ANNEX 73

# Indexes

Index is one of most used statistical indicators and they are used to describe and analyse economic activity of separate enterprise or industry, as well as to describe the development of state economy and carry out international comparisons.

There are used following symbols to describe indexed indicators:

q – quantity of definite goods in physical expression
p – price of unit of goods
pq – value of goods or production returns
T – joint time use or number of employed

**Individual indexes and general indexes**

Individual indexes describe changes of separate units of statistical population and they are described by symbol "i". Individual indexes in its terms are usual relative values (growth rates, relative changes of projection realization and etc.).

**Individual index of physical value**, formula:

$$iq = \frac{q_1}{q_0}$$

**Price individual index**, formula:

$$ip = \frac{P_1}{P_0}$$

**Individual index of production** value, formula:

$$ipq = \frac{p_1}{p_0}\frac{q_1}{q_0}$$

For separate production type the value increase (decrease) in the reporting year compared to base year is calculated considered two factors:

$$\Delta pq = p_1 q_1 - p_0 q_0$$

Including:

- In impact of Production physical value:

$$\Delta pq_{(q)} = (q_1 - q_0) * p_0$$

- In impact of prices changes:

$$\Delta pq_{(p)} = (p_1 - p_0) * q_1$$

**General index of production value (goods turnover)** $l_{pq}$ characterize relation between production value in the reported period and the production value in the base period. It is calculated by following formula:

$$I_{pq} = \frac{\sum p_1 q_1}{\sum p_0 q_0}$$

- **General index of production physical value** is the index of quantity indicator. In this index th indexed value will be value of production in the natural expression, but the scales – price. As the index of physical value is the index of quantity indicator the base period prices are used as scales usually. It is calculated by following formula **(E.Laspeires formula)**:

$$I_q = \frac{\sum q_1 p_0}{\sum q_0 p_0}$$

In the absolute expression it will be:

$$\sum q_1 p_0 - \sum q_0 p_0$$

German statistician **G. Pashe** suggested calculating the joint index of physical value by following formula:

$$I_q = \frac{\sum q_1 \, p_1}{\sum q_0 \, p_1}$$

- **Price General index** is also the index of qualitative indicator. In this index indexed element is the price. The amount/value of goods production or realization is taken as correlator in the reported period ($q_1$). The formula of price joint index is following **(G.Pashe formula):**

$$I_p = \frac{\sum q_1 \, p_1}{\sum q_1 \, p_0}$$ Where

$\sum p_1 q_1$ - produced or realized production value in the reported period expressed by the price of the same period;

$\sum p_0 q_1$ - produced or realized production value in the reported period, expressed by price in the base period.

In the absolute expression it will be:

$$\sum p_1 q_1 - \sum p_0 q_1$$

**Price general index** could be calculated also in following way - taking the value of production manufacturing, realization in the base year as the correlator **(Laspeires formula):**

$$I_p = \frac{\sum p_1 \, q_0}{\sum p_0 \, q_0}$$

**General indexes by I. Fisher formula:**

$$I_p = \sqrt{\frac{\sum q_0 p_1}{\sum q_0 p_0} \times \frac{\sum q_1 p_1}{\sum q_1 p_0}}$$

$$I_q = \sqrt{\frac{\sum q_1 p_0}{\sum q_0 p_0} \times \frac{\sum q_1 p_1}{\sum q_0 p_1}}$$

## Indexes of average value

**Index of variable composition** express average level relation of researched phenomena's and characterises joint actual changes of average level in the reported period compering with base period:

$$I_{\bar{x}(\text{var.comp.})} = \frac{\sum x_1 f_1}{\sum f_1} \div \frac{\sum x_0 f_0}{\sum f_0} = \overline{x_1} \div \overline{x_0}$$

The absolute increase of average level of researched phenomena is calculated in the following way:

$$\Delta(\overline{x}) = \overline{x_1} - \overline{x_0}$$

If the relative frequency of variants are used in calculations, then the **index of variable composition has following formula:**

$$I_{\bar{x}(\text{var.com})} = \frac{\sum x_1 w_1}{\sum x_0 w_0}$$

**Index of fixed composition** shows only one factor - changes of the indexed phenomena`s variants numeral meaning. That is calculated with fixed scale. Structure of cluster in both periods (reporting and base period) is chosen equal:

$$I_{x(\,fixed.com.)} = \frac{\sum x_1 f_1}{\sum f_1} \div \frac{\sum x_0 f_1}{\sum f_1} = \frac{\sum x_1 f_1}{\sum x_0 f_1}$$

If the relative frequency of variants are used in calculations, then the index of fixed content has following formula:

$$I_{\bar{x}(\,fix.cont)} = \frac{\sum x_1 w_1}{\sum x_0 w_1}$$

**Index of structural changes effect** characters influence of structural changes of researched phenomena to the dynamic of average level of phenomena.

Index takes only one factor – cluster structure – changes in the reported period compared to the base period:

$$I_{x(struct.cont)} = \frac{\sum x_0 f_1}{\sum f_1} \div \frac{\sum x_0 f_0}{\sum f_0}$$

If the index calculation would be done by relative frequency of variants, then the index of influence structure changes will be calculated by formula:

$$I_{x(struct)} = \frac{\sum x_0 w_1}{\sum x_0 w_0}$$

| **Index of variable composition** | = | **Index of fixed compositiont** | **x** | **Index of structural changes effect** |
|---|---|---|---|---|
| $I_{\bar{x}(\mathrm{var}.com)}$ | = | $I_{\bar{x}(\,fix.com.)}$ | **x** | $I_{\bar{x}(struct.com.)}$ |