Why do we need measures of underlying inflation?

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The Riksbank's inflation target is expressed in terms of the annual rate of increase in the consumer price index (CPI). As the target is a so-called flexible inflation target the Riksbank does not always strive to achieve an inflation level of exactly 2 per cent, but the forecast for CPI inflation is normally in the range of 2 per cent seen over the course of a couple of years. But even if the target is defined in terms of the CPI, it may be interesting to analyse different measures of underlying inflation. A characteristic of these measures is that the effects of temporary price fluctuations are reduced. By studying measures of underlying inflation we can therefore get an indication of the more lasting inflation pressures. It may also be interesting to make forecasts for different measures of underlying inflation in order to illustrate how different components of the CPI develop during the forecast period. Measures of inflation that are not directly affected by the Riksbank's monetary policy are of particular interest. To date, the Riksbank has used the CPIX inflation measure for this. In the current situation, however, it is mainly as a result of increasing housing prices and an indexation of excise duties that the CPIX is expected to be below the CPI in the medium to long term. The CPIX is therefore no longer a particularly good measure. We present a better measure for this purpose in this article, the CPI with a fixed interest rate.

The Riksbank's inflation target is expressed in terms of CPI inflation

According to the Sveriges Riksbank Act, the aim of the Riksbank's monetary policy is to "maintain price stability". The Riksbank has defined this more precisely by adopting an operational target for inflation of 2 per cent, measured as the annual change in the consumer price index (CPI).

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At the same time, a specific measure of underlying inflation, the CPIX, has acquired a special status in monetary policy analysis.[2] Many observers have thus assumed that although the CPI is the official target it is actually the forecasts for the CPIX that govern the interest rate decisions of the Riksbank. Giavazzi and Mishkin (2006) argued that by using this procedure the Riksbank created an unnecessary degree of uncertainty. They recommended that the Riksbank should base its monetary policy decisions on the development of the target variable and at the same time felt that this target variable should be the CPIX.

The Riksbank has chosen to continue to define the target in terms of the rate of increase in the CPI. On the other hand, it is now the forecasts for CPI inflation that govern decisions on monetary policy.[3] According to Kuttner (2004), 17 of 21 countries have chosen to define their inflation targets in terms of as broad a measure of inflation as possible. In Iceland, South Africa, South Korea and Thailand the central banks have deliberately chosen to exclude certain prices from the inflation measure relating to the target. The fact that the Riksbank has chosen to continue to allow the inflation target to be defined in terms of the CPI is thus in line with international practice.

The Riksbank follows and regularly reports on the development of a number of different measures of underlying inflation. In this article, we explain what is meant by underlying inflation and outline what characteristics these measures should have if they are to be useful for monetary policy analysis. We also perform a statistical analysis of the forecasting capacity of the various measures of underlying inflation that the Riksbank uses. This is followed by a special review of the CPIX measure of inflation. One conclusion is that the CPIX is unsuitable as a measure for governing monetary policy when the target variable is the CPI. CPIX inflation is expected to be lower than CPI inflation for some considerable time to come for reasons that have nothing do with changes in the repo rate. The article concludes with a presentation of another measure of underlying inflation that better excludes the direct effects of the Riksbank's decisions on monetary policy.

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2 CPIX is calculated as CPI excluding mortgage interest costs and the direct effects of changes in indirect taxes and subsidies.

3 See press release no. 9, 2007, Sveriges Riksbank, and "The Riksbank's Inflation Target – The CPI, other Measures of Inflation and tha Phase – out of the CPIX", speech by Barbro Wickman-Parak 9 June, 2008.

Underlying inflation reflects the lasting inflation trends

Given that the inflation target is defined in terms of the rate of increase in the CPI, what are the reasons for examining various measures of underlying inflation such as the CPIX? Let us begin by taking a closer look at what is meant by underlying inflation and at what the various measures of underlying inflation can be used for.

If we look at the research in this field we can see that there are various reasons for the interest in measures of underlying inflation. The most common is that one wants to see what the long-run, lasting or trend inflation is (see for example Clark, 2001).[4] In the United States, for instance, price changes relating to food and energy are usually excluded for this reason.[5]

Study, for example, what happens if food prices rise permanently as the result of a increased demand on the world market. If this the only thing that happens then CPI inflation, that is, the twelve month change in the CPI, will increase at first. After twelve months, however, the higher food prices will no longer be part of the 12-month figures and CPI inflation will be back at its original level. If, at the point when food prices increase, you are interested in illustrating more long-term inflation trends then you can do one of two things. The first is to exclude price increases that you believe to be temporary from the index you are studying. In the example, this corresponds to the CPI excluding food prices. The second is to produce a forecast for CPI inflation that shows that the higher food prices disappear from the 12-month figures after twelve months.

Studying the development of a measure of underlying inflation can thus be seen as a complement to studying forecasts for CPI inflation. In both alternatives an attempt is made to filter out the "white noise" in the monthly price changes in order to get a clearer picture of the more enduring inflation trends. The "white noise" is filtered out by excluding price changes for goods for which prices fluctuate greatly. In an inflation forecast, the "white noise" can instead be reduced by looking further forward than the twelve months during which a price change affects the annual rate of change. If there are components that say nothing about the long-

[4] Another reason for studying measures of underlying inflation relates to the belief, for a variety of reasons, that changes in the CPI are not a good measure of inflation, see Bryan & Cecchetti (1994) and Bryan, Cecchetti & O'Sullivan (2002). A third reason for studying underlying measures relates to sampling theory. According to this view, the aim is to measure the same thing that the CPI tries to measure but in a more efficient way, see Bryan, Cecchetti & Wiggins II (1997). A fourth reason has to do with the fact that a central bank that aims to pursue a welfare-maximising policy should only try to stabilise sluggish prices, see Woodford (2003).

[5] Mishkin (2008), however, justifies the use of the same measure of underlying inflation by referring to Woodford's research, i.e. the fourth reason in the previous footnote.

term inflation trends then they will not influence the inflation forecast in the longer term either.

Mortgage costs have been excluded for pedagogical reasons

When we speak about underlying inflation we are usually interested in the lasting inflation trends. In the case of the Riksbank there is also a reason that relates to how the Swedish CPI is calculated. The Swedish method for calculating housing costs is directly affected by changes in mortgage costs. The Riksbank's monetary policy decisions thus affect the CPI in a counter-intuitive way. The immediate effect of increasing the repo rate with the aim of curbing inflation is, namely, that CPI inflation increases. In most other countries, housing costs are measured using methods that do not comprise mortgage costs. In the United States and Norway, for example, housing costs for owner-occupied homes are approximated with the measured market rents for similar housing. In the most important inflation measure used by the European Central Bank, HICP, housing costs for owner-occupied homes are not included at all. In the UK, the inflation target is also expressed in terms of the HICP. In Australia, housing costs are measured using the so-called net acquisition method. This means that the price of new houses is included in the CPI with a weight that corresponds to the expenditure for new houses. The Riksbank's decision to highlight the CPIX is thus linked to the fact that housing costs for owner-occupied homes are measured in a special way in Sweden.

Nessén & Söderström (2001) analyse underlying inflation in a model in which the CPI is measured in a way similar to the approach used in Sweden. A decision by the central bank to increase the policy rate drives up mortgage costs and thus also pushes up the CPI initially. Nessén & Söderström find that it may sometimes be optimal to react to a measure of underlying inflation that is not directly affected by mortgage costs even though the inflation target is defined in terms of the rate of increase in the CPI.

Let us reflect a little on what these results mean. In the model, the target is defined in terms of the rate of increase in the CPI and a measure of the stability of the real economy in line with the idea of flexible inflation targeting. It is therefore always optimal to stabilise the *forecast* for CPI inflation around the inflation target. The forecast for CPI inflation is determined by the model's structure and parameters, and by the shocks that have occurred. Some shocks only affect CPI inflation temporarily, that is, they do not affect the more long-term forecast for CPI inflation. If we describe monetary policy in terms of a reaction function, that is, that

monetary policy *reacts* to different outcomes, monetary policy should only react to those factors that determine future CPI inflation. However, these factors are not necessarily the same as the CPI outcomes. We can thus describe the optimal policy in two different ways that essentially entail the same thing. The central bank should stabilise the *forecasts* for CPI inflation around the target, that is, *react* to the measure of underlying inflation that determines future CPI inflation.

Another interesting result in the analysis conducted by Nessén & Söderström (2001) is how the counter-intuitive effect on mortgage costs affects monetary policy. Despite the fact that the direct effect on inflation "goes in the wrong direction" via the mortgage costs, a central bank should still stabilise the forecasts for CPI inflation. If CPI inflation is high, the central bank should not, however, increase the repo rate quite as much as if mortgage costs had no impact, as the "wrong direction" effect would then drive up CPI inflation further. Similarly, when CPI inflation is low, the central bank should not reduce the policy rate so much because this would push down CPI inflation further. The consequence of the fact that mortgage costs push inflation in the wrong direction is thus that the optimal monetary-policy response will be slightly weaker than otherwise, which means that the process of bringing inflation back to the target will take a little longer.

Different measures of underlying inflation provide a relatively similar picture

The Riksbank follows and regularly reports on the development of a number of different measures of underlying inflation in the Monetary Policy Report. These measures vary in character. In some of them, for example, price changes for certain predetermined components that are judged to be more short-term and temporary in nature are excluded from CPI inflation. The CPIX, the CPIX excluding energy and the CPIX excluding food and energy are examples of such measures of underlying inflation. Others are designed so that they use statistical methods to systematically exclude or reduce the significance of product groups with volatile prices. MEDIAN, TRIM85 and UND24 are examples of such measures of underlying inflation.

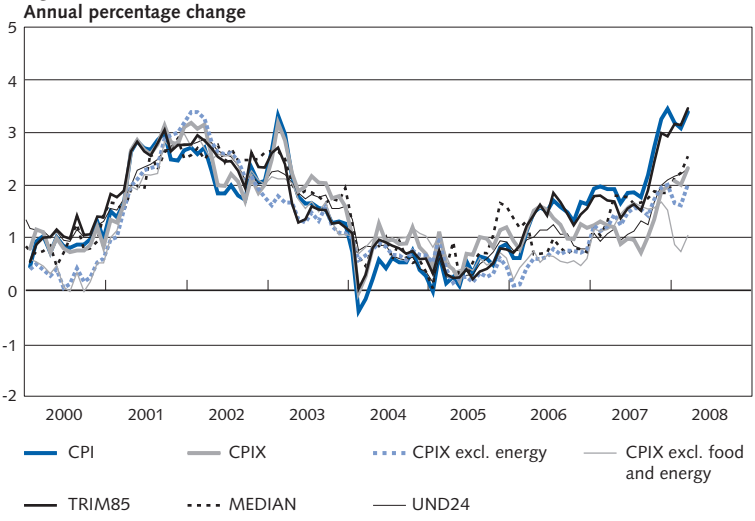
The measured price changes form the starting point in MEDIAN and TRIM85. These are ranked from the price that has fallen most (risen least) to the price that has increased most (fallen least). Simplifying somewhat, we can then view MEDIAN as the median price change, that is, the price change in the middle of the range, in this ranking. TRIM85 is calculated, once again somewhat simplified, by first excluding the 7.5 per cent of

prices that have fallen most and the 7.5 per cent that have risen most. The average price change in the remaining 85 per cent is then calculated.[6] MEDIAN and TRIM85 are thus both similar and yet different to measures such as the CPIX. The similarity lies in the fact that certain price changes are excluded every month. The difference is that in the CPIX the same goods and services are excluded every month, while in MEDIAN and TRIM85 different goods and services may be excluded from the index from one month to the next.

UND24 is calculated in a slightly different way. For each product included in the CPI, the variance in the difference in the rate of change between the respective components and the total CPI for the last 24 months is calculated. The price changes for the various products are weighed together to provide UND24 by using weights based on this variance. The more stable the price of a certain product has been, the greater the weight for this product when UND24 is calculated, and vice versa. This procedure means that a price change for a product or service with a price that has fluctuated greatly over the previous 24 months has little impact on UND24.

In Figure 1, we can see how the various measures of underlying inflation have developed since 2000. Over the period as a whole, the rate of increase for the underlying measures is somewhat more stable than

Figure 1. Various inflation measures
Annual percentage change



Source: Statistics Sweden and the Riksbank.

[6] In practice, the weights are also used when calculating MEDIAN and TRIM85. After the products have been ranked from the lowest to the highest price changes, those products with 7.5 per cent of the total weight sum that have the highest and lowest price changes respectively are excluded when calculating TRIM85. In MEDIAN, the products with 50 per cent of the total weight sum that have highest and lowest price changes respectively are excluded.

the rate of increase for the CPI. One possible interpretation of this is that the underlying measures have to a certain extent filtered out the "white noise". The various measures provide a relatively similar picture of inflation trends, even though there may be significant differences in the case of single years. One example is late 2007, when CPI inflation rose significantly, whereas according to all the underlying measures except TRIM85 inflation increased only moderately. According to most of the measures of underlying inflation, therefore, a large part of the recent increase in CPI inflation is not permanent.

Underlying inflation should have the same average as CPI inflation

According to Roger (1998), an important property of a measure of underlying inflation is that it should be unbiased, that is, the measure should have a mean that in the long term corresponds to the mean of the target variable. This is in practice a considerable problem as most types of statistical processing of the CPI risk changing the mean. This problem is particularly serious when the measure of underlying inflation is used as a rudder for monetary policy even though the target is expressed in terms of the CPI. Forecasts for the underlying measure cannot then be compared directly to the inflation target.

All of the measures of underlying inflation described above have on average increased more rapidly than the CPI since 1995 (see Table 1). This applies particularly to the CPIX. The CPI has on average increased by 1.2 per cent since 1995, while the average increase for the CPIX has been 1.5 per cent. In the period since 2000, the differences have been smaller, which demonstrates that the relation between the measures vary over time. As all of these measures of underlying inflation change the weighting of the components in the CPI, the expected value in the medium term will not be the same as for the CPI if relative price adjustments between the products are expected to occur. For example, the volatile goods prices rise on average more slowly than the stable services prices as a result of higher productivity growth in those sectors that produce goods.

Table 1. Average annual rate of increase in various measures of inflation (per cent).

	CPI	CPIX	CPIX excl. energy	CPIX excl. food and energy	TRIM85	UND24	MEDIAN
1985–	3.2	3.0	3.0	3.3	3.2	2.9	3.2
1990–	2.5	2.4	2.3	2.6	2.4	2.1	2.4
1995–	1.2	1.5	1.4	1.5	1.3	1.3	1.4
2000–	1.5	1.5	1.2	1.3	1.6	1.4	1.5

Sources: Statistics Sweden and own calculations.

Underlying inflation can be used as an indicator of future CPI inflation

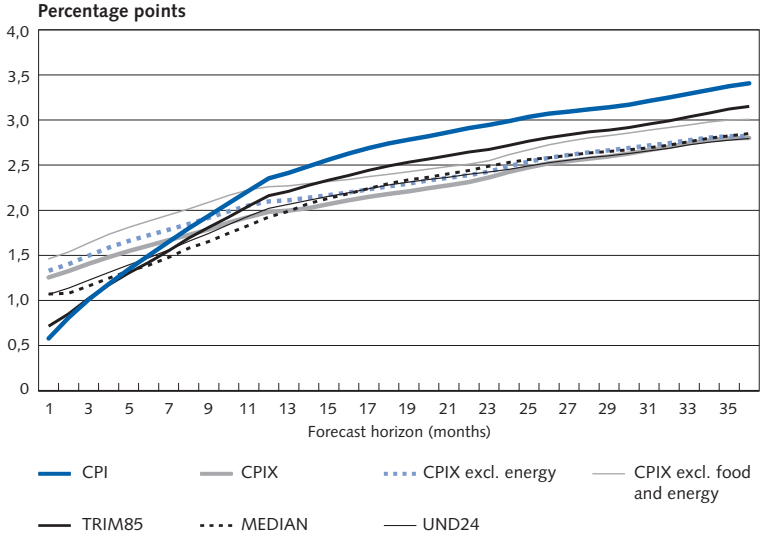
As the various measures of underlying inflation do not necessarily have the same mean as CPI inflation there are problems associated with using them as monetary policy rudders. They may, however, still be of interest as indicators of future inflationary pressures, see for example Wynne (1999). How good then are the latest outcomes of a measure of underlying inflation as a forecast of future CPI inflation? In order to study this, the Root Mean Square Error (RMSE) between the respective measures of underlying inflation and the inflation measured by the CPI over a forward period of 1 to 36 months is compared using the formula:

$$RMSE = \sqrt{\frac{1}{T}\sum_{t}(\Pi_{t+h}^{CPI} - \Pi_{t}^{core})^2},$$

where Π_t^{core} is the underlying inflation in month t, Π_{t+h}^{CPI} is the rate of inflation according to the CPI h months ahead, where h=1 to 36. Monthly data for the period January 1984 to March 2008 has been used, so that T=290 to 255. All inflation measures are expressed in terms of annual percentage change. The results are shown in Figure 2.

We can see in the figure that the CPI has an RMSE of approximately 0.5 percentage points over the course of one month. This means that if we make a "naïve" forecast, that is assume that CPI inflation in a months

Figure 2. RMSE for forecasts of the annual rate of change in the CPI for various forecast horizons from 1984 to 2008
Percentage points



Source: The Riksbank.

time will be the same as the current outcome for CPI inflation, then the RMSE will be 0.5 percentage points over the course of one month. Similarly, if we assume that in 36 months time the CPI will be the same as the latest CPI outcome then the RMSE will be 3.5 percentage points in 36 months time. If instead we allow the current outcome for UND24 inflation to act as a forecast of future CPI inflation we will get an RMSE of approximately 1 percentage point over the course of a month and of slightly less than 3 percentage points in 36 months time.

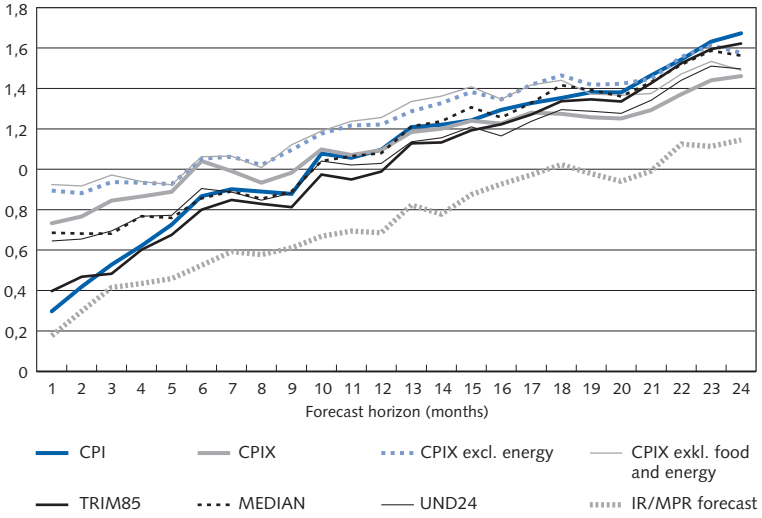
A low RMSE indicates a good forecasting capacity. As can be seen in Figure 2, UND24, MEDIAN, the CPIX, and the CPIX excluding energy are those measures of underlying inflation that have the best forecasting capacity for CPI inflation in the slightly longer term. Today's CPI is worst at predicting future CPI inflation for forecast horizons longer than 12 months. These results indicate that measures of underlying inflation are useful as indicators of more lasting inflation pressures.

However, none of the measures provide better forecasts than the CPI forecasts published by the Riksbank. In Figure 3, the RMSE for the CPI forecasts for various horizons published by the Riksbank from the fourth inflation report in 1998 to the first monetary policy report in 2008 is compared to the RMSE for the various measures for the same months and same forecast horizons. The Riksbank's forecasts are better for all forecast horizons. We could therefore say that the Riksbank's forecasts of CPI inflation represent the best measure of underlying inflation pressures in the economy as they are better at predicting future inflation than any of the other measures of underlying inflation. The advantage of the measures of underlying inflation compared to the Riksbank's forecasts is, however, that they become immediately available when new outcomes are published and that they are not affected by judgments.

Calculating mortgage costs for owner – occupied homes in the CPI

As mentioned above, mortgage costs for owner – occupied homes in the CPI are directly affected when the Riksbank changes interest rates. We would therefore like to show how these costs are calculated and what the effects can be. The mortgage costs in the CPI are affected by the development of house prices and market interest rates. This is a rather complicated process in that certain factors have a rapid impact on mortgage costs while others take a long time. The basic idea behind the Swedish calculation method is to attempt to calculate the mortgage costs that homeowners would have had if they had borrowed a sum equivalent to

Figure 3. RMSE for forecasts of the annual rate of change in the CPI for various forecast horizons from the Fourth Inflation Report 1998 to the First Monetary Policy Report 2008
Percentage points



Source: The Riksbank.

the total purchase price for the property concerned. The index for mortgage costs is calculated as:

Mortgage cost index = Interest rate index × Capital stock index

To produce an index for mortgage costs, Statistics Sweden thus calculates two indexes, one for the average interest rate for all outstanding mortgages (the interest rate index) and one for how the purchase price of the housing stock that the loans finance is developing (the capital stock index). The mortgage cost index is thus affected by the development of interest rates and by the development of purchase prices for the houses in the housing stock.

The interest rate index measures the development of the average interest rate for last mortgage loans in banks, variable-rate loans in mortgage institutions and fixed-rate loans in mortgage institutions with fixed-rate terms of 1, 2, 3, 5 and 8 years.[7] The rates for the fixed loans are included in the calculations as a moving average for the relevant fixed-rate term. For example, a change in the 5-year fixed interest rate is

[7] Loans with fixed-rate terms of 1, 3 and 8 years were introduced into the CPI in 2004. Last mortgage loans in banks, variable-rate mortgages and loans with fixed-rates of 2 and 5 years were already included. Loans with a fixed-term of 8 years have a small weight in the interest rate index (approximately 3 per cent). Loans with a fixed term of 5 years have a weight of 19.5 per cent. Loans with fixed terms of 1, 2 and 3 years have weights of 1.5, 14.2, and 9.7 per cent respectively.

included as a moving average over the last 60 months. This is because a loan with a term of five years is renewed on average every fifth year.

The interest rate index is then calculated as a weighted average of the interest rates included where the weights reflect the actual loan structure of the households. As just over half of all mortgages are made up of last mortgage loans in banks together with variable-rate mortgages, variable-rate loans have a weight of just over 50 per cent in the interest rate index. This means that any changes in the short-term rates have a relatively direct impact on the interest rate index. At the same time, the remaining interest rates are calculated as a moving average over time, which means that changes in these rates only gradually affect the interest rate index.

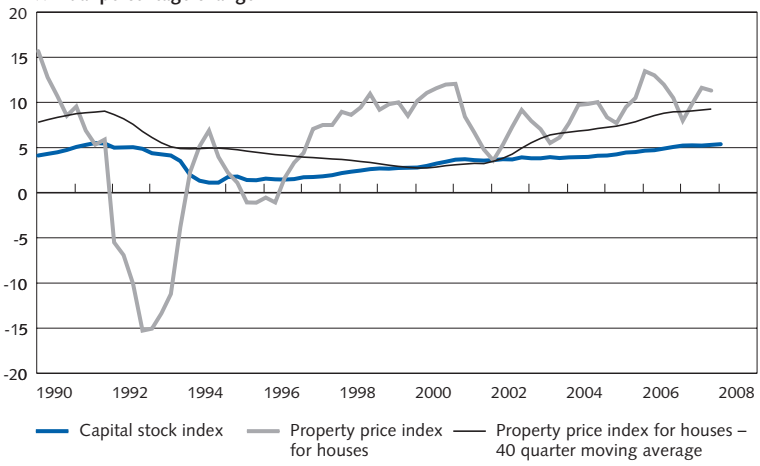
The capital stock index measures the average purchase price for the housing stock financed by mortgages. Statistics Sweden attempts to estimate the change that takes place when houses change owners or new houses are constructed.[8] The difference between the capital stock index and the property price index is that in the latter the price change has a direct impact on the entire housing stock directly, while the effect on the capital stock index occurs when the house concerned changes owner. The result of this calculation method is that there is a considerable time lag before changes in house prices affect the capital stock index.

If we assume that no new construction takes place and that house prices on one single occasion increase by 30 per cent and thereafter remain stable at the new level, and that all properties change owner every 20th year, then the value of the housing stock, and thus the average purchase price, will be adjusted upwards by 1.5 per cent (30 per cent $\times$ 1/20) per year for a period of 20 years. This calculation method means that rising property prices will only affect the capital stock index to the extent that properties change owners, which is a gradual process. Rising property prices thus have a relatively small direct effect on the capital stock index, although the effect is also protracted.

The capital stock has grown at an increasingly rapid rate since the mid-1990s (see Figure 4). The figure also clearly shows that the capital stock index moves sluggishly in relation to property prices.

[8] The rate of price increases for new houses is calculated using the Construction Price Index for new houses.

Figure 4. The capital stock index in the CPI and the property price for houses
Annual percentage change



Sources: Statistics Sweden and own calculations.

The CPIX is expected to increase at a slower rate than the CPI because house prices have risen dramatically

Since 1995, the CPIX has on average increased more rapidly than the CPI, which is mainly due to the Riksbank's interest rate cuts in the late 1990s. Between 1995 and 1999, the repo rate was cut from approximately 9 per cent to around 3 per cent. Interest rates with a fixed term of 5 years also fell by approximately 6 percentage points.[9] The generally lower interest rates reduced CPI inflation but not CPIX inflation. There is now reason to believe, however, that for some considerable time to come the CPIX will instead increase at a slower rate than the CPI even if there is no significant change in the general level of interest rates. This is explained by the way mortgage costs are calculated in the CPI.

Given how the mortgage costs are calculated, the capital stock index will continue to increase relatively quickly over the next few years almost irrespective of what happens with property prices in the near future. When houses that were bought 15 to 20 years ago are sold the average purchase price will increase rapidly as prices are much higher now than when the houses were bought.

In April 2008, the mortgage cost index in the CPI increased by over 21 per cent expressed as an annual rate. As the weight of the mortgage cost index constitutes approximately 4.5 per cent of the CPI, the mortgage cost index contributed approximately 1 percentage point to

[9] See the box "The Riksbank's monetary policy – target and indicators" in Inflation Report 2003:3.

the annual rate of increase in the CPI of 3.4 per cent. This contribution mainly stems from the increase in interest rates but also from the increase in the value of the property stock. If the value of the property stock had remained constant during the period, the contribution would have been approximately 0.2 percentage points lower.

The change in the capital stock index has of course influenced the Riksbank's forecast for the CPI. In the Monetary Policy Update of April 2008, the Riksbank assumed that the capital stock index will increase by an average of approximately 7 per cent per year in the period 2008-2011. This is a somewhat higher rate of change than for the previous year (see Figure 4). This was the most important reason why the CPIX was expected to increase more slowly than the CPI towards the end of the forecast period, as when the CPIX is calculated the entire mortgage cost index is excluded from the change in the CPI. Towards the end of the forecast period the annual rate of increase of CPIX amounts to 1.9 per cent while the CPI increases by 2.2 per cent; a difference of approximately 0.3 percentage points. The average interest rates increase by approximately 1.5 per cent on an annual basis, while the total mortgage cost index increases by almost 9 per cent as a result of the increase in the value of the houses in the capital stock. Despite the fact that mortgage interest rates themselves will increase relatively slowly, the total mortgage cost index will increase fairly quickly due to the increase in the average purchase price for houses in the housing stock.

Tax adjustment is another reason why the CPIX is expected to increase more slowly than the CPI

When calculating CPIX inflation, not only mortgage interest costs but also the direct effects of changes in indirect taxes and product subsidies are excluded from CPI inflation. The CPIX is thus also a constant tax index that attempts to measure what inflation would have been if the indirect taxes had remained unchanged during the measurement period. When the tax adjustment is made, however, at least three complications arise in practice. The first is due to the assumption that all the direct effects of changes in indirect taxes affect consumer prices immediately. The calculation of the CPIX is initially based on the actual prices included in the CPI. The entire effect of the tax increase is then excluded from these actual prices. In practice, however, there is reason to believe that the actual price will not increase by the full amount of the tax increase immediately. This means that too much is excluded from the CPI when calculating the CPIX. The assumption that changes in taxation are immediately passed through to consumer prices means, paradoxically; that the CPIX may fall

when taxes are increased and vice versa, even though no other prices are changed.

The second complication relates to which taxes are taken into account in the adjustment. In this case an adjustment is made for changes in indirect taxes and subsidies, that is, taxes on and subsidies for products, but the prices of consumer goods are also affected by other taxes. When the government, for example, wanted to stimulate demand in certain service sectors, a reduction of VAT or of employers' contributions was discussed. When calculating the CPIX, however, only the effect of a reduction in VAT will be excluded. However, the likely effect on prices of these two alternative ways of stimulating service sectors will probably be the same in the long term. There are other problems relating, for example, to how changes in the property tax are taken into account. The fact that the choice of fiscal policy measure influences the impact on the CPIX means that the decision on which measures should be excluded is arbitrary to a certain degree.

The third complication relates to the indexation of excise duties. For example, taxes on energy, alcohol and tobacco are stipulated in terms of kronor/kWh, kronor/l and kronor/gr respectively. If all prices rise by 2 per cent per year, then the percentage of consumer prices represented by excise duties will decrease over time. In Sweden, therefore, certain excise duties are indexed as a means of maintaining the duty's percentage of the price. The regulations stipulate, for example, that the excise duty on petrol should be indexed with the annual rate of increase in the CPI in June of the previous year. In recent years, however, the duty on petrol has been increased above this level as an element of the so-called environmental tax shift. Other excise duties are also normally indexed with some measure of price trends. However, every increase in excise duties is excluded from CPI inflation when the CPIX is calculated. This means that even in the long term there are tax changes that lead to differences between CPI inflation and CPIX inflation. The overall effect of the indexation of excise duties is estimated to be approximately 0.1 percentage points.

In the longer term, (approximately 3-5 years) when it is assumed that changed interest rates will not affect the mortgage cost component, the assessment at the moment is therefore that CPIX inflation will be approximately 0.3 percentage points lower than CPI inflation: 0.2 percentage points from the mortgage cost component and 0.1 percentage points from the indexation of excise duties. This is the Riksbank's forecast and it is as usual uncertain.[10]

[10] The same assessment was made by the National Institute of Economic Research in a box published in the report The Swedish Economy in Januari 2008.

The expectation that the CPIX will be lower than the CPI is mainly due to the fact that the value of the housing stock has increased over a long period of time and is expected to go on increasing in the future, but is also partly due to the indexation of excise duties. When the Riksbank introduced the CPIX measure, the main purpose was to provide a measure of inflation that was not directly affected by the monetary policy conducted and the direct effects of temporary fiscal policy measures. In the current situation, however, it is mainly other factors, the protracted effects of increasing property prices and the regulations governing excise duties, that lead to the expectation that the CPIX will be lower than the CPI. The CPIX is therefore not a particularly good measure if we want to have a measure of underlying inflation that is not affected by the monetary policy conducted.

A new measure of underlying inflation that better adjusts for the effects of the monetary policy conducted

The Swedish method for calculating housing costs entails certain pedagogical challenges. When the Riksbank raises the repo rate, as we pointed out above, this also increases the CPI initially. It may therefore be a good idea to also present measures of underlying inflation that exclude the effects of changes in the repo rate. However, as also mentioned above, the CPIX is not a particularly good alternative as it excludes more than just the changes in the repo rate. The CPI with a fixed interest rate is probably a better measure.[11] In this measure, only the interest rate index is held constant, which means that changes in the capital stock index have an impact on the mortage cost index and thus affect the CPI with a fixed interest rate.[12]

Keeping all interest rates constant in this way should lead to the CPI with a fixed interest rate having the same long-term mean as the CPI. In the current monetary policy regime it is a reasonable assumption that the nominal interest rate does not have a trend. Even if the repo rate is constant, the effective mortgage rate paid by households may vary some-

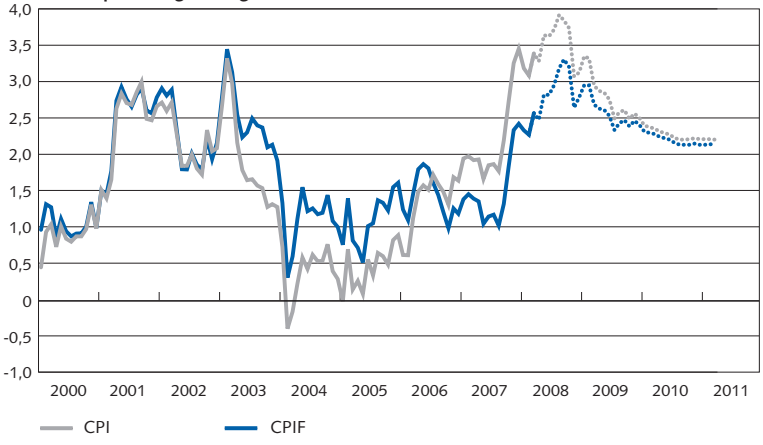
[11] A similar discussion was conducted in the enquiry on a review of the consumer price index (SOU 1999:124)

[12] In the CPI with a fixed interest rate as well, too much is actually excluded from CPI inflation. Ideally, only the effect of changes in the repo rate should be excluded. Short-term interest rates, which constitute over 50 per cent of the interest rate index, are affected relatively directly by changes in the repo rate. Short-term interest rates may also be affected by other factors, however, such as changes in bank margins. In the wake of the recent turmoil on the financial markets, for example, the difference between the repo rate and variable mortgage rates has increased. Mortgage rates with longer terms are also included in the index. These are largely affected by factors other than the Riksbank's decisions on the repo rate even though changes in the repo rate normally also affect interest rates with longer terms. It is, however, not possible in practice to calculate a measure that only excludes the direct effects of changes in the repo rate.

what over time as a result of increasing competition on the mortgage market or changes in risk and term premiums or mortgage terms. This should not, however, entail any major changes in the average interest rate over the course of a few years. It is possible that there may be long-term trends in the real interest rates, but these should also be limited. The Riksbank's forecasts for mortgage rates with different terms are based on the average observed difference over the last few years between the repo rate and variable-rate mortgages being unchanged, and on interest rates for fixed-rate mortgages developing in line with the expectations hypothesis.[13]

Figure 5 presents outcomes and forecasts for the CPI and the CPI with a fixed interest rate. In April 2008, the rate of increase in the CPI with a fixed interest rate was 0.8 percentage points lower than the rate of increase in the CPI as the increase in interest rates over the last 12 months affects the CPI but not the CPI with a fixed interest rate. The delayed effects of rising interest rates will also push up CPI inflation over the next few years, but towards the end of the forecast period the CPI will increase at approximately the same rate as the CPI with a fixed interest rate according to the forecast made in the Monetary Policy Update of April 2008. In this case there is no obvious added value to be gained from publishing forecasts for the CPI with a fixed interest rate, although outcomes may be important for illustrating the fact that it is reasonable to assume that a large element of the currently high inflation is temporary (as the

Figure 5. The CPI and the CPI with a fixed interest rate, outcomes and forecasts from the Monetary Policy Update in April 2008
Annual percentage change



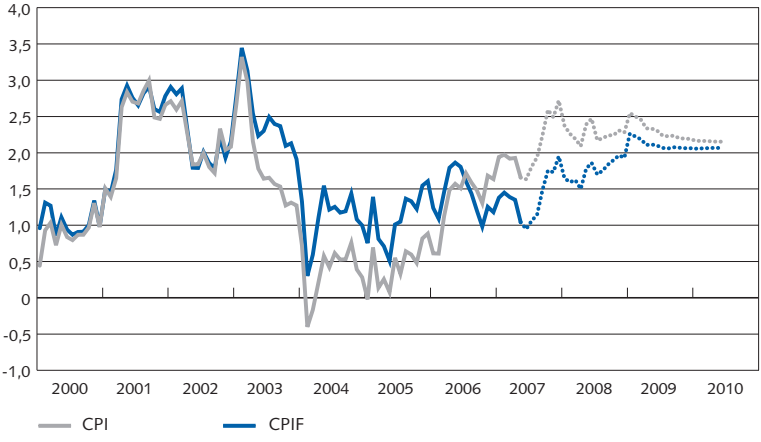
Note. CPIF refers to CPI with a fixed interest rate.
Sources: Statistics Sweden and the Riksbank.

[13] The expectations hypothesis determines the slope of the yield curve as long-term interest rates are determined on the basis of expectations concerning the future level of short-term interest rates.

repo rate is expected to remain more or less unchanged in the Riksbank's latest forecast).

If the repo rate is expected to change significantly during the forecast period, however, the forecast for the CPI with a fixed interest rate will also be of interest in the long term as the mortgage costs of the households will affect CPI inflation throughout the forecast period. A relevant example is from June 2007 (Monetary Policy Report 2007:2) when the repo rate was expected to rise from 3.25 per cent to 4.4 per cent by the second quarter of 2010. In the Riksbank's forecast from this report for mortgage rates with different terms, the forecast for the CPI with a fixed interest rate deviates from the forecast for the CPI two to three years ahead as well, see Figure 6.[14] In this situation it may be instructive to also present the forecast for the CPI with a fixed interest rate as this makes it clear that the only reason that CPI inflation exceeds 2 per cent in 3 years is the delayed effect of interest rate increases. If we look even further ahead this effect will disappear.

Figure 6. The CPI and CPI with a fixed interest rate, outcomes and forecasts from the Monetary Policy report 2007:2 (annual percentage change)
Annual percentage change



Note: CPIF = the CPI with a Fixed interest rate.
Sources: Statistics Sweden and the Riksbank.

The CPIX has served its purpose in monetary policy communication

The special status that the CPIX has had in the monetary policy analyses of the Riksbank is mainly linked to the simple rule for monetary policy

[14] The Riksbank does not publish forecasts for mortgage rates but in this calculation the expectations hypothesis and the average difference between mortgage rates and government bond rates has been used. The result is consistent with the published forecast for the 10-year interest rate for government bonds.

that was launched in Inflation Report 1997:4 and confirmed in the clarification of 1999.[15] This rule stated that if the forecast for inflation, given an unchanged repo rate, deviated from the inflation target two years ahead then there were grounds for considering a change in the interest rate.

This simple policy rule focused on the forecasted level of inflation exactly two years ahead. In the period in which the simple policy rule was launched the Riksbank had significantly reduced the policy rate, which meant that mortgage costs pushed down CPI inflation for a substantial period of time. The cuts in interest rates also affected the forecast for CPI inflation two years ahead, which was the most important horizon according to the simple policy rule. This was an important reason for excluding mortgage costs from the index (the CPIX) on which the monetary policy decisions were based.

However, the Riksbank has altered its working methods somewhat in recent years. The forecast horizon has been extended from two to three years and forecasts for the future repo rate are also published now. In the choice between different forecasts for the repo rate, the entire path forecast for CPI inflation and the development of the real economy now play a part. The alterations made mean that the simple policy rule is no longer applicable. Furthermore, there is no research that supports the idea that a central bank should base its monetary policy on stabilising *the forecasts* for anything other than its target variable. If the target is defined in terms of a certain inflation measure, the policy should be based on the forecasts for this particular measure.

In the light of the changes made it is therefore natural that the CPIX no longer has any special status among the underlying measures of inflation. The Riksbank will continue to monitor the measure, but its main area of use will be as one of many indicators of future CPI inflation. When there is a need to illustrate what degree of current inflation is due to the interest rate changes made by the Riksbank itself, the CPI with a fixed interest rate is a better alternative than the CPIX. This does not mean, however, that the CPI with a fixed interest rate will play the same role in monetary policy communication as the CPIX previously did. The optimal policy is the policy that stabilises the forecast for CPI inflation around the target and there is no single measure of underlying inflation that works in all situations and that always excludes exactly those factors that have no lasting effects on CPI inflation.

[15] See Heikensten (1999).

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