Agricultural price statistics in the Czech Republic

Zemědělská cenová statistika v České republice

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Abstract: Price indices of agricultural producers and forestry price indices were revised in the year 2000. The process in question involved a revision of the set of commodities and re-basing of the current base period to the new base period effective for the calculation of agricultural price indices. The weighting scheme of products and their aggregated groups has been changed. The contribution deals with the analysis of a new project regarding the construction of price indices of agricultural producers according to the Eurostat methodology. This project shows different approaches in measuring the weighting schemes of seasonal products and products without seasonality.

Key words: price agricultural statistics, state statistical report, price index, aggregation of prices, weighting scheme

Abstrakt: Cenové indexy zemědělských výrobců a indexy cen v lesnictví prošly revizí v roce 2000. Byl revidován výběr reprezentantů a bylo stanoveno nové základní období indexů. Změnil se váhový systém pro výrobky a pro jejich agregáty. V příspěvku je analyzován nový projekt pro výpočet indexů cen zemědělských výrobců podle metodiky Eurostatu, který reaguje na různé možné přístupy pro váhová schémata sezónních a nesezónních komodit.

Klíčová slova: cenová zemědělská statistika, státní statistický výkaz, cenový index, agregace cen, váhové schéma

The aim of Price Statistics is to provide indices of price levels i.e. changes in the levels of prices, which are suitable for both direct testimony and elimination of price movement by indicators surveyed in the current prices (so-called statistical deflation). The direct testimony on price level movement has to be prompt and tangible. From this point of view, it is useful in practice to pay close attention to monthly price indices of the individual types of prices.

The Agriculture Price Statistics exploits selective methods verified by the statistics theory and practice. From those verifications and experience, it is well known that an acquisition of credible information is possible to ensure by a representative sample. Price trends survey is based on a set of the selected products, so-called price representatives.

Along with the physical quantities, the selling prices of agricultural products have a decisive influence on farmers' incomes. It therefore seems useful to have indicators showing how agricultural revenues are influenced by their price component. This indicator directly relates to the measurements of price movements and transitional price trends, which are especially used in connection with the analysis of farmers' incomes. As a tool for measurements in question, there are absolute agriculture prices and on the other hand agricultural price indices. Thus the purpose of the price indices is to provide information on the trends in producer prices of agricultural products and the effect of the relative price changes on agricultural income.

AIM AND METHODOLOGY

The aim of this contribution is to compare and analyse methods for calculation of the absolute agricultural prices and their price indices. A long time used national methodology varies from the methodology corresponding to the Eurostat requirements (the European Statistical Office) in a way of weighting, in the structure of indices and its level of detail. For further and more detailed description and comparison, these two approaches will be called the "national" and the "EU concept".

Methodology of price survey and collection

The current system of statistical survey has been in use since 1991. The prices are measured in the network of selected agricultural producers. Prices measured by the means of the national statistical questionnaire are contractual prices (free of VAT) for the selected agricultural products related to quality and/or other parameters either given in the name of the product or in the methodological instruction "Description of Representatives for the Questionnaire Ceny Zem 1-12", classified to the Divisions 01–05 of the CZ-CPA. Prices mentioned are designed for the domestic market only (Statistical Yearbook 2004).

Prices of products designated for clearance sales, sales in own trade chains, sales to own employees and sales abroad are not included in the survey (Monthly Report ... 2005).

Prices should be recorded at points, which are as close as possible to those of the transactions, which the farmer actually undertakes. This means that product prices should be recorded at the first marketing stage so as to best indicate the actual producer prices received by farmers (Handbook for the EU ... 2001).

Average monthly prices measured from the surveyed prices are calculated as a simple arithmetic mean of the individual producers. Prices are also divided by the territorial breakdown (districts, regions, areas and the C.R.).

The reporting duty can only be imposed by state administrative authorities on the basis of the law. The State Statistical Service (the Czech Statistical Office, units of the state statistical service established at ministries and at other central government offices – see the Competence Act) lays down the reporting duty on the basis of the Act 89/1995, Section 19 of the Collection, §10, §11, §15. In accordance with the Act 89/1995 the reporting unit has to provide the required information at its own expenses and each unit of the State Statistical Service is bound by the law to prevent the respondents' individual data from being misused.

Methodology of price indices and absolute prices

Since 1992, agricultural prices of 129 representative items were measured (79 crop products, including fruit and vegetables, and 50 animal products) among agricultural producers. Since 2001 (after the other comprehensive revision carried out in 2000), the selection of products was revised and reduced. In consequence of that, prices have been measured only on 95 fundamental agricultural products (63 crop products, including fruit and vegetables, and 32 animal products). The measurement is taken in about 650 selected agricultural producers (Price Indices ... 2001).

Several years ago, a gradual process of harmonization of agricultural price indices and absolute prices by the EU requirements was established. The calculation following the EU requirements and norms (according to the pilot project) was carried out. At the time being, the results are compared and considered.

All the price indices listed in this article are calculated as sample indices – i.e. their calculation is based on the prices of the selected representatives obtained in a sample of reporting units (agricultural producers). The individual price indices of the representatives are grouped to make the aggregate indices for groups and an aggregate index for the whole set of the representatives. This is done by the means of a weighted arithmetic mean of the individual indices where structural indicators of value (sales of agricultural products) of the individual representatives or a group of representatives are used as constant weights. These structural indicators are determined from the figures related to a base ("zero") period (e.g. to years 1993, 1999, 2000) (Statistical Yearbook ... 2003).

The above aggregation into the aggregate index can be described by this modified Laspeyres formula:

$$I = \frac{\sum_i \frac{p_{1i}}{p_{0i}} \times w_{si}}{\sum_i w_{si}} \times 100$$

Where:

p_{1i} = the price of the i-th representative in the reference period

p_{0i} = the price of the i-th representative in the basic period

w_{si} = the constant weight (structural indicator of value, usually in per milles) of the i-th representative/group of representatives.

The elementary monthly index of the price of a representative item is obtained by relating the current monthly price to the reference price, i.e. to the annual average price of the elementary product in the base year.

ANALYSIS OF SURVEYED AND MEASURED RESULTS

According to the "national concept", all agricultural products are considered as highly seasonal items (weighting proportions in different months

are reciprocally diverse). Thus, there is used the two-dimension weighting scheme (matrix) for each product. One dimension is intended as a vertical aggregation from a detailed representative up to the highest aggregate index for the whole set of the representatives "Agricultural products, total". The second dimension is for 12 months in the year. A nominal sum '1000' equals the sum of constant weights of the highest aggregation 'Agricultural products, total' for all 12 months of the base year. The weighting scheme is usually changed every five years. Re-basing is done for the years ending by '0' and '5'.

The annual average price of the representative in the base year is calculated as the weighted arithmetic mean of the monthly average prices with the use of weights presenting the relative monthly proportions of quantities of the sold products to the yearly agricultural production.

In some cases, the representatives with the nil weights and thus the nil prices (it means they do not appear in the agricultural market) are entering into monthly calculations. However, there are no indices measured by these products in question. It results in a discontinuity of the index time series.

For users exploiting the indices of agricultural prices, few price bases exist:

a) previous month = 100
b) corresponding period of the last year = 100
c) year 2000 average = 100
d) year 1999 average = 100 (the fundamental index calculated from prices, the remaining ones are derived)
e) ratio of two rolling averages (the average of last 12 months' index numbers to the average for the previous 12 months).

According to the "EU concept", unlike the "national concept", agricultural products are divided into seasonal items (the group of fruit and vegetables) and the ones without seasonality (the others). As for the calculation of absolute prices and price indices, the different approaches exist for the groups mentioned. Firstly, there is need to define prices of the base period and constant weights so that the monthly price ratio could be computed.

Calculation of base prices of products without seasonality

The annual prices of the base period are calculated as a simple arithmetic mean of the monthly prices of the base year. When there are no transactions and therefore no prices for certain products in some months (the products in question are not currently in the market), the last recorded price is used for the period concerned. Average prices in the subsequent years are calculated similarly as follows: annual prices are calculated as a simple arithmetic mean of the prices measured of all 12 months. It follows that in the case of repetition of the last recorded price, these fictitious prices are also taken into account during the calculation. In the case the price is missing since January of the given year (e.g. January 2001), the last price from the previous year (e.g. November 2000) is used.

There is no price available in May (Table 1). In our case, the price of April (7 195 CZK/t) is used for the following month. It follows that the average price for 2001 is obtained by averaging all 12 months.

Calculation of base prices of seasonal products

The base price for an individual product (fruit and vegetables variety) is calculated by multiplying the price for each month of the base period by the corresponding monthly weight in per cent and dividing the sum of these weighted monthly prices by one hundred. Average prices in subsequent years are calculated similarly as follows: annual prices are calculated as the sum of the weighted monthly prices (multiplying the price for each month of the

Table 1. Rape – calculation of the annual average price – product without seasonality (year 2001)

	1/01	2/01	3/01	4/01	5/01	6/01	7/01	8/01	9/01	10/01	11/01	12/01	2001
Rape – price CZK/t	6 822	7 312	7 563	7 195		7 700	6 570	6 679	6 817	7 140	7 446	7 841	7 190

Table 2. Celery – calculation of the annual average price – seasonal products (year 2001)

	1/01	2/01	3/01	4/01	5/01	6/01	7/01	8/01	9/01	10/01	11/01	12/01	2001
Celery – price CZK/t	7 314	7 261	7 619	9 921			21 450		12 140	8 700	8 943	8 930	9 291
– weight	5.17	6.49	5.77	2.90	0	0	4.03	0	5.92	41.85	19.51	8.35	100

current period by the corresponding monthly weight of the base period in per cent) divided by one hundred. When there are no transactions and therefore no prices for certain products in some months (the weights of the products in question are not defined in the base period), the last recorded price is not used for the period concerned. In the case the price is not available in months in which the weights exist, there is a need to treat the missing observation by the recommended methods.

In the calculation, there are used only prices from January to April, the price of July and prices from September to December (Table 2). The choice of months is dependent on the given weighting scheme of the selected product.

Calculation of value weightings for the months of the base year and monthly indices

Without regard to the seasonality, the annual weights expressed in ‰ are obtained by relating the annual sales of individual products to the total amount of sales. These weights are used both in the calculation of monthly and annual indices of products without seasonality and the aggregation of groups of agricultural products (without seasonality) with groups "Fruit, total" and "Vegetables, total".

Concerning products without seasonality and their groups, constant weights are applied to the calculation of the monthly aggregated indices during the whole year. In the case that some product is missing in the market in the particular month, it is sufficient to transfer the price from the last surveyed period to the reference period. In consequence of the price repetition and treatment in months mentioned, the monthly index of these representatives is equal to 100. Unlike the "national concept", a continuity of price series is maintained.

For each month, the permillages (‰) for seasonal products are calculated from the absolute value weights. The monthly weight for the product group "total fruit" and "total vegetables" is made equal to the weight used for the mentioned groups in the annual index. Just these weights are used in the month index calculation of seasonal products (Table 3).

The calculation of weights of other seasonal products and in other months is analogous.

Calculation of annual indices

Price indices of agricultural products without seasonality up to the level "Crop products excl. fruit and vegetables" and "Agricultural production excl. fruit and vegetables" inclusive, are calculated as simple arithmetic means of monthly indices (all 12 months are taken into account). To incorporate the annual indices for fresh fruit and vegetables into the overall index "Agricultural production, the total" corresponding annual weights must be applied.

Concerning seasonal products, monthly value weights in % are measured for each fruit and vegetables variety (according to the conditions in the base year) based on the proportion of the absolute annual value that is marketed in each month (Table 4).

The annual average indices for seasonal products and their groups (fresh fruit and vegetables) measured similarly as base prices are the weighted arithmetic averages of monthly indices. For each seasonal va-

Table 3. Calculation of monthly value weights in ‰ (given the assumption that only two products exist in the fruit market)

	1/00	2/00	3/00	4/00	5/00	6/00	7/00	8/00	9/00	10/00	11/00	12/00	2000
Fruit (abs. weight)						150	400	300					850
Pear (abs. weight)							200	300					500
Cherry (abs. weight)						150	200						350
Fruit (weight in ‰)	15	15	15	15	15	15	15	15	15	15	15	15	15
Pear (weight in ‰)							7.5	15					8.8
Cherry (weight in ‰)						15	7.5						6.2

Annual weight:
850 .....15‰
500..... x (8.8‰)
850.....15‰
350..... x (6.2‰)

x – unknown

Monthly weight (in 7th month):
400.....15‰
200.....x (7.5‰)

Table 4. Calculation of monthly value weights in % (given the assumption that only two products exist in the fruit market)

	1/00	2/00	3/00	4/00	5/00	6/00	7/00	8/00	9/00	10/00	11/00	12/00	2000
Fruit (abs. weight)						150	400	300					850
Pear (abs. weight)							200	300					500
Cherry (abs. weight)						150	200						350
Fruit (weight in %)													
Pear (weight in %)							40	60					100
Cherry (weight in %)						43	57						100

riety covered by the index, a weighted annual mean price relative is calculated. This is obtained from the monthly price relatives in the same way and by applying the same seasonal weights as in the calculation of base prices. The annual indices (up to the level of groups 'Vegetables' and 'Fruit') are then obtained by aggregating the annual price relatives with the annual index weights.

DISCUSSION

After a deeper and more detailed analysis of the approach mentioned concerning the calculation of agricultural price indices and absolute prices, it is possible to state that both methodologies have more or less accurate properties. As regards the calculation of the annual absolute prices average prices measured

Table 5. Comparison of the concepts in the calculation of monthly and annual prices for a selected product (CZK/t) – sugar beat

Month/price	12/00	01/01	02/01	03/01	04/01	05/01	06/01	07/01	08/01	09/01	10/01	11/01	12/01	Annual price
National concept														
Weight (%)	3.80	0	0	0	0	0	0	0	0	1.13	3.59	5.69	3.80	
Sugar beat	979									963	961	964	969	964.5
EU concept														
Sugar beat	979	979	979	979	979	979	979	979	979	963	961	964	969	974.1

Table 6. Comparison of the concepts in the calculation of price indices for selected products – wine

Code	Name	Price index for selected products with the base "previous month = 100"											
		01/02	02/02	03/02	04/02	05/02	06/02	07/02	08/02	09/02	10/02	11/02	12/02
National concept													
106111	Wine	89.6	105.1	98.0	97.8	94.6	112.4	93.8	103.2	131.9	94.8	75.7	111.7
1061111.3055	Grapes for wine production										101.8	102.3	
1061112.3060	White wine	85.7	110.0	90.9	110.0	87.9	120.7	91.4	103.1	97.0	103.1	93.9	106.5
1061112.3065	Red wine	94.3	100.0	106.0	85.7	103.3	103.2	96.9	103.2	100.0	90.6	103.5	119.9
EU concept													
106111	Wine	94.6	102.5	99.0	98.9	97.3	106.0	96.9	101.5	95.0	99.4	100.1	106.4
1061111.3055	Grapes for wine production	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	91.4	101.8	102.3	100.0
1061112.3060	White wine	85.7	110.0	90.9	110.0	87.9	120.7	91.4	103.1	97.0	103.1	93.9	106.5
1061112.3065	Red wine	94.2	100.0	106.1	85.7	103.3	103.2	96.9	103.2	100.0	90.6	103.5	119.9

according to the 'national concept' are more accurate and comply more with the reality (Table 5 and 6).

CONCLUSION

Price Agricultural Statistics provides with the assistance of price indices a prompt information on price changes of the representatives with various degrees of aggregation. Price indices of agricultural producers are used among other for a statistical deflation and a compilation of the Economic Accounts for Agriculture. In this contribution, two methods of construction of price indices were compared, each of them having its own rational priorities. In case of changing the present practice, it would be convenient to publish one price series of price indices only.

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