

Price index for the inflation target

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1. Background

Ever since the Riksbank started inflation targeting in 1993, the inflation target has been expressed in terms of the consumer price index, CPI. The CPI was selected not only because it is a broad price index that represents ordinary purchases, but also because the CPI statistics are of good quality and are published shortly after the end of the month. Furthermore, they are not usually revised retroactively. Another important argument was that CPI is well known among the Swedish public.

However, using CPI as a target variable has posed some difficulties, not least recently. The reason is the way household mortgage rates are included in the owner-occupied housing expenses item in CPI. When, for example, the Riksbank cuts the repo rate to bring inflation up, mortgage rates will decline and thereby also CPI. This direct effect on CPI goes in the “wrong direction”; in other words, the repo rate cut leads to a further drop in inflation in the short run. Chart 1 illustrates the strong relation between the repo rate and CPI inflation. This characteristic of the monetary policy target variable is quite unique to Sweden. In most other countries, the target variable is not affected in the same way by changes to policy rates.²

Chart 1. The repo rate and CPI inflation



Sources: Statistics Sweden and the Riksbank

Because CPI inflation bears this characteristic, the Riksbank has regularly allowed price indexes other than CPI to guide interest rate decisions; recently mainly CPIF (CPI with a fixed interest rate). CPIF inflation has served as an intermediate target

1. Helpful comments and suggestions on earlier drafts by Riksbank staff are gratefully acknowledged.

2. In principle CPI is calculated more or less in the same way in for example Canada, but in practice interest rate changes there have much less of an impact on CPI, see Palmqvist (2013). In Australia and New Zealand too, interest rate changes used to have a substantial direct impact on CPI, but in both countries the calculation method for CPI was modified at the end of the 1990s in a way that eliminated such effects.

Since the inflation target was introduced in 1993, the Riksbank has used the annual change in the consumer price index (CPI) as the target variable. However, CPI has disadvantages as a target variable because changes to the policy rate directly affect CPI, in the “wrong direction”; in the short run raising the policy rate leads to higher inflation and a lower rate leads to lower inflation. This presents difficulties in the communication of monetary policy, makes international comparisons of inflation developments more difficult, complicates evaluations of objective fulfilment, and risks reducing confidence in the inflation target. The problems are not new, but they have increased in the past few years as the repo rate has varied a great deal around a low level. Out of existing main indexes, CPIF and HICP are natural alternatives to CPI as target variables. In terms of outcome, CPIF and HICP are quite similar. CPIF is probably better known in Sweden than HICP, while international comparability might speak in favour of HICP. This commentary discusses the choice of inflation target variable for monetary policy in Sweden.

variable and the Riksbank has usually aimed for a CPIF-inflation close to 2 per cent within around two years. The idea is that, because interest rates sometimes rise and sometimes fall, the differences between inflation according to CPI and CPIF will even out over time.

However, in the past few years, the deviations between CPI and CPIF have been substantial, both upwards and downwards. The period of rate cuts that commenced in December 2011 has, for example, pushed CPI inflation a great deal below CPIF inflation, and close to zero for three years. Conversely, CPI inflation will be pushed up and overshoot the target as the repo rate approaches more historically normal levels ahead. With large interest-rate cycles, an extremely low rate of increase in CPI inflation thus tends to be followed by an unusually high rate of increase, and such periods can be quite protracted.

Large and protracted differences between CPI and CPIF inflation cause quite a few problems. Perhaps the most serious one is that participants in the economy might start to question whether the Riksbank is actually stabilising CPI inflation around the target by stabilising CPIF inflation around 2 per cent. This could lead to decreasing confidence in the inflation target, and long-term inflation expectations starting to drift away.

Another problem is that both domestic and foreign commentators relatively seldom take account of the fact that Swedish CPI is calculated in the way it is when describing the situation in Sweden. This can, for example, lead to misleading international comparisons. For example, in the past few years, media reports have emerged from time to time describing how Sweden is in a state of deflation, despite the fact that the low CPI inflation partly is due to the Riksbank having lowered the repo rate. This may give the impression that the situation in Sweden is worse and inflation is much lower than in other countries, despite the main difference being that Swedish CPI is more sensitive to changes in the policy rate.

A third problem is that evaluations of monetary policy are more difficult if there are substantial differences between the development of the variable that guides the Riksbank, CPIF, and the formal target variable, CPI.

In light of this, it is reasonable to discuss the choice of target variable for monetary policy.

The discussion in this commentary is of a principle and general nature. There are certain more practical aspects that might be of relevance to the choice of target index that are not discussed. It is, for example, not evident how the fact that many financial contracts and the price base amount are linked to CPI should be weighed into a decision regarding the target variable.

This commentary also includes an Appendix 1 which describes different inflation measures and briefly discusses the term inflation.³

Another matter that is not analysed in this commentary, but which is discussed in Appendix 2, is how owner-occupied housing expenses should be treated in the target index. It could be argued that they should be included in the index, given that the target shall refer to a broad inflation measure that is relevant to households and wage-earners, and that housing costs make up a large proportion of the budget of households (around 25 per cent according to the CPI weights). At the same time, owner-occupied housing expenses are genuinely difficult to measure. For decades, statistics authorities have struggled with the question of what the most suitable method is. There are obvious problems for monetary policy by the way owner-occupied housing expenses are currently included in Swedish CPI, but other approaches also have limitations.

3. See also Jansson (2015).

2. Traditional view – stabilising a broad index and anchoring inflation expectations

The purpose of inflation targeting is to create stable conditions in the economy, and reduce uncertainty. This will make it easier for households and corporations to make well-founded economic decisions. In more concrete terms, inflation targeting shall anchor long-term inflation expectations among consumers and wage-earners.

Inflation targets for monetary policy are very common. Nowadays, almost all central banks in the West have inflation targets. The main reason for introducing inflation targets has been the very desire to attain low and stable inflation and anchor long-term inflation expectations: the desire to provide the economy with a “nominal anchor”.

A nominal anchor is important because it is otherwise easy to end up in a price and wage spiral where policymakers find themselves obliged to conduct a policy that fulfils high inflation expectations – a self-perpetuating process. Although such a spiral does not last infinitely, inflation often systematically ends up at an undesirable high level. The development in Sweden in the decades preceding the introduction of the inflation target in 1993 is an example of this. The economy was then stuck in a devaluation cycle, in which recurring cost crises due to excessive wage increases were “addressed” by writing down the value of the SEK.

When the inflation targets were introduced, the primary problem was that inflation expectations were too high. However, it is equally important to prevent expectations from starting to drift downwards. A period of deflation can also have negative implications for the real economy.

What does this say about the choice of target index? If the inflation target is to constitute a nominal anchor, it should refer to a price index that is known and relevant to those who set wages and prices. If the central bank stabilises a price index that is not perceived as relevant, inflation expectations might start to deviate from target, even if the anchor remains in place. This suggests that the central bank should stabilise a broad and well-known index, such as CPI.

Thus, it has been argued that monetary policy shall be focused on broad indexes.⁴ There is also an older discussion indicating that asset prices should be included in the index.⁵

3. New view – stabilising sticky prices

In the past few decades, a new monetary policy theory has emerged, the “New Keynesian theory”, with a partially different view of which target variable that is appropriate. In this theory, macroeconomic relationships are built up from microeconomic theory about the behaviour of households and corporations. Economic models based on this theory are considered well-suited for monetary policy analysis, and are widely used today by various central banks.⁶

New Keynesian theory is characterised by nominal prices and wages being sticky in the short term. In the more traditional view described above, it was also assumed that prices and wages were sticky, but the new element is that the stickiness is explicitly modelled.

When prices and wages are sticky, it takes time for prices to adapt to shocks and changing economic circumstances. Prices will therefore deviate from their optimal level, which leads to inefficient resource allocation. This creates a role for monetary policy besides anchoring inflation expectations. By stabilising an appropriate measure of inflation, undesirable price adjustments are avoided, while desirable price adjustments are accelerated.

4. See also Wynne (2008).

5. See and Goodhart (2001).

6. For more information about New Keynesian theory and models, see Gali (2015) and Woodford (2003).

According to New Keynesian theory, monetary policy shall stabilise a price index in which prices are weighted according to their degree of stickiness: the stickier the price, the greater the weight. Hence, flexible prices will be allowed to adapt “freely”, while monetary policy can concentrate on the sticky prices that create inefficiency. The theory also indicates that other asymmetries can be of importance to the optimal inflation index. For example, a highly cyclical sector shall have a greater weight than a less cyclical sector.⁷

However, devising a theoretically optimal index is difficult in practice. To our knowledge there are no attempts to devise such an index for Sweden.⁸ If the Riksbank’s inflation target were to refer to an optimal index, the index must first be developed, then produced and updated by a party external to the Riksbank, suitably Statistics Sweden.

Another point is that the theoretically optimal index perhaps does not capture the inflation as it is perceived by, for example, consumers and wage-earners. In the theoretical models, participants in the economy can simply compute what stabilisation of the optimal index means to the evolution of the prices that are relevant to them. This is a fairly strong assumption and in reality it might be difficult for the general public to see the link between a stable optimal index and the prices that they perceive to be relevant. The inflation expectations of consumers and wage-earners can thus become more volatile and less anchored with an optimal index than with a well-known general index.

It can also be difficult to explain how an optimal index fits into the Riksbank’s mandate. According to the Riksbank’s mandate, the Riksbank shall maintain price stability. Stabilising the theoretically optimal index probably means other broader inflation indexes become more volatile, which can be problematic.

4. Arguments for stabilising “underlying inflation”

According to the traditional view, as presented above, the central bank shall stabilise the rate of increase in a broad price index, while the New Keynesian theory advocates stabilising a narrower index. But arguments are also expressed in favour of stabilising an index that disregards temporary price fluctuations or changes in prices that cannot be influenced by monetary policy, such as import prices and prices that are strongly weather-dependent.

4.1. “Monetary policy shall disregard temporary price movements”

The usual arguments for letting the target refer to “underlying inflation” or the inflation trend is the desire to focus on a general trending price rise, and disregard temporary price increases.⁹ If monetary policy reacts to temporary price fluctuations, this could give unnecessary volatility in interest rates and the real economy. However, this does not necessarily mean that the central bank’s target variable should be an inflation measure that only measures the inflation trend.

Monetary policy works with a lag and cannot influence current inflation. It must therefore be forward-looking and based on forecasts for inflation and other variables. When monetary policy is forward-looking, it automatically disregards *current* temporary price fluctuations. It only reacts to any long-term effects of temporary price changes. Thus, it does not matter if the central bank focuses on stabilising a broad inflation measure or measures that exclude temporary price fluctuations. The forecasts for all of these measures will be similar in the longer run. For example, an increase in the oil price today will give a temporary increase in the rate of inflation for 12 months ahead (12 months because inflation is measured as

7. See e.g. Mankiw and Reis (2003).

8. Two of the Riksbank’s measures of underlying inflation, UND24 and persistence-weighted measures, could be interpreted as a form of optimal index even though they are rather devised to distinguish a general, trending price increase from a temporary one, see Appendix 1. To our knowledge Atlanta Fed’s “Sticky-Price CPI” for the US is the only optimal index that is regularly updated and published, see <https://www.frbatlanta.org/research/inflationproject/stickyprice/>. Eusepi et al. (2011) also devise an optimal index for the US and find that there are welfare gains in stabilising the index compared with other indexes for underlying inflation.

9. See e.g. Bryan and Cecchetti (1993), Mishkin (2007a) and Blinder (2007).

12-month changes). But that, in itself, will not affect monetary policy if it focuses on inflation in the longer run. This is the reason why central banks mainly use measures that are stripped of temporary price changes for describing outcomes, not for guiding monetary policy.¹⁰ But rising oil prices can also have more long-term effects if they lead producers of goods and services to increase their prices as a result of the rise in the oil price. These more long-term effects of oil price increases will affect the forecasts for both headline inflation and inflation according to measures that exclude temporary price changes, and can therefore affect forward-looking monetary policy.

It is a different situation if monetary policy is not forward-looking, but based on current inflation, for example through a rule in which monetary policy today is set as a function of inflation today (through, for example, a “Taylor rule”). In that case, it might be better to focus on a measure stripped of temporary price fluctuations.¹¹

However, temporary price changes may also occur in *the future*. If they are unexpected, forward-looking monetary policy automatically disregards these. But they can also be expected. Assume, for example, that it is known that in a year’s time, VAT or taxes will increase and directly increase inflation for a certain but limited period of time. In that case, there would be an expected temporary price increase. The central bank can counteract the consequential temporary increase in the broad index by conducting tighter monetary policy. However, the VAT increase reasonably also has implications for the economy, since it could also curb aggregate demand and production. That could have more lasting effects on inflation and should perhaps even be countered with more expansionary monetary policy. Attempts to stabilise a broad price index might, in that case, yield monetary policy that is too tight. On a stand-alone basis, the possibility of expected price increases in the future might therefore suggest that the target should refer to a price index that excludes temporary price fluctuations.

However, with flexible inflation targeting, in which the horizon for when the inflation target shall be reached is allowed to vary, there will be less of a problem concerning expected future price increases like in the example above. In that case, the central bank can let the inflation forecast overshoot the target in the periods in which the VAT or tax increase is expected to have direct effects on inflation, and instead focus on offsetting long-term effects of the temporary price increase.

Rationale similar to that in the example above regarding a VAT or tax hike could be expressed for other one-off changes too, such as an increase in energy prices as a result of a rise in the oil price. The rationale will, of course, be entirely parallel for VAT cuts and one-off changes that drive down inflation for a limited period.

It might be difficult to devise an index that excludes all temporary price changes robustly. Usually, such indexes, for example CPIFXE and Und24 (see Appendix 1), are devised by excluding prices that have previously exhibited great volatility. This method presents two potential problems. First, temporary index movements can be perceived as lasting: if the index rises due to a temporary increase in a historically stable price, the index will rise, even though the price movement is temporary. Second, lasting index movements can be perceived as temporary: if a price that has historically exhibited temporary price movements now starts move more permanently, the index will not capture this because the price is not included in the index or it has a low weight in the index. These measures are therefore not used mechanically. Rather, as described above, the Riksbank uses the forecast for broad inflation measures to manage temporary movements.

An alternative to indexes where certain goods and services are permanently excluded are “trimmed” inflation measures. Here, CPI is “trimmed” by excluding the prices that have

10. See e.g. Nessén and Söderström (2001) for a formal analysis.

11. Bryan and Cecchetti (1993), Mishkin (2007b) and Eusepi et al. (2011).

changed the most since the last date(s) of observation. Such measures, for example Trim85 (see Appendix 1), can also be exposed to the problems described above; temporary price changes can be perceived as enduring, and enduring price changes can be perceived as temporary.

In the same way as communication is difficult if the target refers to a theoretically optimal index, it can also be difficult if the target refers to an index that is stripped of non-enduring price changes. It can be complicated to explain what the underlying index measures, and why it is the relevant target variable. Similarly, it can be difficult to explain how an inflation target defined in terms of an underlying index fits into the Riksbank's mandate. Expectations about inflation as it is perceived by consumers and wage-earners can be more volatile, and this can lead to a weaker anchoring of inflation expectations.

4.2. “Monetary policy shall disregard prices it cannot influence”

The global market price for petrol, diesel, food and several other products included in CPI are not affected by Swedish monetary policy. The same largely applies to the price of electricity and some other goods and services that are strongly weather-dependent. Does that mean that the price index that monetary policy attempts to stabilise should exclude such prices?¹²

The question on which we mainly focus here is whether monetary policy should concentrate on stabilising domestic inflation, and not a broader measure that also contains prices of imported goods and services.

Here, there are no simple answers. Different effects and different arguments pull in different directions.¹³ This is also reflected in the research-based literature, where the answer depends on the analytical methods employed and the assumptions made.¹⁴

In practice, it has also proven difficult to distinguish between domestic and imported inflation, and hence also to devise an index for domestic inflation. One problem is that certain goods are produced domestically in some periods of the year, and imported in others. Another problem is that all goods and services, irrespective of the degree of imported content, are sold on the Swedish market and are hence affected by Swedish salaries, transport costs, etc. A large part of the final consumer price might be determined by circumstances other than the import price of the product. In addition, the prices of many domestic products are set on the global market, despite them being produced in Sweden; i.e. also domestically produced goods are determined by factors abroad.

The Riksbank used to analyse sub-indexes for primarily domestically produced products (UNDINHX) and in mainly imported goods (UNDIMPX). However, the production of these series was terminated in 2007 as problems relating to the domestic/imported breakdown became increasingly evident.¹⁵

An alternative measure of domestic inflation is the GDP deflator. The deflator measures prices of all domestically produced goods and services. A problem is that the deflator is only produced on a quarterly basis and it is also revised a lot retroactively. Also, export prices are included in the GDP deflator.

12. Alan Blinder (1997) writes the following, for example: “As a central banker, I always preferred to view the inflation rate with its food and energy components removed as our [basic goal](#). But not because these components are extremely volatile. (...) The real reason was that the prices of food (really, food at home) and energy are, for the most part, beyond the control of the central bank. The Fed cannot do much about food and energy prices – except, of course, to cause a recession deep enough to ensure that increases in these prices do not lead to overall inflation.” (p. 160; the underscoring is our own.)

13. See e.g. Svensson (2005).

14. For example, Galí and Monacelli (2005) and Benigno and Benigno (2006) assume that the exchange rate reacts endogenously to shocks and corrects for “errors” in the relative price between domestic production and imports. Hence, the central bank shall stabilise domestic inflation. However, the conclusion depends on the exchange rate reacting in such a way that exchange rate fluctuations take full effect on import prices in domestic currency, and that salaries are fully flexible (Campolmi, 2014). See also Adolfson (2007) and also Bean (2006).

15. See Hansson and Johansson (2007).

5. Three broad price indexes: CPI, CPIF and HICP

If the target is to refer to a broad price index, to which index should it then refer? In Sweden, there are three natural alternatives out of existing indexes: CPI, CPIF and HICP. See Appendix 1 and Johansson (2015) for a broader description of these three indexes. In this section, we describe arguments for and against each of them.

5.1. CPI is broad and well-known, but has disadvantages

Ever since the inflation target was introduced in 1993, CPI has been the target index. CPI is a broad price index that represents ordinary purchases and is well-known to the general public. This was also the most important argument for the Riksbank specifying its inflation target in terms of CPI (Sveriges Riksbank, 2010, p. 10).

CPI is intended to show the average increases in prices for the goods and services consumed by households. The theoretical starting point for CPI is the cost-of-living concept. In brief, that means that CPI shall specify the relationship between the monetary amounts required to maintain, in two price situations, the same consumption standard or the same utility level.¹⁶ This involves comparing two situations in which not just prices, but also consumption composition vary. An implication of this is that the index can change even if all prices are unchanged, because the index weights change each year. The effect of weight changes on inflation is often negative because consumers tend to consume less of the goods and services that have become relatively more expensive and which are thus given a lower weight, and more of the goods and services that have become relatively cheaper and which are thus given a greater weight. The size of the effect varies from year to year. It is commonly between -0.1 and -0.2 percentage points annually, but has been around zero in the past three years.

However, as described above there are disadvantages in having CPI as a target variable, primarily because the mortgage rates of households are included very directly in the owner-occupied housing expenses item in CPI. Consequently, repo rate changes have a direct effect on CPI which goes in the “wrong direction”. This direct effect of changes to the policy rate on CPI has also strengthened in the past few years. This is partly because the interest rate has changed a lot and over a long period of time, and partly because the impact on CPI from a change in mortgage rates is greater the lower the interest rate level. If, for example, the mortgage rate declines by 1 percentage point from 2 to 1 per cent, it has a greater effect on the index than if it declines from 5 to 4 per cent. The reason is that it is the percentage change in the mortgage rates that matters for CPI. In the first example, the mortgage rate has declined by 50 per cent while it has declined by 20 per cent in the second example.

There are many problems linked to the repo rate’s substantial direct impact on CPI. One problem that was discussed a great deal when inflation targeting was new was that monetary policy might end up “chasing its tail”.¹⁷ If CPI inflation is above the target, the interest rate is hiked, which leads inflation to rise, and the interest rate to be hiked further, and so on. A related concern is that the Riksbank would not overlook but rather exploit the direct effect of the interest rate on CPI and act opportunistically. If, for example, the CPI inflation forecast is above the target, the interest rate could be cut to such an extent that CPI inflation, through the direct effect on CPI, hits the target. However, the Riksbank communicated at an early stage that CPI is directly affected by interest rate changes and that monetary policy would not “chase its tail”.¹⁸ Therefore, for a long time, measures that exclude this effect have been used to guide monetary policy.¹⁹

16. In CPI, the consumption basket that forms the basis for the calculations is updated at the turn of each year in order for price changes to be based on a consumption composition that is as accurate as possible. The basis for calculating the weights is mainly obtained from the national accounts. Because of the way in which updating is performed, the index level can be adjusted at the turn of years.

17. See Heikensten (1999).

18. See e.g. Bäckström (1998).

19. See e.g. Hansson, Johansson and Palmqvist (2008).

However, the direct impact of interest rate changes on CPI gives rise to other, more relevant problems. One is that evaluations of monetary policy are more difficult to do. Traditionally, the Riksbank has argued that on average CPIF inflation will coincide with CPI inflation. This is correct if nominal interest rates do not move up and down much, and cut and hike phases are relatively short. But this is not always the case. For the last couple of decades, nominal interest rates have trended downwards. The consequence of using CPIF inflation (or similar measures) as the intermediary target has thus been that CPI inflation, on average, has been below CPIF inflation by a relatively wide margin.

Since the financial crisis, the deviations between CPI and CPIF have been particularly substantial – both upwards and downwards. It cannot be ruled out that they will remain substantial for a relatively long time to come. The reason is that interest rates today are very low, and rates will probably rise very slowly over a long period of time before they are stabilised. Hence, CPI inflation will probably overshoot CPIF inflation for many years.

With large, enduring differences between the development of the variable that guides the Riksbank, CPIF, and the formal target variable, CPI, evaluations of monetary policy will be complex.

The Riksbank also faces major communication challenges. The fact that the Riksbank does not publish forecasts that stabilise CPI inflation at the target, but rather forecasts CPI to be quite far off from 2 per cent, can lead to misunderstandings about the Riksbank's ambitions. Ultimately, confidence in the Riksbank actually trying to get CPI inflation to reach 2 per cent might be put to the test, and inflation expectations might start to diverge from the target and become more volatile.

A problem related to the difficulties in evaluating monetary policy is that international comparisons become more difficult and risk giving a misleading picture. The fact that the target is formulated in terms of CPI, while monetary policy in practice focuses on stabilising CPIF has, for example, led to media reports emerging from time to time in recent years describing how Sweden is in a state of deflation. When CPI inflation is negative, this is of course correct in the purely technical sense, but often it does not surface that this is largely a result of the Riksbank having cut the interest rate, and that CPIF inflation is much higher.

CPI's sensitivity to interest rates also means that the target variable in Sweden tends to vary more than the target variables of other countries. Because of this, in an international comparison it can appear as if the Riksbank is not as successful as other central banks in stabilising inflation, despite the main reason being that Swedish CPI is calculated as it is.

5.2. CPIF is broad, relevant and less problematic

Because CPI inflation is directly affected by changes in the policy rate, the Riksbank has, as stated above, regularly allowed inflation indexes other than CPI to guide monetary policy decisions, most recently mainly CPIF.²⁰ Unlike CPI, CPIF is not directly affected by changes in mortgage rates.

The only difference between CPI and CPIF is that the interest rate index in CPI is kept constant in CPIF (see box 1). CPIF is therefore, in the same way as CPI, a broad index that represents ordinary purchases. The index is probably also well-known, particularly since the Riksbank's communication has increasingly focused on CPIF.²¹ It can also be argued that CPIF

20. An alternative measure that the Riksbank used to use is CPIX, in which the entire capital stock index and the effect of indirect taxes and subsidies are removed from CPI. However, this index will not be produced after 2015.

21. While the Riksbank, in earlier press releases, has spoken of "inflation" without further specification, the more recent press releases have explicitly referred to CPIF inflation. For example, in the press release from September 2015, it says: "The expansionary monetary policy (...) supports the continued positive development in the Swedish economy such that CPIF inflation is expected to be close to 2 per cent in 2016."

represents the cost of “ordinary purchases” better than CPI. This is because CPIF is affected less by changes to the interest rate than CPI.²²

A potential problem with both CPIF and CPI is that house prices are included as moving averages of historical price changes. Since house prices have been rising for a long time, CPIF (and CPI) will rise for many years to come, even if house prices and all other prices remain unchanged. Hence, CPIF will, in some sense, overestimate the rate of inflation. The overestimation will amount to around 0.3 percentage points annually in the next five years. Hence, other prices must increase by less than 2 per cent if the Riksbank is to reach its target (measured using CPIF). The effect will be that monetary policy might be tighter than it should be.

It is also worth noting that for CPIF too, there is, to some extent, a direct effect from interest rate changes. Even if the interest rate index is kept constant in CPIF, and CPIF is thus “stripped” of the direct effects of changes to the policy rate, the weight of the interest expense index is changed when consumers’ expenses for interest payments change (see box 1). In the current situation where rising interest rates are expected ahead, the weight of the interest expense index will also increase. This weight is also changed in CPIF. Hence, changes to the policy rate will have some direct effects on CPIF too.

As the bulk of changes in owner-occupied housing expenses related to mortgage rate changes are not included in CPIF, the CPIF might be seen as a much narrower index than CPI. Whether such changes should be included in a price index, and how they should be included in the target index, is an important question that is discussed separately in Appendix 2.

In conclusion, it is worth mentioning that CPIF has been explicitly developed to function as a complement to CPI. Introducing CPIF as the target variable without relation to CPI in the longer term could be problematic.

5.3. HICP is a broad price index without interest rates and house prices

An alternative measure of consumer price inflation is the (EU) harmonised index of consumer prices – the HICP. The HICP is published for all EU countries plus Iceland, Norway, Switzerland and the US, as well as for the EU and for the euro area as a whole.

HICP counts as a “pure” price index, which explicitly distances itself from the cost-of-living approach that forms the basis of CPI. Hence, the rate of change in the HICP is not affected by shifts in the consumer pattern in the same way that CPI is.

HICP is a broad index and represents ordinary purchases. The consumption basket in HICP contains 85-90 per cent of the consumption basket in CPI. In comparison with CPI, interest expenses for owner-occupied housing, housing expenses for tenant-owner homes, property tax, depreciation, house insurance and lotteries are not included. In HICP, however, elderly care, hospital care and some financial services are included, while they are not included in CPI.

Whether or not HICP is well-known is difficult to say. The index may be less well-known than CPI among the general public in Sweden, but relatively well-known in the financial sector and among labour market parties. Even if HICP were less known in Sweden, this would probably be a weak argument against the index as target variable. The index is numerically comparable to CPIF and it is used in many European countries. If HICP were to become a target variable for monetary policy in Sweden, it would probably quickly become a well-known measure here too.

HICP shows the price changes in cases where households choose to retain the base period quantitative composition of consumption, despite relative prices having changed. The

22. In the strictly economic sense, the total housing expenses of home owners includes the amounts from which home owners refrain in interest on equity. However, even if there is a change to these amounts, the household can continue to refrain from the alternative return and continue to consume to the same extent as before. Also, there is a large amount of consumers and wage-earners who are not home owners. For more on this discussion, see for example SOU (1999) and the Konjunkturinstitutet (2002).

calculation of HICP is thus not affected to the same extent as CPI by shifts in the consumer pattern between different years. In the past, this has led to HICP inflation being between 0.1 and 0.2 percentage points higher than CPIF inflation on average annually. In the past two years, however, this effect has been zero.

Currently, owner-occupied housing expenses, except for running operating expenses, are omitted from HICP. Therefore, neither interest rates nor house prices are included in HICP. However, development work is currently in progress in this area, see Appendix 2.

An advantage of HICP is that it makes international comparisons of inflation rates easier. Against this, it can be argued that HICP already exists and that a comparison of HICP inflation in different countries can be made, even if the Riksbank's inflation target refers to another variable. However, as we pointed out above, in practice comparisons are made using the target index in the countries concerned. This suggests that an index should be chosen that is used by countries with which the Riksbank is often compared – HICP, for example. However, we can note that CPIF and HICP are very similar in terms of numbers over time, see Appendix 1.

Box 1. Interest rates and house prices in CPI

CPI includes a sub-index for interest expenses for owner-occupied housing (the mortgage cost index). This sub-index now makes up around 4 per cent of CPI and is affected partly by mortgage rates and partly by the house price inflation, according to the following simplified formula.

Mortgage cost index = Interest rate index × Capital stock index

The interest rate index in CPI aims to measure the development of the mortgage rate for a selection of loans with different fixation periods for a selection of banks and mortgage institutions. The selection is based on financial market statistics and covers fixation periods of 3 months and 1, 2, 3, 5 and 8 years.

The mortgage rates are weighted depending on the rate type's share of total mortgage expenses in the year prior to the index year. The weight of, for example, the floating rate is therefore affected both by the floating rate, and the share of household loans that carry the floating rate. The weight for floating rates has risen recently, and floating rates in 2015 make up around 50 per cent of the interest rate index.

The relationship between a change in mortgage rates and a change in the interest rate index also depends on the level of the mortgage rates. A change in the mortgage rates has a greater effect the lower the level of the interest rate. If, for example, the mortgage rate increases by 1 percentage point from 2 to 3 per cent, this has a greater effect on the index than if it increases from 4 to 5 per cent because the percentage increase is larger in the first case.

The capital stock index measures the purchase price of properties. The capital stock index can be fairly well approximated to a 25-year moving average of the house price index. When property prices have increased much over a long period of time, this will, through the effects on the capital stock index, be a factor in pushing up the mortgage cost index and hence so too CPI and CPIF, even if the interest rate index is kept constant in CPIF. The very long moving average also means that rapid increases in house prices today have a very limited impact on measured inflation.

6. Conclusions

The purpose of inflation targeting is to create stable conditions in the economy, and reduce uncertainty. That makes it easier for households and corporations to make well-founded economic decisions. In concrete terms, inflation targeting shall anchor the long-term inflation expectations of consumers and wage-earners. This suggests that the inflation target should refer to a relevant, broad and well-known index.

Other arguments and more recent monetary policy theory may suggest that the inflation target should refer to a narrower index. However, such indexes can be difficult to devise. They can also be difficult to communicate because they do not necessarily fully capture the inflation that is relevant to consumers and wage-earners.

The Riksbank's approach today is to allow the target to refer to a broad index (CPI), but at the same time, when each decision is made, to follow a strategy in which all available information is used, including measures of underlying inflation, to guide the monetary policy

decision. Monetary policy is flexible, so the horizon for when inflation is expected to reach the inflation target may vary over time. Similar approaches are used by other countries with inflation targets, and all inflation-targeting countries now allow the target to refer to a broad index. There are several countries which, to start with, expressed the target in terms of an index for underlying inflation, but which have now switched to a main measure of inflation as the target index.²³

However, CPI has disadvantages as a target variable because changes to the policy rate directly affect CPI, which goes in the “wrong direction”. This presents difficulties in the communication of monetary policy, makes international comparisons of the development of inflation more difficult, complicates evaluations of objective fulfilment, and risks reducing confidence in the inflation target.

The broad existing main indexes CPIF and HICP are the most natural alternatives to CPI as a target variable. The biggest difference between them is that house prices are not included at all in HICP. However, they are close to each other in terms of outcome. An advantage of CPIF is that it might be better known in Sweden than HICP, while international comparability might speak in favour of HICP.

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23. For example New Zealand, Australia and the UK.

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Appendix 1. Inflation measures

1. Inflation is about rising prices

Not all price increases are inflation. Price increases for one particular product can be the result of increased demand or falling supply for the product. But, it could also be part of a general upturn in prices. In order to speak of inflation, there must be an increase in the general price level, i.e. practically all prices in the economy must rise. Relative price changes are not inflation.

A distinction is usually made between one-off increases of the general price level, and inflation. If, for example, the government increases VAT, prices will rise. If this is all that occurs, the general price level rises from one level to another and then stays where it is. The increase to the VAT rate thus gives rise to a one-off increase in the general price level. Strictly speaking, this increase should not be called inflation.

There are different measures of inflation. The most common and best known measure is the change in the consumer price index, CPI. CPI is intended to show the average development of prices for the goods and services consumed by households. As already mentioned, mortgage rates are included in CPI, which causes some difficulties. The Riksbank therefore focuses on the change in CPIF – CPI with a fixed interest rate. Another relatively well-known measure is the harmonised index of consumer prices, HICP. It attempts to measure more or less the same thing as CPI, while at the same time attempting to use similar (harmonised) methods in the various countries of the EU area. These indexes are explained in further detail in section 2 of this appendix.

Inflation means that the general price level rises. CPI, CPIF and HICP aggregate price increases of individual goods and services. Hence, major price increases for individual commodities, such as oil, could lead CPI to rise. Furthermore, there are one-off changes in the general price level that are not actually inflation, cf. the discussion above regarding VAT increases. In order to remedy this problem, it is common to exclude a number of price changes from CPI. These stripped-down measures are often called measures of underlying inflation, the inflation trend or core inflation. Section 3 of this appendix describes some measures of underlying inflation in Sweden.

2. Main index for inflation

Charts 1-2 and Table 2 compare the historical development and statistical characteristics of CPI, CPIF and HICP.

CPI

CPI is intended to show the average development of prices for the goods and services consumed by households. Each month, Statistics Sweden collects prices from thousands of points of sale. Price indexes for different consumption goods and services are then calculated and weighed together with weights based on a consumption composition that is as up-to-date as possible.

One important aim of CPI is that it shall be used for compensation purposes. For example, it is used to calculate the size of the price base amount, which affects the basic income tax allowance, among other things.

The theoretical starting point for CPI is the cost-of-living concept. In brief, the cost-of-living index theory can be described as CPI specifying “the relationship between the monetary amounts required to maintain, in two price situations, the same consumption

standard, or the same level of utility”.²⁴ This involves comparing two situations where not just prices, but also consumption composition, vary. One implication is that the index can change even if all prices are unchanged.

The effect of the changes to weights on inflation is often negative because consumers tend to consume less of the goods and services that have become relatively more expensive, and which might thus be given a lower weight, and more of the goods and services that have become relatively cheaper, and which might thus be given a greater weight. The size of the effect varies from year to year. It is commonly between -0.1 and -0.2 percentage points, but has been zero in the past three years (see Table 1).

Table 1. CPI – contribution from weight changes

	2008	2009	2010	2011	2012	2013	2014	2015
Contribution	-0.2	-0.2	-0.2	-0.1	-0.3	0.0	0.0	0.0

Source: Johansson (2015)

CPI includes a subindex for mortgage expenses for owner-occupied housing. This index makes up around 4 per cent of CPI and its purpose is to measure the capital cost of households living in privately owned homes. The index is affected by changing mortgage rates, and also by changes to the value of the properties in accordance with the simplified formula below.

$$\text{Mortgage cost index} = \text{Capital stock index} \times \text{Interest rate index}$$

- *The capital stock index* measures the purchase price of properties. The capital stock index can be fairly well approximated by a 25-year moving average of the house price index. When house prices have risen a great deal and/or over a long period of time, this will, through the effects on the capital stock index, be a factor in pushing up the interest expense index and hence also CPI during a number of subsequent years.
- *The interest rate index* measures the development of the average interest rate for mortgages with the floating rate and mortgages with fixation periods of one, two, three, five and eight years. There is a strong link between the Riksbank’s repo rate and floating mortgage rates. When the repo rate changes, this therefore has a direct impact on CPI, through the effects on the interest rate index. An increase to the repo rate hence leads, in the short term, to rising CPI inflation, despite the purpose of the hike being to curb inflationary pressure in the economy.

CPIF

In order to adjust CPI inflation for the direct effects of changed mortgage rates, Statistics Sweden publishes, on behalf of the Riksbank, the CPIF measure. In CPIF the interest rate index is held constant, while changes to the capital stock have the same effect on CPIF as on CPI. In the long term, when the interest rate has stabilised, the rate of increase to CPI and CPIF will therefore be the same.

HICP

HICP (harmonised index of consumer prices) is an index for European inflation comparisons. The index is defined by EU regulations and the calculations are made according to (broad)

24. In CPI, the basket of consumption at the basis of the calculations is updated at the turn of each year in order for price changes to be based on a consumption composition that is as accurate as possible. The source material used for calculating the weights for the goods and services included is mainly obtained from the national accounts. Because of the way in which updating is performed, the index level can be adjusted at the turn of years.

harmonised rules for e.g. coverage, consideration for new products, updating product selection, adjustments for quality changes and index formulae for the calculations. HICP is in place for all EU countries plus Iceland, Norway, Switzerland and the US, as well as for the EU and for the euro area as a whole.

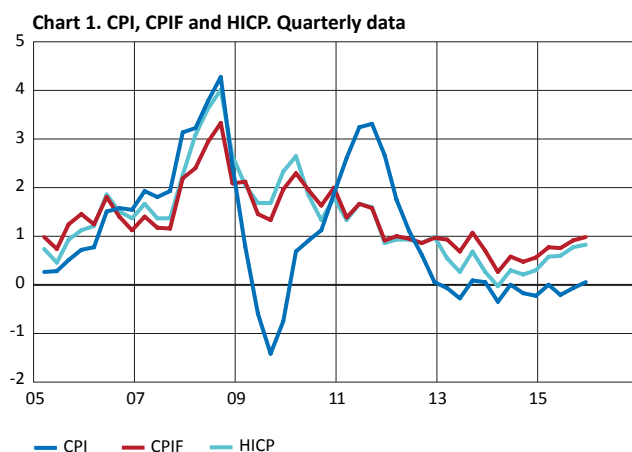
HICP was developed by the European Union in 1997 in order to determine which member states fulfilled the convergence criteria for admission into the EMU. HICP is now used as a target variable in the monetary policy of the ECB and the Bank of England.²⁵

HICP is an index devised specifically for stabilisation purposes. A fundamental principle that has provided guidance with the construction of HICP is that the measure shall measure the average price development of current transactions. Historical, calculated or imputed prices therefore lack relevance in this context. It is therefore common to refer to the fact that HICP takes as its starting point a “clean” price index that explicitly distances itself from the cost-of-living approach.

HICP is a Laspeyres-type chain index and therefore gives a tendency to systematically overestimate increases in the cost of living. The index shows the change in the cost of living in cases where households choose to retain the quantitative composition of consumption of the base period, despite relative prices having changed. The calculation of HICP is thus not affected to the same extent as CPI by shifts in the consumer pattern between different years. Historically, the effect of this is usually between -0.1 and -0.2, and hence causes HICP to rise faster than CPI. In the past two years, however, this effect has been zero.

The consumption basket in HICP contains 85-90 per cent of the consumption basket in CPI. In comparison with CPI, interest expenses for owner-occupied housing, housing expenses for tenant-owner homes (imputed rent in CPI), property tax, depreciation, house insurance and lotteries are not included in HICP. Elderly care, hospital care and certain financial services (services for which the fee is proportionate to the size of the transaction) are included in HICP, but not in CPI.

In HICP, owner-occupied housing expenses are omitted, except for running operating expenses. Therefore, neither interest rates nor house prices are included in HICP. However, development work is in progress regarding an owner-occupied housing item according to the “net acquisition approach, see Appendix 2.



25. In the UK, it was decided in 2003 that the monetary policy target should be expressed in terms of HICP, and they subsequently started calling it CPI.

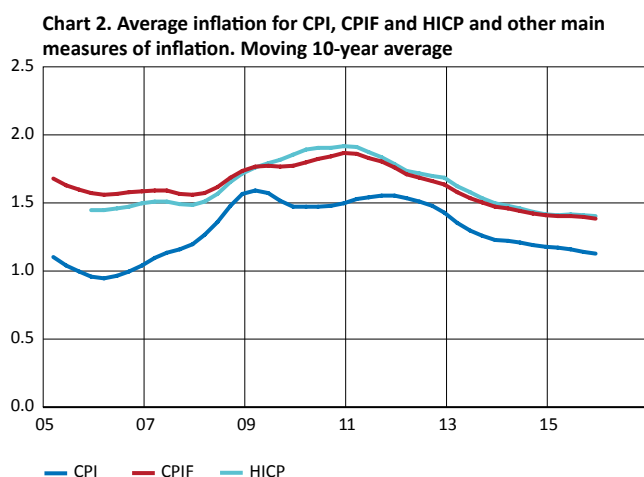


Table 2. Standard deviation and correlation in CPI, CPIF, HICP in the past 10 years

	CPI	CPIF	HICP
CPI	1.36	0.65	0.65
CPIF	0.65	0.67	0.97
HICP	0.65	0.97	0.91

Note. The standard deviation is shown diagonally (in bold) while the correlation between different measures is shown in the other cells.

Sources: Statistics Sweden, the Riksbank and authors' calculations

3. Measures of underlying inflation

The Riksbank uses several measures of so-called underlying inflation in its analysis. A common feature of these measures is that they shall distinguish a general and *non-temporary* price increase from a temporary one. By stripping out temporary fluctuations, the measures are intended to provide an understanding of the more lasting inflation tendency, and hence provide guidance regarding the medium-term development of the Riksbank's target variable CPI.

Below is a brief description of the most important measures used by the Riksbank. Besides these, the analysis of underlying inflation is supplemented by, for example, other simple indicators such as the share of subgroups where the price declines or rises faster than 2 per cent year-on-year.

Charts 3-4 and Table 3 compare the historical development and statistical characteristics of different measures.

CPIF excluding energy (CPIFXE)

Energy prices tend to be highly volatile. Because energy prices make up a substantial part of the CPI basket, just over 8 per cent in 2015, it is not entirely uncommon for sharp fluctuations in energy prices to overshadow other price changes. In the measure CPIFXE (CPI with fixed interest, excluding energy), all energy commodities are excluded, while at the same time, just as in CPIF, the mortgage rates of households are kept constant. CPIFXE can, in certain periods, facilitate the understanding of where inflation is headed in the medium to long term, once a shock to energy prices has subsided.

In CPI, energy commodities consist of various types of fuel as well as electricity and heating fuel for owner-occupied housing (district heating, pellets and light fuel oil).

CPIF-CT (CPIF with constant tax)

In the CPIF-CT measure, household mortgage rates and indirect taxes and subsidies are kept constant. Here, "indirect taxes and subsidies" means taxes and subsidies that are added

directly to various products, such as VAT, energy and carbon dioxide tax. Methodically, CPIF-CS follows previous constant tax indexes that the Riksbank has used in the monetary policy analysis (such as CPIX, previously called UND1X, and UNDINH). All changes to taxes are, for example, assumed to have an immediate and complete impact on consumer prices. However, unlike the previous constant tax indexes, only tax changes that come on top of the change in CPI are considered tax changes in CPIF-CS.²⁶

Und24

The calculation of UND24 is based on CPI broken down into 70 subgroups. All 70 subgroups are used in the calculation of Und24, but they are given a different weight than in CPI. The weight for each subgroup is calculated based on the volatility in its price development. The greater the volatility, the lower the weight in the calculation of Und24. Formally, the weights are based on the standard deviation in the difference between the rate of change of each subgroup and the rate of change in the aggregate CPI. The weights are subsequently set as the inverse of this standard deviation, and are then normalised so that the overall weight total for the Und24 measure equals one. The calculation is done for the time series since 1995 with a rolling 24-month window, meaning that subgroups that have become more (less) volatile over time are given an increasingly lower (higher) weight.

Trim85

Also the calculation of Trim85 is also based on CPI broken down into 70 subgroups. Each month, CPI is trimmed by excluding a number of subgroups with the very highest and very lowest price change rates. In Trim85, 85 per cent of the CPI's weight total is kept. Formally, the calculation is done by ranking the rates of change for the 70 subgroups, whereupon the highest ranked and the lowest ranked are excluded. The exclusions continue until at least 7.5 per cent of CPI's weight total has been trimmed from each end of the ranked price changes. In practice, this approach never manages to trim exactly 7.5 per cent at one end, but always slightly too much. So, the price change rate that was last trimmed off is put back, but with an alternative weight such that the weight total will be exactly 85 per cent of CPI. The groups are then aggregated, with retained relative weights, into an overall inflation figure.

Persistence-weighted measures of underlying inflation

Another way of attempting to aggregate CPI components into one measure of underlying inflation is to give a greater weight to subgroups that have tended to exhibit persistent price changes. This means that a subgroup with price changes that are strongly positively correlated with price changes in the prior period is given a relatively high weight. If the persistence-weighted inflation is higher (lower) than CPI inflation, CPI is expected to rise (fall) in the near future, when fluctuations in subgroups with non-persistent price changes subside.

Formally, the calculation of the measure commences by the estimation of the following equation for CPI broken down into 70 subgroups:

$$\pi_t^i = \beta_0^i + r_i \pi_{t-1}^i + \varepsilon_t^i,$$

where π^i is the annual percentage change in the subgroup i . The estimated coefficients, named r_i , measure the degree of persistence in the price change rate of each subgroup. Based on the estimated persistence coefficients, a normalised weight series for each

26. In Sweden, many taxes are indexed and continually extrapolated with the change in CPI. The purpose is to preserve the tax's share of the price over time. In the former constant tax indexes, all tax changes were treated in the same way, irrespective of the reason. In the CPIF-CS measure, only tax changes on top of normal indexation (CPI change) are considered as actual tax changes.

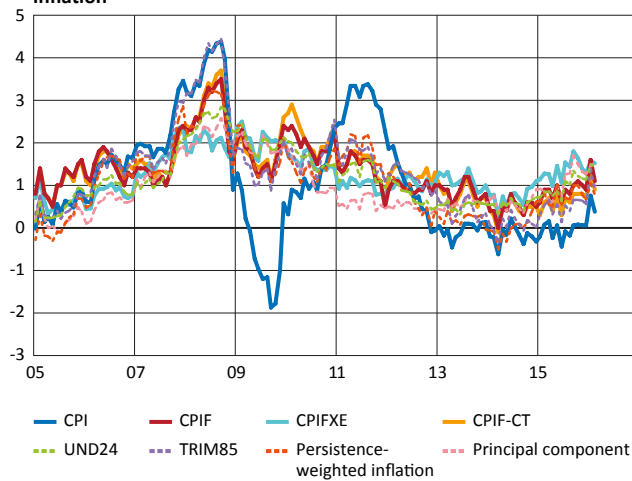
subgroup is created. The calculation is made for the time series since 1995 with a rolling 60-month window, which allows the degree of persistence, and hence the weight, to be changed over time. Finally, the alternative weights are used to aggregate the price change series into one measure of underlying inflation.

Principal components

Principal component analysis is a statistical technique for compressing information, reducing the number of variables and examining systematic variation in data. The method is based on calculating new latent variables, principal components, which can explain substantial elements of the variation in the data-generating process. Such variables are linear combinations of the original variables, and because they are entirely independent of each other (orthogonal), each principal component further explains part of the variation.

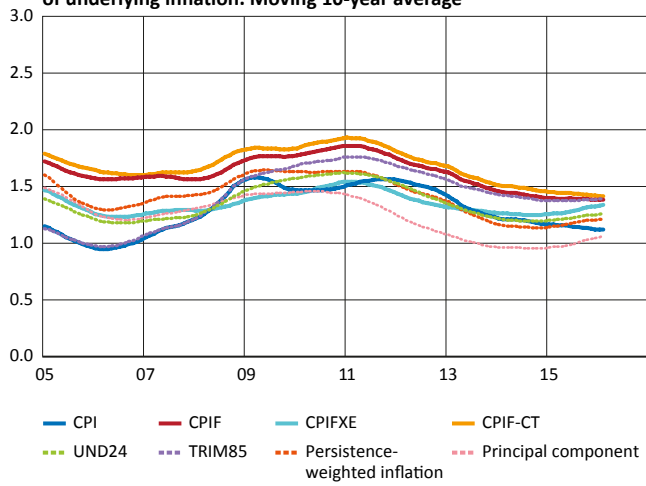
In the inflation literature, there are examples in which principal component analysis is used to calculate measures of underlying inflation. At the Riksbank, principal component analysis is based on CPI broken down into 70 subgroups. The intention is for the first principal component, which explains much (always more than the second principal component) of the variation in the data materials, to reflect the combined component trend for all prices which together make up CPI. No weights from the CPI statistics are included in the calculations.

Chart 3. CPI, CPIF and the Riksbank’s measures of underlying inflation



Sources: Statistics Sweden and the Riksbank

Chart 4. Average inflation for CPI, CPIF and the Riksbank's measures of underlying inflation. Moving 10-year average



Sources: Statistics Sweden and the Riksbank

Table 3. Standard deviation and correlation for CPI, CPIF, HICP and various measures of underlying inflation

	CPI	CPIF	HICP	CPIFXE	CPIF-CT	UND24	TRIM85	PERSISTENCE-WEIGHTED	PRINCIPAL COMPONENT
CPI	1.4	0.7	0.7	0.2	0.7	0.5	0.8	0.8	0.3
CPIF	0.7	0.7	1.0	0.7	1.0	0.9	0.9	0.9	0.7
HICP	0.7	1.0	0.9						
CPIFXE	0.2	0.7		0.5	0.7	0.8	0.7	0.7	0.9
CPIF-CT	0.7	1.0		0.7	0.7	0.9	0.9	0.8	0.7
Und24	0.5	0.9		0.8	0.9	0.7	0.9	0.9	0.9
Trim85	0.8	0.9		0.7	0.9	0.9	1.0	0.9	0.7
Persistence-weighted	0.8	0.9		0.7	0.8	0.9	0.9	0.9	0.8
Principal component	0.3	0.7		0.9	0.7	0.9	0.7	0.8	1.1

Note. The standard deviation is shown diagonally (in bold) while the correlation between different measures is shown in the other cells.

Sources: Statistics Sweden, the Riksbank and own calculations

Appendix 2. More about the calculation of owner-occupied housing expenses

Owner-occupied housing expenses are treated differently in CPI, CPIF and HICP. In this appendix, we take a closer look at the question of how owner-occupied housing expenses can be treated in the target index. However, the owner-occupied housing item is controversial and difficult, and a comprehensive study of the matter requires a separate report. In this appendix, we highlight some more principle matters that are of relevance to the question of choice of index for the inflation target.

In CPI, owner-occupied housing is defined as privately owned houses (“småhus med äganderätt”). Tenant-owned homes (“bostadsrätter”) are not included in CPI’s definition of “owner-occupied housing”. In CPI, rents for rented homes are used as an approximation of the housing expenses for tenant-owned homes, see below. In the following, we allow the term “owner-occupied housing” to refer to privately-owned homes *and* tenant-owned homes (houses and apartments). In the same way, we allow the term “house prices” to refer to the prices of privately-owned houses, and tenant-owner homes (houses and apartments).

1. Arguments in favour of including owner-occupied housing expenses in the target index

The original theory behind inflation targeting may speak in favour of including owner-occupied housing expenses in the target index. There are two reasons for this. First, this theory prescribes that the target index should be broad and relevant to consumers and wage-earners (Chapter 2.2.). Second, housing expenses make up a substantial part of the budget of most households (around 25 per cent according to the weight in CPI), and a large proportion of consumers in Sweden own their homes. If the index is to be broad and relevant, housing expenses for people who live in homes that they own must be captured in the index. The question is which parts of these costs that should be included.

In a strictly economic sense, the total housing expenses of home owners include the amounts from which home owners refrain in interest on equity. This cost depends both on the interest rate level and on house prices (equity). This speaks for including both the interest rate and house prices in the index.

In relation to this, one might envision examples where monetary policy becomes unnecessarily volatile and contributes to house price increases if housing prices are not included in the measure of the cost of owner-occupied housing. Suppose, for example, that a general productivity improvement takes place in the economy and/or the price of goods and services that are consumed domestically does not rise as quickly as the inflation target, while, at the same time, salaries grow at a rate in line with the inflation target. Consumers then have a higher real income, and it is probable that part of the increased income is spent on housing. The price of housing consumption might consequently rise because rents increase (if rents are freely set) and house prices rise. Rising house prices lead to an increase in owner-occupied housing expenses. If house prices are not included in the target index, inflation will be lower than the inflation target and the central bank might conduct more expansionary monetary policy. This might lead to even greater pressure on the housing market. In that respect, it would be good if the index captured the increased housing expenses that result from rising house prices.

However, it could also be argued that parts of the capital expenses for owner-occupied housing are not particularly “relevant” to consumers and wage-earners. Increasing house prices do not imply that running “actual” costs are increasing. The household can continue to refrain from the alternative return and continue to consume to the same extent as before. In addition, there is a large amount of consumers and wage-earners who are not home owners. A relevant question in this respect is whether a central bank with a price stability goal should stabilize the “cost of living” or prices. For more on this discussion, see for example SOU (1999) and Konjunkturinstitutet (2002).

New Keynesian theory may speak in favour of including only a small share of the cost of owner-occupied housing in the index. According to this theory, capital-related costs could be excluded if they are highly flexible. Other parts of owner-occupied housing expenses, such as the cost of refuse collection, maintenance, etc. that may be stickier should be included in the index. This is also in line with how CPIF and HICP are currently calculated.

2. There are different ways of measuring owner-occupied housing expenses²⁷

Measuring owner-occupied housing expenses is far from unproblematic. While the price of a house or an apartment might be known, the price of housing services generated by the home are difficult to measure. The problem is the same as for all durable goods, i.e. goods acquired at a certain point in time, but which generate services for a lengthy subsequent period, e.g. a tablet or a bicycle. However, a substantial difference is that the value of a home often appreciates over time, while a tablet or a bicycle usually depreciates quickly. There are primarily four different ways of measuring owner-occupied housing expenses. All of them have their limitations.

Rental equivalence approach

When a household rents its home, the cost of a month's housing services is clear – it amounts, quite simply, to the rent paid by the household to the landlord. In this case, the household purchases a service like basically any other. However, if the household owns its home there is no equivalent money transaction. Neither is there thus any observable price that can form the basis of an index calculation.

If, parallel to the market on which owned homes are bought and sold there also exists a rental market for the equivalent type of home, an approximation of owner-occupied housing expenses could then be obtained using the monthly rent for equivalent housing on such a market. However, there are several reasons why such a procedure might prove problematic.

One reason is that the rental market, unlike the ownership market, might be strictly regulated. Then the rents paid will not be representative of the home owners' expenses in general. Another reason is that the ownership and rental markets for homes can be two fundamentally different markets, and parallels between them will therefore be misleading.

In Sweden, the rental market for apartments is strictly regulated. For houses, the conclusion has previously been that the rental market is too small to obtain reliable data.²⁸

Alternative cost approach/user cost approach/cost calculation

As an alternative to the rent equivalence approach, an alternative cost approach is perceivable. The alternative cost approach takes account of the financial considerations that would be made on a rental market for houses and apartments.

In order for rental to be an attractive alternative, the rent must cover the return that the owner could have obtained if the capital had been invested elsewhere as well as compensation for operational costs and wear and tear on the house. If the owner also expects the house to decline in price over the rental period, the rent must also cover that. If instead an increase in value is expected, the rent does not need to be as high as would otherwise be the case. The following equation can thus be seen as a parallel to the rent equivalence approach where instead of observing the rent, an attempt is made to indirectly calculate it.

$$K_t = P_t [r_t - p_t + q_t]$$

27. Much of this subsection builds on Konjunkturinstitutet (2002) and Johansson (2015).

28. Konjunkturinstitutet (2002).

K_t = Capital cost in period t

P_t = Price of the home in period t

r_t = Interest in period t

p_t = The price change of the home as a percentage, i.e. $(P_{t+1} - P_t) / P_t$

q_t = Wear and tear, taxes, insurance and charges (water, electricity, refuse, etc.) in period t

The approach is called the alternative cost approach as the expression above reflects the (alternative) cost for the home owner to live in the house him/herself compared with the alternative strategy of investing the capital represented by the house elsewhere.

A challenge in this approach is determining which interest rate and house price change should be used. In the Swedish CPI, a partial version of this approach is used, where $p_t = 0$. In CPIF, also r_t is set equal to a constant. We come back to CPI and CPIF below.

Net acquisition approach

In a net acquisition approach, costs are measured in the same way as for a litre of milk, i.e. by monitoring the price development for houses. Often only the price of newly constructed homes is covered, and land prices are often excluded (hence, “net”). The coverage is limited by definition.

Only operating costs are measured

One might also exclude capital costs and only measure operating costs – such as costs for water and sanitation. Looking at the equation above, this will be as if only Pq_t were included, i.e. a small part of the capital costs. Substantial parts of the capital costs are thus left out. This is how it is currently done in HICP.

Table 1 shows how a selection of inflation-targeting countries have opted to measure owner-occupied housing expenses in their inflation measures.

Table 1. Methods for measuring owner-occupied housing expenses in some countries’ main inflation measure

COUNTRY/REGION	METHOD
Sweden (houses), Canada	Cost calculation
Sweden (tenant-owner homes), US, Japan, Norway	Rental equivalence approach
Australia, New Zealand	Net acquisition approach
Euro area (HICP), UK	Only operating costs

Source: Johansson (2015)

3. CPI(F) and HICP treat owner-occupied housing expenses differently

In the group “Housing” in Sweden’s CPI, there are three types of housing: rented homes, tenant-owned homes and privately owned houses.

The monthly cost for rented homes is measured as existing rents. For tenant-owned homes a rent equivalence approach is used and the monthly cost is measured by the monthly cost for rented homes. For privately owned houses, a so called partial (alternative) cost approach is used. The index is a weighted average of a number of sub-indexes, including the mortgage cost index which is described in Box 1 above, and various indexes for depreciation, electricity and heating, water and housing-related services, municipal property charge, insurance, repairs and site leasehold fees. The method is “partial” because capital gains and capital losses (p_t in the equation above) are, as described above, not included. In CPIF r_t is also set equal to a constant.

The significance of the three types in CPI is indicated by Table 2, which gives their weights in CPI. As can be seen, the total housing item makes up more than 25 per cent of CPI in total. Owner-occupied housing according to our definition (tenant-owner homes and privately owned houses) makes up almost 15 per cent of CPI.

Table 2. The importance of the housing items in CPI. Weighting figure as a percentage of CPI

	2000	2005	2010	2014
04 Housing item	32.0	29.5	27.9	26.4
04.S Rents	15.0	14.1	12.8	11.4
of which tenant-owner homes	4.1	4.0	4.0	4.6
0.4x privately owned houses	11.8	9.2	9.7	9.2
of which mortgage costs	6.9	5.6	6.2	5.7

Source: Statistics Sweden (2014)

When we measure *inflation*, it is the *change* in housing expense that is of importance. Looking at the capital cost equation above, we obtain the following expression for the percentage change in the capital cost:

$$\frac{dK_t}{K_t} = \frac{dP_t}{P_t} + \frac{P_t}{[r_t - \rho_t + d_t]} [dr_t - dp_t + dq_t]$$

CPI basically includes all elements except dp_t , which we can interpret as the expected change in the price of homes. However, as we have already mentioned, CPI has at least two disadvantages.

First, because CPI includes dr_t , it is very sensitive to changes in the interest rate. The problem arises despite it being “theoretically” correct to include mortgage interest expense in the index for housing expenses. From a monetary policy perspective, it might be better if the mortgage cost did not have such a large direct effect on CPI.

Second, changes in house prices ($\frac{dP_t}{P_t}$) are measured as a moving average over a very long period of time. The latest changes in house prices thus have little significance for CPI (and CPIF) today. In the same way, expected changes in house prices in, for example, two years’ time are of little significance to CPI (and CPIF) in two years’ time. From the point of view of monetary policy purposes, it might have been better if changes in house prices had a more direct impact on CPI.

A third problem with CPI (and CPIF), which we have not discussed previously, could be that housing expenses for tenant-owner homes are measured through the rent equivalence approach. Tenant-owner homes make up a substantial part of the stock of owner-occupied homes (according to our definition) and are bought and sold on a free market in the same way as private houses. It is difficult to see why these two types of housing are not treated in more or less the same way in CPI. Whether a change would give clear differences in the index is an empirical question that is beyond the scope of this commentary.

If dp_t , i.e. the change in the expected home price increase, were included in CPI, this could give the same problem as with the interest rate: when the interest rate is cut and house prices rise, home owners obtain a capital gain which brings down inflation, i.e. an effect that “goes in the wrong direction”.

In the Consumer Price Index Board, there is a discussion as to whether tenant-owner homes should be treated equally to private houses. However, to our knowledge, no discussion or work is under way to change the way in which house price changes are included.

In HICP, owner-occupied housing expenses are omitted, except for running operating expenses. Therefore, neither interest rates nor house prices are included in HICP. However,

development work is in progress regarding an owner-occupied housing item according to the net acquisition approach. According to the method, the price development of the capital component of owner-occupied homes shall largely track prices of new owner-occupied homes. "New" owner-occupied homes means in the strict sense those that are new to the household sector, and not just newly constructed ones. "Net" in this context refers to the fact that any owner-occupied homes exiting the household sector should be excluded. Tenant-owner homes shall be included together with privately-owned houses. In addition, certain other costs are added that relate to the purchase of the home such as estate agent fees, stamp duty and mortgage deeds, as well as costs for major repairs, maintenance and insurance.

Whether the net acquisition approach (HICP) or an improved cost calculation (CPI/CPIF) is preferable when selecting the index to which the inflation target should refer is an open question. Where Sweden is concerned, it might however be relevant to take a closer look at whether this gives substantial differences in the figures. However, such a task is beyond the scope of this commentary.

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