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Documentation about calculation methods used for the electricity supply price index (*SPIN 35.1*), home sales (HMPI)

The index figure for electricity (*SPIN 35.11*), home sales, shall reflect the price developments for the final consumer or final user as measured in Swedish crowns. These consist of *Household Consumers* and *Others*. The consumer price index for electricity (excluding grid fees) with taxes removed is used for *Household Consumers.* A model built on price information from the Nordic electricity exchange Nord Pool is used for *Others*. The model for *Others* is composed of four sub-indexes, which are totalled by their individual consumption values. These four parts are spot prices, a one-year contract that follows the calendar year, a one-year contract where delivery begins at a time other than January, and a two-year contract that follows the calendar year. Discussion with power suppliers and the availability of meter data form the basis of the decision to divide measurements into these contracts. The two year contract is intended to represent all contracts with a period longer than 12 months. Furthermore, the index figure for *Household Consumers* and *Others* is totalled by the same principle.

The index figure for grids (*SPIN 35.131*) is based upon price measurements from local grids. The same index figure is used for both consumer categories. Price data is collected from approximately 50 grid areas.

The index figure for electricity supply (*SPIN 35.1*) is a total of the index for electricity (*SPIN 35.11*) at the index for the grid (*SPIN 35.131*).

The model where electricity prices for the *Others* category, as measured through Nord Pool, has been implemented for index figures as of January 2001. The model was expanded upon in January 2006 to also include contracts with periods longer than one year. For earlier periods (before 2001) price information from power producers has been used. Below the subcomponents included in the calculations are described in greater detail.

Calculating an index for spot prices

As of November 2011 Sweden was divided into four bidding areas, where prices differ between areas. This also means that the calculation of the index for spot prices has been changed from November 2011.

The monthly spot prices, in SEK/MWh, per bidding area are retrieved from Nord Pool Spots website[1] each month. Those prices are weighted together

[1] http://www.nordpoolspot.com

into an average spot price for the whole of Sweden, after shares of sold volumes at spot prices for each bidding area, in this way:

$$P_{y,m} = \frac{\sum_{i=SE1}^{SE4} P_{y,m}^{i} \times Q_{y-1}^{i}}{\sum_{i=SE1}^{SE4} Q_{y-1}^{i}}$$

If $P_{y,m}$ is the weighted average of the monthly spot prices a given month *m* in the year *y*, the index links for the spot price index, where December = 100, can be written as:[2]

$$I_{y-1,Dec}^{y,m} = 100 \times P_{y,m} / P_{y-1,Dec}$$

Calculating an index for a calendar year contract

Model for one year contract

The index is intended to show the change over time for those prices paid for electricity delivered during a given month where the electricity price is fixed in a fixed price contract for the calendar year. The fixed price is that which applies for the delivery period and was decided upon by an earlier agreement.

The average price[3] over all contracts regarding the delivery period of January up to and including December in the year *y* can be written as (F=Forward):

$$\overline{P}_{m,y} = \sum_{i=jan}^{dec} w_{i,y-1} \overline{F}_{i;y-1} + \sum_{i=jan}^{dec} w_{i,y-2} \overline{F}_{i;y-2}$$

Where

$\sum_{i=jan}^{dec} w_{i,y-1} + \sum_{i=jan}^{dec} w_{i,y-2} = 1$ is a weighted distribution based on how large the contracts' percentages are concluded every month for the two years preceding the beginning of delivery.

[2] Additions to the price in a given month also occur according to a standardised schematic margin and the electricity certificate fee. The electricity certificate fee is collected from the Swedish power grids' market statistics. The prices used are the average monthly prices multiplied by the percentage of those obligated by a purchasing quota in the *Others* category.

[3] Additions to the price in a given month also occur according to a standardised schematic margin and the electricity certificate fee. See footnote 1.

$\overline{F}_{i,y-1} = (\prod_{i=1}^{n_i} F_{i,y-1})^{1/n_i}$ where $n_{i,\,y-1}$ is the number of business days a month in the year y-1.

$\overline{F}_{i,y-2} = (\prod_{i=1}^{n_i} F_{i,y-2})^{1/n_i}$ where $n_{i,\,y-2}$ is the number of business days a month in the year y-2.

Thus

$$\overline{P}_{m,y} = \sum_{i=jan}^{dec} w_{i,y-1} (\prod_{i=1}^{n_i} F_{i,y-1})^{1/n_i} + \sum_{i=jan}^{dec} w_{i,y-2} (\prod_{i=1}^{n_i} F_{i,y-2})^{1/n_i}$$

This applies for all months *m* in the year *y*, which is perfectly natural as the price is supposed to reflect a fixed price contract that follows the calendar year.

Model for two year contract

The index is intended to show the change over time for those prices for electricity delivered during a given month where the electricity price is fixed in a fixed price contract with a two-year period The fixed price is that which applies for the delivery period and was decided upon by an earlier agreement.

Average price[4] over all contracts regarding the delivery period of January up to and including December in the year y can be written as (F_y = Forward year y):

$$\overline{P}_{m,y} = \frac{1}{2}(\overline{F}^1 + \overline{F}^2)$$

where

$$\overline{F}^1 = \frac{1}{2}\left(\sum_{i=jan,y-3}^{dec,y-2} w_i \overline{F}_{i;y-1} + \sum_{i=jan,y-3}^{dec,y-2} w_i \overline{F}_{i;y} \right) \text{ and}$$

[4] Additions to the price in a given month also occur according to a standardised schematic margin and the electricity certificate fee. See footnote 1.

$\overline{F}^{2} = \frac{1}{2}\left(\sum_{i=jan,y-2}^{dec,y-1} w_i \overline{F}_{i;y} + \sum_{i=jan,y-2}^{dec,y-1} w_i \overline{F}_{i;y+1} \right)$ and there

$\sum_{i=jan,y-2}^{dec,y-1} w_i = 1$ and $\sum_{i=jan,y-3}^{dec,y-2} w_i = 1$ is a weighted distribution based on how large the contracts' percentages are concluded every month for the two years preceding the beginning of delivery.

and

$\overline{F}_{i,y} = (\prod_{i=1}^{n_i} F_{i,y})^{1/n_i}$ where $n_{i,\,y}$ is the number of business days a month in the year y.

This applies for all months *m* during the year *y*, which is perfectly naturally as the price is supposed to reflect the average of two fixed price contracts that each follow two calendar years.

Calculating an index for a "rolling" contract period

This part of the model is intended to measure the part of the fixed-price contract that does not necessarily follow the calendar year. The index is intended to show the change over time for those prices that are paid for electricity delivered during a given month. Deliveries for a rolling 12 month contract occur at a fixed price over the course of 12 months. The fixed price is that which applies for the delivery period and was decided upon by an earlier agreement.

The average price for all contracts regarding the delivery period of the month m to month m+11 can be written as

$$\overline{P}_m^{m+11} = \sum_{M=m-12}^{m-1} w_M \overline{P}_{m;M}^{m+11}, \qquad (1)$$

where

$w_M \left(\sum_{M=m-12}^{m-1} w_M = 1 \right)$ is a weight distribution based on how large the contracts' percentages are and every month for the year preceding the beginning of delivery. In the case of "rolling" contracts, one does not consider that certain contracts can be concluded for more than one year preceding the beginning of delivery

$\overline{P}_{m;M}^{m+11}$ is the delivery period's geometric average price for a given price determination month M:

$$\overline{P}_{m;M}^{m+11} = \tfrac{1}{12} \sum_{\mu=m}^{m+11} \overline{F}_{\mu;M} \qquad (2)$$

where $\overline{F}_{\mu;M}$ is the average price month M for deliveries in the given month μ. $\overline{F}_{\mu;M}$ is meanwhile not known because short-term trade (4 week blocks) starts so very close to the beginning of the delivery period. Thus, it is assumed that the average price during the price determination month is the same for all those months included during each delivery season.

$$\overline{F}_{y,Jan;M} = \overline{F}_{y,Feb;M} = \overline{F}_{y,Mar;M} = \overline{F}_{y,Q1;M} \qquad (3.1)$$

$$\overline{F}_{y,Apr;M} = \overline{F}_{y,Maj;M} = \overline{F}_{y,Jun;M} = \overline{F}_{y,Q2;M} \qquad (3.2)$$

$$\overline{F}_{y,Jul;M} = \overline{F}_{y,Aug;M} = \overline{F}_{y,Sep;M} = \overline{F}_{y,Q3;M} \qquad (3.3)$$

$$\overline{F}_{y,Okt;M} = \overline{F}_{y,Nov;M} = \overline{F}_{y,Dec;M} = \overline{F}_{y,Q4;M} \qquad (3.4)$$

where $\overline{F}_{y,Q1;M}$ To $\overline{F}_{y,Q4;M}$ is the geometric mean figure of the closing prices F and business day h=}}1, …, H\\ during the price determination month M in quarterly terms ENOQ1-y to ENOQ4-y (y=delivery year).

$$\overline{F}_{y,Q_i;M} = \prod_{h=1}^{H} (F_{y,Q_i;M,h})^{1/H} \qquad (4)$$

For quarter *i*

For every price determination month M there is, with the simplification made in (3.1), (3.2), (3.3), and (3.4), average prices for four delivery periods according to (2) that are included in the calculation of the index. A price applies for the delivery from January to December, one for the period April through March, one for the period July to June, and one for the period October to September.

By replacing (2) with (3.1) in (1) the final price can be calculated as an unweighted, average price regarding four individual, fictive contracts with 12 months delivery period (January to December, April to March, July to June, and October to September). The given monthly price is thus the average of the four yearly contracts that refers to delivery during the given month.