

Methodological basis of statistical analysis of foreign trade

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Abstract

The article is devoted to the study of methodological bases and information-analytical aspects of foreign trade statistics. The subject and main tasks of foreign trade statistics are determined. The general principles of formation of the official statistical methodology are considered. Methods of research of structure and dynamics of foreign trade are systematized. As a result, there are two main groups: non-formalized methods (qualitative) and formalized methods (quantitative). A system of indicators used for analytical characterization of foreign trade is proposed. The proposed system is the most informative for assessing foreign trade in order to form management decisions to solve the identified problems and increase the relevant performance indicators.

Keywords: statistics, statistical analysis, foreign trade, indicators, methods.

Introduction

In today's world, improving the quality, accessibility, efficiency of information, its continuous and innovative nature make the statistics system an important factor in ensuring economic growth. Today, postulates about the value of information, personnel, and intellectualism are affirmed at all levels because according to the predictions of many leading scientists, the new century will be primarily an age of information.

A prerequisite for the successful positioning of any country in the world market and obtaining significant benefits from globalization effects is the use of economic and mathematical methods for forecasting the development of its foreign trade. International trade is characterized by dynamic and structural changes, which in some way are reflected in the statistics of key trade indicators. Thus, the basis

for assessing international trade is a statistical study based on the calculation of absolute, relative and average indicators of certain statistics. Using mathematical tools to obtain numerical characteristics, you can assess the foreign trade of any country, as well as compare the relevant indicators of different countries.

The traditional economic and statistical apparatus is losing its relevance and requires the use of modern mathematical tools in conditions of international instability. That is why special attention should be paid to substantiation of tendencies and regularities of development of economic processes in the conditions of influence of unexpected factors of non-economic character (political, military, institutional, social) which more and more define structure and dynamics of world economic processes.

Material and methods

The economic success of any country depends on its trade, as trade is one of the

leading places in terms of impact on economic development. International trade overcomes

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the narrowness of the market, limited resources, as well as increases the possibility of introducing new technologies and provides an opportunity to use the country's resources more efficiently. The study of the main trends of the country's foreign trade, its current state, dynamics and structure is a topical issue that will help determine the main vectors of the direction of development of foreign trade relations of this country (Miziuk S., Morozova M., 2020).

The issue of foreign trade and its impact on economic development is described in the scientific works of many famous scientists. Problematic issues of statistical methodology are presented in the works of domestic and foreign researchers, such as Peter Hackl (2011), Gerald Keller (2014), Verma, P., Dumka, A., Bhardwaj, A. (2021), Yerina I.V. (2016), Kaliuzhna N. (2017), Popova Y.M., Guchenko Y.O. (2017), Miziuk S., Morozova M., (2020), Paranytsia N.V. (2018). The range of used research methods varies from a purely descriptive approach to formalized methods of economic and mathematical modeling. There is a need for scientists to study the essence of existing methods and approaches, to carry out their comparative analysis, to identify limitations in the application in modern conditions of uncertainty.

Yerina I. V. (2016) notes that international trade statistics are an integral part of foreign economic activity statistics. The subject of its research is the economic exchange of services between producers and consumers around the world. Statistics characterize the state and development of foreign trade relations in the field of services (which are carried out both in the economic territory of the country and abroad) between economic entities – residents

Results and discussion

Assessment of the level of development of the country's foreign trade allows to analyze and assess its competitiveness in the world market. It is accepted to apply a number of methods and approaches for establishment of the basic strategic priorities, tendencies of a modern condition of foreign trade of the country. They

and non-residents of the country (Yerina I.V., 2016).

The opinion of Popova Y.M. and Guchenko Y.O. (2017) is similar. They believe that it is statistics that assess and analyze foreign trade not only at the state level, but also at the level of the business entity. Scientists believe that the subject of foreign trade statistics is the quantitative side of the processes and phenomena that occur in the field of foreign economic activity, in inseparable connection with their quantitative characteristics (goods, services, values that make up the country's exports and imports) (Popova Y.M., Guchenko Y.O., 2017).

The main tasks of foreign trade statistics are:

- full and reliable accounting of export-import operations;
- analysis of the structure, dynamics and trends of foreign trade flows of the country in conjunction with the analysis of the macroeconomic situation;
- providing data for streamlining trade and balance of payments, forecasting macroeconomic indicators in the system of national accounts;
- interstate comparative analysis of foreign trade indicators of partner countries;
- information support of the highest bodies of state power for the formation and implementation of scientifically sound trade and economic policy of the state, holding international meetings and negotiations (Yerina I.V., 2016).

The main purpose of this article is to summarize the existing methodological approaches to information and analytical aspects of statistical analysis of foreign trade.

can be divided into two main categories: non-formalized, or qualitative, and formalized - quantitative (Table 1). Non-formalized approaches should be understood as those that are based on logical procedures of generalization of manifestations of reality and do not provide confirmation of the author's

conclusions by certain analytical dependence and calculations. The formalized approach involves research using quantitative methods and avoids the errors of subjectivity that are typical of the non-formalized approach. It is the

use of quantitative methods that gives thorough forecasts of trends and dynamics of development of the object of study (in this case – the country's foreign trade) (Kaliuzhna N.,2017).

Table 1 – Systematization of methods for studying the structure and dynamics of foreign trade

Group	Method / approach	The essence	Application in the context of foreign trade research
<i>Non-formalized</i>			
Factor approach	Descriptive approach	Based on the identification, description and systematization of factors that affect the dynamics and structure of foreign trade and determine trends in its development	Assessment of the state and determination of prospects for the development of foreign trade on the basis of logical reasoning and generalization of statistical data
	Generalization of statistical data		
<i>Formalized</i>			
Methods of analysis of the balance of foreign trade	Indicative method	It is used to calculate the main indicators of foreign trade and compare them with acceptable values	Calculation of export / import / foreign trade quota, trade balance, indicator of import coverage by export
	Index method	Provides for the calculation of indices based on certain ratios of foreign trade and allows to evaluate the effectiveness of its implementation	Calculation of indices: Laspeyres, Paasche, value of exports / imports, terms of trade, price ratios of foreign trade turnover
Method of international comparisons		Cost comparison of indicators of development of national economies	Improved (due to the use of corrective indicators) method of data comparison
Method of structural analysis		Analysis of the structure of foreign trade in commodity and / or geographical context	ABC-analysis of the structure of exports / imports
Matrix analysis method		Determining the characteristics of foreign trade as a function of specific parameters of the situation with the possibility of graphical generalization	Matrix analysis of the structure of foreign trade by goods and countries
Methods of statistical analysis	Analysis of variance	Estimation of sufficiency of sample indicators of connection of effective and factor signs for distribution to the general data set	Analysis of variance in the average annual basic growth rate of exports / imports of goods
	Correlation-regression analysis	Detection of mathematical dependence between the studied features and establishment by means of correlation coefficient of a comparative estimation of density of interrelation	Establishing a link between a country's GDP and exports to other countries
Scenario planning (forecasting)		Forecasting the development options of the economic entity based on the definition of general factors of influence	Using automated models of general economic equilibrium and intersectoral balance

Group	Method / approach	The essence	Application in the context of foreign trade research
	Gravitational modeling	Based on the idea of gravitational attraction: the strength of interaction between economic entities is directly proportional to the product of indicators of their significance and inversely proportional distance between them	Gravitational model of a country's trade with other countries
	Fuzzy logic methodology	Construction of a linguistic model of quantitatively unmeasurable economic quantities with their subsequent transformation into a numerical model based on a system of rules	Model for forecasting the success of export-import operations in Central and Eastern Europe
	Imitation modeling	Reproduction in time (forecasting) of foreign trade development according to the list of scenarios	Forecasting the development of the country's foreign trade in the medium term
Econometric models	Modeling of one-dimensional time series (deterministic approach)	The set of mathematical and statistical methods of analysis to identify the structure of time series and their prediction; is the basis for the construction of deterministic (trend) models of a certain functional type	Trend models of bilateral trade; econometric models of foreign trade turnover
	Stochastic modeling (probabilistic approach)	Determining the probabilities of different states of the system in the future based on known information about its current and previous states	Flexible tools for analysis and forecasting of foreign trade

The factor approach is based on the identification and systematization of factors that affect the dynamics of foreign trade. It is used to assess the situation, as well as to determine the main prospects for foreign trade. This method is quite effective in identifying the general patterns of international specialization of the country, especially in the situation of finding new markets (when there is a large amount of statistics) or for a purely descriptive nature of the study (Miziuk S., Morozova M., 2020). Thus, non-formalized analysis based on a factor approach is an important basis for assessing the current state and establishing trends in foreign trade relations of the state. It is advisable to use it in combination with formalized research methods. This will help increase the validity of forecasts of the dynamics and structure of the country's foreign trade.

It is very important to use any formalized research methods because it involves

determining the factors that reflect the state and prospects of foreign trade. The most common are indicative and index research methods. The indicative method is based on the calculation and comparison of the main indicators of foreign trade. The index method, often used by various scholars, outlines the calculation of major indices based on trade ratios. Balance analysis helps to classify information on foreign trade, to characterize the main trends and factors affecting trade. The disadvantage of this method is that it gives only "dry statistics" and does not allow to provide any predictions about the dynamics of indicators.

A kind of the formalized approach to the analysis of foreign trade is the use of matrix analysis, which allows to determine the values of the model elements as a function of specific parameters of the situation by using the rules of matrix theory. The method of international

comparisons (including its modifications) allows to establish development trends and analyze the structure of foreign trade. It provides a comparison of cost indicators of national economies. We may also use structural analysis to analyze foreign trade. This method involves the separation of constituent elements (subsystems) in the structure of the object of study and the definition of relations and relationships between them in order to form a comprehensive view of the object of study as a whole. A type of structural analysis is ABC-analysis, which involves analyzing the structure of foreign trade in commodity and/or geographical context in order to determine the importance of certain groups of goods and/or regions in ensuring the overall result of foreign economic activity.

Methods of economic and mathematical modeling occupy a significant place among the methods of foreign trade research. The use of mathematical methods to solve economic problems increases the level of validity of

conclusions and recommendations regarding trends in foreign trade (Kaliuzhna N.,2017).

We believe that it is advisable to use statistical methods for the analysis of foreign trade, their main advantage is that they are quite reliable. The main task of such methods is to compress information because a person cannot draw the right conclusions by working with large amounts of data. The advantages of statistical methods of analysis are the ability to obtain fairly reliable conclusions based on a small sample. An important aspect of the soundness of statistical analysis is the optimal choice of the form of the regression equation. When choosing it, you can consciously or unconsciously avoid “inconvenient” data that refute the hypothesis of the desired “convenient” (usually linear) regression.

The system of interconnected statistical indicators, which are grouped into five blocks, is used to comprehensively assess the state and development of the country's foreign trade and its position in the world market (Fig.1) (Yerina I. V., 2016).

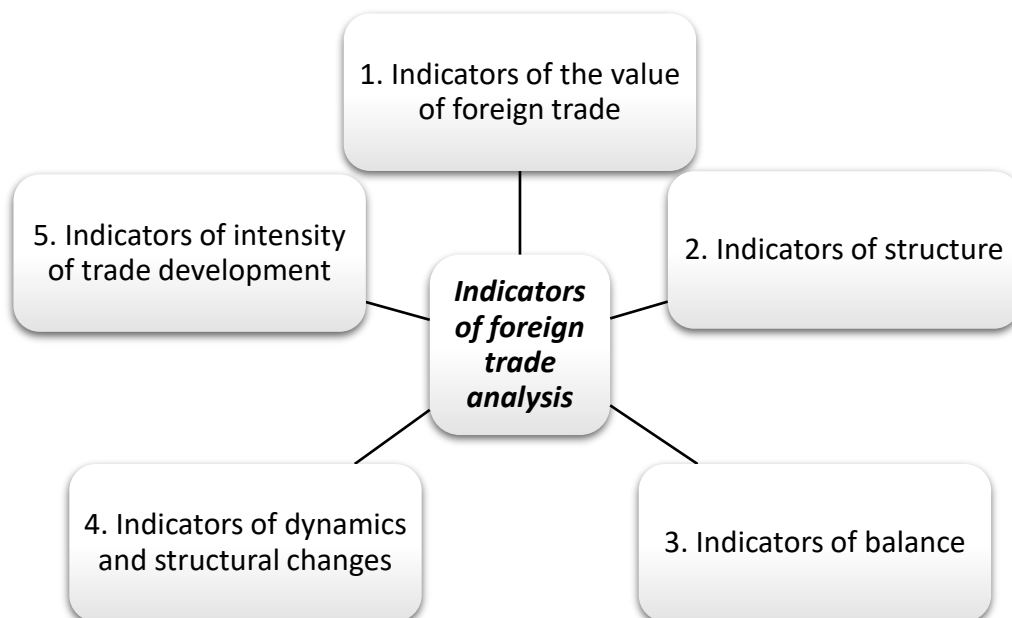


Figure 1 – Blocks of interrelated indicators of foreign trade statistics

The first block contains indicators of the value of foreign trade. Foreign trade in goods and services consists of two counter-flows – exports and imports. The second block contains indicators that characterize the species

composition and geographical orientation of export-import flows of services. The third block is represented by indicators of balanced foreign trade. The fourth block combines traditional statistical indicators of intensity of dynamics –

indices, absolute increments and growth rates (decrease), which characterize the absolute and relative rate of change of scale, structure and balance of trade in services (exports, imports, trade balance and coverage ratios) for a certain period. The fifth block combines indicators that characterize the level of foreign trade of the country and the degree of its activity in international trade.

In statistical practice, the following indicators are used for the analytical characteristics of foreign trade (Popova Y. M., Guchenko Y. O., 2017):

1) the volume of foreign trade (exports, imports, foreign trade, foreign trade balance);

2) development and balance of foreign trade (level of openness of the economy, export quota, level of import dependence, level of export coverage by imports);

3) the dynamics of foreign trade (index of "terms of trade", elasticity);

4) efficiency of foreign trade (currency efficiency, budget efficiency, production efficiency).

Taking into account the presented results, we offer the author's system of statistical indicators of the state and development of the country's foreign trade (Table 2).

Table 2 – The system of statistical indicators of the state and development of foreign trade *

<i>Indicator</i>	<i>Formula</i>	<i>Characterizes</i>
Openness of the economy	$K_o = \frac{X}{GDP}$	the level of openness of the economy
Terms of trade	$w = \frac{P_X}{P_M}$	changing the country's position in world trade
The role of the country among other countries	$K_X = \frac{X_{ij}}{\sum_{j=1}^k X_{ij}}$	the level of international specialization of the world by certain industries or groups of goods
Indicator of import dependence	$K_{Md} = \frac{M_i}{S_i}$	the ratio of imports and consumption of a particular product
Import quota	$K_M = \frac{M}{GDP}$	importance of imports for the national economy
Export diversification index	$S_j = \frac{\sum_{i=1}^l h_{ij} - h_i }{2}$	differences in the structure of the country's foreign trade
Net trade index	$NT = \frac{X - M}{X + M}$	the level of excess of exports over imports
Indicator of import coverage by export	$K_{X/M} = \frac{X}{M}$	
Index of geographical concentration of exports	$S_i = \sqrt{\sum_{j=1}^k \left(\frac{X_{ij}}{X_i} \right)^2}$	the state of the world market for specific product groups
Marketability index	$K_{X+M} = \frac{X + M}{GDP}$	degree of participation in the international division of labor
Export competitiveness index	$K_j = \frac{X_j^1}{HX_j}$	competitiveness of the country's exports
Export profitability indicator	$R = \frac{V}{C}$	profitability of exports of certain goods of enterprises engaged in foreign economic activity

* - the symbols used in table 2 are given in table 3

Table 2 – Symbols of indicators of the state and development of foreign trade

$X, X_i, X_{ij}, X^1_j, HX_j$	export of the country, export of the i-th type of goods, export of the i-th type of goods of the j-th country in the reporting period, hypothetical export of the j-th country
M, M_i	import of the country, import of the i-th type of goods
S_i	consumption of the i-th type of goods
GDP	Gross Domestic Product
P_M, P_X	import and export price index
h_i, h_{ij}	the share of the i-th type of goods in world exports, the share of the i-th type of goods in total exports of the j-th country
V, C	profit from the sale of goods by enterprises of the country, the cost of goods
k	number of countries

The list of indicators that we have proposed is somewhat limited, but we believe that it is the most informative for an adequate assessment of foreign trade in order to form management decisions to eliminate identified problems and increase the relevant performance indicators.

Thus, the following principles should be the basis for building a system of analytical indicators of foreign trade (Popova Y. M., Guchenko Y.O., 2017):

1) compliance with the general methodology and principles of construction of statistical information officially used in the country;

2) ensuring compatibility with similar indicators in the system of state centralized statistics;

3) meeting the needs of users in quality and operational information that reflects the basic facts and processes occurring in the foreign economic activity of the country.

Conclusions

Methodological approaches of scientists to the analysis of foreign trade can be generalized by the criterion of using quantitative research methods and grouped into non-formalized (qualitative) and formalized (quantitative). The use of informal analysis in combination with formalized research methods (provided they are given unconditional priority) will help increase the validity of forecasts of the dynamics and structure of foreign trade. The existence of unexpected and unexpected factors influencing

foreign trade makes the task of choosing formalized methods relevant. This approach is suitable for obtaining long-term reliable forecasts.

The probabilistic nature of the development of foreign trade relations in the current unstable economic and geopolitical conditions allows us to consider statistical analysis as a promising method to ensure the soundness of long-term forecasts of foreign trade.

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