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Analysis of the effectiveness of state procurement and commodity interventions in the grain market in Russia

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Subject. Effectiveness of state interventions aimed at stabilising domestic prices.
Objectives. To study the effectiveness of procurement and commodity interventions in the grain market regarding their ability to stabilise grain prices within Russia.
Methodology. Correlation analysis, economic and mathematical modelling based on regression models, calculation of statistical indicators of variation.
Conclusions. Procurement and commodity interventions conducted in Russia are not effective enough to ensure price stability in the grain market, which was confirmed by the low values of average linear deviations of actual market prices from the values calculated by regression equations for the periods of interventions. Building economic and mathematical models of the relationship between grain prices and significant factors showed that domestic prices considerably depended on global grain prices and were also highly influenced by the dynamics of production factors in grain-consuming industries. Thus, it is necessary to supplement the mechanism of interventions used in Russia, specifically through measures that help to reduce the dependence on external factors with a high influence. The results of the conducted study may be further used to determine a wider range of factors that affect domestic grain prices and, based on this, to improve the conducted state interventions.

Keywords: grain market, procurement interventions, commodity interventions, state regulation, price, wheat, barley, rye.

Introduction

Interventions, including procurement and commodity interventions, are the most important element for the state regulation of the grain market in Russia. The legal basis for this tool of state regulation is the federal law issued on December 29, 2006 No. 264-FZ "On the Development of Agriculture", which enables the state to intervene in the market. The law identifies the goals that must be achieved by interventions in the Russian market: the stabilisation of prices and support of incomes for agricultural producers. In other countries interventions are also used to ensure the stability of the supply of the corresponding type of products in the domestic market of the country and to prevent shortages. This type of intervention is called food security (Lazarevich & Kohnovich, 2022).

Procurement interventions are a specially organised purchase of products by the state from the market, which is performed in case the prices are reduced below a certain calculated minimum level. The purchase of goods by the state intervention fund should contribute to price maintenance in the grain market and thus support the income and profits of producers. Commodity interventions involve the opposite action, that is selling the products, and they are also aimed at ensuring the stability of market prices. The products from the intervention fund are sold by the state when an increase in prices is above certain values.

The grain market in Russia has been regulated using the intervention mechanism for quite a long time, since 2001. However, there is still no agreement among researchers and experts on whether this mechanism is effective or not, and there is no shared understanding of how the effectiveness of interventions is expressed and what approaches to its assessment exist.

Works of modern authors discuss many areas of concern associated with the operation of the mechanism of state interventions in the grain market, including the issue of the approaches used to assess interventions as a tool.

O. G. Charykova and I. I. Chernysheva evaluated the effectiveness of interventions in the context of reimbursement of public expenditure on state regulation of the grain market. According to the authors, the low effectiveness of interventions was due to their untimely application, unreasonable tender prices, violation of grain storage time, and organisational and economical issues when using interventions (Charykova & Chernysheva, 2019).

A similar approach is favoured by (Doroshuk, 2016), who noted that grain remained in the state intervention fund for an unreasonably long time, and there was no effective system for the management of its storage costs, which led to significant public expenditures. The author also stated that procurement grain prices were lower than free market prices, which resulted in losses of potential income by producers.

I. N. Rykova, A. A. Yurieva, S. S. Aksenov as well as V. Ya. Uzun and D. S. Ternovsky suggested assessing the effectiveness of interventions from the point of view of ensuring not only the necessary income of the state but also the income of producers (Rykova et al., 2018; Uzun & Ternovsky, 2020). These authors associated the ineffectiveness of interventions with a wrong assessment of intervention prices and low grain quality in the state intervention fund. It should be noted that the issue of low quality goods purchased by the intervention fund is rather typical not only for Russia but abroad as well (Daoud et al., 2019; Okhlopkov et al., 2020).

Apart from the issue of justifying approaches to the assessment of intervention effectiveness, there is also an issue of imperfections in the intervention mechanism itself. Some authors noted that the intervention goals could not be achieved due to the lack of comprehensive monitoring and forecasting of the grain market situation by the government (Shilovskaya, 2011). Researchers also mentioned some drawbacks in the state legislation of interventions in Russia that also led to the reduced effectiveness of this tool (Lebedev, 2020).

Some existing works argue that interventions must be used to ensure food security in Russia, similar to some other countries that use this tool to ensure the stable availability of products in the domestic market (Pakhomov et al., 2019). Most authors believe that one of the issues related to interventions is their insufficient volume regarding the flow of grain in the market (Ryazanov, 2022). It should be noted that leading countries producing and exporting grain have a rather significant intervention fund of this product: more than 30 % in China, about 35 % in Canada, and about 15 % in the USA (Voronin et al., 2019). Taking into account the conclusion drawn by the Committee on World Food Security back in 2011, an insufficient intervention fund results in spikes and volatility of prices, therefore this fund must have a sufficient volume to have an effective impact on the price situation (Lazarevich & Kohnovich, 2022).

Most authors note that although on the whole interventions have a rather limited potential of market influence, they allow quickly stabilising the prices in the grain market (Avarsky et al., 2014).

Thus, it is relevant to study the effectiveness of interventions due to the fact that the purpose of their application is important, which is associated with ensuring the stability of prices for grain products within the country and the lack of a comprehensive assessment of the effectiveness of this tool. It should be noted that most of the works on the studied topic were written many years ago, while the mechanism for the implementation of interventions has been constantly improved through the identification of errors and drawbacks. Based on this, it is necessary to update the approaches to the assessment of the effectiveness of interventions in the domestic grain market in Russia, and the effectiveness of interventions being currently used should also be evaluated ensuring, based on its results, the formation of suggestions for the further improvement of this tool of state regulation.

The effectiveness of grain interventions should be primarily evaluated in terms of the goals that they must achieve in the market. According to the already mentioned article 14 of the federal law issued on 29.12.2006 No. 264-FZ, the stabilisation of prices is one of the main goals of procurement and commodity interventions in Russia. Another goal of this tool, which is to support the incomes of producers, is also important but it was not the subject of this study as it must be studied separately in other academic works (Gainutdinov, I. G. Mukhametgaliev, F. N. Khismatulli, M. M. Avkhadiev, F. N. Aleksandrova, 2022; Petrushina, 2022).

The goal of this work was to study the effectiveness of application of state procurement and commodity interventions expressed in their ability to stabilise domestic grain prices in Russia.

Materials and Methods

When we studied the values reflecting the results of the procurement and commodity interventions of grain, we used the official data from Rosstat, the Unified Interdepartmental Statistical Information System, the National Mercantile Exchange (NME), the Federal Customs Service of Russia (FCS), the World Bank, the International Monetary Fund.

Different periods were analysed. In the first part of the work, we studied the annual data from 2012 to 2021; in the second part of the work, we analysed the figures by months from 2015 to 2021. This specific feature of the formation of the initial data was due to the lack of the necessary figures for months in the past.

In the first part of the work, we specified the notions on the scale of state interventions in the grain market known in the academic community, and in order to do that we evaluated the volume of purchases and sales of grain at the NME in relation to the gross harvest of each of the crops. It was also found that the effective achievement of the goals of interventions in Russia is hindered by the influence of grain prices in the global market as its volatility determines the formation of prices within Russia to a large extent.

A hypothesis was formed that grain market interventions contribute to the deviation of a

price for each crop from the value that is determined based on usual pricing conditions in the market which do not presuppose state intervention in market processes and reduces the volatility of prices as compared to usual market conditions.

To test the hypothesis, in the second part of the study we built multiple linear regression models for each grain crop. Taking into account internal and external factors as well as the specific pricing in relation to each type of grain, each model made the price of grain dependent on market values that were significant from the point of view of price formation.

It was assumed that the regression models, while representing the price of grain as a linear function of certain variables, characterised normal pricing conditions in the market that do not presuppose state regulation. The price values calculated by the regression models were a conditional reference as to possible prices without the interventions in the grain market.

Regression models, preliminary correlation analysis, and further statistical calculations were performed using the MS Excel analysis package and built-in formulas.

To assess the degree of influence of interventions on the price situation in the market, we calculated the values of average linear deviation of actual market prices from the values by regression equations for the entire analysed period as a whole and for the values associated only with the periods of interventions. If the values obtained for the periods of interventions were higher than for the entire period, we made a conclusion that state regulation affected the prices.

To analyse the influence of interventions on price stability, we calculated the coefficient of price variation for each grain crop using two methods. The first one involved the calculation of the whole studied period and the second one also included the calculation of the whole period but the price values in the months of interventions were replaced with those estimated using the regression models. Thus, we conditionally compared the degree of price volatility according to the actual results of interventions and according to the simulated situation, which presumed that prices were determined based on their market parameters. If the coefficients of variation by actual prices were lower than with those replaced by estimated ones, in this case interventions had a positive impact on maintaining price stability.

According to the results of the study, based on the obtained coefficients of variation and the values of the average linear deviation, we made conclusions about the effectiveness or insufficient effectiveness of interventions for each grain crop.

Results

The initial point of the analysis was the formation of the initial database required for the assessment of the influence of interventions on prices for certain grain products within Russia. First of all, we prepared data on the volumes of conducted interventions, according to the information of the National Mercantile Exchange which is a marketplace used for purchasing and selling grain in the course of interventions. The periods of interventions specified in this work were determined based on the months when grain was actually purchased or sold at NME, but not on the periods of officially announced dates of interventions. This decision was associated with the fact that in some months stock trading was not conducted at NME or no deals were consummated in trading.

The trading volumes at NME were compared to the annual gross harvest of each of the studied crops. It was also taken into account that the gross grain harvest was statistically accounted for a calendar year, and an intervention can sometimes overlap on two years, so it was necessary to evaluate the trading volumes in relation to the volumes of the gross grain harvest for both years in which trading was conducted (Table 1).

The table shows that the volume of trading at NME is small regarding the gross harvest of grain crops, and in recent years the scale of intervention operations has not changed significantly. It

T a b l e 1

Physical trading volumes at NME during procurement and commodity interventions in the Russian Federation in 2012–2021

Date of interventions	Nature of interventions	Absolute value of tenders at the National Mercantile Exchange, thousand tons			Share in the gross harvest, %		
		Wheat	Barley	Rye	Wheat	Barley	Rye
October 2012 – July 2013	Commodity	3423,3	185,1	101,2	9,1–6,6	1,3–1,2	4,7–3
October 2013 – February 2014	Procurement	467,8	142,3	–	0,9–0,8	0,9–0,7	–
September 2014 – June 2015	Procurement	973,4	113,7	94	1,6–1,6	0,6–0,6	2,9–4,5
September 2015 – April 2016	Procurement	1662,4	20,5	17,7	2,7–2,3	0,1–0,1	0,8–0,7
September 2016 – December 2016	Procurement	855,9	50,9	–	1,2	0,3	–
June 2018 – November 2019	Commodity	1553,3	202,6	139,7	2,2–2,1	1,2–1	7,3–9,8
April 2020 – October 2021	Commodity	1822,6	32,7	–	2,1–2,4	0,2–0,2	–

S o u r c e: compiled by the authors using the data by NME and Rosstat.

should also be noted that the implementation of the intervention mechanism is mainly aimed at the regulation of wheat prices, which is confirmed by the fact that relative volumes of interventions for this crop are generally higher.

As Russia is one of the largest grain suppliers in the world, the connection with external markets has an impact on the prices for grain crops in the domestic market of Russia. Over recent years, the Russian Federation has been exporting about 30 % of the total amount of grain and leguminous crops harvested in the country. The important role of exports explains the need to study the physical volumes of exports of each of the analysed types of grain as well. The analysis did not include import volumes, as the supply of the studied types of grain crops to the Russian market from abroad is not significant and it cannot have a serious impact on the market. As evaluated by researchers, the share of internal production in the total grain resources of Russia is 99 %, which proves that the grain import is not significant for domestic market volumes (Panasenko et al., 2019). During the assessment of export volumes, it is also important to take into account the traditional global prices for each of the grain crops.

The results of a relative assessment of the value of grain exports as compared to the volumes of the gross harvest, as well as the global average annual prices for wheat and barley are presented in the diagram below (Fig. 1). Global prices for rye were not considered due to the relatively small volume of their exports and the lack of objective statistical data.

The figure shows significant relative volumes of grain supplies to export markets. The relative size of wheat exports is especially high. This situation determines the need to take into account the impact of the global market situation when analysing prices on the grain market within Russia.

When we studied the relationship between global market prices and the volume of grain exports from Russia based on annual data, no significant relationship between these indicators was found. The linear correlation coefficient for these values was –0.12 for wheat and –0.07 for barley. This can be explained by the fact that a rather stable mix of grain product suppliers has formed in the global market that retain their market shares, and these shares do not depend on the dynamics of global prices. The lack of a correlation dependence of export volumes on glo-
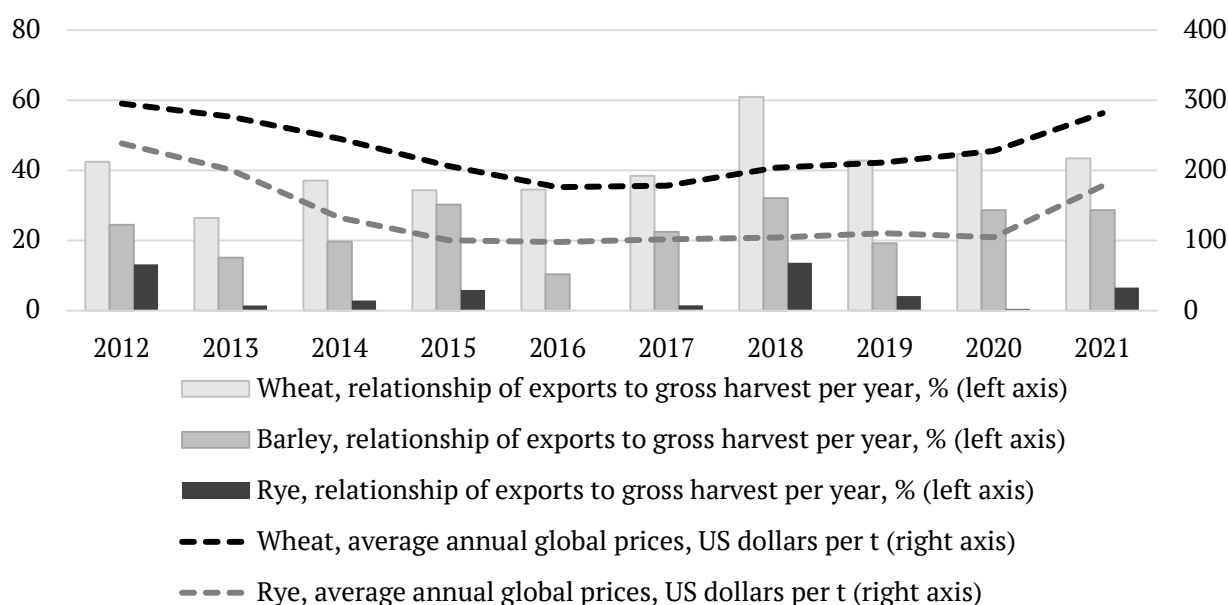
Fig.1. Relative volumes of wheat, barley, and rye exports in the Russian Federation in 2012–2021.
[compiled by the authors according to the data from Rosstat, Federal Customs Service,
World Bank, International Monetary Fund]

bal prices may also arise as a result of the annual data generalisation. As it will be shown later in this paper in a more detailed analysis, the relationship between global and Russian grain prices can be clearly identified.

To assess the effectiveness of interventions within Russia to ensure price stability in the grain market, we constructed regression models that show what prices would look like in Russia without interventions. Prior to building the models, we conducted a correlation analysis to select the most significant factors that form prices for each grain crop.

To analyse the closeness of the relationship with the grain price, we considered the indicators of production indices in the main grain-consuming industries (as calculated per base – January 2015). We also studied global prices in roubles, which allows taking into account the influence of the exchange rate, and natural values of exports and commodity stocks. The specified set of factors allowed including both internal and external factors affecting prices in the study, which have available quantitative information for analysis. The results of the correlation analysis are pre-

sented in Table 2. The table shows the correlation coefficients of the above-mentioned values with average monthly prices for each grain crop in order to primarily select the most significant factors regarding pricing.

As the table shows, two significant factors were found for the formation of wheat and rye prices: global prices and production index in grain-consuming industries. As for establishing prices for rye, the significant factors were production indices of prepared feed and production indices of bread-making and confectionery industries (the latter was taken into account as the second factor for the construction of a multi-factorial model). A regression analysis was performed for the selected factors, and the results are presented in the table below (Table 3). When building regression models, the initial data was taken from January 2015 to December 2021 (84 observations in total).

In all three models, the explained variable is the average monthly price for each grain crops. A graphical comparison of actual and estimated prices obtained using regression models is presented below (Fig. 2).

T a b l e 2

Correlation analysis between the prices for certain grain crops and influence factors

Wheat		Barley		Rye	
Global prices in roubles per ton	0,900637	Global prices in roubles per ton	0,874950	Production index in the flour-milling industry	0,382348
Average production index in consuming industries	0,598742	Average production index in consuming industries	0,668926	Production index in the bread-making and confectionery industries	0,448402
Physical volume of exports	−0,170304	–	–	Production index of prepared animal feed	0,836048
Commodity stock by volume	−0,048696	–	–	–	–

S o u r c e: according to the Unified Interdepartmental Statistical Information System, World Bank, International Monetary Fund.

T a b l e 3

Regression analysis of the dependence of domestic grain prices on significant factors

Variables	Internal wheat prices	Internal barley prices	Internal rye prices
Global wheat prices in roubles	0,597*** [13,938]	–	–
Global barley prices in roubles	–	0,590*** [11,619]	–
Average production index in grain-consuming industries	288,846* [0,185]	4355,078*** [3,264]	–
Production index in the bread-making and confectionery industries	–	–	−9217,153*** [−3,558]
Production index of prepared animal feed	–	–	0,836048*** [12,945]
Free term	1410,888 [1,070]	40,082 [0,033]	3577,956* [1,700]
Number of observations	84	84	84
Corrected R^2	0,807	0,788	0,733
F-statistics	174,043***	154,959***	115,063***

N o t e. The square brackets indicate Student's t-statistics. Estimates of regression parameters that are significant at levels of 10, 5, and 1% are marked with *,** and ***, respectively.

The prices calculated by the equations can be used for an objective analysis of the nature of the impact of interventions on the price situation in the grain market within Russia, and also for drawing further decisions on maintaining the stability of domestic prices in the country for certain grain crops.

To make a conclusion that the conducted interventions have an impact on market prices for grain within Russia, the average linear deviation of prices in general for the period should be less than the same figure for the months when the interventions were performed. If this condition is fulfilled, the situation will reflect the fact that state regulation contributes to the deviation of prices from normal market values. The coefficient of variation by actual prices should also be higher than the coefficient of variation by estimated prices during the intervention periods. This would mean that without interven-
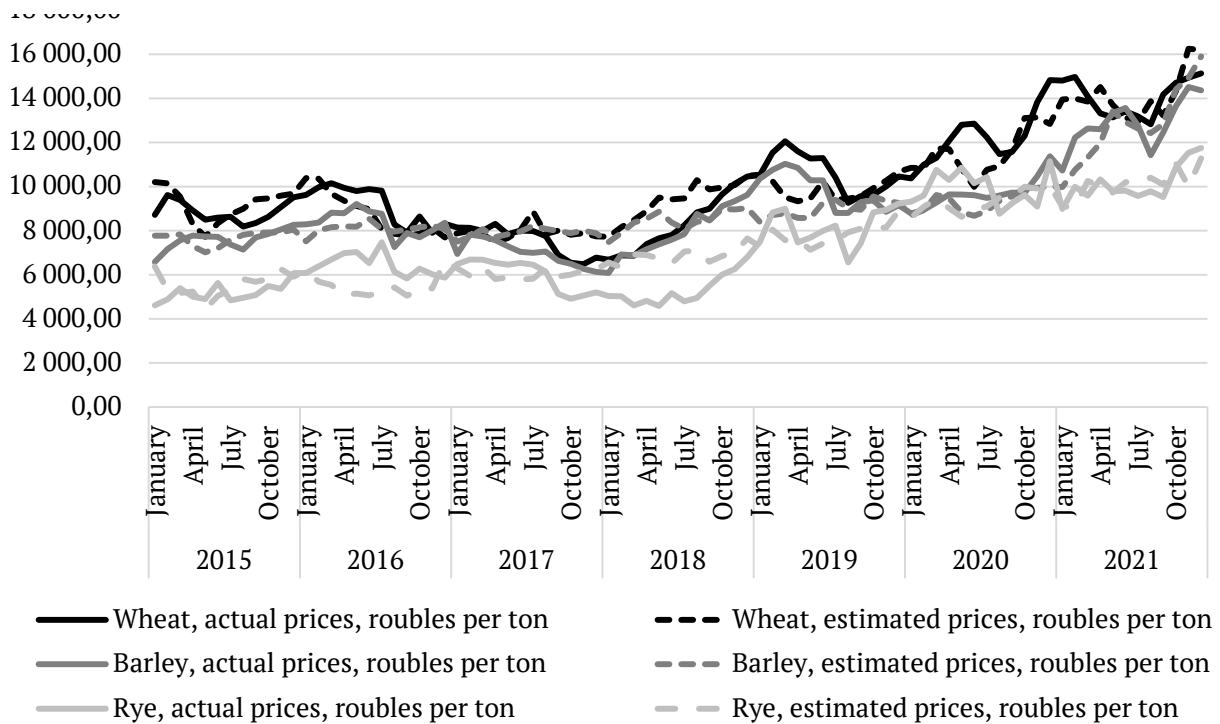
Fig.2. Actual and estimated prices for wheat, barley, and rye in the Russian Federation in 2015–2021. [estimated according to the Unified Interdepartmental Statistical Information System, World Bank, International Monetary Fund]

T a b l e 4

Evaluation of the effectiveness of state procurement and commodity interventions

Grain/indicator	Average linear deviation of actual prices from estimated prices		The coefficient of variation	
	Total for the period	During interventions	By actual prices	When replaced by estimated prices during interventions
Wheat	800,2337	804,9849	23,2498	21,8409
Barley	709,6926	648,7208	22,1705	21,4382
Rye	877,3767	793,6781	28,3498	26,6907

S o u r c e: calculated by the author.

tions prices are more subject to volatility. When the two above-mentioned conditions are fulfilled, it can be said that the interventions are effective from the point of view of ensuring stability of the price situation in the grain market within Russia. The above-mentioned values were calculated for certain types of grain crops based on the actual data for Russia, and the results are presented in Table 4.

The results of the calculations indicate the lack of effectiveness of the conducted interventions aimed at the maintenance of domestic grain

prices, which is explained by their slight impact on the price situation. Average linear deviation of actual market prices from the calculated ones when checking the price during the intervention was higher only for wheat, but only slightly. The coefficient of variation for actual prices was lower only for barley, but the difference was also negligible.

Therefore, the hypothesis regarding the influence of the conducted interventions on the stabilisation of domestic grain prices was not confirmed, and, as a result, further research showed

that this tool of state regulation is not effective enough for the maintenance of stable prices in Russia.

Research methods used in this study have both objective advantages and disadvantages. The disadvantage is building regression models based on market prices that have already been affected to some extent by the state regulation measures. The obvious advantage of the applied methods is their universal nature and flexibility of economical and mathematical modelling. Further research methods may include more complex econometric models that allow eliminating the influence of state price regulation from the initial data for a more precise assessment of the influence of market pricing factors exclusively.

Discussion

The study showed that procurement and commodity interventions conducted in the grain market in Russia are not effective enough regarding the maintenance of stable prices within the country. The dynamics of grain prices in Russia is decisively influenced by the global market situation, which is expressed in considerable grain exports, as mentioned by many authors in their works (Petrushina & Zhilyakov, 2021; Svetlov, 2022).

As it was noted before, there are few articles studying the effectiveness of interventions and their impact on domestic grain prices. The work that stands out among the existing Russian studies is by N. M. Svetlov who justified the optimal size of the required intervention fund in Russia and the corridor of relatively stable prices, which deserves high appreciation (Svetlov, 2022). However, the suggested indicators were calculated by the author in absolute terms, which reduced the value of the obtained results after some time due to changes in prices, grain harvest volumes in the country, and other significant factors that affected the interventions.

The study of international publications dedicated to the research topic showed that different countries applied their own specific methods of ensuring the effectiveness of intervention tools.

A study of the influence of market factors on grain prices in India showed that with a reduction in the volume of grain sales in the domestic market of the country, associated with a decrease in demand, in order to prevent a fall in grain prices, the government carries out purchasing interventions. The government also ensures the further processing of the purchases grain into food products, which leads to an increase of various ready-made goods produced from grain in the market (Gupta, 2013).

The studies conducted in China allowed identifying a significant influence of market liquidity factors and factors of grain speculations on grain prices (Wang et al., 2022). It was found that insufficient liquidity of the product market and speculations on the part of various market participants were the main factors that result in the instability of grain prices within the country. Therefore, state regulation should be mainly aimed at overcoming the negative influence of these factors.

A study of the dependence of prices on various factors in the grain market in Ethiopia showed that the instability of prices in this country was caused to a large extent by a deviation from the conditions of market competition (Wondemu, 2015). Therefore, the main efforts of the government must be aimed at the restoration of competition in the grain market.

The study of factors affecting grain prices in the domestic market of Indonesia showed that in this country the government plays the key role and actively intervenes in domestic pricing (Lusiana & Astrid, 2020). For instance, they have a policy of establishing minimal grain prices in order to protect producers from unfavourable pricing situation spikes that result in the decrease of prices.

As for specific features of grain prices in Tanzania, the government has a policy of isolation of the domestic market from the international mar-

ket (Gerrard & Roe, 1983). As a result, the factors ensuring the closed nature of the domestic market by the efforts of the state had a positive effect on price stabilisation and the increase in the production of grain and in the volume of external grain trade in the country.

It can be seen that in various countries governments form their own price stabilisation mechanisms using different tools of state regulation, including interventions. The generally accepted global practice of effective price stabilization has not been developed so far, and each country has its own individual features.

Further prospects of the improvement of the effectiveness of state interventions in order to ensure price stability in Russia should be associated with the identification and introduction of significant factors in the list of intervention measures that were determined by economic and mathematical modelling and can be used to significantly decrease price volatility.

Conclusions

As a result of the conducted study, we studied the effectiveness of state procurement and commodity interventions in Russia regarding their ability to stabilise domestic grain prices. The study showed that the effective implementation of interventions in Russia was hindered by their relatively small volumes on a market scale against the background of significant exports of grain products, as well as the strong impact of global prices.

Using statistical calculations and economic and mathematical modelling, we determined a model for the quantitative relationship between grain prices within Russia and significant market factors, including global grain prices and average production indices in grain-consuming industries.

The results of the study are of great scientific and practical significance. The scientific novelty of the study is due to the mathematical proof of the insufficient effectiveness of interventions conducted in Russia to stabilise domestic grain prices. The obtained economic and mathematical models for the relationship between grain prices and significant factors reflect a considerable impact of global grain prices on domestic prices and a strong influence of the dynamics of production in grain-consuming industries.

The results of the study are also practically important for the improvement of state regulation by the authorised agencies that make decisions regarding the interventions. The conducted study is significant in relation with the expansion of the list of goods that interventions can be applied to, specifically in relation with the inclusion of sugar on this list (Order of the Government of the Russian Federation issued on 25 August 2021 No. 2354-r).

The authors associate the further development of the research results with the identification of significant market factors that were not considered, which will complement the factors already taken into account, thus providing an information basis for the future improvement of the mechanism for the stabilisation of domestic prices based on the application of state interventions. It is reasonable to complement the existing intervention mechanism in Russia with the measures that ensure the reduction of the dependence on the dynamics of global prices and the dynamics of internal production in internal consumers of Russian grain.

Conflict of Interest

The authors declare the absence of obvious and potential conflicts of interest related to the publication of this article.

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Экономика отраслевых рынков

Анализ эффективности государственных закупочных и товарных интервенций на рынке зерна в России

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Предмет. Эффективность государственных интервенций по обеспечению стабильности внутренних цен.

Цели. Исследование эффективности проведения закупочных и товарных интервенций на рынке зерновой продукции с точки зрения их способности стабилизировать цены на зерно внутри России.

Методология. Корреляционный анализ, экономико-математическое моделирование на основе регрессионных моделей, расчет статистических показателей вариации.

Выводы. Проводимые в России закупочные и товарные интервенции имеют недостаточную эффективность по обеспечению стабильности цен на зерновом рынке, что подтвердили низкие значения средних линейных отклонений фактических рыночных цен от значений, рассчитанных по регрессионным уравнениям для периодов проведения интервенций. Построение экономико-математических моделей связи цен на зерно со значимыми факторами показало, что внутренние цены существенно зависят от мировых цен на зерно, а также находятся под сильным влиянием факторов динамики производства в отраслях – потребителях зерна. Таким образом, необходимо дополнение механизма используемых в России интервенций, в том числе за счет мер, обеспечивающих снижение зависимости от сильно воздействующих внешних факторов. Дальнейшее использование результатов проведенного исследования может осуществляться путем определения более широкого состава факторов, влияющих на внутренние цены на зерно, и усовершенствования на этой основе проводимых государственных интервенций.

Ключевые слова: рынок зерна, закупочные интервенции, товарные интервенции, государственное регулирование, цена, пшеница, ячмень, рожь.

Конфликт интересов

Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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