

# Development of foreign economic activity at the regional level: impact factors modeling

Roman V. Fedorenko, Tamas Czegledy, Nadezda A. Zaichikova

**Abstract**— The article is devoted to the study of factors influencing the process of integration of chosen regions of the Russian Federation into the system of world economic relations. The relevance of the research is due to the increasing importance of foreign trade activities for chosen regions of the country. The dynamic development of international economic integration with a combination of globalization and localization processes characterize the current level of economic growth. These trends contribute to a significant increase in the level of foreign trade activity of particular regions, allowing increasing the competitiveness of the state in the international arena. The purpose of the article is to create an indicative model for assessing the factors that have the most substantial impact on the development of export-import operations at the regional level.

**Keywords**— region, modeling, world economic relations, foreign economic activity, export, import.

## I. INTRODUCTION

In the modern world, the success of a state depends on its ability to integrate into the international economic system. Effective integration gives opportunities to accelerate national economy. The urgency of researching the problem of integrating particular Russian regions into the system of world economic relations is due to the need to find new growth points to ensure successful economic development both at the regional and national levels.

Characteristics of the current Russian national economy condition leads to the conclusion that it is integrated into the world and is part of it, but the role of Russia is reduced mainly to the trade in resources [12]. Most of the particular regions of the country are successfully engaged in foreign economic activity. At the same time, it is necessary to identify the problem of the extremely uneven contribution of different regions of the country to the development of international trade operations. The need to focus on foreign markets is due to the continuous stagnation of the domestic market and the lack of positive expectations regarding the increase in the purchasing power of the local population.

Currently, the Federal center in Russia sets social and economic targets for each region. Responsibility for their achievement rests with the Governor and local authorities. The ability to successfully attract external financial flows and fulfill the requirements of the federal center to ensure the achievement of target indicators of economic development becomes extremely important for the Russian regions. Successful entry into the international market of regional enterprises allows to solve this problem and creates conditions for ensuring financial stability and building the basis for further economic growth.

A large number of researchers of foreign economic activity (FEA), proceed from the statement that it is an effective tool for economic development and a key factor in the formation of territory competitiveness.

A. Molchan et al. claim that "participation in foreign economic relations traditionally provides for the simultaneous implementation and increase of the resource potential of the territory, in some cases becoming the dominant factor of socio-economic development" [11].

M. Partridge et al. notes the importance of the impact of foreign economic activity on the development of the regional labor market [10].

R. V. Fedorenko, Samara State University of Economics, Samara, Russia (e-mail: fedorenko083@yandex.ru).

T. Czegledy, University of Sopron, Sopron, Hungary (e-mail: czegledy.tamas@uni-sopron.hu).

N. A. Zaichikova, Samara State University of Economics, Samara, Russia (e-mail: zajna@yandex.ru).

A significantly smaller number of researchers studied the factors influencing the development of the region's foreign economic activity. For example, Nazarczuk et al. considered the impact of specialization on the activity of foreign economic activity of the region [9]. N. Dritsakis analyzed the relationship between exports, investments and economic development in Bulgaria and Romania using a multivariate autoregressive VAR mode [14].

In this article, the authors consider the problem of enhancing the foreign economic activity of country's particular regions. The purpose of the article is to create an indicative model for assessing the factors that have the most substantial impact on the development of export-import operations at the regional level.

## II. METHODS

The information and empirical base of the research was compiled by statistical data of the Federal State Statistics Service (<http://www.gks.ru/>) and the Federal Customs Service of the Russian Federation (<http://www.customs.ru/>). Models of factors interdependence were built using the methods of mathematical statistics and econometrics. Analysis and processing of statistical information were carried out using the software packages Statistica and Microsoft Excel.

## III. HISTORY OF MODELING FEA DEVELOPMENT

The history of individual elements of international trade, and thus essentially the foreign economic activity of independent state entities, has a number of millennia. In the course of economic thought development appeared a huge number of theoretical and applied models of foreign economic activity.

Mathematical models are a powerful device for research and prediction of various phenomena. The use of mathematical models in economic research allows to:

- Highlight and formally describe the most significant, essential links of economic variables and objects;
- From well-formulated initial data and correlations by mathematical methods, obtain conclusions corresponding to the object being studied to the same extent as the assumptions;
- Mathematical methods (especially statistical) allow to obtain new knowledge about the object, to evaluate the form and parameters of the dependencies of its variables, which are most relevant to the existing observations;
- Accurately and compactly set out the provisions of economic theory; formulate its concepts and conclusions.

As applied to such an object of modeling as foreign economic activity, economic and mathematical models can be defined as mathematical images of various areas and forms of foreign economic activity that are intended to imitate them, serve as confirmation of theories, or as a tool for analysis, forecasting, management.

It should be noted that there is no category of "economic and mathematical models of foreign economic activity" in the economic literature. This concept is rather collective, while its constituent objects are models of certain areas and forms of foreign economic activity, or applied models that imitate the activities of various individualized subjects of foreign economic activity.

The term "model of foreign trade" is most often used in the scientific literature. We can divide entire set of developed models of foreign trade into 3 significant groups depending on the belonging to one or another concept of foreign trade: classical models of foreign trade, neoclassical models of foreign trade and modern models international trade.

Traditionally, the classic models of foreign trade include the model of absolute advantages of

A. Smith [1], the model of comparative advantages of D. Ricardo [2], the model of factor proportions of Heckscher-Ohlin [3]. Many researchers have used the idea of comparative advantage in the study of problems of economic development of regions [6, 7, 8].

Taken together, the classical models of international trade through graphic and arithmetic tools demonstrate theoretical ideas about the causality of the current structure and directions of international trade.

These models are basic in the assessment of factors of foreign economic activity development. They create prerequisites for the disclosure of the mutual influence mechanism of foreign economic activity and the socio-economic state of the macroeconomic objects.

Neoclassical models of international trade or the "standard model of international trade" associated with the theory of general equilibrium in international trade. The general equilibrium model and the partial equilibrium model are referred to the neoclassical models of foreign trade [4].

Taken together, the neoclassical models of international trade have a weak mathematical apparatus used in the analysis. They mainly use geometric and arithmetic tools. Moreover, the models have numerous assumptions (for example, absolute freedom of competition), which reduces their practical applicability in real conditions. Nevertheless, the theoretical conclusions presented in neoclassical models reveal the interrelation of foreign trade and economy; illustrate the mutual impact of changes in the conditions of foreign economic activity and the level of the macroeconomic system well-being. Theoretical postulates of neoclassical models create a significant prerequisite for building multi-factor models of the mutual influence of socio-economic development and foreign economic activity factors.

Current models of international trade relate to the so-called "new trade theory". The main foreign trade modern models feature is the reverse paradigm of international economic activity study. Classical and neoclassical models proceed from the existence of a homogeneous firm, which represents the entire country or industry. They describe the international "top-down" exchange of goods, i.e. focused on macroeconomic systems. With the emergence of the "heterogeneity of firms" theory and due to the development of statistics, the mathematical and econometric apparatus, modern models of foreign trade are associated with the use of a fundamentally inverse mechanism of bottom-up research. While traditional trade theory focused on the country, the newest theory emphasizes the role of firms and firm heterogeneity in international trade [5].

Thus, by economic and mathematical models of foreign economic activity, we understand mathematical models that imitate various manifestations of foreign economic activity at macroeconomic and microeconomic levels of economic activity. The scope of these models is to identify and study the most significant characteristics and trends, as well as the assessment of the foreign economic activity development prospects. The application of economic and mathematical modeling to foreign economic activity is aimed at improving the efficiency of this activity and identifying the key factors of its development.

In the present article, the main object of study is the foreign economic activity of the regions. The authors studied the main factors that can influence the increase of the export potential of the regions and the activation of foreign trade.

Foreign economic activity of the regions is an integral part of the production process. It has a significant impact on the state of the whole country economic system. The development of foreign economic activity at the regional level requires continuous government management, including planning and monitoring through an indicative assessment of key impact factors.

#### IV. IDENTIFICATION OF FACTORS AFFECTING FOREIGN ECONOMIC ACTIVITY

Foreign economic activity for Russia plays a priority role, being an important factor of financial stability. Revenues from foreign economic activity (customs duties, excise taxes, non-tax revenues) form a significant share of the country's budget.

Traditionally, foreign economic activity is understood as various types of business activities related to interaction with partners from abroad. The main subject of foreign economic activity is a company. Based on this position, “foreign economic activity” is an activity of the organization associated with entering the foreign market.

In relation to the national and/or regional economy (macro- and meso-level), foreign economic activity should be understood as the full range of international business relations of firms (micro-level), as well as public entities with foreign partners. These relations are aimed at integrating macro/meso-subject (state, region) to the world economic space. The interrelation of influencing factors at the micro-, macro- and meso- levels is presented in fig. 1.

The basis for the development of foreign economic activity is the successful entry of enterprises to foreign markets. Introduction of modern management technologies, reduction of costs, improvement of product quality, search for unoccupied niches in foreign markets - this is an incomplete list of conditions allowing companies to increase their foreign trade activity.

In the course of development of foreign economic activity and increasing the volume of export-import operations companies become more and more dependent on the state of region economic development. The state of the local infrastructure, the current tax regimes, the availability of financing, the human resource potential of the regions, the capacity of local markets and other indicators refer to the regional level factors of foreign economic activity development.

Conditions at the regional level are directly dependent on national economic factors. The key ones are the dynamics of GDP, the interest rate of the Central Bank, the current tax and customs legislation.

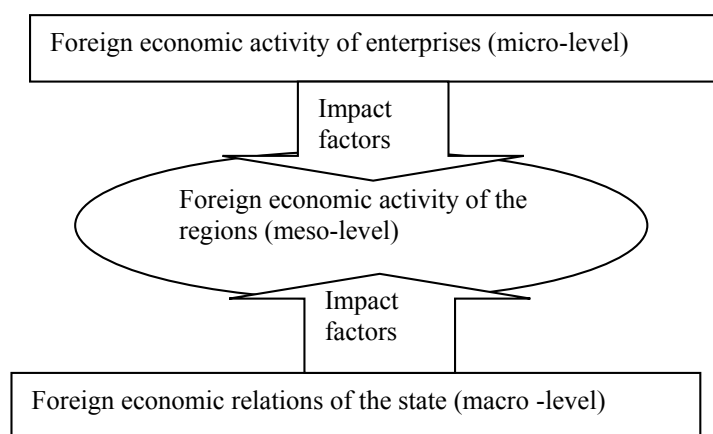


Figure 1 – Interrelation of factors influencing foreign economic activity

In addition to these factors, operating on a country-by-country basis, international factors can also be identified. The most significant factor for the model under consideration is the presence of sanctions and trade restrictions, the activities of international organizations, the dynamics of world prices for the main traded resources.

The main problem of empirical evaluation of factors influencing the development of foreign trade is the difficulty of quantifying their effect. In addition, it is mathematically difficult to quantify the favorable and adverse changes resulting from the impact of certain factors.

##### A. Factors Influencing Foreign Economic Activity at the National Level

The volume of foreign trade turnover largely depends on the level of economic development of the country and its regions. The state of the world economy as a whole, the level of development of relations with developed countries, the cost of oil and gas resources in the international market and the exchange rate of the national currency have a great influence. Figure 2 shows the dynamics of export-import operations of the Russian regions in comparison with the indicators of economic development.

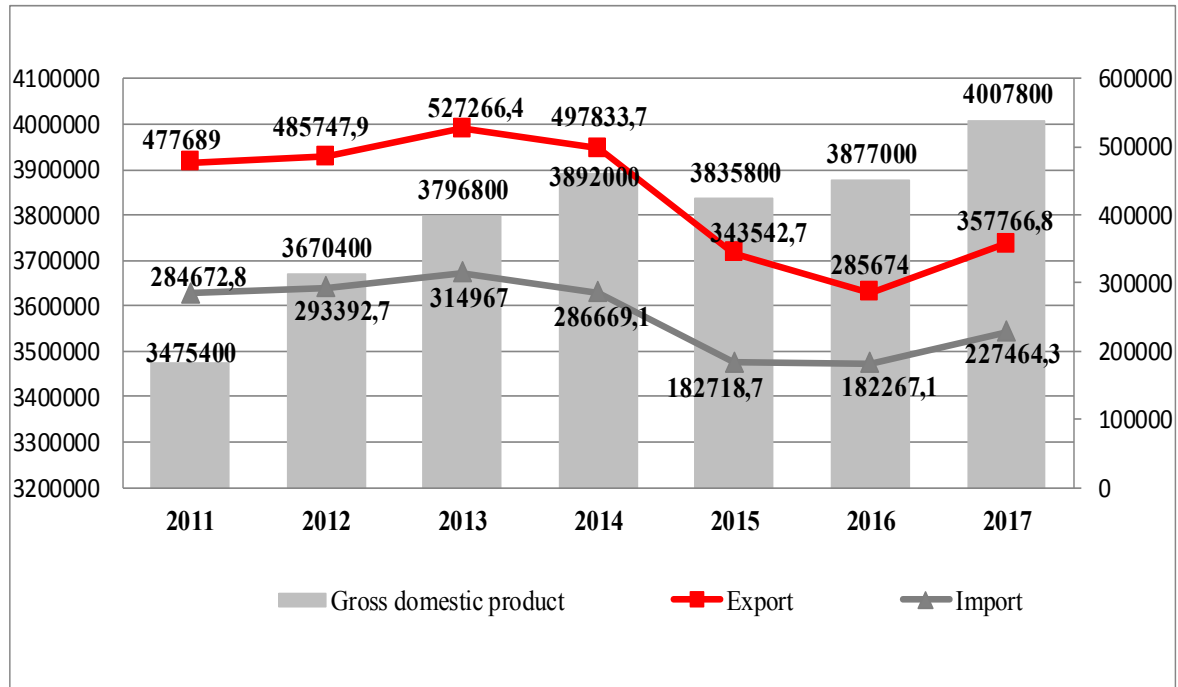


Figure 2 – Dynamics of export-import operations of Russian regions in comparison with indicators of economic development, million dollars USA

In 2011-2014, GDP of Russia grew at a rapid pace. The foreign trade turnover showed a similar dynamics in 2011-2013. The key reasons for the sharp decline in foreign trade turnover in 2014-2016 were the introduction of sanctions and anti-sanctions, which resulted in a significant reduction in export-import operations between Russia and Western countries. The sanctions had a negative impact on the level of Russia's GDP, however, the impact on foreign trade turnover was faster and stronger.

Following the results of 2017 and 2018, we can see the positive dynamics of the foreign trade turnover of the Russian Federation. However, for most of Russia's trading partners, even at the end of 2018, the pre-crisis volume of foreign trade turnover was not achieved. Thus, the foreign trade turnover between the Eurasian Economic Union and the EU in 2018 amounted to only 78% of the 2014 figure. One of the few exceptions to this trend is the turnover between the EU and China, which in 2018 amounted to 116% of the turnover in 2014. In General, we can talk about the presence of serious potential for increasing the volume of foreign trade turnover of Russia, provided that the status quo with Western countries and/or expanding cooperation with Asia-Pacific countries.

#### B. Factors Influencing Foreign Economic Activity at the Regional Level

In recent studies, it is noted that Russia is characterized by significant differences between individual parts of its space, both in terms of volume and structure of participation in foreign economic relations [4]. Significant disproportions are observed according to the data of 2018.

At the end of 2018, only 19 regions of the Russian Federation have a share in the total foreign trade turnover of the country more than 1%. Only seven regions have this share higher than 2% - Moscow (43.7%), St. Petersburg (7.1%), Moscow region (5.1%), Khanty-Mansi Autonomous district (3.0%), the Republic of Tatarstan (2.8%), Kemerovo region (2.5%),

Sakhalin region (2.3%). There are 85 regions in Russia. Seven listed regions provide about 67% of the total foreign trade turnover of the country. Moscow's leading role is due not only to physical volume of cargo concentration, but also to the fact of state registration of a large number of foreign trade companies in the capital of Russia. This explains the fact that the share of Moscow is about the same for both total exports and total imports.

In other leading regions, high rates of foreign trade turnover are achieved in different ways. In the regions, there is a significant discrepancy in the volumes of exports and imports. For example, in Khanty-Mansi Autonomous district foreign trade turnover is 20.6 billion dollars. And of these, 20.1 billion accounted for export operations. For the Sakhalin and Kemerovo regions, a similar situation is typical: exports account for more than 95% of the total foreign trade turnover. These regions are united by almost exclusively raw export orientation.

On average, the excess of exports over imports characterizes most regions of Russia. Of the 7 leading regions only in the Moscow region, the indicator of imports exceeds exports.

## V. MUTUAL INFLUENCE OF THE FACTORS IN DEVELOPMENT OF REGIONAL FOREIGN ECONOMIC ACTIVITY: CONCEPTUAL MODEL

Factors affecting the level of foreign trade of individual regions can be divided into several levels:

- Micro-level. Factors prevailing at the individual enterprise level.
- Meso-level. Factors prevailing at the regional level.
- Macro-level. Factors prevailing at the state level
- Mega-level. Factors emerging in the international market.

Conceptually, the model of mutual influence of factors has the following form:

$$\Phi(\vec{X}) = F(\vec{X}; G(\vec{X}; H(\vec{X}; I(\vec{X}))))), \quad (1)$$

where  $\Phi(\vec{X})$  – the superposition of the four functions,

$I(\vec{X})$  - the functions of the micro-level,

$H(\vec{X}; I)$  – the functions of the meso-level;

$G(\vec{X}; H)$  – the functions of the macro-level,

$F(\vec{X}; G)$  – the functions of the mega-level.

For successful forecasting of foreign trade development prospects it is necessary to consider all levels of factors. The authors chose the foreign economic activity of the regions as the object of research. In this article modeling of interaction of the separate factors operating at the regional level is carried out.

### A. Main Stages of Modelling

Modeling is carried out in several stages. At the first stage, an array of statistical data reflecting the state of the factors acting on the foreign trade of the region is formed. Depending on the purpose of the assessment, a set of statistical data describing foreign economic activity is formed both across the country and across the regions.

At the second stage, it is necessary to find the relationship between the variables under study. Theoretically established relationship between factors and FEA of the region can often not be traced in practice. In this regard, before proceeding to the direct determination of the most important factors, it is necessary to establish the fact of the relationship between the variables studied, and if it exists, to describe this relationship mathematically.

The third stage is scenario forecasting of the impact of certain factors on the level of foreign trade development. This stage is of the greatest practical interest for managers of local, regional

and national level, as it allows to calculate the effectiveness of investments in the development of various parameters of foreign economic activity.

*B. Modeling the Factors of Foreign Economic Activity Development on the Example of Russian Regions*

It is quite difficult to recognize and identify changes in the indicators of export-import activity caused by changes in socio-economic factors. In addition, it is mathematically difficult to quantify the favorable and adverse changes resulting from the impact of certain economic indicators.

Based on the essence of the proposed concept of the mutual influence of foreign trade indicators and the state of macro-and meso - systems, we propose to use absolute changes in the parameters of export or import, explained by the direct impact of indicators of socio-economic development.

We will use indicators of foreign trade activity as indicators of the region's foreign economic activity. Quantitative indicators of foreign trade activity are the volume of exports (EX) and the volume of imports (IM).

Let us consider the problem of constructing spatial econometric models, for which statistical data for 2017 for 85 regions of Russia were collected [13]. We present a scheme of econometric research on the example of building a model for export. For simulation the quality factor variables influencing the export, EX (US\$ million) and imports, IM (US\$ million), socio-economic indicators were selected (table I).

TABLE I.

SYSTEM OF INDICATORS OF SOCIO-ECONOMIC DEVELOPMENT OF REGIONS OF THE RUSSIAN FEDERATION

№	Name of indicator	Unit of measurement	Reference designation
1	Mid-annual number of people employed	thousand people	L1
2	Per capita cash income (per month)	roubles	PLL1
3	Average monthly nominal accrued wages of employees of organizations	roubles	L2
4	Fixed assets in the economy	billions of roubles	PR1
5	Output of agriculture	billions of roubles	PR2
6	Commissioning of the total area of residential premises	thousands m <sup>2</sup>	INFR1
7	Retail trade turnover	billions of roubles	TR
8	Net financial result (profit minus loss) in the economy	billions of roubles	PR3
9	Consumer price index (December to December of the previous year)	%	PLL2
10	Investments in fixed capital	billions of roubles	I
11	Density of public roads with hard surface at the end of the year	km of tracks per 1000 km <sup>2</sup>	INFR2

Since the methodology focuses on both national and regional levels, the table provides an indicative list of numerical indicators. Their set, mostly, is determined by the availability of statistical data, so for the Russian Federation as a whole and its regions indicators are somewhat different.

At the output, after the first stage of modeling, we obtain two numerical matrices of the same time period, the elements of which are the parameters of socio-economic development (SED) and foreign economic activity (FEA):

$${}^1\text{SED}_{s,p} = \{\text{sed}_{ij}\}_{s,p} \quad {}^1\text{FEA}_{m,p} = \{\text{fed}_{ij}\}_{m,p} \quad (2)$$

where  $p$  is the time period,

s, m – number of indicators of socio-economic development and foreign economic activity. For foreign economic activity, there will be no more than two of them: EX, IM; for social and economic development – at least six, namely indicators of blocks L, PLL, PR, INFR, TR, I).

The studied values have a number of features. First, the indicators of foreign economic activity are largely due to internal factors of the national economy, i.e. the level of socio-economic development of the territory. For example, the degree of development of production, of course, affects the volume of foreign economic activity and investment attractiveness for foreign investors.

Secondly, the indicators of socio-economic development are mutually influential. For example, the level of development of production, financial performance of organizations due to the degree of development of the labor market, production and finance affect the standard of living, influences budget revenues.

Third, each parameter of the socio-economic development of the macroeconomic system has a basic part, formed by root causes and subject to insignificant influence of foreign economic activity.

Thus, conditionally indicators of living standards of the population are formed under the influence of internal factors of economic development and social policy of the state, production indicators vary depending on the level of business activity, the phase of economic growth, economic policy.

The third stage of modeling is to conduct a preliminary analysis of the data in order to identify dependencies, determine their quality, and select the most relevant indicators. At this stage, the generated numerical matrices will be investigated by means of correlation analysis tools. Table II presents a matrix of paired correlation coefficients for export (EX).

TABLE II.

MMATRIX OF PAIR COEFFICIENTS OF CORRELATION FOR EXPORT

Показатели	EX	L1	PLL1	L2	PR1	PR2	INFR1	TR	PR3	PLL2	I	INFR2
EX	1	0,800	0,478	0,395	0,813	-0,051	0,305	0,860	0,948	0,152	0,598	0,640
L1	0,800	1	0,400	0,233	0,803	0,338	0,719	0,974	0,852	0,180	0,686	0,602
PLL1	0,478	0,400	1	0,909	0,579	-0,091	0,275	0,454	0,532	0,270	0,596	0,179
L2	0,395	0,233	0,909	1	0,524	-0,281	0,093	0,280	0,456	0,241	0,548	0,021
PR1	0,813	0,803	0,579	0,524	1	0,032	0,460	0,819	0,905	0,324	0,931	0,446
PR2	-0,051	0,338	-0,091	-0,281	0,032	1	0,472	0,247	0,003	-0,033	0,116	0,015
INFR1	0,305	0,719	0,275	0,093	0,460	0,472	1	0,706	0,429	0,139	0,497	0,389
TR	0,860	0,974	0,454	0,280	0,819	0,247	0,706	1	0,894	0,194	0,674	0,649
PR3	0,948	0,852	0,532	0,456	0,905	0,003	0,429	0,894	1	0,192	0,764	0,641
PLL2	0,152	0,180	0,270	0,241	0,324	-0,033	0,139	0,194	0,192	1	0,301	0,065
I	0,598	0,686	0,596	0,548	0,931	0,116	0,497	0,674	0,764	0,301	1	0,313
INFR2	0,640	0,602	0,179	0,021	0,446	0,015	0,389	0,649	0,641	0,065	0,313	1

Source: Authors

As a result of the analysis of the constructed matrix of pair correlation coefficients of the factors selected above, the following conclusions are made: the export is most influenced by such indicators as:

- net financial result (profit minus loss) in the economy;
- retail trade turnover;
- fixed assets in the economy,
- average number of employed,



- density of paved public roads.

Factors in descending order of influence are arranged as follows: PR3, TR, PR1, L1, INFR2, I, PLL1, L2, INFR1, PLL2, PR2. Socio-economic indicators in the regions are correlated and, accordingly, cannot be included in one regression model. To eliminate multicollinearity, factors that mutually affect each other are not used in models together.

After analysis various variants of multifactor models were constructed by the least squares method. Step-by-step methods of factor selection in the model were used to build the best statistical quality and explanatory capacity of the model variants. Robust estimates of standard errors (corrected for heteroscedasticity) were calculated for the models. The regression equation for the export model is:

$$EX = -5425,31 + 2,64339PR1 + 14,0235INFR2,$$

the regression statistics are presented in summary table IV.

The constructed model shows that with an increase in fixed assets by 1 billion rubles, exports will increase by an average of 2,643 million dollars. with a constant density of paved public roads; with an increase in the density of paved public roads by 1 m<sup>2</sup>, exports will increase by an average of \$ 14.024 million at a fixed value of fixed assets.

Table III presents a similar table for import indicators.

TABLE III.

MATRIX OF PAIR COEFFICIENTS OF CORRELATION FOR IMPORT

Показатели	IM	L1	PLL1	L2	PR1	PR2	INFR1	TR	PR3	PLL2	I	INFR2
IM	1	0,844	0,457	0,356	0,907	-0,052	0,455	0,911	0,964	0,152	0,765	0,725
L1	0,844	1	0,387	0,210	0,851	0,338	0,713	0,975	0,850	0,155	0,794	0,621
PLL1	0,457	0,387	1	0,908	0,589	-0,095	0,258	0,446	0,518	0,248	0,670	0,193
L2	0,356	0,210	0,908	1	0,491	-0,292	0,063	0,267	0,429	0,205	0,551	0,038
PR1	0,907	0,851	0,589	0,491	1	0,025	0,447	0,890	0,938	0,261	0,926	0,557
PR2	-0,052	0,338	-0,095	-0,292	0,025	1	0,475	0,247	-0,002	-0,039	0,135	0,017
INFR1	0,455	0,713	0,258	0,063	0,447	0,475	1	0,702	0,410	0,111	0,531	0,407
TR	0,911	0,975	0,446	0,267	0,890	0,247	0,702	1	0,899	0,179	0,810	0,662
PR3	0,964	0,850	0,518	0,429	0,938	-0,002	0,410	0,899	1	0,153	0,839	0,677
PLL2	0,152	0,155	0,248	0,205	0,261	-0,039	0,111	0,179	0,153	1	0,224	0,083
I	0,765	0,794	0,670	0,551	0,926	0,135	0,531	0,810	0,839	0,224	1	0,480
INFR2	0,725	0,621	0,193	0,038	0,557	0,017	0,407	0,662	0,677	0,083	0,480	1

Source: Authors

After analysis of the constructed matrix of pair correlation coefficients of the factors selected above, it is concluded the indicators that affect the import the most are:

- net financial result (profit minus loss) in the economy;
- retail trade turnover;
- fixed assets in the economy,
- average number of people employed,
- investments in fixed capital.

Factors in descending order of influence are arranged as follows: PR3, TR, PR1, L1, I, INFR2, PLL1, INFR1, L2, PLL2, PR2.

If we compare tables II and III, we can conclude that the most important factors affecting exports and imports are the same. Only on the fifth largest coefficient of linear correlation of indicators, there are differences. In addition, a comparison of the two matrices suggests that

socio-economic development indicators have a greater impact on imports than on exports. Thus, the correlation coefficient for imports for only one indicator (PR 3) showed a very high correlation, exceeding the level of 0.9. For the import there are 3 such indicators: PR3, TR, PR1.

After analysis of the matrix of pair coefficients for import various variants of multifactor models were constructed by the least squares method. Step-by-step methods of factor selection in the model were used to build the best statistical quality and explanatory capacity of the model variants. Robust estimates of standard errors (corrected for heteroscedasticity) were calculated for the models. According to the first model for import, the regression equation has the following form:

$$IM = -3533,28 + 2,29619R1 + 8,84305INFR2 - 0,0116066 PR2,$$

It can be said that with an increase in fixed assets by 1 billion rubles, imports will increase by an average of 2,296 million dollars with the remaining factors unchanged. With an increase in the density of public paved roads by 1 m<sup>2</sup>, imports will increase by an average of \$ 8.843 million with the remaining factors unchanged. With an increase in agricultural production by 1 million rubles, imports will decrease by an average of 0.012 million dollars with the remaining factors unchanged. According to the second model for import:

$$IM = -1595,69 + 0,023226PR3 + 3,70419INFR2,$$

With the increase in the net financial result by 1 million rubles, import will increase on average by 0,023 million dollars with the remaining factors unchanged. The increase in the density of public paved roads by 1 m<sup>2</sup> will lead to an increase in imports by an average of \$ 3.704 million dollars with the the remaining factors unchanged.

Below is a summary table of regression indicators for the constructed models (table IV).

TABLE IV.

REGRESSION STATISTICS OF MODEL PERFORMANCE

Models	EX	IM1	IM2
Variable	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)
PR1	2,643394*** (0,244551699)	2,29619*** (0,41619)	-
INFR2	14,023479*** (2,468243)	8,84305*** (2,67075)	3,70419 * (1,90225)
INFR1	-	-	-
PR2	-	-0,0116066** (0,00504801)	-
PR3	-	-	0,023226*** (0,00188712)
Constant	-5425,310*** (1117,894944)	-3533,28*** (750,192)	-1595,69*** (478,779)
R <sup>2</sup>	0,756312	0,898289	0,939635
R <sup>2</sup> <sub>adj</sub>	0,75036817	0,894475	0,938145
F-statistic (Probability)	127,247775 (7,24796E-26)	30,67505 (2,67e-13)	166,3580 (2,08e-29)

Source: Authors

Note:

\* corresponds to the significance of the coefficient estimate at the significance level of 10%;

\*\* corresponds to the significance of the coefficient estimate at significance level 5%;

\*\*\* corresponds to the significance of the coefficient estimate at the significance level of 1%.

Table IV shows that all models meet the requirements of good statistical quality and explanatory capacity. The models are statistically significant in general at the significance level of 1% (Probability<0.01), all models have a very high explanatory ability (determination

coefficient >75%).

In the export model and the first import model, all estimates of the regression coefficients are statistically significant at a significance level of 1%. In the second model for import, the statistical significance of the regression coefficient estimate for the variable INFR2 is statistically significant at the significance level of 10%. However, the corrected coefficient of determination in this model is higher ( $0.938145 > 0.894475$ ), which indicates a better fit of the equation for empirical data.

Thus, if the high explanatory power of the model is a priority, then the IM2 model should be preferred, if the statistical significance of regression coefficient estimates is high, and, as a consequence, the reliability of forecasts is higher, then IM1 model should be preferred. Also, the choice of a model from the two presented can be carried out according to the purpose of the study, based on what factors, from those listed in table IV, are the most suitable for its implementation

## VI. CONCLUSION

Thus, according to the results of the study, it can be concluded that the following factors have the greatest impact on the development of foreign economic activity of the regions: the balanced financial result in the economy, retail trade turnover, fixed assets in the economy and the average annual number of employees.

The compiled matrices of paired correlation coefficients for export and import have minor differences, and demonstrate the stability of estimates of regression coefficients, which is a prerequisite for the study of the considered indicators in dynamics.

Conceptual model to determine the influence of individual factors in the development of foreign economic activity of the region, mathematical and methodological support of their calculation can be used in practical activities of public authorities in the formation and implementation of regional and national economic development strategies. This model allows us to conclude which indicators currently have the greatest impact on the development of export-import activities in the region.

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