Zero Prices in the CPI

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Zero prices

1. Examples

- Medicine, medical services
- Child care
- Radio and TV license fees
- Public transport
- Toll and Parking fees, Motorway toll stickers
- Coffee or food in canteens
- Money exchange or other banking services

Computational problems in a CPI may occur if products with a positive price get a zero price, or if products that have always been for free, get a positive price.

2. Is a zero price relevant?

The relevance of a zero price may depend on the concepts and use of the CPI.

One measure should not be considered an income change and a price change if the CPI is primarily used together with income statistics to calculate purchasing power development.

E.g. if government pays for child care, and this was paid until now by consumers themselves, it should not be considered both an income increase and a price reduction.

In the European Harmonised Index of Consumer Prices (HICP) Council regulation No 1687/98 says:
"Prices used in the HICP are the purchase prices paid by households to purchase individual goods and services in monetary transactions. Where goods and services have been available to consumers free of charge, and subsequently an actual price is charged then the change from a zero price to the actual price, and vice versa, should be taken into account in the HICP."

3. An ambiguity in the definition of a zero price

CASE 1: A shopping mall builds a new parking garage and parking there is for free. This zero price has no relevance for the CPI.

CASE 2: A shopping mall builds a new parking garage, where parking costs €5 per day. This is a new product offer and is not treated as a price increase in the CPI, but from then on price changes are relevant for the CPI. After five years it is decided that from that time parking is for free. This is a price decrease to zero and gives a lower CPI-result.

4. Can we determine a weight for the transactions concerned?

If prices go from positive to zero, does the sample correctly reflect the share in consumption of which the price goes to zero?

If prices go from zero to positive, how much weight must be attributed to the new items in the CPI.
Be aware that quantities used in the time that the price was zero may overestimate the impact.
Where a strict Laspeyres principle may ask for high Q_o quantities of products consumed, an estimate of how much consumers are going to buy at positive prices may be more appropriate. Here we ask for wisdom from the index compilers.

e.g.

- Consumers must pay for a certain medicine, but an alternative medicine may still be provided for free.
- Consumers must pay for the use of payment cards, but the use of debit cards is still for free

5. Zero price for an individual product offer

5.1 Zero prices in a Dutot index

$$Dut_{0,1} = \frac{\sum_{i=1}^{N} P_{i1}}{\sum_{i=1}^{N} P_{i0}}$$

This does not lead to complications.

5.2 Zero Prices in a Jevons index

$$Jev_{0,1} = \sqrt[N]{\frac{\prod_{i=1}^{N} P_{i1}}{\prod_{i=1}^{N} P_{i0}}}$$

If one price becomes zero, e.g. $P_{N1}=0$, then the whole index is zero.

Also a very low price is not feasible.

If we take $P_{z,1} = P_{z,0} * 10^{-y}$ *and all other prices do not change, then*

$$Jev_{0,1} = \sqrt[N]{\frac{\prod_{i=1}^{N} P_{i1}}{\prod_{i=1}^{N} P_{i0}}} = \sqrt[N]{\frac{\prod_{i=1}^{N} P_{i0} * 10^{-y}}{\prod_{i=1}^{N} P_{i0}}} = \sqrt[N]{10^{-y}}$$

which is arbitrary.

Now if product offer N has a weight w the elementary index becomes:

$$\text{Index}_{EA} = (1\text{-w})*\text{JEV(N-1)} + \text{w}*0 = (1\text{-w})*\text{JEV(N-1)}$$

where JEV(N-1) is the Jevons index for the price observations that are non-zero in both periods compared.

Is there an imputed price for P_{N1} that gives the same result? Yes, that is:

$$\hat{P}_{N1} = (1-\mathrm{w})^{N} * \mathrm{JEV}(\mathrm{N}-1) * P_{N0}$$

If there is no additional information on the weight an equally weighted result for the sample would be to put

w = 1/N.

With n becoming larger the term $(1-1/\mathrm{N})^{N}$ converges to 1/e which equals 0.36788.

For a zero price becoming positive we use the inverse formula to make an estimated price for period 0.

$$\hat{P}_{N0} = \frac{1}{(1-\mathrm{w})^{N} * \mathrm{JEV}(\mathrm{N}-1)} * P_{N1}$$

6. Zero prices for an elementary aggregate

If in the Laspeyres index

$$L_{t,0} = \sum_{i=1}^{N} w_{i,0} * \frac{P_{i,t}}{P_{i,0}}$$

the price index for an elementary aggregate $P_{j,t}$ falls to zero, this gives no complications.

However, if for elementary aggregate *j* the base index $P_{j,0}$ and the weight $w_{j,o}$ were zero, we go back to the original Laspeyres formula, and combine the data for EA j with those for an elementary aggregate *k*.

$$L_{t,0} = \frac{\sum_{i=1}^{N} P_{i,t} * Q_{i,0}}{\sum_{i=1}^{N} P_{i,0} * Q_{i,0}} = \frac{P_{j,t} * Q_{j,0} + P_{k,t} * Q_{k,0} + \sum_{i \neq j \neq k}^{N} P_{i,t} * Q_{i,0}}{P_{k,0} * Q_{k,0} + \sum_{i \neq j \neq k}^{N} P_{i,0} * Q_{i,0}}$$

The combined term has a weight $w_{i,k}$ and an elementary index:

$$L_{t,o}^{jk} = \frac{P_{j,t} * Q_{j,0} + P_{k,t} * Q_{k,0}}{P_{k,0} * Q_{k,0}}$$

From the next period the item can be split into *j* and *k*.

N.B. Note the remarks in chapter 4 on choosing the right $Q_{j,0}$!!

Note that both EA's have a high elementary index and EA k has given some weight to *j*. Since these EA's are not published the trick is not visible in published results.

7. Zero prices for an ECOICOP

Two additional problems:

- all data are published and must be explained.
- in a harmonised index HICP national data must fit in European aggregation

The index and weight for the new ECOICOP must start in December with index 100 and a weight, which comes from other ECOICOP subclasses in the same ECOICOP class. This is to allow for consistent aggregation also across countries. Then calculate a January index for the new ECOICOP that brings the class index at the required level.

The smaller the weight taken for the new subclass the higher the index will need to be. My recommendation is:

- Calculate weights on the basis of December expenditures for existing subclasses and estimated January expenditures for the new subclass.
- In this case the index for the new subclass in December is 100 and in January it is exactly 100 + class index

Example:

		Index			Estimated expenditures				Recommended	Indices
		December	January			December	January		weights	
Existing subclasses	1	100	105		1	5000	5250		0,385	105,000
Existing subclasses	2	100	102		2	3000	3060		0,231	102,000
Existing subclasses	3	100	100		3	2000	2000		0,154	100,000
New subclass	4	100	???		4		3000		0,231	233,100
					Total	10000	13310		1	133,100
			Total expenditures for the weights				13000			