Olena Kushchenko, Larisa Izotova. Analytical methodology of international comparisons of the European Union Countries (Аналітична методологія міжнародних співставлень країн Європейського союзу). *Комерціалізація інновацій: захист інтелектуального капіталу, маркетинг та комунікації монографія* / за ред. к.е.н., доц. Сагер Л.Ю., к.е.н., доц. Сигиди Л.О. Суми: Сумський державний університет, 2022. С. 133-140. URL https://essuir.sumdu.edu.ua/handle/123456789/88684

Анотація: У розділі монографії розкрито основоположні принципи та сутність міжнародних співставлень аналітичних показників. Детально розглянуто необхідність таких територіальних зрівнянь в рамках сучасного Європейського Союзу у зв'язку з самими різними потребами держав, а також для аналітичної оцінки їх конкурентоспроможності на різних рівнях. Методологія представлених показників є фундаментом інформаційної бази, яка необхідна щодо прийняття управлінських рішень.
Ключові слова: двохсторонні міжнародні співставлення статистичних показників, багатосторонні співставлення, Програма міжнародних співставлень (ПМС), паритет купівельної спроможності, система «перехідних ключів».

Summary: Fundamental principles and essence of international comparisons of analytical indexes are revealed in the monograph section. It is considered in detail the necessity of such territorial equalizations within the framework of modern European Union in connection with the different necessities of the states, and also for the analytical estimation of their competitiveness on different levels. The methodology of the given indicators makes up the informational base necessary to make correct managerial decisions.
Key words: bilateral cross-country comparisons of statistical indicators, multilateral comparisons, International Comparison Program (ICP), purchasing power parity (PPP), "transitive key" system.

УДК 311:001.8:339.9

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АНАЛІТИЧНА МЕТОДОЛОГІЯ МІЖНАРОДНИХ СПІВСТАВЛЕНЬ КРАЇН ЕВРОПЕЙСЬКОГО СОЮЗУ

ANALYTICAL METHODOLOGY OF INTERNATIONAL COMPARISONS OF THE EUROPEAN UNION COUNTRIES

Анотація: У розділі монографії розкрито основоположні принципи та сутність міжнародних співставлень аналітичних показників. Детально розглянуто необхідність таких територіальних зрівнянь в рамках сучасного Європейського Союзу у зв'язку з самими різними потребами держав, а також для аналітичної оцінки їх конкурентоспроможності на різних рівнях. Методологія представлених показників є фундаментом інформаційної бази, яка необхідна щодо прийняття управлінських рішень.

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Summary: Fundamental principles and essence of international comparisons of analytical indexes are revealed in the monograph section. It is considered in detail the necessity of such territorial equalizations within the framework of modern European Union in connection with the different necessities of the states, and also for the analytical estimation of their competitiveness on different levels. The methodology of the given indicators makes up the informational base necessary to make correct managerial decisions.

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The problem to be considered. As a science, statistics deals with objective regularities and patterns of social phenomena development and, therefore, statistical methodology is applied in all areas of social life featured by mass nature of the phenomena. Almost in all cases of comparison of published data from different countries and in the analysis of methodological explanations we can see similarities and differences in the concept of statistical units, methods of primary data collection and processing, in changes of the territory or region and population size, in periods or times of statistical observation as in units of measurement, on price level, purchasing power parity and in other features affecting the value of cost and physical parameters under comparison. That's why the use of unified statistical methodology is very actual today.

The analysis of the latest researches and publications. A number of the Ukrainian economists study and describe cross-country comparisons in their works: Danchenok L.A., Holovach A.V., Hrynenko V.V., Honcharenko N.I., Kovalevskii G.V., Parfinenko A.Y., Rozhdestvenskaia L.G., Sidorov V.I., Shelkunova M.S., Vishnevskaia O.O., Vishnevetskaia L.I., Zachozhai V.B. etc. They refer to cross-country comparisons of indicators to territorial comparisons. Such comparisons are most widely used in connection with the varied development of the requirements

of foreign trade and other economical and cultural ties, Ukrainian making cross-country agreements, etc.

The main subject of the article is to reveal the peculiarities of statistical methodology of multilateral comparisons on macro level.

The basic part. In order to solve these emerging problems and to be actually able to compare parameters the "transitive key" system is used (Dianov, 2006). When comparing parameters of production volumes in physical units of the Ukrainian and foreign countries, the parameters of other countries are converted into metric units and made subject to some corrections in case there is a difference in the quality of compared goods and services. Besides, not only general values are compared but also values per capita, which actually help to achieve better comparability of social and economic phenomena.

Special indicators of real currency purchasing power are applied to other economic indicators for their comparisons in the recent 30-40 years, considering the price ratios of the home markets in each country. Therewith the researchers proceed from the assumption that all cost indicators consist of the following key elements: price (p) and quantity of goods or service (q). Owing to such factors the elementary comparison requires to obtain the following ratios:

$$\frac{p_1q_1}{p_2q_2}, \text{ when } \frac{p_1q_2}{p_2q_1} \text{ and } \frac{p_2q_2}{p_1q_2}.$$

Thereby, the obtained ratios determine the values of the currency purchasing power indicators of a country in relation to the purchasing power of currency of another country. Calculations of the values of such indicators are performed with the representative goods, proceeding from the structure of the elements in the compared indicators.

Bilateral cross-country comparisons are performed most often for identifying ratios of the scale of social and economic development of Ukraine and its partners under the existing or future cross-country agreements, which have become substantially important for the recent decade.

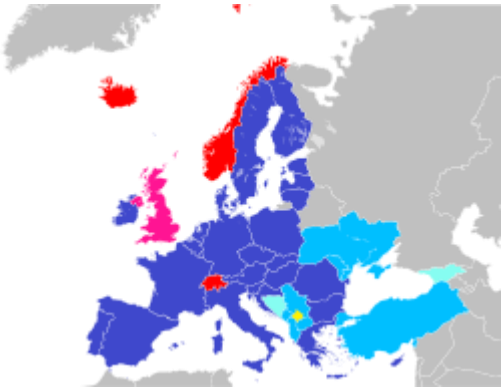
Statistics has designed special methods for solving problems arising in connection with achieving the comparability of the required parameters: identifying similarities and distinctions, "transitive keys", recalculation of the cost of parameters into monetary units of the compared countries under special "purchasing power parity" (PPP): $I_{PPP} = \frac{1}{I_p} = \frac{\sum q_0 p_0}{\sum q_0 p_1} = \frac{\sum q_0 p_0}{\sum i_p q_0 p_0}$,

and a number of other methods applicable alongside with the traditional methods of statistics (Dianov, 2006).

Multilateral comparisons of indicators, both natural and cost indicators, are often applied by statistical bodies of countries for identifying the levels and regularities in the development of certain phenomena in Ukraine with such development in appropriate levels indentified in a group of other countries, for example, in EU states. In such instances the composition of indicators of those countries should be brought to comparability with the Ukrainian indicators or on the contrary, with the composition of EU states. The efficiency of economic development of the EU countries can be defined with the integral indicator of the economic development (I_{ED}) (Kovalevskiy, 2013).

The European Union has its goal to integrate European countries. The countries, members of the EU, have common economic market, one common currency and no passport-visa control. Any country which corresponds to Copenhagen criteria can become a member of EU. Countries-members of the European Union are countries that joined European economic community, beginning from 1958. First the European Union was founded by six countries, but five stages of successive expansion of EU took place after 1958. On May, 1, 2004 10 new members joined in EU, that became most expansion of Union for all its history. After an exit in 2020 of Great Britain, EU counts 27 participating countries. On February, 28, 2022 President of Ukraine gave a request on entering into EU (Pic. 1).

Once comparability of values in compared indicators of a group of countries is achieved, the methods of correlation analysis become particularly important, especially for the analysis of aggregated economic indicators (Holovach, 2005).



Countries-members States, candidates to EU are the following: Iceland, Macedonia, Serbia, Turkey and Montenegro Albania sent its claim to join EU Bosnia & Herzegovina and Kosovo are regarded as potential EU state-members

Pic. 1 Countries-members and European Union candidates (List, 2020**)**

As for the natural indicators, no special complexities arise in comparisons, except for conversion of data of such foreign countries into metrical units of measurement or into other standard international measurement units. In particular, comparisons of indicators of living standards of population, consumption of the key food products and nonfood items, and also housing supply of the population, etc. have become highly relevant.

Since 1968, under the aegis of the United Nations Organization, the ICP – International Comparison Program has been established for calculation of the values of "purchasing power parity" (PPP) for various countries (Kushchenko, 2018). It's one of the most complicated international statistical projects, which carries out the harmony of national methodologies, concepts and terms as to the choice of commodities-representatives and price comparison.

Beginning from the year of 1996 the results of this of International Comparison Program (ICP) have been published every 3 years. The program acquired global character: in 2005 the number of states-participants achieved 146

(while in 2002 there were only 42). For the first time ever the ICP defined the volume of global GNP and the major indicators of the world economy. National indicators are compared not only with the USA level, as earlier, but also with the average value of the world as a whole. Data, published regularly by the ICP, enable to compare GNP of different countries as a whole or as its separate components (Programma, 2022).

The key task of ICP is to obtain PPP values for gross national product values, both for its total amount, and for its components, and also other parameters, so that indicators of various countries could be recalculated into a common currency, which is USD, and to achieve the direct comparability of such indicators for direct mutual measurements.

The methodology of PPP is as follows:

- First, the values of the currency purchasing power parity is to be calculated for homogeneous "primary groups" according to their representative goods in countries-partners. Within the frames of Global round ICP picked out 155 primary groups, CIS – 183, OECD – 202, Euro stat – 224 primary groups. It should be noted that the number of primary groups became smaller, earlier 280 were picked out. The reason for reduction is in the growth of heterogeneous of the countries' development and their statistical potential (Programma, 2022);

- then PPP values are calculated to obtain the aggregated parameters of GNP indicators as average weight values obtainable from PPP primary groups, which are included into a specific aggregated value.

The representative goods are selected in each particular instance in such a way that they meet specified requirements:

- Comparability, i e. they should be identical in all countries;

- Representative ability, i. e. they should be specific for each primary groups in each country and should have a significant weight in the structure of an indicator.

When having been aggregated, the results of the calculated PPP and comparisons should meet the following requirements of the analytical nature:

- Invariance, i. e. the results of PPP calculations should not depend on the selected base of comparison (the base country, specific weights of components of its GNP etc.);

- Transitivity, i. e. when direct comparisons of PPP should produce the same results as the indirect comparisons made through the third countries. The demands for transitivity can be written down the following way:

$$I_{A/B} = I_{A/D} / I_{B/D},$$

Where $I_{A/B}$ – indicator of direct comparison of indexes of A and B countries,

$I_{A/D}$ – indicator of direct comparison of indexes of A and D countries,

$I_{B/D}$ – indicators of direct comparison of indexes of B and D countries;

The requirement of transitivity is very important for multilateral comparisons, because the indices calculated for a group of countries should be strictly mutually agreed and not give conflicting answers;

- the independence index of the choice of reference country. This is another important requirement for the indices as direct pairs and multilateral comparisons. It means that the value of the indices should not depend on the choice of reference country. According to the statistical methodology, this requirement can be written as follows:

$$I_{A/D} I_{D/A} = 1.$$

This requirement implies that the multiplication of index, expressing the country's A ratio to country D, and expressing a ratio of country D index to country A must be equal to 1;

- additively, i.e. indexes obtained for individual components of GDP, should be agreed between themselves and with the GDP index as a whole. For example, there should not be a situation in which the consumer index and of country A to country B, equals to 110%, accumulation index – 115% and GDP index -120%.

The requirement of additively assumes that the GDP of the country A in the prices of country B can be obtained by summing the individual elements of the GDP A country and country's B prices. Adding together the results of paired comparisons should give the same results as an indirect comparison via third

countries. However, not all methods and formula indexes correspond to the requirements of additively;

- all results must have the system specificity weights for the structures of the GDP of all the participating countries. So when comparing the GDP of the United States and the Ukraine as typical weights it is necessary to use prices of the United States those of the Ukraine, but not the prices of any other third country (Programme, 2022).

It should be minded that some of the above-mentioned requirements to the indexes are in a certain contradiction to each other. In particular the latter requirement of specificity of weights contradicts to transitivity, since the indexes that are most meet the requirement of specificity weights are usually not transitive. For example, the Fisher price index formula:

$$I_p^F = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \cdot \frac{\sum p_1 q_1}{\sum p_0 q_1}},$$

which corresponds to the demand of specificity weights and enables to get a definite result for each pair of countries, does not comply with the requirement of transitivity.

Individual index of the physical volume of the product is calculated by the following formula: $i_q = \frac{q_1}{q_0}$

General indexes of quantitative indicators.

Aggregate index of the product cost or the goods turnover:

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

This index shows at how many times the product cost has increased in the reporting period via the base period. By multiplying the result by 100 we obtain the percentage index of the product cost increase.

The aggregate index of the product physical volume is calculated as follows:

$$\overline{I_q} = \frac{\sum\left(\frac{q_1}{q_0}\right)q_0 p_0}{\sum q_0 p_0} = \frac{\sum i_q q_0 p_0}{\sum q_0 p_0} = \frac{\sum q_1 p_0}{\sum q_0 p_0} \ .$$

Index of the product output physical volume shows how many times the physical product output has increased or, if we multiply the result by 100, it shows its percentage increase in the reporting period against the base period.

Average harmonic weighed index of the physical volume of output:

$$\overline{I_p} = \frac{\sum p_1 q_1}{\sum\left(\frac{1}{i_p}\right)p_1 q_1}$$

Each qualitative indicator is connected with a particular volumetric indicator per unit of which it is calculated. Thus, such qualitative indicators as price p, cost z, and labour intensity t relate to the production output.

Paasche prices aggregate index formula is presented as follows:

$$I_p^P = \frac{\sum p_1 q_1}{\sum p_0 q_1}$$

Paasche price index shows how many times on average the price level has increased for the mass of goods sold in the reporting period or shows its growth in percentage in the reporting period against the base period.

Laspeyres aggregate index formula is presented as follows:

$$I_p^L - = \frac{\sum p_1 q_0}{\sum p_0 q_0} = \sum i_p d_{q_0 p_0}$$

E. Laspeyres proposed to calculate the price summary index with weighted functions represented by the amount of products manufactured in the base period.

Fisher “ideal” price index is presented as follows:

$$I_p^F = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \cdot \frac{\sum p_1 q_1}{\sum p_0 q_1}} \ .$$

In studying the average value dynamics, the task is to calculate the degree of the effect of the two factors: the changes in the averaged index values and the changes in the phenomenon structure. This task is performed by index method, i.e.,

by creation of the system of interconnected indexes into which variable structure indexes, constant structure indexes and structural shifts are included.

Variable structure index is presented as follows:

$$I_{\text{var.str.}} = \frac{\sum q_1 p_1}{\sum q_1} : \frac{\sum q_0 p_0}{\sum q_0} = \frac{\sum d_1 p_1}{\sum d_0 p_0}.$$

The fixed (constant) structure index takes account of changes in solely him indexed value and shows the average rate of change in reviewed value of the set units:

$$I_{fxd.str.} = \frac{\sum q_1 p_1}{\sum q_1} : \frac{\sum q_1 p_0}{\sum q_1} = \frac{\sum d_1 p_1}{\sum d_1 p_0} = \frac{\sum d_1 i_p}{\sum d_1}, \text{ and if } \Sigma d=1, \; I_{\frac{p}{p}} = \sum d_1 i_p .$$

Index of the structural shifts characterizes the effect of the change in the studied phenomenon on the dynamics of the average level of the indexed indicator:

$$I_{str.sh.} = \frac{\sum q_1 p_0}{\sum q_1} : \frac{\sum q_0 p_0}{\sum q_0} = \frac{\sum p_0 d_1}{\sum p_0 d_0}.$$

Chain and baseline indexes.

Chain indexes reflect the change of the indicator level in the current period as compared to the level of the previous period; baseline indexes, as compared to the baseline level, which is most often taken as the initial level of the dynamics sequence.

The product of chain indexes is equal to the baseline index value of the last period (the property of transitivity or of circular convergence of indexes). Consequently, the relation between the baseline index of the reporting period and the baseline index of the preceding period will allow obtaining the chain index of the reporting period.

All Paasche price indexes used the current period of weight functions (indexes with variable weights), while the physical volume indexes and Laspeyres price indexes use the fixed (indexes with constant weight functions) or the baseline one.

All results should possess typicalness of the system of weights for structures of GNP values and GNP structures of all participating countries (Programma, 2022).

Conclusions. Multilateral comparisons of international statistical indexes substantially expand analytical possibilities for identifying common trends in social and economic development of both groups of countries and the global community. The results of such comparisons help to identify the levels and regularities in the development of various countries through comparisons of the systems of comparable parameters.

Multilateral comparisons performed on a comparable basis create the initial basis for expansion and improvement of economic analysis, which is important for solving a lot of existing problems of the market economy and entering the global economic relationships.

To a certain extent social and economic indicators are measurers of the development of different branches of industry and types of services, including touring services (Kushchenko, 2015). They indicate the position held by a country or a region in the economy, gives the initial valuation of the economic and human potential of a given country. To a certain extent indicators serve as a basis for social and economic forecast of any activity development.

The major indicators of the state social and economic policy are:

- Area of the territory;
- Population;
- Gross domestic product (GDP);
- Volume of exported products;
- Average annual number of population employed;
- Average annual unemployed population;
- Monthly average wages;
- Cash income of the population;
- Cash expenses of the population;
- Average level of education.

The unified indicator reflecting the level of economic development of the regions may also serve as the indicator of development. Such indicator used in the international practice of inter-country comparison, is the index of development of human potential. It is calculated on the basis of three indexes: longevity, educational level (including literacy of adult population) and the gross domestic product per capita.

Macro marketing becomes especially important today, when marketing of the country and its society makes the greatest satisfaction of people's needs and demands its primary goal. Multilateral comparisons on macro level enable to make branding of the territory, that is a purposeful formation of an image of a given country, city, region in the minds of citizens and world public opinion. Global connections and local roots acquire special importance in modern world.

In my opinion, the EU should accept all the countries of Europe such as Macedonia, Moldova, Ukraine, Belorussia and may it be that one day all these nations be counted amongst its member states. Even Russia at some time in the future should also take its rightful place in a unified Europe as another European member. However, some of these countries have some economical and political issues which must be resolved first.

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