Description of CPIF measures

Background

The most common and well-known measure of inflation in Sweden is the changes in the Consumer Price Index (CPI). The purpose of the CPI is to show the general price changes among the products that households consume in the economy. Another measure of inflation is the changes in the CPIF (CPI with fixed interest rate). It shows the same price changes as the CPI, but without the direct effects of monetary policy changes. The Riksbank's monetary policy affects the CPI through interest rate changes to households' housing loans. The CPIF replaces the CPI as a target variable in the Riksbank inflation target from September 2017.

Statistics Sweden also determines two other measures of inflation not related to the CPIF. The CPIF excluding energy (CPIF-XE), in which all energy products are excluded, and the CPIF with constant tax (CPIF-CT), in which taxes and subsidies imposed on consumers are kept at a constant. All measures of inflation that Statistics Sweden determines are based on the same price data as the CPI. Publication is done in connection with CPI publication.

Calculating the CPIF

The only difference between the CPI and the CPIF lies in the handling of households' interest costs. There are two interest cost indices (IC) in the CPI: one for owner-occupied housing (one- or two-dwelling building/houses with ownership rights) and one for tenant-owned dwellings. Both are calculated as the product of an index for interest rates (IR), and an index for households' capital costs (KAP) using formulas 1 and 2 below:

1) $IC, owner\ occupied\ housing = IR, owner\ occupied\ housing \times KAP, owner\ occupied\ housing/100$

2) $IC, owner\ tenant\ owned\ dwellings = IR, tenant\ owned\ dwellings \times KAP, tenant\ owned\ dwellings/100$

In the CPIF, the effect of changes in interest rates on households' housing loans is excluded from the price changes. This means that, in principle, both interest rate indices (in formula 1 and 2 above), are kept unchanged, even if the interest rates change. Technically speaking, the calculation is done by first subtracting the interest cost index multiplied by its weight for one- or two dwelling buildings and

tenant-owned dwellings respectively from the CPI. Then, the weight for interest costs is added back, but multiplied by the capital stock index. In this way, the capital stock index takes over the entire weight for interest costs and the effect is a constant maintenance of the interest rate index. A simplified formula for the calculation is shown below:

Formula 3. CPIF

$$\text{CPI} \left\{ \begin{array}{l} \left(I_{KPI} \times w_{KPI}\right. \\ \text{- Interest costs} \left\{ \begin{array}{l} -I_{RK:EH} \times w_{RK:EH} \\ -I_{RK:BR} \times w_{RK:BR} \end{array} \right. \\ \text{+ Capital stock} \left\{ \begin{array}{l} +I_{KAP:EH} \times w_{RK:EH} \\ \left.+I_{KAP:BR} \times w_{RK:BR}\right) \end{array} \right. \end{array} \right\} \frac{}{1000} = \text{CPIF}$$

The designations in the formula above are:

I_{KPI} = Index for the CPI in total

w_{KPI}= Weight in parts per thousand for the CPI in total

$I_{RK:EH}$ = Index for interest costs of owners of one- or two-dwelling buildings with ownership rights

$w_{RK:EH}$= Weight in parts per thousand for interest costs of owners of one- or two-dwelling buildings with ownership rights' interest costs

$I_{RK:BR}$ = Index for tenant-owned dwellings' interest costs

$w_{RK:BR}$= Weight in parts per thousand for tenant-owned dwellings' interest costs

$I_{KAP:EH}$ = Capital stock index for owners of one- or two-dwelling buildings with ownership rights

$I_{KAP:BR}$ = Capital stock index for tenant-owned dwellings

The formula above is simplified in the sense that it does not take account of the various link elements of the index construction. The calculation of the CPIF follows the CPIF index construction, described in more detail in Statistics Sweden's documentation on CPI production (SCB-DOK, updated every year and available at https://www.scb.se/PR0101).

About interest rates and housing in the CPI

The CPI uses a "partial cost approach" to measure households' housing with ownership rights, that is, one- or two-dwelling buildings with ownership rights and tenant-owned dwellings. The price changes for several different cost components are monitored for the purpose of approximating the total housing cost, see table 1 below.

Table 1. Cost components for owner-occupied housing and tenanct-owned dwellings in the CPI (excl. electricity)

Component of the cost approach for owner-occupied housing	*The equivalent for owners of tenanct-owned dwellings with ownership rights*	*Components of the cost approach for tenanct-owned dwellings*
Interest costs	Household interest costs related to transfer of owner-occupied housing	Interest costs
	Interest costs are also paid by an association with regard to common loans	Monthly fee
Land rights	Paid where applicable by the association	
Municipal real estate fee	The property fee is paid by the association	
Industrial cleaning, water, sewerage	The monthly fee includes municipal services such as water and waste collection.	
Homeowners' insurance	Property insurance is paid by the association.	
Pellets, fuel oil, district heating	Heating is paid by the association as a rule	
Depreciation	The association takes joint responsibility for maintenance of the exterior of the property	
Repair, goods	The resident is responsible for repair and maintenance inside the dwelling.	Interior repair

Interest rate index

The interest rate index measures various interest rates for housing loans. The information is collected from Statistics Sweden's Financial market statistics and consists of average interest rates for the entire housing loan stock, that is, both new and older loans for which the household has interest costs. The calculation includes interest rates for six different "contract intervals" as below:

- 0 months up to 3 months contract
- More than 3 months up to 1 year contract
- More than 1 year up to 2 years contract
- More than 2 years up to 3 years contract
- More than 3 years up to 5 years contract
- More than 5 years contract

Financial market statistics interest rates are published with a one month delay. The CPI therefore reports a projection for the current month using listed interest rates collected from lenders' websites. More information about the interest rate index is available in Statistics Sweden's documentation on CPI production (SCB-DOK, updated every year and available at https://www.scb.se/PR0101).

Capital stock index for one- or two dwelling buildings

The capital stock index for one- or two dwelling buildings shows the changes for capital that households have invested in their housing, valued at purchase price. Borrowed capital for which they have interest expenses and equity that they have placed in their housing. Equity is expected to be placed in some other asset, such as debt securities, instead of housing. Households' renounced interest income for such an alternative investment therefore involves an alternative cost. The reason for the whole capital being valued at purchase price is that it applied at the time of borrowing and thereby determines the size of the financing. As a factor of the interest rate index, the capital stock index thus highlights households' cost changes for loan financing and renounced return on capital through a change in property prices.

Capital stock index calculation uses two main components: a house price index (I) and historical acquisition times for houses in the stock (N).

Formula 4. Capital stock index, one- or two dwelling buildings

$$KS_{EH} = \left(\frac{\sum_{j=0}^{k} N^{i-2,B-j} \times I^{q-j}}{\sum_{j=0}^{k} N^{i-2,B-j} \times I^{q-j-4}} \right)^{m/12}$$

The designations in formula 2 are:

• *i* = current year (that is, the year that the CPI calculation refers to).

• *i-2* = two years prior to the current year. The year that the ownership structure refers to, since it is published with a two-year delay.

• *j* = the current owner's ownership time, in number of quarters since acquisition.

• *B* = the number of quarters from when the house price index (Statistics Sweden's property index, FPI) and historical acquisition times are available (early 1960s) up to and including the fourth quarter of year i-2.

• k= the number of quarters back for which the index is calculated. Calculated from the first value to the most recent quarter (j=0).

• *m* = current month, 1 to 12.

• *q* = the quarter in which the more recent FPI was published, calculated for month m (with the quarters in consecutive numbering across all years in succession.) (Note: CPI is included with a delay of 1 to 2 quarters.)

• N^i = the number of acquired houses in year i.

• *I* = Statistics Sweden's property index (FPI).

• $N^{i-2,B-j}$ = the number of houses in year i-2 that the owners acquired in year when quarter B-j occurred.

Capital stock index for tenant-owned dwellings

Capital stock index calculation of tenant-owned dwellings is similar to the calculation for one- or two dwelling buildings. The main difference is that the price index for tenant-owned dwellings has a different source and is available in the database.

Formula 5. Capital stock index, tenant-owned dwellings

$$KS_{BR} = \left(\frac{\sum_{j=0}^{M} N^{i-2,B-j} \times I^{m-j-1}}{\sum_{j=0}^{M} N^{i-2,B-j} \times I^{m-j-13}} \right)^{m/12}$$

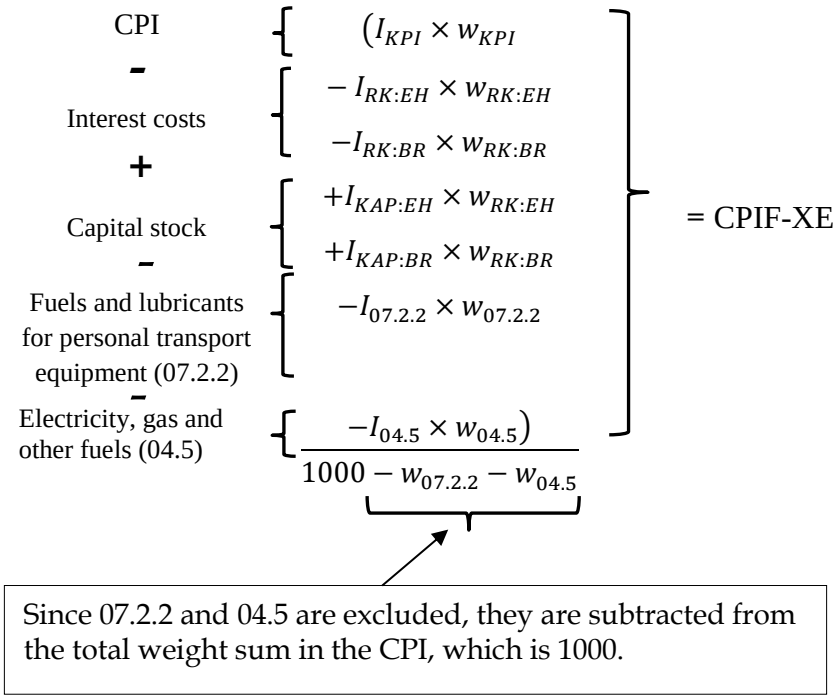
The designations in the formula above are:

- $N^{i-2,B-j}$ = number of dwellings in year i-2 that the owners acquired in the year when quarter B-j occurred.
- *I* = Index series for transfer prices on tenant-owned dwellings (between 1997 and 2004, Statistics Sweden data is used, and from 2005 and onwards, Valueguard is used). Published with a one-month delay, which is why I^{m-j-1} and I^{m-j-13}
- *i* = current year (that is, the year that the CPI calculation refers to).
- *i-2* =the year to which the ownership structure refers. (Note: This information has a two-year delay.)
- *j* = the current owner's ownership time since acquisition, in number of months.
- *B* = the 12th month in year i-2 (with quarter in consecutive numbering across all years in succession).
- *m* = current month, 1 to 12.

Calculating the CPIF-XE

The CPIF-XE does not include energy products from CPIF, that is, the COICOP groups *07.2.2 Fuels and lubricants for personal transport equipment* and *04.5 Electricity, gas and other fuels*. *Fuels and lubricants for personal transport equipment* includes petrol, diesel and E85. *Electricity, gas and other fuels* includes electricity and fuel for domestic purposes (pellets, district heating, heating oil and household gas). Excluding energy products (rather than keeping them as constants) means that the overall weight in the CPIF-XE is lower than in the CPI and CPIF. This also means that other products in the basket gain a larger significance, relatively speaking. Calculation of the CPIF-XE is done according to formula 4 below.

Formula 6. CPIF excluding energy



Beyond those used in the CPIF, other designations follow below.

$I_{07.2.2}$= Index for COICOP group 07.2.2 Fuels and lubricants for personal transport equipment.

$w_{07.2.2}$ =Weight in parts per thousand for COICOP group 07.2.2 Fuels and lubricants for personal transport equipment.

$I_{04.5}$= Index for COICOP group 04.5 Electricity, gas and other fuels.

$w_{04.5}$ =Weight in parts per thousand for COICOP group 04.5 Electricity, gas and other fuels.

Calculating the CPIF-CT

In the CPIF-CT, taxes and subsidies that directly affect some consumer products are kept constant. In practice, such calculation means that the effect of tax changes at the consumer level are cleared away, see formula 7 below.

Formula 7. CPIF-CT

$$\begin{aligned}
&\text{CPI} && \left\{ \left(I_{KPI} \times w_{KPI}\right) \right. \\
&- && \\
&\text{Interest costs} && \left\{ \begin{array}{l} -I_{RK:EH} \times w_{RK:EH} \\ -I_{RK:BR} \times w_{RK:BR} \end{array} \right. \\
&+ && \\
&\text{Capital stock} && \left\{ \begin{array}{l} +I_{KAP:EH} \times w_{RK:EH} \\ +I_{KAP:BR} \times w_{RK:BR} \end{array} \right. \\
&- && \\
&\text{(Taxes - subsidies)} && \left\{ \left. \frac{-\sum_{k \in S\&S} E_{(S\&S),k}}{1000} \right. \right\} = \text{CPIF-CT}
\end{aligned}$$

It is worth noting that the weight sum in the CPIF-CT is the same as in the CPI and the CPIF. Neither the interest rate index nor the taxes and subsidies included in the price of many products is excluded from the measurement. In addition to the designations presented for the CPIF, $\sum_{k \in S\&S} E_{(S\&S),k}$ is also used, which is the deduction term for the net of taxes and subsidies, expressed as the sum of all effects $E_{(S\&S),k}$ for each tax and subsidy k.

Delimitation, taxes and subsidies

The taxes and subsidies in the CPIF-CT directly added to the consumer price (such as value-added tax, fuel for transport and alcohol taxes) are kept constant. Another delimitation is made with regard to the size of the tax/subsidy. Only taxes and subsidies above a certain levy amount are handled in the measurement; many lesser taxes and subsidies considered to have marginal effect are disregarded.

The following two delimitation rules determine when a relevant tax or subsidy should be kept constant:

- Taxes and subsidies with a levy higher than 0.5 percent of the total tax levy in a specific year are taken into account, that is, kept constant in the measurement.
- At least 95 percent of the relevant taxes are to always be kept constant, regardless of the size of individual taxes and subsidies.

Handling depending on the type of tax and subsidy

Taxes and subsidies may be defined as a percentage share of the price or as the number of Swedish kronor per unit of quantity (for instance,

Swedish kronor per litre). When the price of a product changes, percentage taxes automatically retain their share of the price (for example, in figure 1a and 1b). This does not occur automatically with quantity taxes. In products in which a constant number of Swedish kronor have been added to the price and the net price increases at the same time, the tax's share of the price decreases over time unless an adjustment is made (examples in figure 1c and 1d). However, some quantity taxes are regularly adjusted using a price index, known as indexing (examples in figure 1e and 1f).

Unless the quantity tax rates are adjusted upwards with some regularity, the real tax levy drops gradually (represented by the grey line in figure 1d). With, for instance, a yearly inflation of 2 percent, the real tax levy drops by about ten percent over a five-year period.

To achieve more neutral treatment of quantity taxes or subsidies compared with percentage taxes or subsidies, in addition to the general price changes, only the effect of tax changes is cleared. To achieve this effect, the index for nominal tax changes is shared in every period with the CPI total, see formula 8 below:

Formula 8. Calculation of the effect of a quantity tax changes

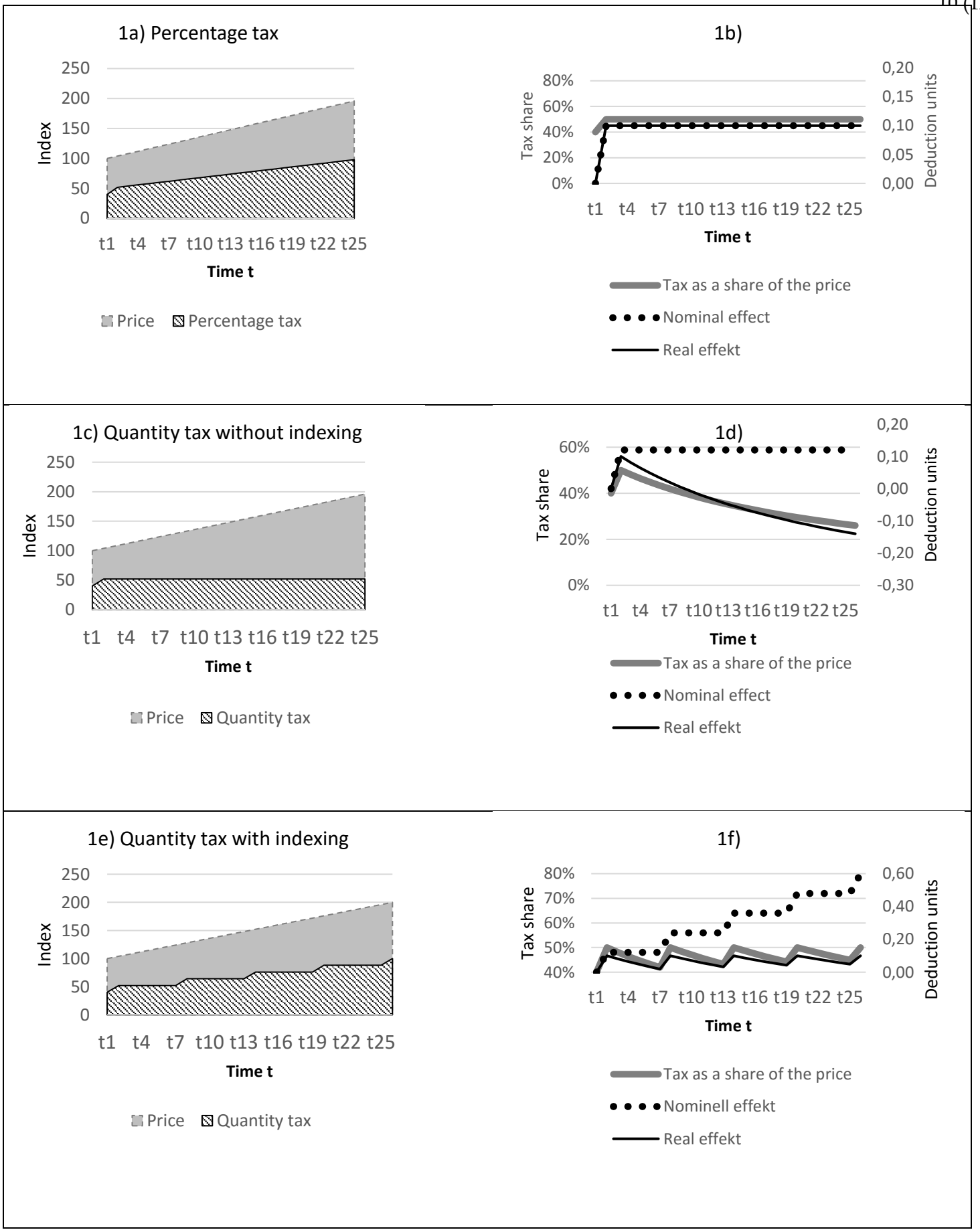
$$E = \left(\frac{\frac{tax\ rate\ current\ period}{tax\ rate\ \ base\ period} \times 100}{I_{CPI}} \times 100 - 100 \right) \times w_{tax}$$

Here, $w_{tax,}$ the weight of the quantity tax is calculated as the levy of the tax, including any additional value-added tax, as a share of the CPIF-FS total consumption amount.

I_{CPI} is the index for the CPI total.

The equivalent calculation is done for subsidies, although the effect is there given the opposite designation.

Figure 1a-1f.


1a) Percentage tax
Index
250
200
150
100
50
0
t1 t4 t7 t10 t13 t16 t19 t22 t25
Time t
Price
Percentage tax
1b)
Tax share
80%
60%
40%
20%
0%
0,20
0,15
0,10
0,05
0,00
Deduction units
t1 t4 t7 t10 t13 t16 t19 t22 t25
Time t
Tax as a share of the price
Nominal effect
Real effekt
1c) Quantity tax without indexing
Index
250
200
150
100
50
0
t1 t4 t7 t10 t13 t16 t19 t22 t25
Time t
Price
Quantity tax
1d)
Tax share
60%
40%
20%
0%
0,20
0,10
0,00
-0,10
-0,20
-0,30
Deduction units
t1 t4 t7 t10 t13 t16 t19 t22 t25
Time t
Tax as a share of the price
Nominal effect
Real effekt
1e) Quantity tax with indexing
Index
250
200
150
100
50
0
t1 t4 t7 t10 t13 t16 t19 t22 t25
Time t
Price
Quantity tax
1f)
Tax share
80%
70%
60%
50%
40%
0,60
0,40
0,20
0,00
Deduction units
t1 t4 t7 t10 t13 t16 t19 t22 t25
Time t
Tax as a share of the price
Nominell effekt
Real effekt

Other measures of inflation

The purpose of this document has been to describe the CPIF measures. However, Statistics Sweden also determines other measures of inflation; CPI-CT (CPI with constant tax), HICP (Harmonised Index for Consumer Prices), and HICP-CT (HICP with constant tax). An overview in table 2 provides a picture of how the CPIF measures relate to these inflation measurements.

Table 2 Overview: CPIF measures compared with other measures of inflation

Measurement	*Description*	*Product basket size compared with the CPI*	*Held constant compared with the CPI*	*index construction*	*Start period for the index series*
CPIF	Consumer price changes cleared for direct effects of monetary policy changes	Same weight as the CPI	Interest rate for borrowed and own housing capital	Same as the CPI	January 1987
CPIF-CT	Consumer price changes cleared for direct effects of monetary policy changes and taxes or subsidies	Same weight as CPI and CPIF	Interest rate for borrowed and own housing capital as well as real effects of taxes and subsidies at the consumption level	Same as the CPI	January 1987
CPIF excluding energy	Consumer price changes cleared for direct effects of monetary policy changes, excluding energy goods	Electrical current, fuel for personal transport and heating oil are excluded from the CPIF	Interest rate for borrowed and own housing capital	Same as the CPI	January 1987
CPI-CT	Consumer price changes cleared for direct effects of changes in taxes or subsidies	Same weight as the CPI	Real effects of taxes and subsidies at the consumption level	Same as the CPI	January 1980
HICP	Consumer price changes, harmonised for methodology at the EU level	Lotteries, hospital care and more or less the entire home item are excluded. Fund services are included in the HICP, but not in the CPI.		December links of the Laspeyres type	January 1996
HICP-CT	Consumer price changes, harmonised for methodology at the EU level. Cleared for direct effects of tax changes	Lotteries, hospital care and more or less the entire home item are excluded. Fund services are included in the HICP, but not in the CPI.	Nominal effects of taxes at the consumption level (although not subsidies)	December links of the Laspeyres type	January 1996