# METHODOLOGICAL NOTES

## CALCULATION OF AVERAGE PRICES AND PRICE INDICES

**The agricultural producer price indices** measure price movements of selected crop and animal products and determine temporary trends on the agricultural market. They are important part of European statistical database and indispensable indicator for compiling The Economic Accounts for Agriculture. Classification of the price index of agricultural producers is based on a methodology of the Eurostat.

## Average prices

The agricultural price statistics distinguishes seasonal and unseasonal commodities. The seasonal commodities are available in the market only in some months of the year and include fruits, vegetables, etc. On the contrary, the unseasonal commodities are available in the market for the whole year. They include livestock, milk, etc.

The average prices and the average unit prices are an output of the price agricultural statistics for both seasonal and unseasonal commodities. The average monthly and annual prices are published for the Czech Republic and in addition for some important commodities the average monthly prices for individual regions are published.

**The average monthly price** of the observed agricultural products is a simple arithmetic mean of reported prices of individual producers.

**The average monthly unit price** of products is calculated as quotient of total sales of production and total quantity sold for the certain period. Data are always indicated in comparison with the average prices with monthly delay.

**The average annual price and average price from the beginning of the year** are calculated for the unseasonal commodities as the simple arithmetic mean from the average monthly prices and for the **seasonal commodities** are calculated as a weighted arithmetic mean of individual months in which price was observed.

## Fixed base price index

**A structure of the agricultural producer price indices** is formed by 59 basic agricultural products (price representatives), 46 of which are crop products, including fruits and vegetables, and 13 of which are animal products. Further, the prices of 38 another products, which aren't included into calculation of indices, are observed. Only their average prices are published.

**The monthly price indices** of individual representatives are calculated as quotient of their average price in the reference month and **the average annual price in 2020 (basic period)**. The monthly indices for higher aggregations are calculated using the weighted arithmetic average of the price indices of relevant products (weights in per mill).

The price indices are calculated on a basis of prices from the samples of representatives into aggregation using a calculation formula of the Laspeyres type (see below). The calculation uses **constant weights which are derived as the average sales from selling agricultural products from 2019 to 2021.**

$$IB_{m,r} = I_{1/0} = \frac{\sum \frac{p_1}{p_0} p_0 q_0}{\sum p_0 q_0} *100$$

$p_1$   - The price in the reference period

$p_0$   - The price in the basic period

$p_0 q_0$ - The constant weight

# Derived indices

The indices with derived price base are calculated and published along with the fixed base indices, which are computed to the price base „**2020 average = 100**". The mentioned fixed base indices are used for the calculations derived indices on the level of representative or higher aggregations.

1. Calculation of the price indices to the base „previous period = 100" for representative and aggregation (month-over-month index)

- **Month-over-month index (Monthly growth rate)**

$$IP_{m,r} = \frac{IB_{m,r}}{IB_{m-1,r}} *100$$

$IB_{m,r}$   - The fixed base index in the reference month ($m^{th}$) and year ($r^{th}$)

$IB_{m-1,r}$ - The fixed base index in previous month

- **Average monthly growth rate from the beginning of the year to the m$^{th}$ month**
  It is not counted for the seasonal commodity.

$$\overline{IP}_{m,r} = \sqrt[m]{\frac{IB_{m,r}}{IB_{12,r-1}}} * 100$$

$IB_{m,r}$   - The fixed base index in the reference month ($m^{th}$) and year ($r^{th}$)

$IB_{12,r-1}$ - The fixed base index in December of the previous year

- **Average monthly growth rate in the reference quarter**
  It is not counted for the seasonal commodity.

$$\overline{IP}_{m,r}^{Q} = \sqrt[3]{\frac{IB_{m,r}}{IB_{m-3,r}}} * 100$$

$IB_{m,r}$   - The fixed base index in the last month ($m = 3, 6, 9, 12$) of the reference quarter

$IB_{m-3,r}$ - The fixed base index in the last month ($m = 3, 6, 9, 12$) of the previous quarter

2. <u>Calculation of the price indices to the base „corresponding period of the previous year = 100"
   for representative and aggregation</u>

- **Monthly year-over-year index**

$$IS_{m,r} = \frac{IB_{m,r}}{IB_{m,r-1}} * 100$$

$IB_{m,r}$ - The fixed base index in the reference month ($m^{th}$) and year ($r^{th}$)

$IB_{m,r-1}$ - The fixed base index in the corresponding month of the previous year

- **Average monthly year-over-year index from the beginning of the year to the mth month**

$$\overline{IS}_{m,r} = \frac{\overline{IB}_{m,r}}{\overline{IB}_{m,r-1}} * 100 = \frac{\frac{1}{m} * \sum_{i=1}^{m} IB_{i,r}}{\frac{1}{m} * \sum_{i=1}^{m} IB_{i,r-1}} * 100$$

$\overline{IB}_{m,r}$ - The arithmetic average of the fixed base indices from the beginning of the year to the reference month ($m^{th}$) of the year ($r^{th}$)

$\overline{IB}_{m,r-1}$ - The arithmetic average of the fixed base indices from the beginning of the previous year to the corresponding month of the previous year

- **Average monthly year-over-year index in the reference quarter**

$$\overline{IS}_{m,r}^{Q} = \frac{\overline{IB}_{m,r}^{Q}}{\overline{IB}_{m,r-1}^{Q}} * 100 = \frac{\frac{1}{3} * \sum_{i=m-2}^{m} IB_{i,r}}{\frac{1}{3} * \sum_{i=m-2}^{m} IB_{i,r-1}} * 100$$

$\overline{IB}_{m,r}^{Q}$ - The quarterly arithmetic mean of the fixed base indices to the last month ($m = 3, 6, 9, 12$) of the reference quarter and year ($r^{th}$)

$\overline{IB}_{m,r-1}^{Q}$ - The quarterly arithmetic mean of the fixed base indices to the last month ($m = 3, 6, 9, 12$) of the corresponding quarter of the previous year

## WEIGHTING SCHEME

The weighting scheme of aggregated groups and subgroups is based on The Economic Accounts for Agriculture. The weights of individual representatives are based on sales which are reported by the agricultural producers.

By reason of the seasonality of some products, **variable monthly weights** are used to calculation of the agricultural producer price indices

The weights of agricultural seasonal and unseasonal commodities differ from each other in the different months of the year. Therefore, the two-dimensional weighting scheme in the form of a matrix is used in the index calculation. The first dimension is vertical aggregation from the level of representatives up to the total level and the second horizontal dimension is for 12 months of the year.

- **The monthly weights in absolute values**, which are obtained from sales from selling agricultural products from 2019 to 2021, are used for calculation of the average price from the beginning of the year and for calculation of the average fixed base index for the seasonal commodities. The monthly weights in absolute values are used in the calculation of the average fixed base index for the certain quarter for seasonal commodities and the average fixed base index from the beginning of the year for aggregations.

- **The monthly weights expressed in ‰** are calculated from the monthly weights in absolute values. They are used for calculation of the monthly fixed base index for individual aggregations. The sum of the weight into highest aggregate level „Total agricultural products including fishes" is equal to 1000 in each month.

The monthly weights in absolute values for **the unseasonal commodities** are calculated by equally splitting of annual absolute weights, i.e. every month is expressed as 1/12 from annual weight.

The monthly weights in absolute values for **the seasonal commodities** are calculated by splitting their annual weights among months in which the seasonal commodities are available in the agricultural market. Ratios of weights in individual months are based on reported sales from selling agricultural products.

## PRICE COLLECTION

Prices of the selected agricultural products, which are determined for the domestic and foreign market, are monthly collected through the state statistical statement „**Ceny Zem 1 – 12**" at about 500 selected agricultural producers. The surveyed prices are exercise (contract) prices (excluding own consumption) **without VAT and transportation cost** associated with delivering to customers.

## REVISION AND ITS HISTORY

A purpose of revision is actualization of the making system of the price statistics, particularly by reason of accumulated changes in real described field. The revisions are planned and they are usually performed in five-year periods.

For the last time the agricultural producer price indices have been subjected to the standard comprehensive revision **during the year 2022**. Within this revision the selection of representatives and respondents was revised, the new price and index basis was set, and the new weighting scheme based on the structure of sales for selling agricultural products in individual months was introduced. The approach to the weighting schemes and the system of the calculation had to be

changed because in the new revised structure was necessary to allocate some other agricultural products and include them among the seasonal representatives.

The current methodology of the statistical survey of the agricultural producer price indices has been valid since **January 2023**.