MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

West Ukrainian National University

Methodical instructions to study the discipline

«INTERNATIONAL STATISTICS»

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Reviewers:

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Examples of solution of the tasks in the course «International Statistics» are considered in methodical instructions on the base of necessary theoretical knowledge. Methodical instructions to study the discipline «International Statistics» are proposed for students for helping them in solution of individual tasks.

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Goals and Objectives of the study discipline "International Statistics"

Purpose of the study subjects.

Program and thematic discipline plan are focused on the formation of basic knowledge of students on the basis of international statistics for solving theoretical and practical economic problems. This discipline is fundamental to general economic disciplines that form the professional outlook of future economists. It also gives information needed by the discipline "Theory Probability and Mathematical Statistics", "Economic Analysis", "Investment Management". The purpose of teaching the discipline "International Statistics" is to help students in mastering the most important principles of statistics of international organizations and their international recommendations in the field of statistics, which are currently widely used in the transformation of domestic statistics into international practice.

Task of study of discipline.

As a result of studying the discipline "International Statistics" students should know the basic definitions, rules and understand relationships between topics and sections of this discipline. The main tasks of studying the discipline "International Statistics" are to give a clear idea of the system of statistical indicators of the Organization United Nations, its specialized agencies and others international organizations; identify common features and differences in the principles of organization statistics of various international organizations; to get acquainted with the methodology of reduction to comparability of indicators based on international standards; help students in methods of economic and statistical analysis of the development of individual countries in the world community; instill calculation skills to analyze data on the development of individuals countries of the world; to teach students the skills of applying the methodology of international organizations with assess the performance of a market economy and promote the development of skills to work with the most important international statistical publications.

According to the requirements of the educational-professional program "International Statistics" as a result of studying the discipline students should be able:

- know history of international statistics;
- know major international statistical organizations and existing systems of key indicators in international statistics;
- know methodology for calculating statistical indicators in international organizations;

• know major international groupings and classifications;
• be able to collect statistical information on the economic situation of Ukraine and international economy;
• use a modern system of indicators of international economic statistics;
• carry out statistical estimates of population parameters;
• apply methods of statistical analysis to study socio-economic phenomena and processes of countries in the world community;
• check the comparability of statistical information for different countries;
• analyze and compare statistical information of the economy of Ukraine and other countries.

Competencies, the formation of which provides study of the discipline "International Statistics":

• Ability of the solution complex specialized problems and practical problems in the economic sphere, which are characterized by complexity and uncertainty of conditions, which involves the application of theories and methods of economics;
• Ability to abstract thinking, analysis and synthesis;
• Ability to apply knowledge in practical situations;
• Ability to communicate in a foreign language;
• Skills in the use of information and communication technologies;
• Ability to search, process and analyze information from various sources;
• Ability to make informed decisions;
• Ability to explain economic and social processes and phenomena on the basis of theoretical models, analyze and interpret the results;
• Ability to apply economic-mathematical methods and models to solve economic problems;
• Ability to use computer technology and data processing software to solve economic problems, analyze information and prepare analytical reports;
• Ability to analyze and solve problems in the field of economic and social relations;
• Ability to predict socio-economic processes on the basis of standard theoretical and econometric models;
• Ability to use modern sources of economic, social, managerial, accounting information for the preparation of official documents and analytical reports;
• Ability to substantiate economic decisions on the basis of understanding the laws of economic systems and processes and with the use of modern methodological tools;
• Ability to apply the latest methods for processing and analysis of large data sets, which are used to solve current economic problems in business and provide work with information that allows you to explore the specifics of the business environment, economic processes and phenomena;
• Ability to model economic processes, systems and phenomena, management of economic objects in terms of risk and analysis and forecasting of economic

situations using modern mathematical models and the latest information technologies.

Learning outcomes.

As a result of studying the discipline "International Statistics" the student must be able to:

Know and use economic terminology, explain the basic concepts of micro- and macroeconomics.

Understand the principles of economics, features of economic systems.

Apply analytical and methodological tools to substantiate proposals and make management decisions by various economic agents (individuals, households, enterprises and public authorities).

Use professional reasoning to convey information, ideas, problems and ways to solve them to professionals and non-specialists in the field of economic activity.

Explain the models of socio-economic phenomena in terms of fundamental principles and knowledge based on an understanding of the main directions of development of economics.

Apply appropriate economic and mathematical methods and models to solve economic problems.

Understand the main features of the modern world and national economy, institutional structure, areas of social, economic and foreign economic policy of the state.

To analyze the functioning and development of economic entities, to determine the functional areas, to calculate the relevant indicators that characterize the effectiveness of their activities.

Be able to analyze the processes of state and market regulation of socio-economic and labor relations.

Apply the acquired theoretical knowledge to solve practical problems and meaningfully interpret the results.

Identify sources and understand the methodology for determining and methods of obtaining socio-economic data, collect and analyze the necessary information, calculate economic and social indicators.

Be able to use data, provide arguments, critically evaluate logic and draw conclusions from scientific and analytical texts on economics.

Use regulations and legal acts governing professional activities.

Use information and communication technologies to solve socio-economic problems, prepare and present analytical reports.

Be able to think abstractly, apply analysis and synthesis to identify key characteristics of economic systems at different levels, as well as the behavior of their subjects.

Show skills of independent work, demonstrate critical, creative, self-critical thinking.

Demonstrate the ability to act socially responsibly and consciously on the basis of ethical principles, to appreciate and respect cultural diversity, individual differences.

International statistics is an important branch of knowledge and practical activity for the collection, processing, analysis and publication of statistical information about economic phenomena at the level of the world economy as a whole. International economic statistics are developed by the statistical services of international organizations after receiving initial information from national statistical bodies, brought to a comparative form, summarized in regional and world summaries, published for wide use in comparative analysis. It evaluates and analyzes data on the level and dynamics of development of the world community and is the basis for relevant forecasts.

The main function of international economic statistics is the development of international recommendations for the unified calculation of the system of statistical indicators and their groupings according to standard classifications for all countries and territories based on international standards of accounting and statistics, built according to a unified methodology. The zones provide comparability of the composition and methods of calculation of the entire system of indicators for the analysis of trends and patterns of economic development of countries. This is what distinguished international economic statistics with its special subject, object and methods.

The subject of international statistics is the methodology of studying the quantitative side of the state and patterns of development of the world economy. It characterizes not only quantitative, but also qualitative aspects of the economic state and development of countries, their global economic relations, as well as regions and the world as a whole. Now it is represented by a wide network of relative autonomous and independent organizations.

If the object of statistical observation is the world economy and the economic phenomena that occur in it, then as a rule, a separate country is taken as the unit of observation. Statistical information about the world economy is based on a unified system of statistical indicators, which are calculated according to unified recommendations developed and approved by international organizations as international statistical standards. International economic statistics summarizes the current experience of applying a single system of indicators in various countries and international organizations, produces and improves the system of international statistical information with the help of the activities of the UN Statistical Commission and statistical services of other international organizations of the UN system, the International Statistical Institute and other international organizations.

Statistical information of countries, as a rule, differs in the content of indicators, the methodology of their calculation, understanding of the object of statistical observation, periods and moments of observation,

units of measurement, etc.

Therefore, international economic statistics faces a number of problems, for the solution of which it is necessary:

1) to coordinate all the most important statistical works of a global nature through the UN Statistical Commission (the highest body that unites the main statisticians from the UN member states from all over the world, founded in 1946) by developing appropriate programs;

2) to move from the development of international standards for individual statistical indicators to the development and improvement of their system for the versatile characterization of the world economy in its various forms;

3) develop and apply methodologies for calculating aggregate value indicators in the same monetary units, taking into account the real purchasing power of the currencies of different countries;

4) to construct reliable values of dynamic series of comparable indicators to identify world trends and make forecasts of the possible development of the world and individual countries for both short-term and long-term periods, developing the necessary models for this;

5) to achieve comparability of the content of national indicators in accordance with defined international standards. Promotion of the development of national statistics on the basis of the implementation of international standards in statistics and solving the problems of unification of collection, processing and distribution of statistical publications of international organizations.

INTERNATIONAL SYSTEM OF NATIONAL ACCOUNTS
Integrated economic accounts and their components

The system of national accounts is a system of interconnected statistical indicators, which is built in the form of a specific set of accounts and tables in order to reproduce the full picture of economic activity of the state.

National accounts are an integrated system of accounts. System of accounts is divided into subgroups (Table 1):

1) accounts of current operations;
2) accounts of accumulation;
3) balance of assets and liabilities.

Consolidated submission of accounts

Table 1

Complete sequence of accounts for institutional sectors				
Accounts current operations	1. Account of production	1. Account of production		
	2. Accounts of distribution and using income	2.1.Accounts primary distribution of income	2.1.1. Account of formation of income 2.1.2. Account of distribution of primary income	2.1.2.1. Account of Entrepreneurial income 2.1.2.2. Account of distribution
		2.2. Accounts secondary distribution of income		
		2.3. Account of income of redistribu-tion in natural form		
		2.4.Account of using of income 2.4.1. Account of using of disposable income 2.4.2. Account of using of adjusted disposable		

		income		
Accounts of accumula-tion	3. Accounts of accumula-tion	3.1.Account of operations with capital 3.2.Financial account 3.3. Account of others changes in assets	3.3.1. Account of other changes in volume of assets 3.3.2.Accounts of revaluation	3.3.2.1. Account of neutral holding profit (damage) 3.3.2.2. Account of real holding profit (damage)
Balance of assets and liabilities	4. Balances assets and liabilities	4.1.Initial asset balance and liabilities 4.2.Changes in the balance sheet assets and liabilities 4.3. The final balance assets and liabilities		
Accounts of operations				
0.Account goods and services	0.Account goods and services			
Account of other countries				
Accounts of current operations	5. Account other countries world	5.1. Account of external operations with goods and services		

		5.2.Account external primary income and current transfers		
Accounts of accumulation		5.3.Accounts accumulation for external operations	5.3.1. Account of operations with capital	
			5.3.2.Financial account	
			5.3.3.Invoice other changes in assets	5.3.3.1. Other changes in volume of assets 5.3.3.2. Accounts of revaluation
Balance assets and liabilities		5.4. Account of external assets and liabilities	5.4.1. Beginnings balance of assets and liabilities	
			5.4.2.Changes in asset balance and liabilities	
			5.4.3.Final Balance of assets and liabilities	

Example 1. Let consider the next data on macroeconomic processes in the country:

Indicator	**Million dollars USA**
Gross output (at basic prices)	995630
Taxes excluding subsidies on products	52851
Taxes on production and imports accrued by residents	62777
Taxes on production and imports received by residents	62780
Subsidies for production and imports	6700
Balance of primary incomes received from other countries	-3097
Intermediate consumption	607029
Wages of employees accrued by residents	216600
Remuneration of employees received by residents	218384
Property income received from other countries	2035
Property income paid to other countries	8863
Current transfers received from other countries	16188
Current transfers paid to other countries	1358
Final consumer spending	337879
Consumption of fixed capital	50545
Gross fixed capital formation	96965
Change in inventories of working capital	2736
Acquisitions other than disposals of valuables	175

Capital transfers received from other countries	71
Capital transfers transferred to other countries	112
Acquisitions excluding disposal of unproduced items non-financial assets	289
Net acquisition of financial assets	93781
Pure acceptance of financial obligations	81584
Exports of goods and services	227252
Import of goods and services	223555

Find:
current accounts.

Formulas for solution

Net taxes on production and imports (accrued by residents) = Taxes on production and imports accrued by residents-Subsidies on production and imports

62777-6700=56077

Net taxes on production and imports received by residents = Taxes on production and imports received by residents-Subsidy on production and imports

62780-6700=56080

GDP (Gross Domestic Product) = Gross Output + Taxes Excluding Subsidies on Products-Intermediate Consumption

995630+52851-607029=441452

Net domestic product = GDP-Consumption of fixed capital

441452-50545=390907

Gross profit (mixed income) = GDP-Remuneration of employees accrued by residents-Net taxes on production and imports
(PPP), accrued by residents

441452-216600-56077=168775

Net income (mixed income) = Gross profit-Consumption of fixed capital

168775-50545=118230

Gross national income = Gross income + Remuneration of employees received by residents + Net taxes on production and imports received by residents + Property income received from other countries-Property income paid to other countries

168775+218384+ 56080+2035-8863=436411

Net national income = Gross national income-Consumption of fixed capital

436411-50545=385866

Gross disposable income = Gross national income + Current transfers received from other countries-Current transfers paid to other countries

436411+16188-1358= 451241

Net disposable income = Gross disposable income-Consumption of fixed capital

451241-50545=400696

Gross Savings = Gross Disposable Income-Final Consumer Expenditures

451241-337879=113362

Net savings = Gross savings-Consumption of fixed capital

113362-50545=62817

Gross domestic product = 603704 + 27127 - 363487 = 267344 million dollars.

USA

Pure domestic product

= 267344 - 38885 = 228459 million dollars. USA

Net income (mixed income) =

= 114909 - 38885 = 76024 million dollars. USA

Gross profit (mixed income) =

= 267344 - 122188 - 30247 = 114909 million dollars. USA

Net income (mixed income) =

= 114909 - 38885 = 76024 million dollars. USA

Gross national income

= 114909 + 122940 + 30249 + 581 - 4432 = $ 264247 million USA

Net national income

= 264247 - 38885 = 225362 million dollars. USA

Gross disposable income =

= 264247 + 12299 - 592 = $ 275954 million. USA

Net disposable income

= 275954 - 38885 = 237069 million dollars.

Gross savings =

= 275954 - 201624 = 74330 million dollars. USA

Net savings =

= 74330 - 38885 = 35445 million dollars. USA

Production account

Using	Million dollars USA	Resource	Million dollars USA
Intermediate consumption	607029	Gross output (at basic prices)	995630
Gross Domestic Product	441452	Taxes excluding subsidies on products	52851
Total	1048481	Total (issue in market prices)	1048481
Consumption of the main capital	50545		
Pure internal product	390907		

Income generation account

Using	Million dollars USA	Resource	Million dollars USA
Paying employees, accrued by residents	216600		
Net taxes on production and import, accrued by residents	56077		
Gross profit, mixed income	168775	Gross domestic product	441452
Total	441452	Total	441452
Net profit, mixed income	76024		

Primary income distribution account

Using	Million dollars USA	Resource	Million dollars USA
Property income, paid to others countries	8863	Gross profit, mixed income	168775
		Paying of employees, received by residents	218384
Gross national income	436411	Net taxes on production and import, received by residents	56080

		Income of property, obtained from others countries	2035
Total	445274	Total	445274
Pure national income	385866		

Secondary distribution of income account

Using	Million dollars USA	Resource	Million dollars USA
Current transfers, paid to other countries	1358	Gross national income	436411
Gross disposable income	451241	Current transfers, received from other countries	16188
Total	452599	Total	452599
Net disposable income	397573		

Use of disposable income account

Using	Million dollars USA	Resource	Million dollars USA
Final consumer spending	337879	Gross disposable income	451241
Gross savings	113362		
Total	451241	Total	451241
Net savings	62817		

Indexes in International Statistics

CONCEPT OF INDEXES AND THEIR TYPES

In statistical practice, indexes, along with average values, are the most common statistical indicators. Literally translated from Latin, "index" means "index". In the practice of statistical analysis, an index is an indicator of the relative change of a given level of any phenomenon compared to another level of it, taken as the basis of comparison.

The origin of the index method is attributed to the beginning of the 17th century, although index calculations, not translated into the language of mathematical formulas, are found in the works of J. Boden (dated 1568 and 1576) and T. Mann (1609). It was in 1738 that the French economist Duteau proposed to calculate the generalized indicator of price changes as the ratio of the sum of prices p for certain types of goods in the reporting period to the sum of prices for the same goods in the base period according to the formula:

$$I_p = \frac{\Sigma p_1}{\Sigma p_0}$$

For the same purpose, the Italian economist Carli in 1764 proposed a more complicated formula:

$$I_p = \frac{\sum \frac{p_1}{p_0}}{n}$$

With the development of statistical practice, it was proven that such methods of obtaining a generalized estimate of price level changes do not take into account the fact that in each of the compared periods different quantities of the same goods are sold. That is why the German statisticians E. Laspeyres and G. Paashe proposed to calculate price indices in aggregate form. In 1871, Laspeyres proposed such a formula:

$$I_p = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}$$

where

p_1, p_0 – prices for certain types of goods, respectively, in the base and current periods

q_0 – the number of sold goods of each type in the base period.

In 1874, H. Paashe proposed such a form of aggregate price index:

$$I_p = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}$$

where

q_1 – the number of sold goods of each type in the current period.

The numerator and denominator of this index contain aggregates that have a defined economic essence. In contrast to the Laspeyres index, the Paasche index contains the actual value of the sold volume of goods in the current period (numerator) and its conditional estimate in the prices of the base period (denominator). The difference between the numerator and the denominator shows the real gain (loss) of buyers, which they received as a result of a decrease (increase) in prices for certain types of goods.

Since the results of index calculations according to previous formulas for the same initial data will be different, it was this circumstance that led Western indexology to the "ideal" form of the index proposed by I. Fischer in 1921, which corresponded to the geometric mean of the index values, calculated on the basis of the formulas Laspeyres and Paasche. The formula of the "ideal" index looked like this:

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

It should be noted that the use of the geometric mean in index calculations also dates back to the works of I. Fisher. Back in 1863 U.Jevons proposed to calculate the composite price index as a geometric mean of the price indices for individual types of goods, i.e. according to the formula:

$$I_p = \sqrt[n]{\prod_{i=1}^{n} \frac{p_{i1}}{p_{i0}}}$$

At the present stage, Laspeyres and Paasche indices are the basis of two equal index systems: base-weighted (Laspeyres) and current-weighted (Paasche).

Statistical indexes make it possible to solve such basic tasks:

- give a description of the general change of a complex economic indicator or individual indicators-factors that form it;
- highlight the influence of one of the factors in the change of a complex indicator by eliminating the influence of other factors;
- separate, highlight the effect of the change in the structure of the phenomenon on the indexed value.

With their help:
- the development of the national economy is characterized as a whole and its individual branches;
- the results of production and economic activity of enterprises and organizations are analyzed;
- the role of individual factors in the formation of the most important economic indicators is investigated;
- production reserves are revealed.
Indexes are also used in:
- international comparisons of economic indicators;
- determining the standard of living;
- monitoring of business activity in the economy, etc.
In the development of index theory in our country, two directions have developed: generalizing or synthetic and analytical.
The generalizing direction interprets the index as an indicator of the average change in the level of the studied indicator.
In analytical theory, indices are indicators of changes in the level of the resulting value under the influence of a change in the indexed value.
Individual, group (sub-indices) and general indexes are distinguished by the degree of coverage of the elements of the population. According to the method of calculation and economic content, indices are aggregated, weighted average, indices of average values, territorial indices. Index systems can be two-factor and multi-factor.
Depending on the basis of comparison, when calculating indices, chain and base indices are distinguished, and according to the economic content - indices of dynamics, comparison, compliance with norms and standards, territorial indices, etc.
A special group consists of indices of average values, which combine indices of variable composition, constant composition and structural shifts.
The main element of the index is the indexed quantity. The indexed value is the value of a characteristic of a statistical population, the change of which is the object of research.
For ease of perception of indices in the theory of statistics, certain symbols have been developed. Each indexed value has its own symbolic designation. These quantities are divided into quantitative, qualitative and volumetric.
Qualitative values characterize the level of a feature in a unit of the population, namely:

p – unit price of the product;

c – unit cost of production.

Quantitative values characterize the size of the phenomenon or the number of the population.

Volumetric values represent the volume of a feature and are always the product of one qualitative and one quantitative indicator (if we are talking about a two-factor index model), for example:

pq = p × q – turnover or product value/

In order to distinguish to which period the indexed values belong, subscript symbols are used: "1" - compared (current, reporting) level, "0" – the level with which we compare.

If indices are calculated for a number of periods, then serial numbers 1,2,3...etc. are used.

ECONOMIC CONTENT AND METHOD OF CALCULATING INDIVIDUAL INDICES

Individual indices characterize the change of only one element of the population, for example, the change in the production of passenger cars of a certain brand. The individual index is conventionally denoted by the Latin letter "i". The symbol of the phenomenon whose change is being studied is always placed at the base of the index. Individual indexes of qualitative indicators have the following form:

$i_p = \frac{p_1}{p_0}$ – individual product unit price index;

$i_f = \frac{f_1}{f_0}$ – individual salary index of one employee.

Individual indexes of quantitative indicators are calculated as follows:

$i_q = \frac{q_1}{q_0}$ – individual index of the physical volume of products;

$i_T = \frac{T_1}{T_0}$ – individual index of the number of employees.

Individual indexes of volumetric indicators are recorded as follows:

$i_{pq} = \frac{p_1 q_1}{p_0 q_0} = i_p \times i_q$ – individual turnover;

$i_{zq} = \frac{z_1 q_1}{z_0 q_0} = i_z \times i_q$ – individual index of production costs.

Individual indexes can be calculated as an index series for several periods. At the same time, there are two ways of calculating individual indices: chain and base. With the chain method of calculation, the indexed value of the previous period is taken as the basis of comparison. At the same time, the basis of comparison is constantly changing. For example, for a price index, the chain indices for different periods are calculated as follows:

$$i_{10} = \frac{p_1}{p_0},\ i_{21} = \frac{p_2}{p_1},\ i_{32} = \frac{p_3}{p_2}\ \ldots$$

With the basic method of calculation, the constant indexed value of some one period is taken as the basis. For example, for the index of the physical volume of production, the base indices are calculated as follows:

$$i_{10} = \frac{q_1}{q_0},\ i_{20} = \frac{q_2}{q_0},\ i_{30} = \frac{q_3}{q_0}\ \ldots$$

INDEXES OF AGGREGATE FORM

Aggregate indices are the main form of general and group indices. Their name comes from the Latin word "aggrega", which means "to join". The numerator and denominator of the indices contain combined sets (aggregates) of the elements of the studied statistical populations.

In complex statistical aggregates, comparability of different units is achieved with the help of special coefficients of indexed values, so-called coefficients. They are necessary for the transition from natural measures of variable units of the statistical population to homogeneous indicators.

It represents the ratio of sums of products of indexed values and their sums. This means that the numerator and denominator contain the sums of the products of two interrelated indicators, one of which is qualitative, and the other is quantitative. General indices are denoted by the symbol "I", and the subscript indicates the indicator whose change is characterized by this index.

In the aggregated data, the coefficients p, z, f can be indexed separately, the "weights" q or the aggregate as a whole can be indexed separately. If the scale is indexed, the weights are fixed at an unchanged level (basic or current). Similarly, the counter is fixed if the weights change.

Depending on the rules for building indexes, the index systems of E. Laspeyres, G. Paasche, and I. Fischer are distinguished. In Ukraine, a combined system of aggregate indices is used, which is built according to the following rules.

In the aggregate indices of qualitative indicators, the indexed indicator in the numerator is taken for the reporting period, in the denominator -

for the base, and the multiplier is fixed at the level of the reporting period (H. Paasche method). For example, when studying changes in turnover due to prices, the number of products should be fixed at the level of the reporting period. Under this condition, it is possible to determine the real savings, which are obtained in the case of a decrease in prices or overspending, if the prices increased. The general price index will look like this:

$$I_p = \frac{\sum p_1 q_1}{\sum p_0 q_1};$$

The numerator of the aggregate index of the qualitative indicator contains the value of the volume indicator for the reporting period, and the value of the volume indicator in the denominator, provided that the value of the quality indicator remains at the level of the base period.

In aggregate indices of quantitative indicators, the numerator is the indexed indicator for the reporting period, the denominator is the base indicator, and the coefficient is fixed at the level of the base period (E. Laspeyres method). For example, to determine the change in turnover in the current period compared to the base period due to a change in the physical volume of sold goods, prices should be

fixed at the level of the base period. In this case, the physical turnover index will look like this:

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

Thus, in aggregate indexes of quantitative indicators, the denominator contains the value of the volume indicator in the base period, and the numerator contains the volume indicator for the reporting period, provided that the qualitative indicator remains at the base level.

In the aggregate indexes of volume indicators, the numerator contains both coefficients for the reporting period, and the denominator - the basic one, that is, both qualitative and quantitative indicators are indexed. For example, by multiplying the prices by the corresponding number of goods sold and summing up the products, we get the total turnover. To determine the change of this indicator in the current period compared to the base period, the turnover index should be used:

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

Taking into account the multiplicative relationship between the indexed quantity (weight) and the effective indicator (summary), these indices are linked into the system:

$$I_{pq} = I_p \times I_q; I_{zq} = I_z \times I_q; I_{fT} = I_f \times I_T; I_{ys} = I_y \times I_s.$$

Within the framework of the system of interdependent indices, the role of each individual factor in the relative or absolute change of the volumetric index is determined.

The absolute change is defined as the difference between the numerator and the denominator of the corresponding index. For example, the absolute change in turnover as a whole:

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

splits into two components:

- due to prices:
-

$$\Delta pq(p) = \Sigma p_1 q_1 - \Sigma p_0 q_1,$$

- due to changes in the physical volume of goods

$$\Delta pq(q) = \Sigma p_0 q_1 - \Sigma p_0 q_0 .$$

Aggregate indexes can be defined as chain and base indexes. In chain indexes, the indexed indicator is taken for adjacent time periods (next and previous), and in basic indexes, the base value of the indexed indicator is taken in the denominator.

Efficiency of exporting and importing goods

Example. There are data on export-import transactions between the two countries:

Exports				Import			
Good	Foreign exchange revenue, thousands of dollars USA	Production costs, thousands of dollars USA	K^{CEE}	Good	Import value, thousands of dollars USA	Foreign exchange costs for acquisition, thousands of dollars USA	K^{CEI}
A	110	115	0,96	D	412	135	3,05
B	830	692	1,20	E	1288	920	1,40
C	185	54	3,50	F	160	200	0,80
Total (in the average)	1125	861	1,31	Total (in the average)	1860	1255	1,48

We will analyze the efficiency of exporting goods from the first to the second country.

First, let's calculate the coefficients of foreign exchange efficiency of exports (K^{CEE}, results in the table). So, K^{CEE} of product A is equal to 0.96. Thus, for every dollar of costs for the production of product A, there is 0.96 dollars. currency revenue. Similar conclusions for goods B and C.

The average K^{CEE} is equal to 1.31, that is, on average for the group of exported goods, each dollar of production costs accounts for 1.31 dollars currency revenue.

Let consider the import of goods. The conclusions are as follows. The coefficient of currency efficiency of import (K^{CEI}) of commodity D is equal to 3.05. Thus, for every dollar spent on its acquisition, there are 3.05 dollars. of the value of the imported product D in the prices of its sale within the country. The conclusions on goods E and F are similar.

The average K^{CEI} is equal to 1.48. Thus, for each dollar spent on the purchase of a group of imported goods, there is an average of $1.48 the value of imported goods in the prices of their sale within the country.

Let's see which export goods should be left and which should be removed from the trade turnover. The average K^{CEI} = 1.48, its inverse value is equal to 0.68. For all considered goods, K^{CEE} was greater than 0.68. Thus, their foreign exchange efficiency of exports is covered by a sufficiently high average efficiency of imports. Other things being equal, all goods can be left as part of foreign trade turnover. Let's draw conclusions about which imported goods should remain and which should be removed from trade. Average K^{CEE} = 1.31, its inverse value is equal to 0.76. For all the considered goods, the value of K^{CEI} was greater than 0.76. Thus, their foreign exchange efficiency of imports is covered by a sufficiently high average efficiency of exports. Other things being equal, all goods can be left as part of foreign trade turnover.