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Competitive Advantages and Sustainable Development of Russian Agrarian Sector

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Abstract

The performance of Russian Agricultural Sector under international economic restrictions is a matter of concern. In this article we analyse the impact of international economic restrictions and macroeconomic factors on the output of Russian agricultural sector. We employed ARIMAX model with the time period from 1991 to 2017, using nine economic factors as covariates and agricultural value added as a dependent variable. It was found that despite on negative impact of sanctions on special aspects of Russian economy, international economic restrictions of 2014 at the end of 2017 had a significant and positive effect on the output of Russian agricultural sector.

Keywords: agricultural sector, Russian agriculture, international economic restrictions, import substitution, time series model, ARIMAX

1. INTRODUCTION

Agriculture is a branch of the economy of the country, which not only produces the most necessary products for human beings, but also is a kind of catalyst indicating the economic development of the state. Generally sustainability of the agricultural sector is a complex, open, a dynamically developing, multilevel and multi-purpose system, represented, on the one hand, by a set of structural elements, on the other — a subsystem of the macro level and the main link in the complex of measures to provide the population with food. It is based on the process of transition from one qualitative state to another under the influence of factors of internal and external environment based on economic growth. Herewith the most important properties and the ability of the system to fulfil the goals and objectives aimed primarily at a rational combination are preserved efficiency of economic activity, environmental safety and social orientation.

In the context of the current economic crisis, the importance of a comprehensive analysis of the sustainability of the agricultural sector, aimed at the positioning of its components, as well as obtaining generalized characteristics on the basis of complete and reliable information about the processes taking place in agriculture, is actualized. This is possible only through the development of a system of interrelated and complementary indicators and integrated assessment methods. However, despite the presence of undoubted scientific and practical achievements in the field of sustainable development of the agricultural sector, most of its aspects need further clarification, require further systematic study. In particular, to date, the economic science has not finally developed approaches to justify the selection of criteria and indicators that allow obtaining a reliable description of the level, direction and intensity of changes in the sustainability of the industry, methods of integrated assessment of the processes taking place in it. In 2014 international economic restrictions against Russia took effect, and Russia introduced some import restrictions regarding agro-industrial products and thereby put itself in the position of import substitution ([10], [15], [5], [8]. Events of 2014, which is attributed to international economic restrictions, to a great extent had an impact to Russian food sector, and people assess this effect in different ways. Some authors ([9], [3]) conclude that under restrictions pressure and crises, manufacturing effectiveness of agro business enterprises makes worse, but under the conditions of import substitution and, as a consequence, weakening competition and increasing government support, firms are able to occupy new niches and improve their conditions with the help of government support. Some publishers ([13], [14]) estimate sanction impact from the perspective of end-consumer. They marked that import embargo is reflected in food prices, that changes a purchasing power of population. The authors also notice that policy of import substitution allows Russia to find new trade

partners from countries suppliers in the EAEU and the CIS and decrease import dependence from Europe countries. But the emphasize that still there is no substitution for some categories of products. In recent articles [11] about Russian agriculture it has been specified that economic restrictions of 2014 allowed Russia to decrease volumes of import, raise consumption of food on average, but for low-income family's food consumption compose the highest share from total consumption.

Agricultural sector apart from sanctions is influenced by different factors [7]. The factors affecting the sector include climate and environmental management changes, science and technology improvement, demographic and social transformations, new models of economic and politic development or management system [1]. [2] and [11] analysing the growth factors in agricultural products output, focuses on the innovative activity, which from their point of view is the main factor of economic development. Therefore, they conclude that it is necessary to build up of scientific and technical potential with high share of innovation and to intensify the production process in the agro-industrial complex. Malysheva [4] considering the factors affecting the development of agriculture, organizes and groups them into the following categories: land as the main production factor in agro industry, government support as a factor of agricultural sector financing, competitiveness as a go-to-market factor, environmental conditions, scientific and technological progress and products prices.

2. METHODOLOGY

As a method of forecasting the Box–Jenkins approach was chosen, which is one of the best for analyzing and forecasting time series. This method applies two types of models, including ARMA (autoregressive moving average) and ARIMA (autoregressive integrated moving average), which helps to fit time-series model based on past values. In current research we will use extended version of ARIMA model, which is abbreviated as ARIMAX (Autoregressive Integrated Moving Average with Explanatory Variable). The method relates to technics of ARIMA model but assumes the application of additional independent factors (multivariate dataset), but not only lagged values of dependent variables and errors (univariate dataset). Other words ARIMAX refers to set of independent variables for a single dependent variable (regressor). The nature of this type of model is close to OLS estimates.

In general, ARIMAX model may be represented by the following formula:

$$y_t = \alpha + \beta \times time + \gamma * covariate + u_t \quad (1)$$

where y_t – the regressor,

$time$ – the indicator of a time period in years,

covariate – the indicator of independent variable,

u_t –residuals.

In the special case ARIMAX (p, d, q) can be represented as:

$$y_t = \gamma + \varphi_1 y_{d,t-1} + \ldots + \varphi_p y_{d,t-p} + \theta_1 u_{t-1} + \ldots + \theta_q u_{t-q} + \beta x_t + u, \quad (2)$$

where y_t – time- series component from the equation (1),

p and q –lags for AR(p) and MA(q) components,

$y_{d,t-1}, \ldots, y_{d,t-p}$ – lagged values of the time-series component differentiated d times,

ε_t – stochastic disturbance,

$u_{t-q}, \ldots, u_{t-1}$ – lagged values of the residuals' component.

3. RESULTS AND DISCUSSION

All input data are given in Table 1.

On the first step in order to check stationarity of the row we construct a plot with our dependent variable, which is agricultural value added. The result is demonstrated under.

Table 1. - Descriptive statistics for the model. Source: Rosstat, OECD, FAO, World Bank

	Aggreculture value added (constant 2010 US$)	Foreign Direct Investment	Rural population	GDP Deflator	Arable land	Area of land use	Exchange rate	Share of employment in agriculture (% of total employment)
Abbreviations	**agro_value**	**FDI**	**rur_pop**	**GDP_defl**	**arable_land**	**land_area**	**exch_rate**	**share_emp**
Unit of measure	**Value mln US$**	**Value mln US$, 2010 prices**	**thousand people**	**Value US$, 2010 prices**	**1000 ha**	**1000 ha**	**RUB/ USD**	**%**
1991	62344,13	2574,4	39292,35	41,56	132672	221631	0,00	14,24
1992	56733,16	3674,06	39356,21	42,51	132008	218795	0,04	15,42
1993	54463,84	2341,89	39368,93	43,52	129538	217711	0,35	15,56
1994	47928,18	631,35	39287,84	44,45	128422	216400	1,39	16,15
1995	44093,92	1332,94	39341,90	45,33	127500	216111	3,58	15,77
1996	41756,94	1994,14	39297,38	46,15	126024	217989	5,12	15,27
1997	42800,87	6753,81	39227,69	47,02	127466	217287	5,79	12,16
1998	34754,30	3630,16	39167,53	33,24	126132	216790	9,70	11,69
1999	40697,29	9688,83	39097,84	22,60	124975	217162	24,62	15,01
2000	45865,85	11547,94	38925,85	27,22	124374	216861	28,13	14,49
2001	51094,25	8160,29	38770,56	30,58	123860	216651	29,17	12,05
2002	52578,72	10562,27	38469,26	32,90	123465	216277	31,35	11,34
2003	51637,08	24940,44	38415,46	38,29	122559	215980	30,69	10,80
2004	52172,13	27848,97	38204,52	49,06	122146	215680	28,81	10,00
2005	52094,10	28085,58	38020,61	59,63	121781	215488	28,28	10,14
2006	53397,70	41772,53	37829,81	71,43	121574	215463	27,19	9,88
2007	53888,19	50744,32	37688,57	86,41	121574	215494	25,58	8,86
2008	56975,09	54076,21	37632,39	104,92	121649	215450	24,85	8,53
2009	57932,56	41114,85	37604,56	83,79	121750	213952	31,74	8,43
2010	50991,69	41116,46	37613,60	100,00	119000	214650	30,37	7,75
2011	58238,94	38058,81	37499,50	127,79	120000	214350	29,38	7,69
2012	57542,57	21556,14	37298,60	132,81	119750	216840	30,84	7,33
2013	60147,66	52822,32	37228,80	135,61	122240	217722	31,84	6,99
2014	61059,17	53800,4	37118,20	120,98	123122	217722	38,38	6,72
2015	62817,70	33328,3	37985,10	82,28	123122	217722	60,94	6,71
2016	64908,09	35215,26	37887,30	77,40	123122	217722	67,06	6,72
2017	65841,37	34984,6	37772,00	93,60	123122	217722	58,34	5,90

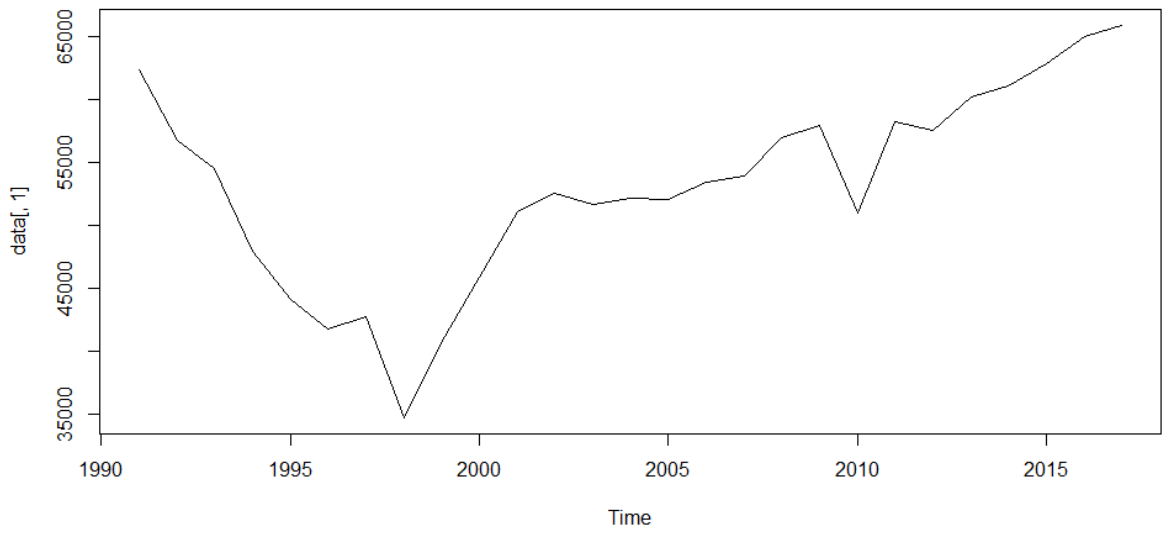

Figure 1. Graphical representation of agricultural value added from 1991 to 2017.

Source: R-Studio

In order to check stationarity, we run Dickey-Fuller test. The results of the test (p-value>0,05) and the Figure 1 testifies about non-stationarity of the row. Hence, we take first differences from all variables. Next step of the determination of model is the test on lagged variables. On this step we derive graphs of autocorrelation function and partial autocorrelations function, the results of which are represented in Appendix C. The graphs show that none of the lines cross the dashed line, this means we do not have lags in both dependent variables and residuals. The conducted tests allow us to form a model ARIMAX (0, 1, 0), where zero is devoted to absence of lag variables and one to first differences. The last step before the model estimation is diagnostics of residuals in the model. We accomplish Ljung–Box test and autocorrelation functions (ACF and PACF) and come the conclusion that stochastic component of the model appears as random noise, which means we have a good model that took all the useful information from the data. As the model shows, significant factors in the model are foreign direct investment, exchange rate (RUB/USD), agricultural support, import volume, and existence of crises and sanctions (economic restrictions). Other factors are not significant, but they should be included in the model because the explanatory power of the model has increased with their existence. With an increase in foreign direct investment by 1 million dollars, the increase in agricultural production achieves 66 thousand dollars. The relationship illustrates positive dependence of FDI and agriculture output, it means that attracting foreign direct investment has a positive effect on the state of the agro-industrial sector. With the weakening ruble by 1 ruble toward to dollar, agricultural value added on average increases by 4.5 million dollars. This relationship ratio can be explained as follows. Weakening ruble makes oil lower priced, import more expensive and export cheaper, which creates a competitive advantage to the national producer that boost the output of agrosector. At the same time import of machinery for the sector becomes costly.

We have obtained a positive correlation between sanction implementation and agricultural sector performance. The same conclusion was stated by [9], [3]. In fact, international economic restrictions of 2014 decrease number of foreign direct investments [6], in some degree it reduces consumption of fixed capital, lead to effect in exchange rate and oil price fluctuation [12] etc. At the same time international economic restrictions of 2014 allows Russia to limit import and give opportunity for the targeted country to expand local production, which has a positive effect to the sector at the end of 2017.

4. CONCLUSION

The performance of Russian agricultural sector and Russian economy after imposition of international economic restrictions in 2014 is still the topic with heightened interest especially in Russian literature. The topic stays relevance because international economic restrictions are extended until the end of 2019. In Russian articles researchers pay attention to the dynamics of agricultural production in different categories of production, changes in food prices, import and export volumes, but none of

them use econometrics or mathematical statistic tools in order to estimate the complex effect of sanctions and economic factors on the performance of the agro-industrial complex. Meanwhile in foreign researches we can observe a variety of econometric models, which allow evaluating consequences of international economic restrictions, specifically to such indicators as change of GDP, living standard of population, investments flows, level of employment etc. The results of the research match with the previous findings. Some authors also conclude that economic restriction in long run will have positive effect on the economy and agricultural sector as well.

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