euro area during the second half of the year and this continued to hold back economic activity in Sweden under 2013 as well.

CPIF inflation fell from around 2 per cent to a level of around 1 per cent in 2011. It remained there until the middle of 2013, when it fell further. The low inflationary pressures were explained in the Riksbank's reports partly by low increases in the prices of imported goods, due to the weak international developments. Moreover, the krona had strengthened considerably in 2010, as economic developments in Sweden had been relatively stronger than those in other countries. This contributed to holding back import prices in the years following 2010.

With regard to domestic cost pressures, moderate wage increases combined with high productivity growth had contributed to a decline in unit labour costs in 2010. The increases in these costs were on a more normal level during the following years, but they then slowed again in 2013, which held back inflationary pressures. From 2012 and onwards, low increases in energy prices also contributed to pushing down inflation. A further factor emphasised in the Riksbank's reports was that companies appeared to be finding it unusually difficult, from an historical perspective, to raise their prices in line with cost

increases. The reasons for this could be the considerable uncertainty over international economic activity and the fact that companies perceived an increased competitive pressure.²¹

Summary: The driving forces behind inflation

Summarising the sections above on the factors contributing to the development in inflation during the period 1995-2015, a first observation is that the driving forces the Riksbank has highlighted in its reports during the period concur well with the driving forces identified by Ramses as important.

Of course, they do not concur completely. In addition to the fact that the model cannot for natural reasons capture all details of the economy, there are also other explanations. For instance, the reports reflect the Riksbank's views as developed in real time as new data was accessed and new analyses were made. The model, on the other hand, uses data for the entire inflation-targeting period and revised statistics.

Another difference is that the analysis in Ramses identifies factors that have made unusually large contributions to inflation in relation to normal patterns. The reports' explanations for the development of inflation on the other hand reflect both normal and abnormal factors. This can be an explanation as to why the reports highlight, for instance, cyclical developments and the exchange rate as important in certain periods, while Ramses does not. Economic activity or the exchange rate may then very well have contributed to, for example, pushing down inflation, but not to an unusual extent compared to how economic activity, the exchange rate, inflation and so on normally move together according to the model.

With regard to individual driving forces that have contributed to holding back inflation according to the Riksbank's reports, low price increases on imported goods have been a recurring factor. The explanation as to why import prices have been low has varied and it has not always been possible to identify this with any certainty. Periodically, the Riksbank has been able to clearly point to weak economic activity abroad and/or a strong krona. Sometimes, more "structural" causes have been emphasised, such as increased global price pressure as a result of tougher competition or changes in Swedish import patterns where goods to a larger degree are imported from countries with lower prices. The fact that international developments have been an important factor behind the development of inflation is supported by the analysis in Ramses, although according to the model results it is difficult to determine whether it is a question of "normal" cyclical effects or structural changes. Changes of the latter form can also be interpreted by the model as unusually low price mark-ups by companies.

According to Ramses, price mark-ups were the single most important factor behind the low inflation during the second half of the 1990s. Intuitively, this agrees well with the explanations in the Inflation Reports regarding cuts to indirect taxes and deregulation

²¹ See Andersson, Corbo and Löf (2015) for more details on the causes of the low inflation in recent years.

of various markets during this period. Such changes can affect price levels and thus temporarily affect inflation. As the shocks to price mark-ups in Ramses capture “abnormal” variations in inflation given the cost increases in the companies, they will probably capture these temporary changes.

It is also possible that the shocks to price mark-ups capture the reports’ explanations that are more about structural factors, such as a decline in inflation propensity and lower trade-off between resource utilisation and inflation – precisely because these are variations that cannot be explained by the normal relationship between these variables. However, one should bear in mind that the “normal” relationships in this case apply to different periods. What is described as normal in the Inflation Reports during the second half of the 1990s is based on data for the 1980s and early 1990s. What the model regards as normal, on the other hand, is based on data for the period 1995-2014. So the fact that the model identified unusually low price mark-ups at the end of the 1990s can be consistent with the reports’ explanation that the relationship between inflation and resource utilisation was abnormally weak at that time. However, the comparison is then with data for the period from 1995 onwards, rather than data for the period prior to 1995.²²

An important factor behind the low inflation that has been emphasised in the Riksbank’s reports is the unusually strong productivity. This explanation gains increasing scope in the reports from the end of the 1990s. Ramses also identifies unusually large productivity improvements having contributed to pushing down inflation since the end of the 1990s, but the model indicates that it was in the mid-2000s that productivity growth had greatest significance.

To some extent the difference may reflect the fact that the reports and the model focus on different measures of productivity. The growth in labour productivity that the reports focus on was stronger in the mid-1990s and showed a relatively high trend level up until the financial crisis. Analyses made during the period indicated that the strong development was initially driven by investment in new capital, largely information and communication technology, rather than TFP.²³ This situation changed at the start of the new millennium and it was then primarily TFP that was growing strongly, which concurs with the model’s results. The reasons for the strong TFP were unclear, but one possible explanation raised was that a gradual increase in the use of information technology had entailed efficiency gains in production. However, other possible explanations were also mentioned, such as increased international and domestic competition and other structural changes in the economy.

22 Note that this does not apply to the unusually small price mark-ups during the second half of the 1990s. In recent years when the Riksbank has highlighted unusually low price mark-ups as an important factor behind the low inflation, the period being analysed is in principle the same as the one on which the analysis in Ramses is based.

23 See, for instance, the article “Driving forces behind productivity” in *Monetary Policy Report* 2007:2.

Why was inflation lower than expected?

So far, the focus has been on describing the factors behind the development in inflation during the inflation-targeting period. As the section above showed, these factors have generally contributed to pushing down inflation. On average, inflation has thus been low. More specifically, it has been lower than the Riksbank's inflation target of 2 per cent. Opinions differ on what conclusions should be drawn from this regarding how well monetary policy has been conducted. But irrespective of this, one can note that the average CPI inflation rate would probably have been higher and closer to the target if monetary policy had been even more expansionary.²⁴

So why wasn't it? One way of answering this question is to start with the Riksbank's inflation forecasts. The material on which the Committee on Finance's annual assessments of monetary policy are based shows that the inflation forecasts have generally overestimated how high inflation would become. Given this, one can draw the conclusion that if the forecasts had been accurate, and the Riksbank had known that inflationary pressures would be so low, then monetary policy would probably have been more expansionary.

The Riksbank's explanations as to why inflation was overestimated were that it was surprised by factors that caused inflation to be lower than expected. The reports' descriptions of inflation identify a number of possible factors. But even if they have held back inflation during this period, it is not self-evident that they have also held back inflation *more* than the Riksbank was expecting. To investigate whether this is the case, one needs to analyse the Riksbank's assessments of these factors.

Based on the first part of this article, it is evident that surprisingly low import prices and an unexpectedly strong growth in productivity are two main candidates for factors that have caused the Riksbank to overestimate inflation. Moreover, the Riksbank has previously highlighted these particular factors as explanations for forecasting errors in the reports provided for the Committee on Finance's assessments.²⁵ The section below therefore describes in greater detail the Riksbank's forecasts for these variables.

THE RIKSBANK'S FORECASTS OF IMPORT PRICES

As described above, the inflation impulses from abroad were in focus right from the start of the inflation-targeting regime, often in connection with surprisingly low inflation outcomes. During, for instance, the first quarter of 1995, producer prices rose very sharply, which indicated an increase in inflationary pressures in the economy. However, the effect on consumer prices was unexpectedly weak and during the second half of 1995 CPI inflation fell and continued to fall heavily in 1996. As mentioned earlier, this was largely due to

²⁴ As we have seen, a lower policy rate means that CPI inflation is pushed *down* further in the short term. But over a good ten years, the stimulus effect of the lower interest rate, which thus contributes to pushing *up* inflation, should have dominated the direct effect.

²⁵ However, the reports give a somewhat limited picture, as the analysis contained in them focuses on developments three years at a time.

falling interest rates, but another contributing factor was that the krona appreciated, which led to lower prices on import goods.

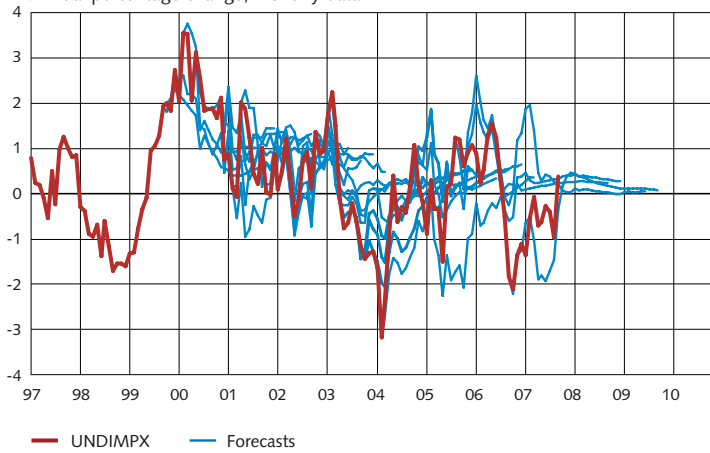
The interest in the contribution to inflation from import prices meant that it was desirable from an early stage for the Riksbank to illustrate how CPI inflation was affected by this component and to compare it with developments in price increases on domestically-produced goods and services. The Riksbank began to publish this type of breakdown in the Inflation Reports published in 1996, with CPI broken down into price increases on goods and services that were largely domestically-produced and goods and services that were largely imported (as well as an interest expenditure part). These two measures, eventually christened UNDINH and UNDIMPX, were given considerable scope in the Riksbank's analysis of inflation.²⁶ Forecasts of these variables were first published in the Inflation Reports issued in 1999, but in 2007 this stopped, which means that the analysis below applies to the period between these years.

UNDIMPX was somewhat overestimated in the longer run

Figure 3 shows the underlying measure of mainly imported goods and services, UNDIMPX, and the Riksbank's forecasts on different occasions. The figures show that although the Riksbank overestimated import prices in certain years, for instance, 2003, in other years they were underestimated and in some periods the outcomes were relatively close to the forecasts. In total, it is difficult to distinguish any systematic overestimation of the import prices. However, if one limits the analysis to the longer-run forecasts of UNDIMPX, the Riksbank overestimated developments by 0.6 percentage points on average.

²⁶ At the beginning, a measure called UNDINH was calculated by the Riksbank, but then Statistics Sweden took over this responsibility and the name was changed to UNDINH. The measure that reflected prices of imported consumer goods and services was calculated by the Riksbank itself given UND1(X) and UNDINH(X). After a while this measure was named UNDIMPX.

Figure 3. UNDIMPX, outcomes and forecasts
Annual percentage change, monthly data



Note. UNDIMPX refers to prices of mainly imported goods and services in CPIX (previously known as UND1X). The forecasts made up to the middle of 2005 were based on the assumption that the repo rate would be held constant during the forecast period. From the end of 2005 until the end of 2006, the forecasts were based on the assumption that the repo rate would follow market expectations of the repo rate, as reflected in market pricing. Sources: Statistics Sweden and the Riksbank

Larger overestimation of UNDIMPX excluding oil products

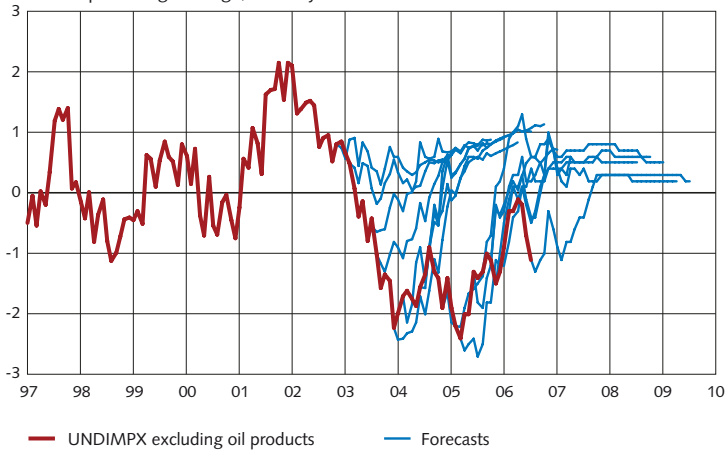
Given the picture of the forecasts for UNDIMPX given in Figure 3, it is perhaps difficult to understand the scope given to developments in import prices in the Riksbank's reports during this period.²⁷ So why were surprisingly low import prices often raised as an important factor in the Riksbank's communication during the period around the mid-2000s?

One way of illustrating why is to look more closely at the measure UNDIMPX excluding oil products. During 2003, the Riksbank changed the underlying measure of inflation on which monetary policy was based. As a result of energy prices fluctuating more than usual in winter 2002-2003, the measure was changed from the CPIX (then known as UND1X) to the CPIX excluding energy prices. For the same reason, the Riksbank also began making forecasts for UNDIMPX excluding prices of oil products.²⁸ The forecasts are shown in Figure 4 below together with the outcomes.

²⁷ See also the results in Assarsson (2007), which indicate that the forecasting error for UNDIMPX may have been of importance for the Riksbank overestimating CPIX inflation in certain years, but not over the whole period.

²⁸ Forecasts were also made of UNDINHx excluding electricity prices (which were considered to be mainly domestically generated). Forecasts of UNDIMPX and UNDINHx excluding energy prices were published regularly from 2004.

Figure 4. UNDIMPX excluding oil products, outcomes and forecasts
Annual percentage change, monthly data



Note. UNDIMPX refers to prices of mainly imported goods and services in CPIX (previously known as UND1X). The forecasts made up to the middle of 2005 were based on the assumption that the repo rate would be held constant during the forecast period. From the end of 2005 until the end of 2006, the forecasts were based on the assumption that the repo rate would follow market expectations of the repo rate, as reflected in market pricing. Sources: Statistics Sweden and the Riksbank

From the figure it is clear that the annual percentage change in UNDIMPX excluding oil products began to fall heavily in 2003 and at the beginning of 2004 it was around -2 per cent. Hence, import prices were by that time 2 per cent lower than in the same period the previous year. As the forecasts indicate, the Riksbank kept assuming that prices would relatively quickly return to more normal levels and begin rising again. But despite downward revisions to the forecasts, the increase in import prices excluding oil products continued to be surprisingly weak and it was not until the end of 2005 that prices began to show a trend towards more normal levels. However, this trend was broken in the middle of 2006 and the annual percentage change in UNDIMPX excluding oil products never rose above zero, that is, year on year prices of these goods and services fell continuously from the beginning of 2003 and onwards.

The Riksbank thus overestimated the development of import prices excluding oil over a relatively long period in the mid-2000s. But this was largely counteracted by oil price increases being unexpectedly high, which meant that the relatively large overestimation of the price increases on other import goods did not have the same impact on the UNDIMPX forecasts – the underestimation of the oil price “offset” the overestimation of the other import prices. Of course, the forecasting errors in themselves were not particularly

satisfactory and much of the Riksbank's analysis during this period was therefore aimed at the question of the surprisingly weak development in import prices.²⁹

It is debatable what significance the overestimation of other import goods had for the forecasts of inflation measured as the CPIX, which was the measure of inflation that primarily guided monetary policy in this period. At first glance, this may appear obvious. If the CPIX forecast was produced "bottom-up" via the forecasts for all sub-indexes, the forecasting error for UNDIMPX excluding oil ought to have been counteracted by the forecasting error for the oil price when all sub-indexes were totalled. The overestimation of import prices excluding oil should therefore not have had such great significance for the CPIX forecast and monetary policy.

There are arguments against this conclusion, however.³⁰ To begin with, monetary policy in 2003 and at the beginning of 2004 was expressly guided by CPIX *excluding* energy prices. With regard to the rest of the period, one can also note that the Riksbank's forecasts for import prices *including* oil, that is, UNDIMPX, actually overestimated developments 1½-2 years ahead, which was the relevant horizon for monetary policy. Monetary policy was thus determined on the basis of CPIX forecasts indicating that inflation would be higher two years ahead than what turned out to be the case. In part, this could reasonably have been due to overestimating inflationary pressures from other import prices as shown in Figure 4. So there is much to suggest that surprisingly low import prices were actually an important explanation for long-term inflationary pressures being overestimated by the Riksbank in the mid-2000s.

UNDIMPX was inadequate as a measure of inflation impulses from abroad

The basis for the reasoning in the previous section is that UNDIMPX actually reflects the development of import prices in a satisfactory manner. But right from the introduction of UNDINH and UNDIMPX, the Riksbank emphasised the inadequacies in these measures, for instance that it was not clear how the breakdown into imported and domestically-produced goods and services should be made. As the question of the development in import prices gained greater focus in the mid-2000s and became the subject of more in-depth analysis, these inadequacies were brought more and more to light. The Riksbank's conclusion was that the breakdown was too inadequate and did not sufficiently capture what was interesting here, namely distinguishing the impact of international factors on inflation in Sweden from the impact of domestic factors. At the beginning of 2007, these measures were therefore phased out of the Riksbank's communication.

29 See, for instance, the articles "The exchange rate and imported inflation" in *Inflation Report* 2004:2, "Oil prices and monetary policy" in *Inflation Report* 2004:3, "Recent developments in inflation" in *Inflation Report* 2005:1 and "Why are Swedish import prices so low?" in *Inflation Report* 2005:2. The material for assessing monetary policy published in the first reports each year during the period 2005-2007 summarises the analysis.

30 A general objection is that one should not draw too many conclusions based on the assumption that the CPIX forecast was automatically determined via the weighted sum of the forecasts for various sub-indexes. This was rather a process whereby the CPIX forecast as an aggregate and the forecasts for the various sub-indexes were produced simultaneously, that is, there was an equal element of "top-down" and "bottom-up".

Hansson and Johansson (2007) describe further details relating to the problems of the breakdown into imported and domestic inflation and the reasons why the Riksbank phased out UNDIMPX and UNDINHX. They show, for instance, that the import content in Swedish household consumption according to so-called input/output tables is less than the weight UNDIMPX had in the CPIX. UNDIMPX was thus not a good measure for analysing how much changes in import prices at the border actually influence Swedish consumer prices. Hansson and Johansson argue that it is more interesting to divide the CPIX up into price indexes for energy products, food, goods (excluding energy and food) and services. In their opinion, this kind of breakdown has several advantages, including the fact that there are similarities in pricing in the respective product groups. As there is a large import content in goods, particularly excluding energy and food, it is possible, for instance, that these prices are affected more directly by international factors than by developments in prices of services.

Given the significance that import prices had for the Riksbank's analysis ever since the inflation target was introduced, it may appear drastic to abandon the measure of prices of imported consumer goods and services without having any clear alternative. The significance of import prices for inflation in Sweden did not become less of a question after 2007. However, the need to illustrate the development in import prices in a pedagogical manner must be balanced against the deficiencies of this measure and how it may affect both analyses and communication.

One example is that the change of the UNDIMPX was often routinely termed "imported inflation" in the economic debate (which the Riksbank also contributed to sometimes), when one actually meant "change of prices of largely imported goods and services". This probably contributed to the UNDIMPX sometimes being interpreted as the part of inflation developments that monetary policy could not affect. As Hansson and Johansson point out, even if the UNDIMPX had only consisted of prices of imported goods and services, which was doubtful that it did, then this interpretation would not have been correct. Monetary policy affects the nominal exchange rate and thereby import prices at the border. Moreover, import goods are sold on the Swedish market and are therefore affected by Swedish conditions with regard to wages, distribution costs and so on and thereby also Swedish monetary policy.

One possible advantage of the Riksbank moving from UNDIMPX and UNDINHX towards a breakdown of the CPI like that advocated by Hansson and Johansson is that it may have contributed to a more nuanced discussion. In their article Hansson and Johansson show, for instance, that the development of the price index for goods excluding energy and food is very similar to the development of UNDIMPX excluding oil products, which is not so strange as they concern largely the same goods. Examining why the Riksbank overestimated the UNDIMPX excluding oil products is therefore in principle the same as examining why the prices of goods excluding energy and food was overestimated. One might think that the label shouldn't matter. But the analysis will probably be more unbiased if the starting point is that the increase in goods prices has been unusually weak rather

than that “imported inflation” has been unexpectedly low. For instance, it becomes more obvious that it is not merely factors that have affected prices at the border that can explain developments, but that domestic factors may also have affected cost pressures in the sectors that produce and distribute goods. One obvious factor is the strong productivity growth that was in focus during this period.

THE RIKSBANK’S FORECASTS OF PRODUCTIVITY

One of the main explanations that the Riksbank has previously mentioned with regard to overestimating inflation is that productivity has been unexpectedly strong. This meant that high growth in the economy was combined with surprisingly low cost pressures in companies and thus that inflationary pressures were surprisingly low. To gain an overall picture of the extent to which the Riksbank has overestimated productivity growth, an analysis of the Riksbank’s productivity assessments is provided below. The focus is on the period when the Riksbank particularly emphasised the strong productivity growth, that is, from around the end of the 1990s up to the financial crisis.

The analysis uses the forecasts for annual productivity growth, as there are no quarterly forecasts published for this prior to 2005.³¹ There is some information on the Riksbank’s assessment of future productivity growth in the reports published from the middle of 1997. The Riksbank has published quantified forecasts of productivity growth year on year since the Inflation Report 1999:4 and in the second and third reports for 1999 there are also discussions in the text that can be translated into quantified forecasts for individual years. Thus, the first forecasts in this material are those published in the Inflation Report 1999:2.

One complication is that different definitions of productivity growth have been forecast in different periods.³² In the diagrams in the following sections, the outcomes for different definitions have been matched against the corresponding forecasts. The outcomes are taken from the first published figure for each respective year, which is published when the National Accounts for the fourth quarter of a particular year are published. It is worth noting that the figure in this first release generally differed relatively substantially from the revised figures in subsequent releases. This is illustrated and discussed in greater detail in the section below.

31 Productivity refers throughout to labour productivity defined as real GDP divided by the number of hours worked or real value added at base price in the business sector divided by the number of hours worked in the business sector.

32 With effect from *Inflation Report* 1999:2 and up to and including *Inflation Report* 2002:4 the forecast for productivity growth referred to the total economy. After that, there was a changeover to forecasts for productivity growth in the business sector up to and including *Inflation Report* 2005:2. This was changed to calendar-adjusted productivity growth in the business sector with effect from *Inflation Report* 2005:3 and later to calendar-adjusted productivity growth in the total economy with effect from *Monetary Policy Report* 2007:1.

The Riksbank underestimated productivity during the first half of the 2000s

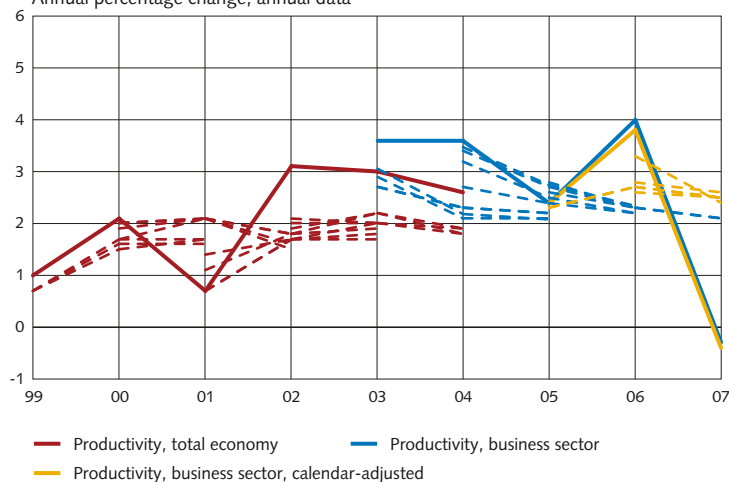
Although the Riksbank did not publish any quantified forecasts for productivity growth prior to 1999, the reports from the middle of 1997 contain descriptions of how it believed productivity would increase over the coming two years. The Riksbank noted that productivity had grown strongly and discussed in the reports how long this development was expected to last. The conclusion was that productivity growth would probably follow a cyclical pattern and gradually decline from the high level. But in the middle of 1998 and to some extent at the beginning of 1999, the Riksbank revised up its assessment of the average rate of productivity growth going forward. One justification was that the high outcomes reflected lasting improvements in productivity due to structural changes in the Swedish economy.

A picture of the Riksbank's assessment of productivity at this time is contained in the final Inflation Report of 1998. Here it was noted that productivity growth in the previous year was unusually high and the assessment was that developments in 1999-2000 would be on a par with the average productivity growth in 1990-1996, which was 1.7 per cent per year. This proved to be a good assessment, as the average in 1999-2000 according to the first outcomes was 1.6 per cent per year.³³

Figure 5 illustrates the first releases and forecasts for the different measures of productivity growth published by the Riksbank during the period 1999-2006. The unbroken lines illustrate the various outcomes. The broken lines show the forecasts at different times for the outcomes with the corresponding colours. As shown in the figure, the Riksbank in general underestimated productivity growth during the period prior to the financial crisis. The exceptions are 2001, when economic activity slowed down, which meant that productivity was weaker than expected, and 2005, when the forecast were on average close to the outcome. As expected, the largest errors generally apply to the forecasts made for developments two years ahead. But it is remarkable that the last forecast made for the current year, that is, when the figures for several of the year's quarters were known, in some cases underestimates the outcome for the whole year rather substantially. In the year 2002, for example, the underestimation is around 1 percentage point.

³³ Data revisions since then indicate, however, that the productivity statistics in real time underestimated the actual development by more than 1 percentage point.

Figure 5. Productivity, forecasts and outcomes
Annual percentage change, annual data



Note. The outcomes here are the first published figures for the respective years. The forecasts made up to the middle of 2005 were based on the assumption that the repo rate would be held constant during the forecast period. From the end of 2005 until the end of 2006, the forecasts were based on the assumption that the repo rate would follow market expectations of the repo rate, as reflected in market pricing.

Sources: Statistics Sweden, the Riksbank and own calculations

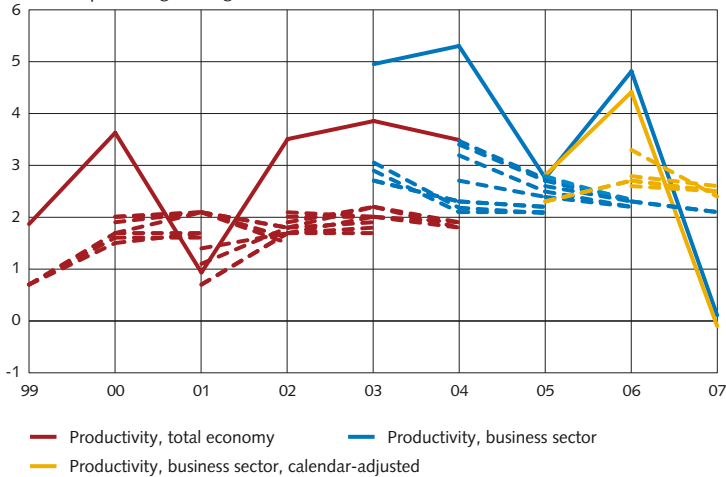
Productivity was stronger than the first figures indicated

Over a relatively long period in the early 2000s the Riksbank thus underestimated productivity growth. Productivity is an important component of unit labour costs – a measure of the companies' manufacturing costs linked to labour input. If productivity is high, less labour input is needed to manufacture a unit. When productivity increases without wages increasing correspondingly, the rate of increase in unit labour costs is lower. Stronger productivity than expected therefore probably contributed to cost developments being surprisingly weak and to inflationary pressures in the economy being overestimated.

Moreover, the first published figures for productivity growth do not provide the full picture with regard to how much inflationary pressures may have been overestimated. Unlike inflation statistics, which is rarely revised, productivity figures, which are based on National Accounts data, can be revised relatively substantially. It appears that the revisions during this period were considerable and that productivity growth was even higher than the first figures indicated. This is illustrated in Figure 6, which is identical to Figure 5 except that the outcomes now include the total revisions in the National Accounts up to the end of 2015. A comparison of Figures 5 and 6 shows that it is actually only forecasting errors for developments in 2001 and 2006 that do not change to any great extent when the forecasts are compared with the most recently published figures instead of the first published figures. For all the other years, the forecasting errors are much greater when the most recently published figures are used and developments in 2005 are now also underestimated in the forecasts.

It should be noted that Figure 6 cannot be used to evaluate the actual productivity forecasts. To evaluate them, one should try as far as possible to base the analysis on the information that was available when the forecasts were made, which does not include later revisions to the statistics. What Figure 6 illustrates is that the Riksbank's productivity forecasts may have contributed to cost pressures being overestimated in real time. But the cost pressures were even lower than the Riksbank, or for that matter any other forecaster, had reason to believe at that time.

Figure 6. Productivity, forecasts and revised outcomes
Annual percentage change, annual data



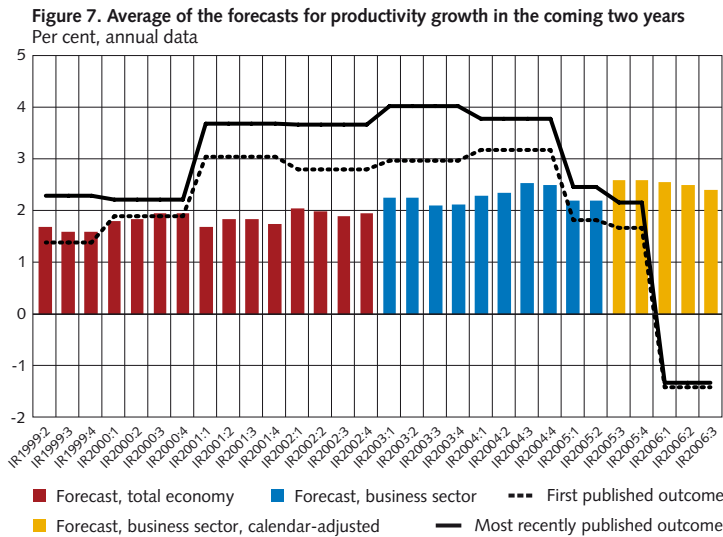
Note. The outcomes here are the revised figures for the respective years according to the most recent National Accounts. The forecasts made up to the middle of 2005 were based on the assumption that the repo rate would be held constant during the forecast period. From the end of 2005 until the end of 2006, the forecasts were based on the assumption that the repo rate would follow market expectations of the repo rate, as reflected in market pricing.

Sources: Statistics Sweden, the Riksbank and own calculations

The Riksbank's assessment of average productivity growth was gradually revised upwards

As illustrated above, the Riksbank underestimated productivity growth during the period 1999-2006. But this does not mean that productivity was missing from the analysis. As mentioned earlier, the Inflation Reports during this period on the contrary often contain discussions of productivity and to what extent the developments reflect lasting or temporary factors. The uncertainty of the assessment is often emphasised. One indication of this is that productivity was mentioned as a factor in the so-called risk outlook in almost 60 per cent of the reports between *Inflation Report 1999:2* and *Inflation Report 2006:3*. As the forecasts in Figure 5 illustrate, the Riksbank's assessment in general was that the high outcomes were largely due to temporary factors and that productivity growth would return to more normal levels. The assessment of this normal or average level changed somewhat during the period, however.

Figure 7 shows the average growth in productivity in the two coming years according to the forecasts made in the different reports. For instance, the first column shows the average of the forecasts for 2000 and 2001 (year $t+1$ and $t+2$) in the second report of 1999 (year t). Red columns apply to forecasts for productivity growth in the total economy, while blue and yellow columns apply to the corresponding figures for the business sector (where yellow is calendar-adjusted growth). As the figure shows, there was a gradual upward adjustment of the average until the end of year 2000, before it fell somewhat, probably as a result of the weaker outcomes in 2001. In 2002, the average rose again and was then adjusted upwards gradually until the end of 2004. The average forecast for productivity growth in the business sector was then around 2.5 per cent per year. As a contrast, the lines in the figure illustrate what the outcomes were, according to the first published figures and according to the most recently published statistics. Once again, it is very clear that the forecasts made up to 2005 underestimated developments.



Note. The columns illustrate the average productivity growth over the coming two years, that is year $t+1$ and $t+2$, according to the forecast published in reports year t . The broken line is the first published figures for the respective year, while the unbroken line is the outcome according to the most recent National Accounts. The forecasts made up to the middle of 2005 were based on the assumption that the repo rate would be held constant during the forecast period. From the end of 2005 until the end of 2006, the forecasts were based on the assumption that the repo rate would follow market expectations of the repo rate, as reflected in market pricing.

Sources: Statistics Sweden, the Riksbank and own calculations

Summary and concluding remarks

The purpose of this article has been to contribute to the discussion on the Riksbank's attainment of the inflation target by describing the driving forces behind inflation during the period 1995-2015. This was analysed in the first section with the aid of the Riksbank's macro model of the Swedish economy, Ramses. In the second section, the results of this analysis were compared with the Riksbank's explanations for the development of inflation as described in real time in the Riksbank's reports during the period.

Perhaps not so surprisingly, the conclusion is that different factors have driven developments to differing extents during the period. On the whole, the reports' descriptions concur well with the results of the model analysis with regard to identifying which factors are involved. However, there are some differences. The reports periodically highlight cyclical developments and the exchange rate to a greater extent than the model. This can be partly explained by the model identifying factors whose contributions to inflation were higher than historical patterns would suggest which was not necessarily what the reports reflected.

As Ramses is of necessity a simplification of the economy, the model result is sometimes open to interpretation. One example of this is developments during the second half of the 1990s, when the model identifies unusually low price mark-ups in companies as the most important factor behind the low inflation. Intuitively, this concurs relatively well with what the reports during this period called a reduced "inflation propensity", that is, a change in the relationship between cost pressures and price increases that was linked to the decline in inflation expectations and the increased confidence in economic policy following the 1990s crisis. A period with abnormally weak links between increased cost pressures and price increases could be captured in the model as unusually small price mark-ups, but it is not possible to make such a connection with any certainty.

Among the factors contributing to pushing down inflation, the low price increases on imported goods have been a recurring factor discussed in the Riksbank's reports. Periodically, it has been possible to link this to weak international economic activity and/or a strong krona. But sometimes the causes have not been as clear and the reports have also highlighted more structural explanations, such as increased global competition and changes in Swedish import patterns, where goods to a larger degree are imported from countries with lower prices. The model results generally support the picture that international developments, sometimes combined with the exchange rate, have been an important factor behind the low inflation. But it is difficult to distinguish potential structural changes from other possible explanations.

Productivity is also an important explanatory factor for the low inflation. It is also difficult to identify with any certainty the causes behind its development, and the Riksbank's reports during the period often contain discussions of these and how long the strong growth in productivity is expected to last. The model analysis also shows that productivity contributed to a large extent to pushing down inflation around the mid-2000s,

but based on this it is not possible to say whether the unusually strong TFP development was a result of earlier deregulation, increased competition, greater use of IT or some other factor included in the discussions.

The concluding part of the article analysed import prices and productivity further, examining to what extent developments in these variable surprised the Riksbank. They have previously been highlighted as two of the most important reasons for inflation being overestimated in the Riksbank's forecasts. With regard to the forecasts for import prices excluding oil products, there was a clear overestimation of how high the price increases would become around the mid-2000s. This overestimation was counterbalanced to some extent by oil price increases being underestimated. But much suggests that surprisingly low import prices were an important explanation for inflationary pressures at longer horizons being overestimated by the Riksbank. However, this conclusion is based on what has turned out to be an uncertain assumption that the measure of import prices on which the Riksbank based its forecasts actually reflected developments in import prices satisfactorily. During the 2000s, productivity growth was also much higher than the Riksbank's forecasts, which probably contributed to inflationary pressures in the economy being overestimated. Later revisions to the National Accounts also indicate that inflationary pressures were actually even lower than there was reason to believe at the time.

In conclusion, the main purpose of this article has been to provide a base that can be used to broaden a discussion that often starts out from a single figure – an average for inflation is of course significant, but it does not tell the whole story. In this context it is worth pointing out that the Riksbank's aim is to bring inflation back to 2 per cent when it deviates from the target. This should *implicitly* mean that the average inflation rate is 2 per cent. But one of the conditions necessary for this to apply is that inflation over time is pushed up and down symmetrically by unexpected factors that cause it to deviate from the target.

What can be said in this perspective about the period 1995-2015? When the inflation target was introduced, many people probably took it for granted that twenty years would be enough time for such symmetry to arise. With hindsight, this does not appear to be the case. One might of course interpret the driving forces behind inflation in different ways, but on an overall level the factors that have held inflation back have dominated during this period. To some extent, these have been factors that can be linked to traditional fluctuations in economic activity. But at least according to the Riksbank's reports these have to a great extent also been factors of a more structural nature in the sense that they have changed earlier "normal" relationships, if not permanently then at least for a long period of time. This has contributed to pushing down inflation to a surprisingly large degree.

However, this description is also open to criticism. How many years in a row is it acceptable to be surprised by strong productivity, for example? If reality changes, one must be prepared to also change the map to be able to orientate oneself. This is certainly a good point. But at the same time it is important to remember that this is a genuine difficulty for monetary policy, where the decisions are largely based on forecasts. Which changes are

temporary and which are more lasting? And, if so, how lasting? To what extent should monetary policy be adapted?³⁴

Deliberations of this type often show up in the Riksbank's reports published 1995-2015. With hindsight, it sometimes makes for frustrating reading. But if one tries to follow developments in real time, how the analysis struggles to grasp and understand the driving forces behind the changes in the economy and their potential effects, one also gains a feeling for how difficult this is in practice. It is important to remember this in the discussions of the monetary policy framework. There is nothing to indicate that the economic environment following the financial crisis would be easier to analyse and predict than the period before – compare, for instance, the current debate on “secular stagnation” or the effects of digitalisation on the economy. A necessary starting point for the discussions on the Riksbank's target attainment, possible changes to the monetary policy framework and what one wishes to achieve with them is that one has realistic expectations of what monetary policy can actually achieve.

34 According to Faust and Leeper (2015) the macro economy is best described as marked by “disparate confounding dynamics”, where inflation and other macroeconomic variables vary in ways that make it difficult to identify normal fluctuations in economic activity and to formulate appropriate monetary policy. The picture of developments in 1995-2015 painted by the Riksbank's reports fits this description well in many ways.

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