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# The use of Superlative Index Links in the Swedish CPI

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# Purpose of the Presentation

- Present the **approach** of the of the national Swedish CPI
- Present the **construction** of the CPI
- Explain the use of **superlative index links** in the CPI



# Background and Approach

- New index construction in 2005 following a Government Commission
- Cost-of-living index as a target (as before)
- Superlative index formula (Walsh) for macro level aggregation
- Avoid potential substitution bias
- Takes advantage of the modern theory of superlative indices
- A more clear theoretical foundation
- Fully comparable over time



# Uses of the Index


- For compensation and as a general measure of change in the cost of living of households
- For transforming nominal value changes into volume changes (deflator)
- For macro-economic policy



# The Chained CPI

$$\begin{aligned}
 I_{1980}^{2012,jan} = & \overbrace{I_{1980}^{1980,dec} * I_{1980,dec}^{1981,dec} * I_{1981,dec}^{1982,dec} * \dots * I_{2002,dec}^{2003,dec}} \\
 & * \underbrace{I_{2003,dec}^{2004}} * \underbrace{I_{2004}^{2005} * \dots * I_{2009}^{2010}} * \underbrace{I_{2010}^{2012,jan}}
 \end{aligned}$$


- Annual links chained over December until 2005 (Laspeyres-type)
- Transition using the average price level of 2004
- Annual links chained over the full year after 2005 (Walsh)
- A final link measures change in price level up to the current month, from average price level of year before preceeding year (Laspeyres)


$$I_{1980}^{2012, jan} = \dots I_{2008}^{2009} * I_{2009}^{2010} * I_{2010}^{2012, jan}$$

- The annual links in the Swedish CPI refers to the average price level of the year considered from the preceding year and are calculated using a **Walsh-index formula**

$$I_{2009}^{2010} = \frac{P_i^{2010} * \sqrt{Q_i^{2009} * Q_i^{2010}}}{P_i^{2009} * \sqrt{Q_i^{2009} * Q_i^{2010}}}$$

- CPI basket of goods and services of an annual link reflects a **blend of consumption patterns** of the year concerned and the preceding year


$$I_{1980}^{2012,jan} = \dots I_{2008}^{2009} * I_{2009}^{2010} * I_{2010}^{2012,jan}$$

- The final link is calculated using a **Laspeyres-index formula** and measures the change in price level from the average price level of the year before the preceding to the price level of the current month

$$I_{2010}^{2012,jan} = \frac{P_i^{2012,jan} * Q_i^{2010}}{P_i^{2010} * Q_i^{2010}}$$

- CPI basket of goods and services of a final link reflects the consumption patterns of the year before the preceding year




# Elementary Aggregate Indices

- Price collection follows prices during a period of 13 months, from December of the preceding year to December of the year concerned
- An index denoted  $I_{2011,dec;g}^{2012,m}$  is computed for each product group  $g$
- Used as building blocks when calculating the chained index







$$I_{1980}^{2012,jan} = \dots I_{2008}^{2009} * I_{2009}^{2010} * I_{2010}^{2012,jan}$$

- Using the elementary aggregate indices as building blocks the two final links in the chained index is computed for each product group  $g$

$$I_{2009;g}^{2010} = \frac{I_{2008,dec;g}^{2009,dec} * \frac{1}{12} \sum_{m=1}^{12} I_{2009,dec;g}^{2010,m}}{\frac{1}{12} \sum_{m=1}^{12} I_{2008,dec;g}^{2009,m}}$$




$$I_{1980}^{2012,jan} = \dots I_{2008}^{2009} * I_{2009}^{2010} * I_{2010}^{2012,jan}$$


- Using the elementary aggregate indices as building blocks the two final links in the chained index is computed for each product group  $g$

$$I_{2010;g}^{2012,jan} = \frac{I_{2009,dec;g}^{2010,dec}}{\frac{1}{12} \sum_{m=1}^{12} I_{2009,dec;g}^{2010,m}} * I_{2010,dec;g}^{2011,dec} * I_{2011,dec;g}^{2012,jan}$$



# Revision of the Index Links

- The Swedish CPI is formally established as it is published each month
- Revised index links of the form  $I_{2010,dec;g}^{2011,m,rev}$  are computed for each product group annually
- Revised price data, quality adjustments and weighting material etc.
- The revised index links are included in the two final links of the chained CPI


$$I_{1980}^{2012,jan} = \dots I_{2008}^{2009} * I_{2009}^{2010} * I_{2010}^{2012,jan}$$




# Weighting the CPI

- In order to obtain the index links that is used in the chained index, sub-indices for product groups  $g$  has to be weighted together
- **Consumption values** are used as weighting mechanism, rather than consumed quantities
- Weights are updated annually
- For the CPI during 2012 the latest data on consumption that is needed in the computations is for 2010 and earlier





$$I_{1980}^{2012, jan} = \dots I_{2008}^{2009} * I_{2009}^{2010} * I_{2010}^{2012, jan}$$

$$I_{2009}^{2010} = \sum_g W_g * I_{2009;g}^{2010}$$

$$W_g = \frac{\sqrt{U_g^{2009} * U_g^{2010} / I_{2009;g}^{2010}}}{\sum_{g'} \sqrt{U_{g'}^{2009} * U_{g'}^{2010} / I_{2009;g'}^{2010}}}$$

For product group  $g$  with consumption value  $U$  and where  $\sum W_g = 1$



$$I_{1980}^{2012,jan} = \dots I_{2008}^{2009} * I_{2009}^{2010} * I_{2010}^{2012,jan}$$


$$I_{2010}^{2012,jan} = \sum_g W'_g * I_{2010;g}^{2012,jan}$$

$$W'_g = \frac{U_g^{2010} / I_{2010;g}^{2012,jan}}{\sum_{g'} U_{g'}^{2010} / I_{2010;g'}^{2012,jan}}$$

For product group  $g$  with consumption value  $U$  and where  $\sum W'_g = 1$



# Summary

- New index construction for the national Swedish CPI in 2005
- COLI as a target (as before)
- The CPI is an chain index with annual links
- The annual links are computed by a superlative index formula, *Walsh index*
- Stronger theoretical foundation for the COLI target

