ORIGINAL PAPER

DOI: 10.26794/2587-5671-2021-25-3-35-52
UDC 33,63(045)
JEL Q10, Q13, Q14

Modeling the Rating System of Export-Oriented Companies in the Agro-Industrial Complex of the Russian Federation. Subsidy Mechanism

E.G. Semyashkin[a] ✉, **A.M. Karminskii**[b]
National Research University Higher School of Economics, Moscow, Russia
[a] https://orcid.org/0000-0002-7225-5462; [b] https://orcid.org/0000-0001-8943-4611
✉Corresponding author

ABSTRACT

The study explores the influence of internal factors on the level of exports of products of the agro-industrial complex of the Russian Federation (AIC RF). The **subject** of the research is the competitiveness of export-oriented companies in the agro-industrial complex of the Russian Federation. The **relevance** of the study is due to the growth of exports of agricultural products, which is gradually becoming one of the most important sources of foreign exchange earnings in the country. The **aim** of the paper is to form a rating model for Russian companies focused on the export of agricultural products, on the basis of which to propose the most effective measures to support agricultural enterprises. The authors apply the following **methods**: systematization and classification of information, statistical, coefficient, and regression analysis. Such tools as linear regression models, logistic regression (logit, probit), ordered probit model are considered. The authors use the Ginny coefficient (area under the curve Roc) for binomial models and an adjusted R^2 for the linear model as a quality criterion for the model. As a **result,** the study identified the key internal and external factors affecting the competitiveness of agricultural exporting companies. Internal factors include stocks, net assets, short-term borrowings, equity capital, fixed assets turnover, long-term liabilities, accounts payable. Among the external factors for both ordinal and binomial models, the most significant were the increase in imports, the logarithm of GDP, and the logarithm of GDP per capita. A model of rating assessment of companies has been developed. Proposals are formulated for using the developed system as a simulation model when making decisions on the development and support of food exports in Russia. The authors propose a combined mechanism for supporting enterprises, depending on the rating determined by the model. It is **concluded** that the implementation of this approach will significantly increase the level of economic efficiency of budget support funds aimed at stimulating exports. The prospect for further research on this topic is to study the influence of qualitative factors that were not included in the model: the drought index, sanctions, and other macroeconomic events and parameters.

Keywords: export; agro-industrial complex; internal factors; subsidy mechanism; linear, binomial, and ordinal models

For citation: **Semyashkin E.G., Karminskii A.M. Modeling the rating system of export-oriented companies in the agro-industrial complex of the Russian Federation. Subsidy mechanism.** ***Finance: Theory and Practice*****. 2021;25(3):35-52. (In Russ.). DOI: 10.26794/2587-5671-2021-25-3-35-52**

INTRODUCTION

The state and private investors are putting more emphasis on increasing the export potential of agriculture with every passing year. Its advanced development is becoming increasingly important. The volume of food exports in 2019 amounted to about 6.5% of the total exports of the Russian Federation (of which 4% were cereals). Russia ranked first in the world in grain exports, overtaking the United States and China.[1]

The government pays special attention to improving the legal and regulatory framework for export regulation. In 2019, more than 9 government resolutions were issued, in one way or another aimed at supporting the export of agriculture, including grain crops and meat products. The volume of subsidies for the introduction of advanced technologies into production is increasing.[2] Steps are being actively taken to improve the attractiveness of investing private funds in this area, and bureaucratic procedures are partially weakened.[3]

The novelty of the study is due to the fact that previously in Russian practice, the rating assessment of exporters of agricultural products was not carried out. The relevance of the topic is emphasized by the growth of agricultural exports, it is becoming one of the most important sources of foreign exchange earnings in the country, the sector of creating new high-paying jobs.

World economic theory has a long tradition of studying international trade. David Ricardo made his contribution to this science. In his theory of comparative advantages, he proved the need for mutually beneficial trade even in the presence of absolute advantage of the country in the production of any product, arguing that the total volume of exports can be increased through specialization [1].

Among the modern researchers who paid attention to this problem, we note the Nobel Prize in Economics Paul Krugman, who states that the theory of "international trade" is based on geographical inequality, the receipt of more revenues by countries with a large amount of production, leading to an increase in exports [2].

Nobel laureates P. Samuelson [3] and W. Leontief [4] also made significant contributions to the theory of export activities.

In the Russian Federation, attention was paid to the development of the export potential of agricultural products in the works of A.G. Paptsov, I.G. Ushacheva, A.I. Altukhov, and others, where special attention was paid to the practice of foreign countries, in particular in their work "Export of AIC products in Russia: Trends and development" [5] and in a number of other works [6].

We also note that earlier some authors attempted to study and describe using econometric models the factors that affect the level of exports and imports of a country or regions as a whole. The study of the relationship between the volume of exports and some factors at the level of a particular region was carried out in the work of A.V. Lapin [7]. The work of D.R. Zarubaiko [8] examines the impact of export operations on one of the macro-factors: the level of China's GDP. S.S. Jana, T.N. Sahu [9] investigated the influence of direct investment on the level of India's foreign trade.

We also highlight the works of J. Laborda, V. Salas [10], and other research [11, 12], which investigated the business and financial cycles of export-oriented companies, the level of their exports depending on the country's competitiveness and demand in the domestic market.

The article by S. Sashi, S. Bhavish [13] presents the results of a study of the impact

[1] Analytics. Export volumes. Agroinvestor. URL: https://www.agroinvestor.ru/ agroinvestor/9930/ (accessed on 15.11.2020).

[2] Development strategy of AO "Russian Export Center" until 2019. URL: https://www. exportcenter.ru/company/document/ (accessed on 15.11.2020).

[3] Federal Scientific and Technical Program for the Development of Agriculture for 2017–2025. Resolution of the Government of the Russian Federation of August 25, 2017, No. 996. URL: http://government.ru/docs/29004/ (accessed on 15.11.2020).

of sanctions on various sectors of the Iranian economy as the main reason for the decline in the level of its exports.

The purpose of this study is to develop a rating model for Russian companies focused on the export of agricultural products, to form, on its basis, the most effective toolkit for subsidizing agricultural enterprises. The following objectives have been set:

- to determine the parameters of indicative growth, on which companies can focus when implementing their strategy, which requires adjustments to current activities;
- to give recommendations on improving the mechanism of budgetary support for the export of agricultural products to increase its economic effectiveness.

In the course of the work, the influence of internal factors on the export level of individual companies was assessed. The article discusses tools such as linear regression models, logistic regression (logit, probit), ordered probit, and logit models (in the rating constructor, an ordinal model was used to build a rating system).

As criteria for the quality of the models the Ginny coefficient (area under the ROC curve), estimates of errors of the first and second kind to test the hypothesis about the significance of the model parameters, and the adjusted R^2 for different models were used.

It is the influence of internal factors that determines the financial condition and the level of competitiveness of the company as a whole. In other words, the internal assessment allows drawing a conclusion about the preliminary state of the enterprise.

The financial indicators of the organizations were downloaded from the SPARK[4] database.

Let us consider the importance of food exports for the Russian economy in comparison with export indicators as a whole. If from 2016 to 2019 Russian exports as a whole increased from 285 to 423.3 billion dollars, or by 48.5%, then non-resource non-energy exports (NE) increased over the same period from 109 to 154.5 billion dollars, or 41.7% (*Fig. 1*), the growth of food exports amounted to 57.1%. It grew from USD 16.3 billion to USD 25.6 billion. That is, at the moment, one of the drivers of the development of NRE in Russia, along with the chemical industry, metallurgy, and mechanical engineering, is the agro-industrial complex.

A positive trend is that, in general, there is a faster growth in food exports, which leads to a gradual increase in the share of the agro-industrial complex[5] in total exports.

It should be noted that for the period from 2016 to 2019, not only the volume but also the structure of exports of products of the agro-industrial complex of the Russian Federation changed significantly. Exports of grain and meat products grew at a faster pace [14].

Thus, the dairy and meat industries showed the highest growth rates among the agro-industrial complex at the end of 2019[6] (+29.8%). The oil and fat industry (+ 28%), food and processing industry (+ 12.7%) demonstrate high growth rates compared to 2018. At the same time, the export of perfumery, cosmetics, and pharmaceuticals increased by about 10.1% (*Fig. 2*).

The growing volumes of agricultural exports in recent years, the rapidly changing economic situation pose new challenges for economic science, lead to the need to develop new tools for regulating economic processes, for example, those that will assess the competitiveness of export-oriented agricultural companies based on the latest retrospective data. The results obtained can be used to improve the management of industry exports, to increase the economic return on

[4] SPARK database. Reporting of agro-industrial companies. URL: http://www. spark-interfax.ru/ (accessed on 15.11.2020).

[5] Russian Export Center, 2020. Analytics on Russian exports. URL: https://www.exportcenter.ru/international_markets/russian_exports/ (accessed on 15.11.2020).

[6] Export center. Volumes of non-resource exports. 2020. URL: https://www.exportcenter.ru/press_center/news/obemy-nesyrevogo-neenergeticheskogo-eksporta-vyrosli-v-2019-godu/ (accessed on 15.11.2020).

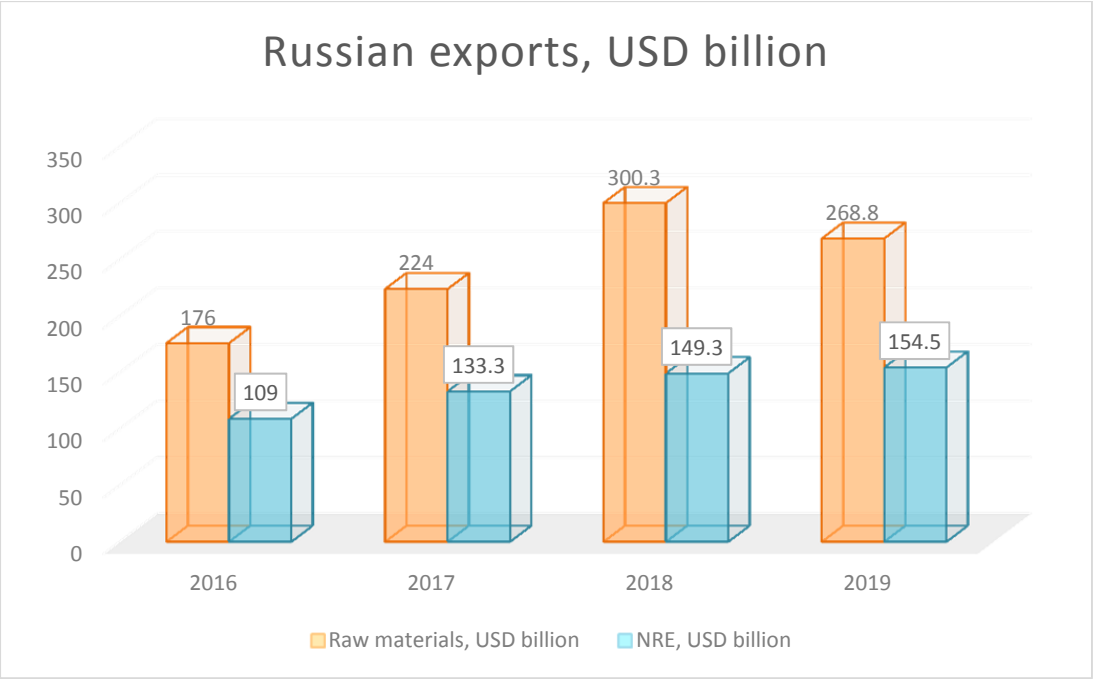


Fig. 1. **Dynamics of Russian exports in 2016–2019**

Source: Rosstat.

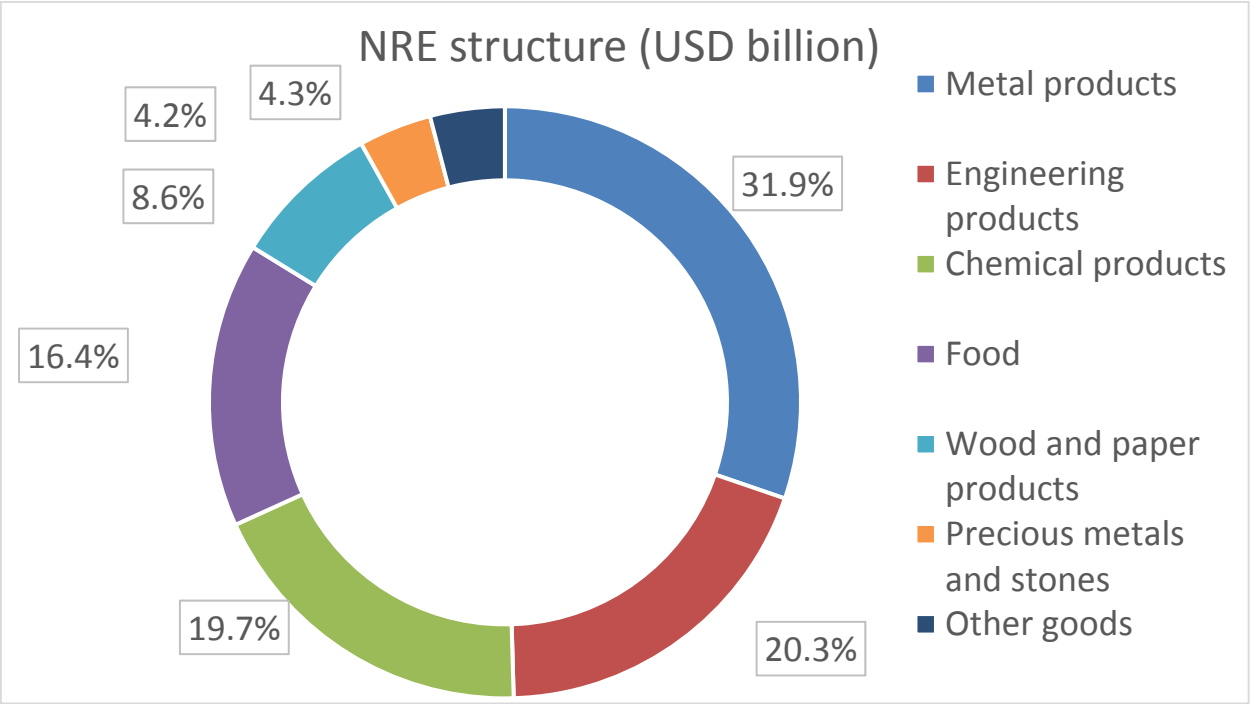


Fig. 2. **Structure of non-primary exports in 2019**

Source: compiled by the authors.

budgetary funds spent on export promotion. In this case, it becomes quite obvious that exporting companies should be differentiated according to their competitive capabilities.

As mentioned earlier, an econometric model based on an ordered logit/probit model was used to construct a rating of export-oriented agro-industrial companies. The

dependent variable y_i (the company's export growth rate) will take the following values: 1, 2,... 5 — depending on the growth rate. x_i — vector of values of independent variables [15].

$$y^* = x_i' + \varepsilon_i; \quad (1)$$

$$\left\{ \begin{array}{l} y_i = 1, if \ \ y_i^* \le c_i; \\ y_i = r, if \ \ c_{r-1} \le y_i^* \le c_r, 2 \le r \le k-1; \\ y_i = k, if \ \ y_i^* \le c_{k-1.} \end{array} \right\}. \quad (2)$$

The ordered selection method involves obtaining estimates of the model parameters, the vector of coefficients β and a set of threshold values ($c_1, ..., c_{k-1}$) by the maximum likelihood method for the system of equations:

$$\left\{ \begin{array}{l} P(y_i = 0) = F(c_1 - x_i'\beta); \\ P(y_i = r) = F(c_{r-1} - x_i'\beta) - F(c_r - x_i'\beta), 2 \le r \le k-1; \\ P(y_i = k) = 1 - F(c_{k-1} - x_i'\beta), \end{array} \right\}, \quad (3)$$

where errors ε_i are assumed to be independent, have zero mathematical expectation and are normally distributed in the ratio.

PRELIMINARY DATA ANALYSIS

The paper estimates the regression of the dynamics of exports (million rubles) of agricultural products in Russia concerning the last year in the context of individual companies.

The initial data were downloaded from the Rosstat databases, the Bank of Russia website (open data), the expert.ru website, the SPARK database (these companies' indicators are based on RAS and other sources), as well as the ACRA rating agency website for the period from 2005 to 2019 for 14 leading exporters of agricultural products (annual data, 210 observations). The data on the list of leaders was prepared based on the rating of the largest exporters of Russia for 2018.[7] The list of companies from the original sample is presented in *Table 1*.

[7] Expert. Online. Russian exporters rating for 2018. URL: https://expert.ru/dossier/story/rating200/ (accessed on 15.11.2020).

Table 1

List of leading companies in the export of agricultural products

No.	Organizational and legal form	Name of the company
1	AO	AGROPRODUCT (SODRUZHESTVO)
2	AO	ASTON
3	OOO	BUNGE CIS
4	OOO	RUSAGRO GROUP OF COMPANIES
5	OOO	CARGILL
6	OOO	MARS
7	AO	NMZhK
8	AO	NEFIS-BIOPRODUCT
9	OOO	PRODIMEX
10	OOO	RUSSIAN OILS (KERNEL)
11	AO	SOLAR PRODUCTS HOLDING
12	AO	EFKO
13	OOO	YUG RUSI
14	OOO	YUG SIBIRI

Source: Journal Expert Online, 2018. URL: https://expert.ru/dossier/story/rating200/ (accessed on 15.11.2020).

The companies in the sample have the organizational and legal form "OOO" — a limited liability company or "AO" — a joint-stock company.

All calculations, building models were performed in Stata and Excel programs.

As a dependent variable for the linear model, an increase in the export of agricultural products was selected in relation to the previous period (year) in the context of the company, at the same time, for binomial models, the binary variable of the export of the agricultural sector (Export_logit, where 1 — if there was an increase in export by 5 or more percent in relation to the previous year, 0 — in the opposite case).

The ordinal model, the variable responsible for the Export_logit export, level will be converted into the Export_ordered_logit, variable, based on 5 levels (categories) of export growth (*Fig. 3*):

- category 7 (SS) — more than 30% in relation to the previous year;
- category 6 (S) — from 20 to 30%;
- category 5 (A) — from 10 to 20%;
- category 4 (B) — from 5 to 10%;
- category 3 (C) — from 0 дto 5%;
- category 2 (D) — from –5 to 0%;
- category 1 (E) — less than –5%.

We note a relatively high number of assessments of the SS level, which is driven by macro parameters: changes in the exchange rate, business reputation, technological improvement, and some other factors that were not included in the model.

After a preliminary analysis of the initial data and calibration of the models — both linear, binomial, and ordinal — the variables described in *Table 2* act as explanatory parameters.

Table 3 presents descriptive statistics of the initial parameters of the model and more detailed characteristics of the studied variables.

The selection of indicators was based on the absence of multicollinearity and correlation between the dependent parameters.

The number of observations for each of the parameters, depending on the availability of data, varies from 152 to 170. The dollar exchange rate varied in the range from 24.8 to 68.1 rubles.

It is also worth noting that the increase in the level of export of agricultural products by companies for the entire observation period mainly ranges from –90 to + 100%.

At the same time, we note that only 14% of companies from the sample have a joint ownership form (*Fig. 4*).

MODELING

As the null hypothesis H_0 in linear, binomial, and ordinal models, we take the hypothesis

Table 2

Explanatory variables of the internal factor model

Explanatory variable	Variable designation
Currency rate (USD)	Course
Type of ownership	Ownership
Stocks	Stocks
Net assets	Net_assets
Short-term debt	Short_borrowed
Equity	Equity
Revenue	Revenue
Fixed assets turnover	Fixed_assets_ turnover_times
Total assets turnover ratio	Total_assets_ turnover_ratio
Return on costs	Return_costs
Return on earnings before interest and taxes	EBITM
Return on assets (ROA)	ROA
Return on equity (ROE)	ROE
Revenue per employee	Revenue_on_staff
Revenue to salary	Revenue_to_ salary
Long-term investment	Long_ investments
Intangible assets	Intangible_assets
Non-current assets	Non-current_ assets
Long term duties	Long_duties
Accounts payable	Accounts_ payable
Debt-to-equity ratio	Debt_equity_ ratio
Equity capital concentration ratio (autonomy)	Equity_capital_ concentration
Absolute liquidity	Absolute_ liquidity_ ratio

Source: compiled by the authors.

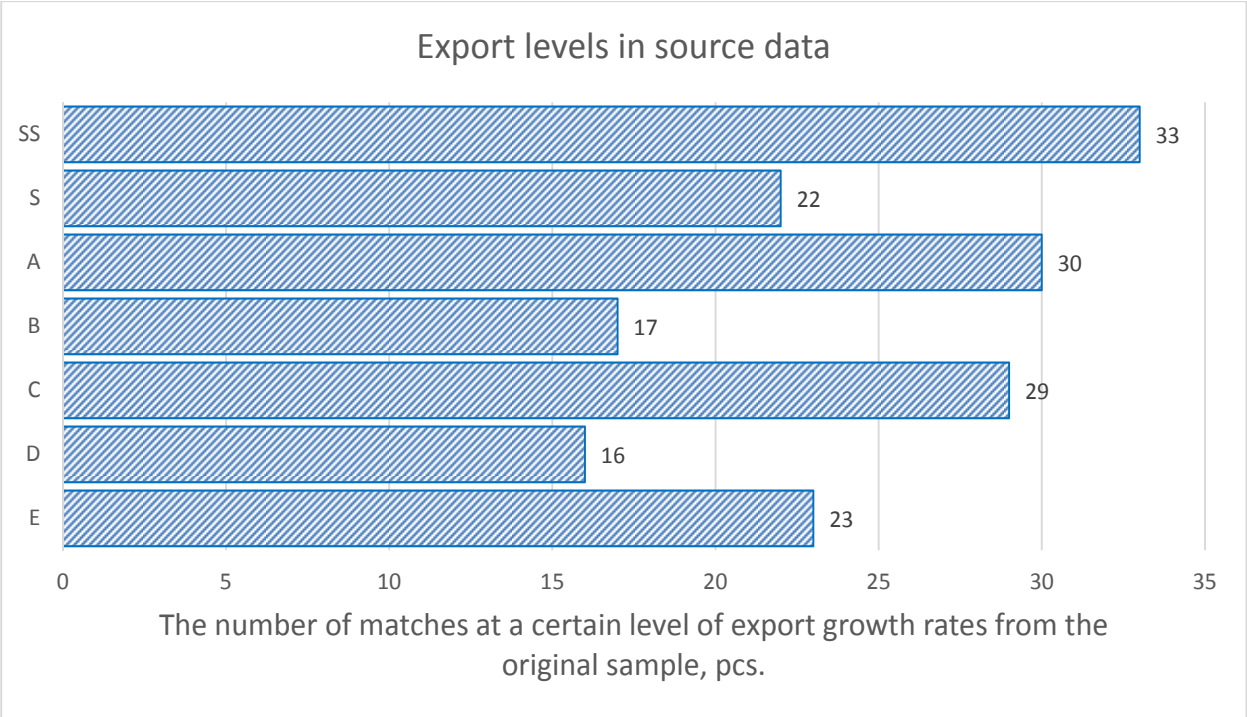


Fig. 3. **Assessment of the dynamics of exports in accordance with the delineation by levels**

Source: compiled by the authors.

of the significance of the parameters for the explanatory variables (i.e. H_0 : the coefficients are zero), which will be one of the criteria for the significance of the model. In the linear model, F- statistics will be used, in binomial and ordinal — Prorb.

At the first stage, we will carry out a correlation analysis. There is a high positive relationship between the assets of companies and their stocks, revenue, and capital of the organization, reserves, and assets of companies, long-term investments and capital of companies, turnover, and long-term investments. Subsequently, the combination of these parameters was excluded from the model.

To check for multicollinearity, VIF, was calculated, its values > 12 indicate its presence. To adjust in further calculations, excess variables (net assets, long-term debt, non-current assets, EBIT) were excluded, after which the average VIF value was 1.92. In other words, there is no multicollinearity between the parameters and the corrected model.

The *F*-statistic of the constructed model is 3.54, while the critical value at a significance level of 0.001 for this set of initial data is 0.99, which suggests that the proposed null hypothesis is rejected and the regression model is generally recognized as significant.

Table 4 shows the output data of the linear model (model 1), binomial (logit-model 2, probit-model 3), and ordinal models (ordered logit-model 4, ordered probit-model 5).

Linear model

Checking the presence of heteroscedasticity in a linear model, where the null hypothesis assumes homoscedasticity according to the results of the Breusch-Pagan test, showed that the probability of rejecting the hypothesis is 0.0198, which is less than 5%. Therefore, in the absence of a non-constant variance of random errors of the model, the null hypothesis of homoscedasticity is accepted.

After calibrating the model, we note the significance of the parameters of the linear model (*Table 4*):

- at 1% level — currency rate (Course), intangible assets (Intangible_assets);

Table 3

Descriptive statistics for the sample. Company data

Variable	Unit of measure	Numb. of obs.	Average	Std. Error	Min	Max
Currency rate (USD)	RUB	170	43.56	16.11	24.86	66.08
Type of ownership	1 – foreign, 2 – joint, 3 – private	170	1.77	0.90	1	3
Stocks	RUB million	169	2670	2990	0	14100
Net assests	RUB million	170	6700	15000	–8190	82700
Short-term debt	RUB million	170	4630	5530	0	27400
Equity	RUB million	170	7180	15200	–8190	82700
Revenue	RUB million	169	20000	25700	0	139000
Fixed assets turnover	Times	140	280	934	0	5991
Total assets turnover ratio	%	140	1.27	1.53	0	8.34
Debt-to-equity ratio	%	167	19.78	154.22	–153,74	1880.00
Return on costs	%	168	5.42	70.06	–1	908.13
EBITM	%	141	3.50	22.98	–29.22	238.39
ROA	%	164	0.038	0.34	–3.29	2.25
ROE	%	166	0.50	2.74	–5.96	31.73
Absolute liquidity	%	166	0.34	0.69	0	4.58
Revenue per employee	RUB million	170	55.6	141	0	957
Revenue to salary	–	170	48.81	120.39	–21.14	683.54
Long-term investment	RUB million	152	5500	13900	0	75000
Fixed assests	RUB million	168	2960	4150	0	21000
Intangible assets	RUB million	147	30.30	93.60	0	744
Non-current assets	RUB million	169	8750	16600	0	86700
Long-term duties	RUB million	167	3760	10300	0	70900
Accounts payable	RUB million	170	2850	3970	0	2330
Equity capital concentration(autonomy)	%	170	0.27	0.27	–0.42	0.99

Source: compiled by the authors.

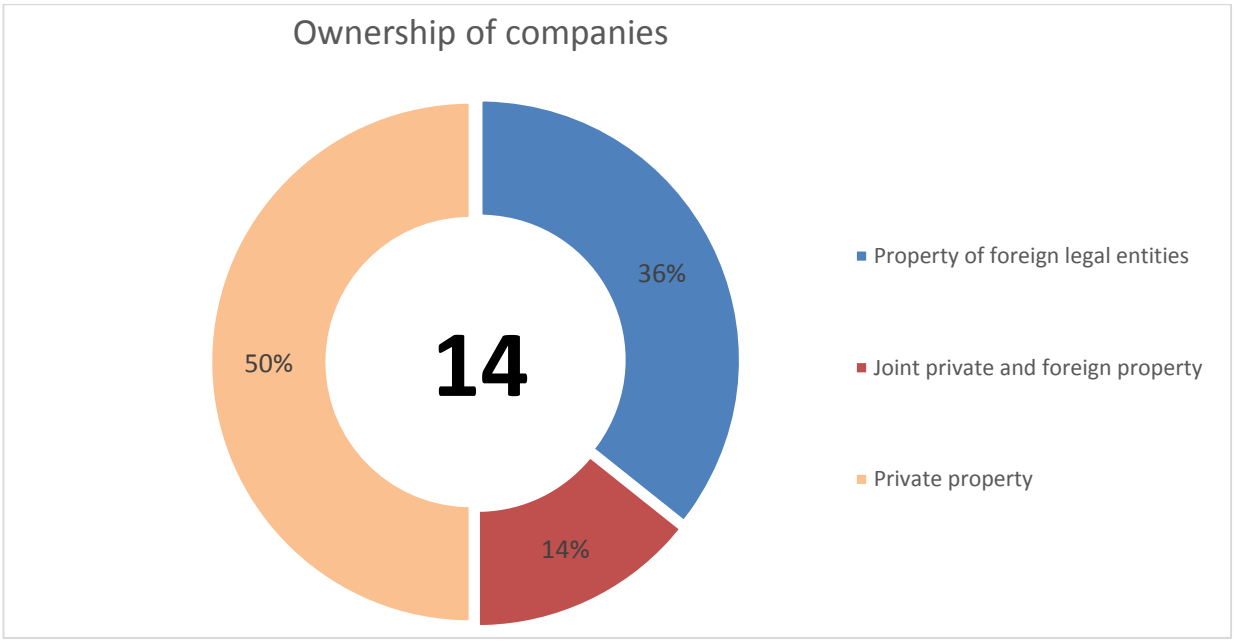


Fig. 4. **Ownership of companies from the original sample**

Source: compiled by the authors.

• at a 5% level — stocks (Stocks), accounts payable (Account_paybale);

• at a 10% level — revenue (Revenue), revenue on staff (Revenue_on_staff), revenue to salary (Revenue_to_salary).

Note the relatively high adjusted R^2 of 0.62.

It is also worth noting the insignificance of the linear independent variables: ownership, absolute liquidity ratio, return on equity (ROE) and return on assets (ROA), return on earnings before interest and taxes (EBITM), and long-term borrowing.

Binomial models

The following variables are significant in logit and probit models:

• at 1% level — short-term borrowings (Short_borrowed) for the probit model;

• at 5% level — stocks (Stocks), intangible assets (Intangible_assets), long-term liabilities (long_duties) for the logit model;

• at the 10% level — the turnover ratio of total assets (Total_assets_turnover_ratio), return on equity (ROE) for the probit model.

The rest of the variables are not significant even at the 10% level, as evidenced by the p-value for the corresponding variables. Both models are also statistically significant in general, as evidenced by the Chi2 statistic (0.0002 for probit and logit models).

Let us move on to analyzing the results of modeling order models.

The Gini coefficient was used as a quality criterion [16]. For logit and probit models, its value is greater than 0.8, which indicates a high predictive quality of the model (*Fig. 5*).

Ordinal models

As a result of regression analysis (*Table 4*), it was revealed that the following parameters have the greatest influence on the ordinal model:

• at 1% level — stocks (Stocks);

• at a 5% level — net assets (Net_assets), short-term borrowings (Short_borrowed), equity (Equity), fixed assets turnover (Fixed_assets_turnover_times), long-term liabilities (long_duties), accounts payable (Account_paybale);

• at 10% level — the turnover ratio of total assets, (Total_assets_turnover_ratio), return on earnings before interest and taxes (EBITM), return on equity (ROE).

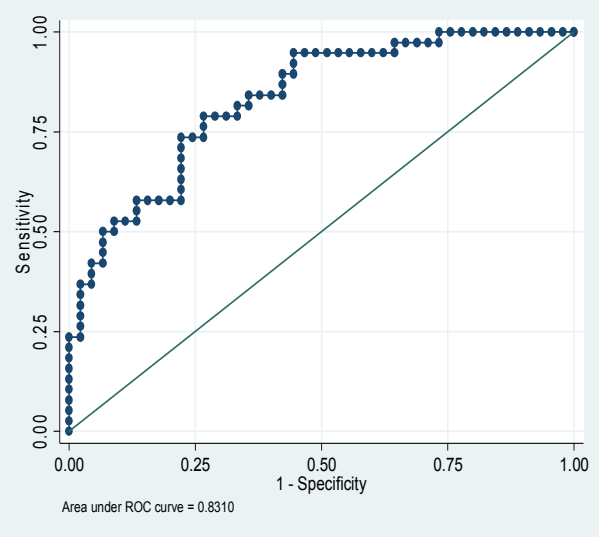
Table 4

Models for assessing the impact on the competitiveness of companies in the field of export

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Course	243.398***	−0.0312	−0.0170	−0.0175	−0.00670
	(78.849)	(0.0232)	(0.0133)	(0.0176)	(0.00959)
Ownership	737.769	−0.880	−0.528	−0.336	−0.214
	(1.864e+06)	(0.595)	(0.358)	(0.376)	(0.226)
Stocks	0.00162**	5.80e-10**	3.34e-10**	3.87e-10***	2.32e-10***
	(0.000679)	(2.70e-10)	(1.53e-10)	(1.44e-10)	(8.44e-11)
Net_assets	0.000173	−1.76e-10	−1.09e-10	−2.30e-10**	−1.33e-10**
	(0.000512)	(1.52e-10)	(8.74e-11)	(1.05e-10)	(6.29e-11)
Short_borrowed	0.000343	−2.91e-10**	−1.67e-10***	−1.30e-10**	−8.48e-11**
	(0.000285)	(1.17e-10)	(6.45e-11)	(6.00e-11)	(0)
Equity	−0.000469	1.46e-10	9.24e-11	1.76e-10**	9.60e-11*
	(0.000433)	(1.20e-10)	(6.58e-11)	(8.67e-11)	(0)
Revenue	0.000223*	−0	−0	−0	−0
	(0.000116)	(0)	(0)	(0)	(0)
Fixed_assets_turnover_times	1.137	−7.30e-05	−5.80e-05	−0.000866**	−0.000521**
	(2.000)	(0.000597)	(0.000352)	(0.000425)	(0.000246)
Total_assets_turnover_ratio	−725.465	0.358*	0.215*	0.344*	0.157
	(787.387)	(0.215)	(0.129)	(0.177)	(0.0958)
Return_costs	5.763	−1.354	−0.829	−0.00130	−0.000795
	(10.260)	(2.024)	(1.155)	(0.00166)	(0.00115)
EBITM	45.847	0.0616	0.0362	0.0526*	0.0306*
	(39.037)	(0.0438)	(0.0254)	(0.0282)	(0.0166)
ROA	1.496e+06	1.333	0.807	0.275	0.175
	(2.770e+06)	(1.664)	(0.921)	(0.470)	(0.320)
ROE	−79.677	−0.226	−0.137*	−0.165*	−0.0996*
	(298.016)	(0.144)	(0.0805)	(0.0850)	(0.0510)
Revenue_on_staff	−0.0311*	1.15e-08	6.59e-09	2.95e-09	1.53e-09
	(0.0179)	(8.40e-09)	(4.96e-09)	(3.20e-09)	(2.04e-09)
Revenue_to_salary	47.377*	−0.00605	−0.00326	0.000865	0.00107
	(24.660)	(0.00779)	(0.00453)	(0.00471)	(0.00284)
Long_investments	0.000746	8.07e-11	8.70e-11	2.23e-10	1.36e-10
	(0.000742)	(4.67e-10)	(2.44e-10)	(1.67e-10)	(1.07e-10)
Intangible_assets	0.0338***	1.74e-08**	1.02e-08**	2.73e-09	1.30e-09
	(0.00909)	(7.24e-09)	(4.11e-09)	(2.25e-09)	(1.04e-09)
Non-current_assets	−0.000416	−1.17e-10	−1.06e-10	−2.03e-10	−1.16e-10
	(0.000733)	(4.62e-10)	(2.43e-10)	(1.76e-10)	(1.11e-10)
Long_duties	−0.000220	2.35e-10**	1.36e-10**	1.06e-10**	5.80e-11*
	(0.000204)	(9.67e-11)	(5.50e-11)	(5.24e-11)	(0)
Accounts_payable	−0.00144**	2.12e-10	1.21e-10	2.57e-10**	1.38e-10*
	(0.000560)	(1.95e-10)	(1.13e-10)	(1.29e-10)	(7.51e-11)
Debt_equity_ratio	–	–	–	–	–
Equity_capital_concentration	5.716e+06	−1.455	−0.897	−0.593	−0.394
	(5.005e+06)	(1.465)	(0.892)	(1.028)	(0.627)
Constant	−4.402e+06	2.289*	1.318		
	(4.331e+06)	(1.378)	(0.811)		
Observations	120	120	120	120	120
R-square	0.620				

Note: significance level *** – p < 0.01; ** – p < 0.05; * – p < 0.1.

Source: compiled by the authors.



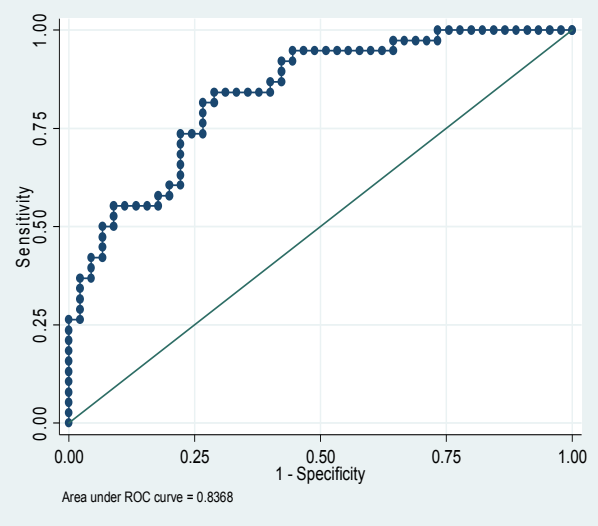


Fig. 5. **Roc-curve logit and breakout models**

Source: compiled by the authors.

Table 5

Prediction error in relative expression for the ordered logit model, %

Rating	Rating forecast					Total
	S	A	B	C	D	
S	10	60	30	0	0	100
A	10	70	20	10	0	100
B	0	15	75	10	0	100
C	0	5	15	70	10	100
D	0	0	5	15	70	100

Source: compiled by the authors.

The rest of the variables (including the exchange rate, the type of ownership of the company, the ratio of revenue to salary) are not significant even at the 10% level, as evidenced by the p-value for the corresponding variables.

Let us move on to the analysis of errors of the first and second kind when predicting the rating from D to S for the ordinal model (*Table 5*).

In general, the forecast across the entire scale is characterized by a relatively small number of discrepancies, which indicates the applicability of calculations as a simulation model in predicting a situation. The exception is level S, which is influenced by other factors that are not included in the internal model (non-quantitative factors such as business reputation, quality of management, etc.).

With regard to the assessment of the export level, it can be concluded that the logit, probit and ordered probit models are generally significant (chi2 = 0.0002; 0.000001). Also, the Gini coefficient can be the quality criterion in calculations for logit and probit models, the value of which is more than 0.8.

Generalizing the simulation results for internal factors, we can conclude that, in general, both binomial and ordinal models showed adequate results.

It was revealed that for ordinal models the most significant parameters were such

indicators as stocks, net assets, short-term borrowings, equity capital, long-term duties, accounts payable, as well as fixed assets turnover. Less significant: the turnover ratio of total assets, return on earnings before interest and taxes, return on equity. At the same time, the form of ownership and the currency rate in the short term (one year) turned out to be insignificant parameters for the model, which may indicate the importance of these parameters over longer time periods.

Next, we move on to a general assessment of the competitiveness of export-oriented companies.

RESULTS OF THE STUDY

The assessment of competitiveness cannot be based only on external or only on internal factors. It is also necessary to consider their mutual influence on each other. Rating modeling based on external factors and the mechanism of pre-rating assessment is described in the theses of the previous work [17].

In addition, not all factors can be estimated using econometric models due to the lack of data or the difficulty of calculating the impact of these indicators. Additionally, one should consider investment support from the state or private investors for a certain direction of export (for example, for political reasons) [18], therefore, a qualitative assessment will be used for them based on the methodology of the existing rating agencies RA Expert and ACRA for non-financial companies (*Table. 6*). The method used to estimate the influencing parameter will be indicated in the "Explanation" column.

The weight of factors within one "direction" is equal. The score for the qualitative factor also ranges from D to SS (or numerically from 1 to 7, where 7 is the best and 1 is the worst). In accordance with the methodology of the above agencies, it was decided to assign specific weight to external assessment — 0.2, internal assessment — 0.4, state support and support of company owners — at 0.2 level.

The final assessment of the competitiveness of export-oriented companies was determined by calculating using the following formula:

$$Comp.asses.\ i = w_{\text{internal}} \times R_{\text{internal}} + \\ + w_{\text{external}} \times R_{\text{external}} + w_{\text{support}} \times R_{support}\ , \quad (4)$$

where: *comp.asses i* is the final assessment of the organization's competitiveness from level D to S;

w — the proportion of the assessment of the direction: internal, external, or support;

R — an assessment of competitiveness at one of the levels.

Internal factors remain the key parameters for the assessment because they primarily determine the state of affairs in the company, its financial stability, and competitive capabilities. Their share is 60%.

Considering external factors and the influence of government and investor support allows us to supplement the model, adjust the assessment of the organization's competitiveness for better or worse, and within the interval value determine the weighted rank from D to SS for an export-oriented company.

The developed system of the final assessment of competitiveness can be used as an auxiliary tool when making decisions on the development of food exports in Russia at the stage of project development.

It can also be used to improve the effectiveness of funds used to subsidize export-oriented agricultural enterprises.

Accordingly, organizations with a higher rating can receive not only a larger amount of funding through government support, but also have a preferential form of guarantee when issuing a loan in terms of reducing the amount of the insurance premium or reducing the interest rate (*Table 6*).

Subsidizing is also possible: purchases of resource-saving equipment, fertilizers; activities in the field of land reclamation; cheaper services and tariffs for companies in the agro-industrial complex; reimbursement

Table 6

Comprehensive structure of the model for assessing the competitiveness of export-oriented companies in the agro-industrial complex of the Russian Federation

Valuation type	Share (w_i)	Destinations	Factor	Explanation
External assessment	0.2	Macroeconomic factors	Import growth	Econometric model
			GDP	
			GDP per capita	
			Industry pre-rating assessment	Scoring model
Internal assessment	0.6	Financial and economic condition	Subsidies (share of subsidies in cost, ratio of subsidies to revenue)	Econometric model
			Stocks	
			Net assets	
			Fixed assets turnover	
			Long-term duties, accounts payable	
			Total assets turnover ratio	
			Return on EBITM	
			Return on Equity (ROE)	
		Technical and technological support	Technological equipment (equipment level, wear)	Qualitative assessment (from level D to S)
			Automation (share of manual labor)	
			Performance indicators (production of meat/grain crops from 1 ha of land, production costs of one ton, amount of fertilizers per unit area)	
			Dependence on imports (share of imported equipment, fertilizers)	
		Personnel and qualifications	The level of qualifications of employees (undergoing retraining, work experience, etc.)	
			Competitiveness of wages	
			Staff motivation	
			Management	
		Management of companies (operational factors)	Business profile (share of products with high added value, degree of vertical integration, product diversification)	
			Market indicators (market share, demand for products, arable land area)	
			Economic development of the region	
			Governmental support	
		Business reputation and market discipline	Business reputation (brand, company connections, etc.)	
			Product quality	
			Entering foreign markets (export share)	
External influence	0.2	State support	The level of support from the state, including the company's influence on the country's industry as a whole	Qualitative assessment (from level D to S)*
		Owner support	Level of support from the owner of the company	

Source: compiled by the authors.

* To consider external influence, it is possible to increase or decrease the assessment only by two levels.

Table 7

Support measures for agribusiness companies depending on a certain rating

Rating	Investment support			Financial support	
	Guarantee in % of the loan amount	Subsidizing the rate of export credits, %	Reduction of the amount of the insurance premium by %	Tax incentives, %	Income compensation, %
SS	50	3	35	35	35
S	45	3	30	30	30
A	30	2	20	20	20
B	15	2	10	10	10
C	5	1	0	0	0
D	0	0	0	0	0
E	0	0	0	0	0

Source: compiled by the authors.

of a part of direct costs for the creation or modernization of real estate of enterprises of the agro-industrial complex, supplying products for export, etc. [19].

The proposed set of preferential support measures in accordance with the final assessment (rating) of export-oriented companies in the agro-industrial complex is presented in *Table. 7.*

The proposed mechanism for subsidizing exports, depending on the rating level, was developed based on the current system of measures of state support for agricultural enterprises used by the Ministry of Agriculture of the Russian Federation and other institutions (Rosselkhozbank, Export Center, etc.[8]).

The proposed mechanism for subsidizing exports, depending on the rating level, was developed based on the current system of measures of state support for agricultural enterprises used by the Ministry of Agriculture of the Russian Federation and other institutions (Rosselkhozbank, Export Center, etc.).

Note that the proposed list of measures in accordance with the rating can be applied to companies in the form of a combined mechanism, i.e. depending on certain circumstances, several support measures will be applied to companies [20]. In addition, it can be differentiated depending on the

Table 8

Reducing export tax duties on grain and fat and oil products, depending on a certain rating

Rating	Reduction of tax duties, %
SS, S	15
A	10
B, C	5
D, E	10

Source: compiled by the authors.

[8] Resolution of 06.09.2018 No. 1063 "On the provision and distribution of other inter-budgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation to reimburse part of the cost of paying interest on investment loans in the agricultural sector". Ministry of Agriculture of Russia. URL: http://static.government.ru/media/files/kaXA7XlYwVWNX-7fr7KWA1AiUD 6u84e6a.pdf (accessed on 20.12.2020).

Table 9

Non-financial support measures

Rating	Non-financial support
SS, S, A	Services of the Russian Export Center (REC): search for foreign counterparties, consultation on customs clearance issues, free training and free access to some analytical products of the center
	Priority access to services of export-import hubs at a preferential rate
B, C	REC services: one-time assistance in finding counterparties, consultations on customs regulation (once every three years), free access to some analytical products of the center

Source: compiled by the authors.

industry specialization of the business, priority industries can be supported at maximum rates, less significant ones — at minimum or by a limited number of support areas, for example, only by investments (if, moreover, the business is well-established and with high profits).

For example, for the fat and oil industry, sugar production, it is necessary to use only investment support, for flax growing — a starting, growing industry, both investment and financial support can be used.

Also, within the framework of financial support (section tax incentives), the item "reduction of tax duties" can be separately noted. Since February 2021, some agricultural products, in particular grain and fat and oil products,[9] are subject to tax duties: up to 50% — over quota and up to 30% — for fat and oil products. Accordingly, depending on a certain rating of the organization, a reduction in the size of the fee is proposed (*Table 8*).

The reduction in tax duties is a temporary support measure in effect at the time of the execution of the government decree on the introduction of duties on these products.

As a point support for enterprises, additional measures are possible in the form of compensation for part of the costs of transporting agricultural products for companies with a rating from B to SS.

Separately, it is worth noting, within the framework of the factor "business profile" of the scoring model (see *Table 6*), the indicator of the degree of processing in the supply of agricultural products to other countries (the share of products with high added value). Processed products are goods with higher profitability, which reduces the cost of transporting the exported product abroad and creates new jobs within the country [21]. Based on this, it is necessary to increase the share of deliveries to other countries of processed agricultural products. Therefore, within the framework of this indicator, regardless of the rating results, an additional level of correction of the proposed benefits is possible. Depending on the share of exports of processed products of the agro-industrial complex in the context of individual goods, the following mechanism for adjusting the benefits described in *Table 7* is proposed: if the share of exports of processed products corresponds to the industry average, then the level of support, depending on the calculated rating, remains unchanged if it is lower, the level of support will decrease proportionally.

For example, budgetary support for grain supplies for export can be differentiated by the share of grain processing when it is supplied for export [22]. If the share of a processed grain of a company is 10%

[9] Resolution of 10.12.2020 No. 2065 "On Amendments to the Rates of Export Customs Duties for Goods Exported from the Russian Federation outside the States Parties to Agreements on the Customs Union". Ministry of Agriculture of Russia. URL: http://static.government.ru/media/files/mYu01fw5fXSAWSYgAbcbpVAjzB 94Klst.pdf (accessed on 20.12.2020).

(in general, according to data for 2020, the share of processed grain and flour products from grain exports is 11.9%[10]), then the company receives support in the amount of 84% (10: 11,9) × 100, if even less, then the support level will be proportionally reduced [23, 24].

In addition to investment or financial support, non-financial assistance can be singled out separately [25], which consists of providing companies with additional services to enter the foreign market (*Table 9*).

In addition to the combined mechanism described above, measures of non-financial support can be proposed for both mature, mature sectors of the agro-industrial complex, and only for developing ones.

CONCLUSIONS

The export of agricultural products every year acquires an increasingly significant role in the Russian economy. With the entry into the world market, the recognition of Russian products is growing, their quality is increasing in accordance with international standards, the dependence on raw materials of the country's economy is decreasing, and new highly profitable jobs are being created.

In addition to state participation (development of sanitary and veterinary, technical, legal norms and rules, support programs, as well as regulation of import and export duties, subsidies of certain industries or certain companies), private investors also show significant interest in the export of agricultural products. As a result, it becomes necessary to identify the most promising, competitive companies to increase the economic efficiency of interaction mechanisms within the framework of public-private partnerships in the field of export.

There are projects related to the development of export opportunities for the agro-industrial complex of individual regions of the Russian Federation, which also need to be assessed as promising.

Both Russian and foreign rating agencies are developing additional sections in their methodologies for assessing the financial stability of agricultural companies. However, the calculations are based only on coefficient adjustments relative to other industries. There is no separate methodology for agribusiness companies, including the development of which is aimed at export. This is not enough to characterize the essence of the processes; the results obtained cannot be used to predict the situation.

In this study, a rating model has been developed for export-oriented agro-industrial companies, taking into account the influence of internal and external factors on the performance of their activities within the framework of the econometric modeling method. In addition, the importance of quality factors is considered.

The article analyzes the companies — leaders in the export of agricultural products of the Russian Federation for the period 2005–2019. The results obtained made it possible to build a simulation model for assessing the rating of export-oriented companies in the agricultural sector of the Russian Federation, which is applicable as an additional forecasting tool in making planning decisions for the future.

The methodological substantiation is based on an assessment of the cumulative impact of both external and internal factors on the performance of the subjects of the export market, which in turn depend on support from the state or investors in a particular industry. Note that the analysis of the company's financial indicators (internal factors), as well as external ones, was based on ordered logit/probit regression and binomial models. The best results for both external and internal factors were shown by binomial and ordinal models. For factors for which it is rather difficult to collect data or assess their impact, qualitative expert judgment was used.

[10] Russian export center. Export of regions. Analytical portal. 2020. URL: http://regionstat.exportcenter.ru/hs/list/ (accessed on 12.02.2021).

As a result of modeling ordinal models, the most significant parameters for internal factors were stocks, net assets, short-term borrowings, equity, fixed assets turnover, long-term liabilities, and accounts payable. Less significant: the turnover ratio of total assets, return on earnings before interest and taxes, return on equity.

For external factors, both for ordinal and binomial models, the most significant parameters were the increase in imports, the logarithm of GDP, and the logarithm of GDP per capita.

However, it should be noted that after a certain period of time, the constructed model will gradually to a lesser extent reflect the current level of competitiveness, that is, it will require periodic adjustments of both econometric models, which are the basis for the assessment. internal and external factors, as well as qualitative indicators based on new data.

The formed system can be used as supporting material, namely, as a simulation model when deciding on the development of food exports in Russia at the stage of developing design solutions.

Accordingly, higher-rated organizations can receive more funding from government support, preferential guarantees when issuing a loan in terms of reducing the insurance premium or lowering the interest rate, as well as other support measures described in the previous section of this study.

Implementation of this approach will significantly increase the level of economic effectiveness of budget support funds aimed at stimulating exports.

REFERENCES

1. Ricardo D. On the principles of political economy and taxation. London: John Murrey; 1817. (Russ. ed.: Ricardo D. Nachala politicheskoi ekonomii i nalogovogo oblozheniya. Izbrannoe. Moscow: Eksmo; 2013. 960 p.).
2. Krugman P.R., Obstfeld M. International economics: Theory and policy. Englewood Cliffs: Pearson; 2002. 706 p. (Russ. ed.: Krugman P.R., Obstfeld M. Mezhdunarodnaya ekonomika. Teoriya i politika. St. Petersburg: Piter; 2004. 832 p.).
3. Samuelson P.A., Nordhaus W.D. Economics. New York: McGraw-Hill/Irwin Publ.; 2009. 744 p. (Russ. ed.: Samuelson P.A., Nordhaus W.D. Ekonomika. Moscow: Williams; 2007. 1360 p.).
4. Leontief W.W. Selected works (in 3 vols.). Vol. 1: General economic problems of intersectoral analysis. Moscow: Ekonomika; 2006.408 p. (In Russ.).
5. Paptsov A.G., Ushacheva I.G., Altukhov A.I. et al. Export of AIC products in Russia: Trends and development. Moscow: Sam Poligrafist; 2020. 256 p. (In Russ.).
6. Altukhov A.I. State of the grain market of the CIS member states. *Agro-industrial complex: economics, management*. *APK: Ekonomika, upravlenie = Agro-Industrial Complex: Economics, Management*. 2016;(2):49–63. (In Russ.).
7. Lapin A.V. Construction of econometric models and analysis of export and import factors in St. Petersburg. *Molodoi uchenyi = Young Scientist*. 2016;(13):44–46. (In Russ.).
8. Zarubaiko D.R. Econometric analysis of the dependence of Chinese GDP on export operations. *Problemy ekonomiki i menedzhmenta*. 2017;(3):87–91. (In Russ.).
9. Jana S.S., Sahu T.N., Pandey K.D. How far is FDI relevant to India's foreign trade growth? An empirical investigation. *Journal of Economic Structures*. 20209(1):30–42. DOI: 10.1186/s40008–020–00212–6
10. Laborda J., Salas V., Suárez C. Manufacturing firms' export activity: Business and financial cycles overlaps! *International Economics*. 2020;162:1–14. DOI: 10.1016/j.inteco.2020.03.001
11. Diaz-Sarachaga J., Jato-Espino D., Castro-Fresno D. Methodology for the development of a new Sustainable Infrastructure Rating System for Developing Countries (SIRSDEC). *Environmental Science & Policy*. 2017;69:65–72. DOI: 10.1016/j.envsci.2016.12.010
12. Huang Y.-L., Shen C.-H. What role does the investor-paid rating agency play in China? Competitor or information provider. *International Review of Economics & Finance*. 2019;63:253–272. DOI: 10.1016/j.iref.2018.11.007

13. Sashi S., Bhavish S. Macroeconomic implications of us sanctions on Iran: A sectoral financial balances analysis. *Studies in Business and Economics*. 2019;14(3):182–204. DOI: 10.2478/sbe-2019–0053
14. Semyashkin E. G. Export of Russian AIC products: Current development and trends. *Ekonomika sel'skokhozyaistvennykh i pererabatyvayushchikh predpriyatii = Economy of Agricultural and Processing Enterprises*. 2019;(4):33–36. (In Russ.). DOI: 10.31442/0235–2494–2019–0–4–33–36
15. Karminskii A.M. Credit ratings and their modeling. Moscow: HSE Publ.; 2015. 304 p. (In Russ.).
16. Kayser D. Recent research in project finance — a commented bibliography. *Procedia Computer Science*. 2013;17:729–736. DOI: 10.1016/j.procs.2013.05.094
17. Semyashkin E. G. Influence of macroeconomic factors on the export of agricultural products of the Russian Federation: Analysis and trends. *Novaya ekonomicheskaya assotsiatsiya*. 2020;(11):217–222. (In Russ.).
18. Semyashkin E.G., Semyashkin G.M. Northern allowances as part of inter-budgetary relations and their impact on the economy of the enterprise. *APK: Ekonomika, upravlenie = Agro-Industrial Complex: Economics, Management*. 2019;(2):46–56. (In Russ.). DOI: 10.33305/192–46
19. Avarsky N., Ryzhkova S., Hasanova H. Kruchinina V. The market of fat and oil products: Domestic and foreign practice. *APK: Ekonomika, upravlenie = Agro-Industrial Complex: Economics, Management*. 2016;(4):53–59. (In Russ.).
20. Avarsky N., Astrakhantseva E. Methodological aspects of the development of organic agriculture in Russia. *APK: Ekonomika, upravlenie = Agro-Industrial Complex: Economics, Management*. 2017;(8):38–56. (In Russ.).
21. Goncharov V. Industrial potential of the agro-industrial complex: Assessment and development problems. *Ekonomist*. 2016;(2):35–40. (In Russ.).
22. Zharnin E.V., Hort D.O. World trends in technical progress in the agro-industrial complex. *Agrarnoe obozrenie*. 2016;(3):16–26. (In Russ.).
23. Rykova I.N., Metelkova E.O. Effectiveness of agricultural machinery industry state support. *Finansovyi zhurnal = Financial Journal*. 2016;(3):98–104. (In Russ.).
24. Ushachev I., Maslova V., Chekalin V. Economic problems of import substitution in the conditions of scientific and technological development of the agrarian and industrial complex of Russia. *APK: Ekonomika, upravlenie = Agro-Industrial Complex: Economics, Management*. 2017;(11):4–11. (In Russ.).
25. Petrikov A.V. The main directions of the implementation of modern agri-food and rural policy. *Mezhdunarodnyi sel'skokhozyaistvennyi zhurnal = International Agricultural Journal*. 2016;(1):3–9. (In Russ.).

ABOUT THE AUTHORS

Efim G. Semyashkin — Postgraduate Student, National Research University Higher School of Economics, Moscow, Russia
semyashkin-efim@mail.ru

Alexander M. Karminsky — Dr. Sci. (Econ.), tenured professor, National Research University Higher School of Economics, Moscow, Russia
karminsky@mail.ru

The article was submitted on 22.01.2021; revised on 03.03.2021 and accepted for publication on 22.03.2021.
The authors read and approved the final version of the manuscript.