ORGANISATION DE COOPÉRATION ET DE DÉVELOPPEMENT ÉCONOMIQUES

OECD OCDE

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

SEMINAR

Inflation Measures: Too High - Too Low - Internationally Comparable? Paris, 21-22 June 2005

6. Superlative Swedish CPI implementation and comparability

Martin Ribe
(Statistics Sweden)

Superlative Swedish CPI implementation and comparability

M. Ribe
Statistics Sweden

Paper presented at the OECD Conference on Inflation Measures
Paris, June 2005

Abstract

From 2005, the national Swedish CPI is based on a superlative index formula (Walsh index) for macro-level aggregation in annual links of years past, and the Jevons index formula for elementary aggregation. These features should serve to prevent a cumulating "Laspeyres bias" and make the CPI perform reasonably as a cost-of-living index (coli), as is considered appropriate in view of the uses of the CPI for compensation purposes. In most other respects the CPI largely adheres to the European Commission's rules for the HICPs, except for coverage in some product areas. The paper deals with implementation and comparability aspects of the New CPI construction.

New index construction from January 2005

From January 2005, an improved index construction is used for Sweden's Consumer Price Index (CPI). Since then also the computation of the inflation rate is changed.

Main features of the Swedish CPI construction from January 2005 are:

- The CPI is a chain index with annual links – as before.
- The annual links are chained over the full year – not over December as before.
- The annual links between previous years are computed by a superlative index formula, namely Walsh index.
- The final link up to the current month is of Laspeyres type – in principle as before.
- In the price collection, prices are followed normally from December and throughout the following year – as before.
- The sub-indices on the lowest level of aggregation are computed from observed prices as Jevons indices, with index reference period being last year's December = 100. These December-based links are transformed to links based on full years, before higher-level aggregation.

- The CPI is still presented as index numbers with the index reference year 1980 = 100 – as before. The index numbers remain well comparable over time.
- The inflation rate is now computed as the relative change in the CPI numbers – as in most countries but not exactly as previous Swedish practice. This change of method somewhat affects the comparability over time in the Swedish inflation rate.

The principles followed are far from entirely new, but by the changes from January 2005 the index construction is improved in various respects. The changes from January 2005 follow proposals from a Government Commission, which reviewed the Swedish CPI (SOU, 1999), and they are described by Ribe (2004). The changes were decided by the CPI Board (Nämnden för konsumentprisindex), after general approval from the Swedish government (Prop., 2001) of most of the Commission's proposals.

The CPI numbers from January 2005 are a direct continuation of the preceding series of CPI numbers. The interpretation and suitable uses of the CPI numbers are not directly affected. Comparability over time for the index numbers therefore remains largely uninfluenced. However, the comparability of the inflation rate is affected, by the simultaneous change of its computation.

Approximations of a Cost-of-Living Index (COLI)

As the Swedish CPI is to a great extent used for compensation purposes, it has since very long ago been considered that a cost-of-living index (coli; cf. ILO et al., 2004, Ch. 17; Hill, 1999; National Research Council, 2002; Triplett, 1983, 2001) is a relevant target for the Swedish CPI (cf. Ribe, 2001; SOU, 1943, 1999; Statistics Sweden, 2001). Already in the 1940s it was therefore considered that the well-known typical upward bias of a usual Laspeyres-type index, due to consumer substitution, is an undesirable feature which is to be avoided in the CPI computation.

In the Previous CPI construction, used since the 1950s, the problem of potential substitution bias was met by a device known as "long-term index". That practice meant that the index baskets for past years' index links were retrospectively updated to reflect the consumption pattern of the years in question, rather than that of earlier years (for details, see Statistics Sweden, 2001). This retrospective updating of the index basket effectively eliminated the Laspeyres type bias and made the CPI more closely approximate a coli.

Diewert (1976; cf. ILO et al., 2004, Ch. 17) has developed a theory of superlative indices. These are indices that are "exact" for wide classes of possible utility functions, in the sense that they are the true cost-of-living indices corresponding to these possible utility functions. Some of the classical index formulas are actually superlative indices, notably the Fisher, Törnqvist, and Walsh indices.

The New Swedish CPI construction takes advantage of the modern theory of superlative indices. Thus for the annual links between previous years, Walsh

index is used, which is a superlative index formula. As for the previously used device of "long-term index" with retrospective updating of the index basket, the aim is still the same, that is, to avoid the Laspeyres bias and make the CPI more closely approximate a coli. But the New CPI construction has a stronger theoretical basis than the Previous one, in the theory of superlative indices.

Chain index in other form

In the Previous CPI construction, the annual link measured how much the price level had changed from December of the preceding year to December of the year concerned. A final link measured the change in price level up to the current month from December of the preceding year.

In the New index construction, on the other hand, the annual link measures how much the average price level in the year concerned has changed from the average price level of the preceding year. The CPI basket of an annual link reflects a blend of the consumption patterns of the year concerned and the preceding year. That is, the annual chaining is carried out using the full year, rather than December. The final link here measures the change up to the price level of the current month, from the average price level of the year before the preceding year.

The Previous index construction was chained over into the New one using the average price level of the year 2004. The New index construction is thus used starting from January 2005 to measure price changes from the average price level of 2004, while the Previous index construction is used to measure price changes before then.

Consider for example the computation of the CPI number for January 2007, with index reference year 1980 = 100. That CPI number will here be denoted $I_{1980}^{2007,\text{jan}}$. To compute the CPI number as a chain index, you multiply or "chain" together annual links according to the computational formula

$$(1) \qquad I_{1980}^{2007,\text{jan}} = I_{1980}^{1980,\text{dec}} \times I_{1980,\text{dec}}^{1981,\text{dec}} \times I_{1981,\text{dec}}^{1982,\text{dec}} \times \ldots \ldots \times I_{2002,\text{dec}}^{2003,\text{dec}} \times I_{2003,\text{dec}}^{2004} \times I_{2004}^{2005} \times I_{2005}^{2007,\text{jan}} .$$

In this computation for instance $I_{1980,\text{dec}}^{1981,\text{dec}}$ is one of the annual links of the CPI. More precisely, that annual link is what is known as the "long-term link" measuring the price development between December 1980 and December 1981. More detailed descriptions of the Previous methods are given by Statistics Sweden (2001). Other links used in the computation (1) will be described in the following sections.

New index links according to Walsh

After 2004, the annual index links of the CPI is computed according to the New index construction. For example, consider the index link I_{2004}^{2005}, used

in the chaining computation (1). This link measures the price development from the full year 2004 to the full year 2005 – or more precisely stated, from the average price level of 2004 to the average price level of 2005. It is computed by the index formula according to Walsh, which in principle can be written as

$$(2) \qquad I_{2004}^{2005} = \frac{\sum_i P_i^{2005} \times \sqrt{Q_i^{2004} \times Q_i^{2005}}}{\sum_i P_i^{2004} \times \sqrt{Q_i^{2004} \times Q_i^{2005}}} .$$

The summation in the numerator and the denominator runs over the various consumer products i, with annual mean prices P_i and consumed volumes (quantities) Q_i for each year.

The final index link in the chaining (1), the index link $I_{2005}^{2007,\,\mathrm{jan}}$, is computed using the usual index formula according to Laspeyres, which by corresponding notation in principle can be written as

$$(3) \qquad I_{2005}^{2007,\,\mathrm{jan}} = \frac{\sum_i P_i^{2007,\,\mathrm{jan}} \times Q_i^{2005}}{\sum_i P_i^{2005} \times Q_i^{2005}} .$$

This link is an index number that expresses price development up to January 2007, from the average price level of 2005.

In other words, the Walsh index according to equation (2) follows the price development of a basket of consumer products where the consumption volume of product i is $\sqrt{Q_i^{2004} \times Q_i^{2005}}$, thus the geometric mean of the volumes of the two years concerned, Q_i^{2004} and Q_i^{2005}.

Computation by traditional weighting together of sub-indices

The equations (2) and (3) show the conceptual nature of the index links, but they cannot be applied directly for practical computations. For instance, available statistics usually do not supply data on the consumed volume Q_i but instead on the corresponding value or cost of consumption. So for the practical computation, the index is re-written in a different form, along the lines of traditional practice for almost all index computations. So the index links are still computed by weighting together sub-indices for the product groups covered by the CPI.

To consider again the index link I_{2004}^{2005}, that index link is computed as a weighted average

$$(4) \qquad I_{2004}^{2005} = \sum_g W_g \times I_{2004;g}^{2005} \ ,$$

where the sub-indices $I_{2004;g}^{2005}$ for product groups g are weighted together. The weights are here computed by the formula

$$(5) \qquad W_g = \frac{\sqrt{U_g^{2004} \times U_g^{2005} \ / I_{2004;g}^{2005}}}{\sum_{g'} \sqrt{U_{g'}^{2004} \times U_{g'}^{2005} \ / I_{2004;g'}^{2005}}} \ ,$$

where U_g is the value of consumption in product group g during the year indicated. (Note that the weights sum up to one, as they should.) It can be proved mathematically that the weighted average (4) with these weights give a Walsh index, in the aggregation from the level of product groups g up to the overall CPI (cf. SOU, 1999, Bilaga 3).

In the same way the final link in the chaining (1) is computed as a weighted average of sub-indices for product groups,

$$(6) \qquad I_{2005}^{2007,\text{jan}} = \sum_g W'_g \times I_{2005;g}^{2007,\text{jan}} \ .$$

Here of course the weights are computed otherwise, so as to produce a Laspeyres index.

Data for weight computation

The data needed for the computation of the weights W_g used in (4) consist of the consumption values U_g, as is seen from formula (5). The same holds for the weights needed in (6), as well as for the weights used in the Previous CPI construction.

The data on consumption values are as before obtained primarily from the computations of household consumption made in the National Accounts. For the more specified breakdown on detailed product groups, the data from the National Accounts are as previously supplemented by data from the Household Budget Survey and certain other sources.

A new feature is that the data on consumption values do not need to be produced as rapidly as before. For the CPI during 2004, the weights of the final link pertain to 2003, thus the year before the current year. On the other hand, for the computation of the CPI during, e.g., 2007 data will not be needed for the consumption during the year before, i.e. 2006, but only for earlier years, i.e. 2005 and earlier. This is because in the chaining (1), the final link links the year 2005 to the current month.

The relaxing of the need for rapidly produced consumption data is of considerable advantage. The longer time available makes it possible to obtain more accurate data. Furthermore the less hurried production process for the weights can run more smoothly. No notable disadvantages should

result from the less rapid weight production. The timeliness of the weights for the Walsh link (4) is not disturbed, and that is what is vital to ensure the long-term unbiasedness of the CPI.

Approximations for the application of the Walsh formula

There are roughly 350 sub-indices for product groups which are weighted together in (4) and (6). The use of the Walsh index as method applies to the aggregation from the level of those product groups up to the overall CPI, and of course also to intermediate levels of aggregation (Coicop categories).

In practice certain approximations have to be made in the computation of the Walsh index. This is because the statistics on consumption values U_g partly lags behind on the necessary level of detail. Thus to some extent the breakdown of consumption values has to be based on projections from older data. This problem is thoroughly dealt with in the Government Commission Report (SOU, 1999). The computational solution is formally somewhat different from that of the Commission but is effectively entirely equivalent to the latter.

The transition

The phase of transition from the Previous index construction to the New one calls for some particular consideration in the computational design. The computation of the link $I^{2004}_{2003,\mathrm{dec}}$ in the chaining (1) thus has to be of a special form, carried out by this formula:

$$(7) \qquad I^{2004}_{2003,\mathrm{dec}} = \left(\frac{1}{12} \sum_{m=1}^{12} I^{2004,m}_{2003,\mathrm{dec}} \right) \times \frac{I^{2003}_{2002} \times I^{2004}_{2003}}{\frac{1}{12} \sum_{m=1}^{12} I^{2004,m}_{2002}} \, .$$

The summations here run over the months of the year. The monthly index numbers in the left-hand main factor are computed according to the Previous CPI construction, while the index numbers in the right-hand main factor are computed by the formulas (4) and (6) of the New CPI construction.

The somewhat complicated appearance of equation (7) is due to the need to correctly connect together the two index series, that of the Previous CPI construction and that of the New one. For it can be shown that in this way the means of the monthly index numbers during the year of transition 2004 will agree between the Previous and the New index construction, which is as it should be.

The first years

Thus 2004 was the last year with the Previous CPI construction, and the CPI was then chained together as:

$$I^{2004,\mathrm{jan}}_{1980} = I^{1980,\mathrm{dec}}_{1980} \times I^{1981,\mathrm{dec}}_{1980,\mathrm{dec}} \times \ldots \times I^{2004,\mathrm{jan}}_{2003,\mathrm{dec}} \, .$$

The final link $I_{2003,\mathrm{dec}}^{2004,\mathrm{jan}}$ here is what is known as a "short-term link", of Laspeyres type, and the preceding links are "long-term links" with retrospectively updated index baskets, according to the methodology applied before 2005 for the Swedish CPI.

From 2005 the New CPI construction is applied. For technical reasons in the transition, the index assumes a somewhat particular form for that year, corresponding to (1) but with a slightly deviating appearance, that is,

$$I_{1980}^{2005,\mathrm{jan}} = I_{1980}^{1980,\mathrm{dec}} \times I_{1980,\mathrm{dec}}^{1981,\mathrm{dec}} \times \ldots \times I_{2003,\mathrm{dec}}^{2003} \times I_{2003}^{2005,\mathrm{jan}} .$$

Instead of the transitional link (7) occurring in (1), there occurs here a somewhat different particular link $I_{2003,\mathrm{dec}}^{2003}$, computed according to

$$I_{2003,\mathrm{dec}}^{2003} = \left(\frac{1}{12} \sum_{m=1}^{12} I_{2003,\mathrm{dec}}^{2004,m} \right) \times \frac{I_{2002}^{2003}}{\frac{1}{12} \sum_{m=1}^{12} I_{2002}^{2004,m}} .$$

In this expression it holds as in expression (7) that the monthly index numbers in the left-hand main factor are computed according to the Previous CPI construction, while the index numbers in the right-hand main factor are computed by the formulae (4) and (6) of the New CPI construction.

During 2006 the CPI computation becomes

$$I_{1980}^{2006,\mathrm{jan}} = I_{1980}^{1980,\mathrm{dec}} \times I_{1980,\mathrm{dec}}^{1981,\mathrm{dec}} \times \ldots \times I_{2003,\mathrm{dec}}^{2004} \times I_{2004}^{2006,\mathrm{jan}} ,$$

and then for the following years it continues according to the pattern of formula (1).

It may be noted that the deviation from (1) in the computation formula just given for 2005 is in a way illusory. For it can be seen that according to the logic of the index chaining the latter expression is perfectly consistent with the general pattern of (1).

Index computation for product groups

As before, the practical price collection still normally follows the prices during a period of 13 months. That is, the prices are followed from December in the year before the current year, and then monthly during the current year. So for each product group g it is possible to compute an index number for the price development from December of the preceding year up to the current month. These "link elements" are thus of the form

(8) $$I_{2004,\mathrm{dec};g}^{2005,m} ,$$

where m runs through all months of the current year, here 2005.

Using these link elements as building-blocks one can construct the computation of those sub-indices for product groups that are weighted together in the formulas (4) and (6). That is done by these formulas:

$$I_{2004;g}^{2005} = \frac{I_{2003,\mathrm{dec};g}^{2004,\mathrm{dec}} \times \frac{1}{12}\sum_{m=1}^{12} I_{2004,\mathrm{dec};g}^{2005,m}}{\frac{1}{12}\sum_{m=1}^{12} I_{2003,\mathrm{dec};g}^{2004,m}}, \tag{9}$$

$$I_{2005;g}^{2007,\mathrm{jan}} = \frac{I_{2004,\mathrm{dec};g}^{2005,\mathrm{dec}}}{\frac{1}{12}\sum_{m=1}^{12} I_{2004,\mathrm{dec};g}^{2005,m}} \times I_{2005,\mathrm{dec};g}^{2006,\mathrm{dec}} \times I_{2006,\mathrm{dec};g}^{2007,\mathrm{jan}}. \tag{10}$$

Newly introduced product groups need some special consideration here. Assume e.g. that a product group g is newly introduced for 2007, so that prices for it are collected for the first time in December 2006. Then the annual link index $I_{2005;g}^{2007,\mathrm{jan}}$ shall be computed by formula (10) for that product group g, although only the link element $I_{2006,\mathrm{dec};g}^{2007,\mathrm{jan}}$ is available, but not $I_{2004,\mathrm{dec};g}^{2005,m}$ and $I_{2005,\mathrm{dec};g}^{2006,\mathrm{dec}}$ which are also needed in (10). For the latter link elements, imputations then have to be made in (10), by indices for a suitable related aggregate, chosen on a case-by-case basis.

Elementary aggregate indices

On the lowest level of aggregation, link elements (8) for all product groups g are computed from the observed prices. These indices are now, with very few exceptions, computed according to the Jevons index formula, that is, as geometric means of price relatives. For those product groups where micro-level weighting data are available, a weighted form of the Jevons index is applied, using value weights.

As is very well known (and easily proved mathematically), the Jevons index is theoretically likely to follow the consumers' cost under a certain condition of "normal" price elasticity (cf. Ribe, 2001). This is seen as making the Jevons index suitable for a cost-of living index, and thus for the Swedish CPI. Nevertheless, the Jevons index formula has also been found relevant for the HICPs and is thus in line with the harmonisation rules for those indices (Eurostat, 2001).

Exceptions where the Jevons index is not used are municipal services for home-owners, namely water, sewerage, garbage collection and chimney sweeping. For those services, instead the Dutot index is used, that is, ratio of

arithmetic means of prices. This is because those services are mandatory and subject to municipal monopoly, implying a price elasticity equal to zero.

Previously the Dutot index was used also for some other sub-indices, notably that for rents, where the Jevons index is now used.

Inflation rate – Previous method

For several years, until 2004, the Swedish official annual inflation rate was computed by a method that involved an adjustment factor. The adjustment factor canceled out the effects of the retrospective updates of the CPI basket, that were included in the Previous Swedish CPI construction. The inflation rate has then effectively shown the rate of change of an annually chained Laspeyres type index, without retrospective updates of the index basket. The aim can be described as to reflect how the price change over the past twelve months would turn out for an unchanged pattern of consumption. The method is further described by Statistics Sweden (2001).

The official measure of the Swedish annual inflation rate has previously been intended only for uses such as analyses of monetary policy and macroeconomics, not for indexation and cost compensation. This has been essential to stress in the presentation of the figures. The annual inflation rate has tended to lie about 0.2 percentage points above the annual change in the CPI numbers, on average over several years. This difference can be naturally explained by the difference between the two methods with respect to their sensitivity to consumers' adaptations of their consumption when prices change.

Inflation rate – New method

In the Swedish CPI publication for January 2005 and onwards, the inflation rate is computed as the change in per cent of the CPI number over the preceding twelve months. Expressed as a formula the annual inflation rate for January 2007 in per cent is now computed simply as

$$\left(\frac{I_{1980}^{2007,\text{jan}}}{I_{1980}^{2006,\text{jan}}} - 1 \right) \times 100 \ . \tag{11}$$

The mentioned previous use of an adjustment factor is thereby abandoned. Over time an insight has emerged that there are not really strong enough reasons for the use of the previous adjustment factor (as elaborated on in the Government Commission Report, SOU 1999:124).

The "New" method of computation for the inflation rate is already applied in uses of the CPI for indexation and cost compensation. Those uses are thus not concerned by the change of method of computation for the inflation rate.

With the New method the inflation rate is consistent with the index numbers in a natural way. This should make the presentation more readily comprehensible and reduce risks for misunderstanding.

Comparability of index numbers

On average over several years, the transition to a New index construction is expected to have at most a marginal impact on the computed CPI numbers. On the basis of existing data, no systematic tendency can be found statistically significant.

Computations on data for past years have shown that Walsh links between full years have on average fallen below the CPI links by up to about one tenth of a per cent annually. This difference is however not statistically significant and may thus possibly be due to haphazard fluctuations over time. The computations are rendered uncertain by both random variations and the difficulty to retrospectively simulate the New CPI construction in a fully realistic way.

The actual transition to the New index construction is, by the form of the transitional link (7), designed so as not to artificially disturb the level of the index series.

The following table compares the outcomes of different index formulas for annual links of the Swedish CPI for past years. The numbers in the table refer to the average price level of the year, compared to that of the year before. However, the column "Previous method" instead refers to the price in December compared to that of last year's December; this is the "long-term link" used in the Previous index construction.

Table 1. Annual index link (preceding year = 100), by alternative index formulas

Year	Laspeyres	Paasche	Previous method December	Walsh approx.	Edge-worth	Törn-qvist
1993	104,4831	104,1406	103,9105	104,3122	104,3156	104,3133
1994	102,1769	102,0059	102,2910	102,0883	102,0933	102,0884
1995	102,4697	102,1937	102,1679	102,3290	102,3343	102,3295
1996	100,9450	100,5787	99,8227	100,7565	100,7643	100,7538
1997	100,6731	100,3332	101,2690	100,5053	100,5027	100,5047
1998	100,1294	99,8442	99,5546	99,9889	99,9878	99,9887
1999	100,4796	100,2856	100,7853	100,3291	100,3825	100,3920
2000	100,9419	100,7307	101,1520	100,8478	100,8372	100,8431
2001	102,5242	102,4788	102,6581	102,5045	102,5018	102,5011
2002	102,2450	101,9871	102,1676	102,1238	102,1177	102,1265
Mean	101,7068	101,4579	101,5779	101,5785	101,5837	101,5841

It should be noted that these retrospective computations are in some respects approximate. Notably, the treatment of newly introduced product groups might have implied more elaborate considerations in a real application than here.

As expected from general theoretical knowledge, the Laspeyres figures are generally the highest and the Paasche figures the lowest ones. Interestingly, the superlative formulas Walsh and Törnqvist agree fairly closely, as well as the similar Edgeworth formula. The figures for "Previous method" are year

by year not well comparable to the other ones, in pertaining to December rather than full years, but still on average they are fairly close to those of the superlative formulas.

The undisturbed comparability over time between the Precious and the New CPI construction is signified in the presentation of the CPI, by the choice made to continue the CPI series with the same index reference year 1980 = 100 as before. A natural alternative choice would of course have been to start a new index series with index reference year 2004 = 100 from January 2005. However, the governing CPI Board preferred not to emphasize the change of index construction in the latter way, as that change should not be of great concern to users of the index.

Comparability with the HICP

The Harmonised Index of Consumer Prices (HICP) is like before chained over December, in accordance with the harmonisation rules of the European Union (cf. Eurostat, 2001). The more consistent use of the Jevons formula on the lowest level formally affects the comparability over time of the HICP but should have negligible or almost negligible impact, as that method is well comparable to the previous ones.

On the whole the national CPI and for the HICP use the same methods in Sweden, except for the differences in the macro-level index formula and the coverage in some product areas. In particular, the CPI but not the HICP covers the capital cost of owner occupied housing, by a user-cost approach that is presently re-considered (cf. Ribe, 2003), while on the other hand the HICP but not the CPI covers services of social protection and financial services with ad-valorem charges.

Comparison with the US Chained CPI

Apparently superlative indices have internationally not yet been very widely used in actual CPI computation. It may be noted though that the CPI of the United States is since a few years supplemented by an alternative index known as the Chained CPI, described by Cage et al. (2003). This index is monthly chained and uses the Törnqvist index formula, which is a superlative index.

As in the Swedish application and as theoretically expected, the superlative index tends to show smaller price increases than the Laspeyres-type index also in the US application, and here the difference has sometimes been notably large. However the outcome in the US application is influenced not only by the superlative index formula, but also by the use of monthly chaining, with monthly updating of the weights.

A comparison of principal methodological features may be summarised thus:

Index	Chaining method	Index formula
HICP	Annual over December	Laspeyres type
Swedish CPI	Annual over full year	Superlative: Walsh
US Chained CPI	Monthly	Superlative: Törnqvist

Comparability of inflation rate

The inflation rate computed by the New method is expected to be about 0.2 percentage points lower than that computed by the Previous method, on average over several years. However, this effect will vary between years and between months. These conclusions follow from studies of time series for the past couple of decades. This lowering effect can be given a natural explanation from the difference in treatment of the updating of the CPI basket.

The change of method may also imply a somewhat stronger tendency to artificial jumps between December and January in the inflation rate. This tendency is effectively eliminated if an annual moving average of the inflation rate figures is applied.

The lowering effect of the change of method on the inflation figures implies that the Previous and the New methods are not directly comparable to each other. Statistics Sweden has published a back-data time series of inflation numbers computed by the New method (applied to existing CPI numbers), from 1980 on.

It may be noted that according to the reasoning of Triplett (2001), the rate of change of a cost-of-living index should be seen as an appropriate measure of consumer inflation, suitable to guide monetary policy. Similarly, Hill (1999; cf. also ECE/ILO, 2001, par. 41) finds that the same index formula should be relevant for following both the cost of living and the inflation. In contrast, Leifer (2001) suggests a clear distinction between cost-of-living indices on the one hand and consumer price indices on the other hand, where the latter are relevant for inflation measurement.

The following table shows means and standard deviations in time series by month, for differences between alternative inflation rate. The first line of result figures in the table compares inflation rates computed on the one hand by the New methods for both inflation rate end index formula, and on the other hand by the Previous methods for both inflation rate end index formula. The second line compares the annual rate of change in the index according to the New and the Previous index formula. The third line finally compares the New and Previous inflation rate methods, both for the Previous index formula.

Table 2. Means (*m*) and standard deviations (*s*) over time, of differences between alternative inflation rates, in percentage points

	1984-2003		1994-2003	
	m	*s*	*m*	*s*
Difference of inflation rate by the New inflation rate method for New index formula, minus inflation rate by the Previous inflation rate method for the Previous index formula	0.28	0.35	0.30	0.28
Thereof: Effect of index formula	0.12	0.36	0.05	0.26
Difference between inflation rates by the New and Previous inflation rate methods, both for Previous index formula	0.16	0.17	0.24	0.19

Like in connection to Table 1, it should also here be noted that the retrospective index computations according to the New index construction involves certain approximations that may not be entirely typical for a real application.

It may be noted that there is a considerable random variability over time in the differences between the alternative figures, as is seen from the rather high values of the standard deviations. The mean difference due to the effect of the index formula (second line of result figures) does not really differ significantly from zero (by a crude *t*-test).

The following table shows the distribution of changes in the inflation rate from the preceding month. The figures in the table indicate the number of months when the inflation rate changed by various amounts, by the Previous and the New methods. The distributions are given separately for January and other months.

Table 3. Number of months by change in inflation rate, for Previous and New method of computation

		Monthly change in inflation rate, %-age points							
		0,0-0,4	0,5-0,9	1,0-1,4	1,5-1,9	2,0-2,4	2,5-2,9	3,0-3,4	Total
1984-1993									
Previous	- not Jan	75	23	8	0	0	4	0	110
	- Jan	5	2	0	1	0	2	0	10
New	- not Jan	76	22	5	3	0	1	3	110
	- Jan	3	2	1	1	1	1	1	10
1994-2003									
Previous	- not Jan	97	13	0	0	0	0	0	110
	- Jan	6	3	0	0	1	0	0	10
New	- not Jan	102	8	0	0	0	0	0	110
	- Jan	4	4	0	1	1	0	0	10

It is seen that both the Previous and the New methods have a tendency to unusually large jumps in the inflation rate in January. This is hardly surprising, as the outcome may be sensitive to the annual changes in the index basket. However it is notable that this tendency does not seem very

much stronger for the New than for the Previous CPI construction, although the New one is more complex.

Decomposition of the inflation rate

In the presentation of figures on the inflation rate, it is generally of interest to show how much various product groups contribute to the average price change. Such a decomposition of the inflation rate can be made also for a chain index, in principle exactly. For the case of chain indices chained over December, such as the HICPs, such a decomposition method has been described by Ribe (1999) and ILO et al. (2004, Sect. 9.127-9.130). There the idea is that the contribution to the inflation rate of a product group k can be written as:

$$\frac{\text{Cost change for } k\text{, May '98 - May '99}}{\text{Cost of basket in May '98}} =$$

$$= \frac{\text{Cost of basket in Dec '98}}{\text{Cost of basket in May '98}} \times \frac{\text{Cost change for } k\text{, Dec '98 - May '99}}{\text{Cost of basket in Dec '98}} +$$

$$+ \frac{\text{Cost change for } k\text{, May '98 - Dec '98}}{\text{Cost of basket in May '98}}.$$

This formula can be effectively used to compute the mentioned contribution of the product group k to the inflation rate.

The decomposition method can be adapted to be used also for the New Swedish CPI construction. Now the contribution to the inflation rate of the product group k is written as:

$$\frac{\text{Cost change for } k\text{, May '06 - May '07}}{\text{Cost of basket in May '06}} =$$

$$= \frac{\text{Cost of basket, Mean'04}}{\text{Cost of basket in May '06}} \times \frac{\text{Cost of basket, Mean'05}}{\text{Cost of basket, Mean '04}} \times \frac{\text{Cost change for } k\text{, Mean'05 - May'07}}{\text{Cost of basket, Mean'05}} -$$

$$- \frac{\text{Cost of basket, Mean'04}}{\text{Cost of basket in May '06}} \times \frac{\text{Cost change for } k\text{, Mean '04 - May '06}}{\text{Cost of basket, Mean '04}} +$$

$$+ \frac{\text{Cost of basket, Mean'04}}{\text{Cost of basket in May '06}} \times \frac{\text{Cost change for } k\text{, Mean '04 - Mean '05}}{\text{Cost of basket, Mean '04}}.$$

All the ratios on the right-hand side are available as index numbers in the computing system.

Main conclusions on comparability

A few main conclusions on comparability aspects are:

- Different superlative index formulas and similar methods tend to give closely similar results.
- Superlative indices tend to rise at notably lower rates than a Laspeyres type index. This phenomenon is well known and understood, and thus it should normally not be too troublesome in practice.
- While superlative indices appear to be more relevant than Laspeyres-type indices for compensation purposes, they may be adequate also to measure the inflation for other purposes.
- A superlative index and a Laspeyres-type index can be computed as alternatives to each other, from the same set of low-level sub-indices. The Swedish CPI and HICP are an example of this.

Acknowledgement

The author is grateful to colleagues at Statistics Sweden and members of the CPI Board for helpful comments and stimulating discussions in various phases of the work.

Disclaimer

The views expressed in this paper are those of the author solely.

References

R. Cage, J. Greenlees and P. Jackman (2003), Introducing the chained consumer price index, 7th Meeting of the Ottawa Group on Price Indices, in Paris.

Eurostat (2001), Compendium of HICP Reference Documents (2/2001/B/5), available at http://forum.europa.eu.int/Public/irc/dsis/Home/main

W.E. Diewert (1976), Exact and Superlative Index Numbers. Journal of Econometrics, 4, 115–145; reprinted in Essays in Index Number Theory, Vol. 1 (eds. W.E. Diewert and A.O. Nakamura), Amsterdam: North-Holland, 1993, pp. 223–252.

ECE/ILO (2001), Report, Annex: Summary of discussion, Joint ECE/ILO Meeting on Consumer Price Indices, in Geneva.

P. Hill (1999), Inflation, the cost of living and the domain of a consumer price index, Joint ECE/ILO Meeting on Consumer Price Indices, in Geneva.

ILO/IMF/OECD/UNECE/Eurostat/The World Bank (2004), Consumer Price Index Manual: Theory and Practice, Geneva: International Labour Office, available at www.ilo.org

H.-A. Leifer (2001), The suitability of consumer price indices and cost-of-living indices as a measure of inflation, WP-HICP Meeting November 2001, Eurostat, Document No. HCPI 01/376.

National Research Council (2002), At What Price? Panel on Cost-of-Living Indexes, Ed. by C.L. Schultze et al., Washington, DC: National Academy Press.

Prop. (2001), Nya riktlinjer för konsumentprisindex (Bilaga 4), Swedish Government Proposition No 2001/02:1, annex, Stockholm (in Swedish).

M. Ribe (1999), Effects of subcomponents on chained price indices like the HICPs and the MUICP, WP-HICP Meeting October 1999, Eurostat, Document No. HCPI 99/253.

M. Ribe (2001), Cost-of-living index (coli) as target for the Swedish CPI, Joint ECE/ILO Meeting on Consumer Price Indices, in Geneva.

M. Ribe (2003), Swedish re-considerations of user-cost approaches to owner occupied housing, Joint ECE/ILO Meeting on Consumer Price Indices, in Geneva.

M. Ribe (2004), Improved CPI construction from January 2005: Technical description, Statistics Sweden, available at www.scb.se

SOU (1943), Betänkande angående levnadskostnadsindex, Finansdepartementet, Stockholm, Statens Offentliga Utredningar (SOU) 1943:8 (in Swedish).

SOU (1999), Konsumentprisindex, Betänkande från utredningen om Konsumentprisindex, Statens Offentliga Utredningar (SOU) 1999:124, Stockholm (in Swedish, with summary and appendices in English).

Statistics Sweden (2001), The Swedish Consumer Price Index, A Handbook of Methods, SCB, by J. Dalén, available at www.scb.se

J. Triplett (1983), Escalation measures: What is the answer? What is the question?, Price Level Measurement (Ed. W.E. Diewert and C. Montmarquette), Ottawa: Statistics Canada, pp. 457-487.

J. Triplett (2001), Should the cost-of-living index provide the conceptual framework for a consumer price index? Economic Journal 111, F311-F334.