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RESEARCH ARTICLE

Assessing the Shock Resilience of The Agricultural Sector in A Region's Economy Under Import Localization Conditions

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ABSTRACT

The agricultural sector's resilience to external economic shocks, particularly in the context of import localization, is a critical aspect of regional economic sustainability. The Republic of Tatarstan faces challenges related to its dependency on critical imports, such as live animals, in the face of international sanctions and systemic transformations. This study aims to assess the shock resistance of Tatarstan's agricultural sector, specifically evaluating the impact of critical imports on its sustainability and the region's overall economic growth. The research employs a systematic methodology, analyzing import dependencies using econometric models. Key steps include identifying critical imports through statistical filters and modeling the impact of these imports on agricultural growth and the Gross Regional Product (GRP). The study identifies live animals as the primary critical import for the agricultural sector. Econometric analysis reveals that reduced imports of this commodity could decrease agricultural sector growth by 0.36%, leading to a corresponding reduction in GRP growth by 0.361%. Despite these risks, the overall shock resistance of the sector is assessed as moderate. The findings underscore the importance of strategic import substitution and diversification to mitigate risks associated with critical imports. Strengthening these measures is essential for enhancing the resilience and sustainable development of Tatarstan's agricultural sector in the face of external economic pressures.

INTRODUCTION

Economic theory devotes significant attention to the study of sustainable development. According to widely accepted approaches, sustainable development refers to growth that meets the needs of present and future generations (Rio-de-Janeiro Declaration on Environment and Development, n.d.). In a broader interpretation, sustainable development is viewed as economic growth that combines high quality of life, assessed through the lens of social and environmental well-being (Korchagina, 2019). Within this framework, studies of the sustainable development of socio-economic systems, considering potential impacts of various external and internal factors, are focused on a system of corresponding indicators. These indicators typically include measures assessing the economic, social, environmental, and institutional potential of the system (Safiullin et al., 2014; Little Green Data Book, 2009)

At the same time, the theory of economic dynamics and sustainable development encompasses a related but distinct concept – economic security. This doctrine focuses on the factors ensuring the stable economic dynamics of systems amidst continuously and dynamically changing external

and internal conditions. According to one of the founders of this approach, Pareto, economic security involves a combination of three key processes constantly shaped by external and internal pressures: economic development, the stability of state regulatory institutions, and national defense capabilities (Miller & Karpov, 2017).

Another relevant area addressing the sustainable development of economic systems is the theory of shock resilience (referred to as "resilience theory" in English literature). This theory is grounded in models that reveal the sensitivity of economic systems to macroeconomic shocks, whether external or internal (Pilipenko, 2011).

The presented review of economic dynamics theory illustrates clear differentiation among the discussed approaches in terms of their research focus and methodological tools. While the first two theoretical approaches – sustainable development and economic security – are well-developed methodologically, the concept of resilience is relatively young. Consequently, a fully cohesive and consistent set of resilience research methods has not yet emerged within the scientific community, unlike the other two concepts. This issue is particularly relevant at the regional and sectoral levels, where there is a noticeable shortage of studies compared to research focusing on the resilience of macroeconomic systems.

It is worth noting that the theory of resilience gained significant traction in academic publications following the works of Hill (2008), Martin (2012), Fingleton (2012), Lagravines (2015), Klimanov et al. (2019), Safiullin, Elshin (2023), Mikheeva (2021), Malkina (2020), Kuznetsova (2023), Seliverstov (2013), Lazhentsev (2013), and Lexin, Porfiriev (2017).

A review of the approaches to empirically assessing the resilience of economic systems reveals certain methodological shortcomings. These include insufficient formalization of approaches related to a key characteristic of resilience: the system's vulnerability to transformations in external economic connections. Particularly in the context of macroeconomic shocks caused by sanctions, a critical factor for assessing a region’s and its sectors' readiness to counteract destructive effects is the degree of integration into international value chains. This essentially refers to the dependency of regional-sectoral systems on potential disruptions in export-import operations, the efficiency of response mechanisms to external economic restrictions, and the flexibility of supply chain logistics in diversifying geographical supply sources. These considerations largely determine the preparedness of an economic system for crises triggered by external shocks ("Preparation Resilience").

Given this context, it seems reasonable to develop resilience assessment tools further by analyzing and empirically evaluating the preparedness of regional-sectoral systems to counter macroeconomic shocks by identifying vulnerabilities related to the potential localization of access to external markets. This aspect of sustainable development should be examined through the lens of a key characteristic of resilience – dependence on imports.

The aim of this study is to evaluate the impact of sanctions-induced shocks, expressed as the localization of import supplies, on the resilience of the agricultural sector of the Republic of Tatarstan's economy and the influence of its development prospects on the region's economic growth.

1 METHODS AND MATERIALS

Based on the proposed methodological approach, an algorithmic framework is outlined below for the empirical evaluation and analysis of the shock resilience of one of the key sectors of the Republic of Tatarstan’s economy – agriculture.

Considering that the principal feature of the proposed approach is the identification and assessment of the sector's import dependence, the algorithm for evaluating this component, which defines the shock resilience of the studied economic activity, is presented. A critical task in this process is identifying the region's vulnerability to supplies of so-called critical agricultural imports, which contribute to the creation of added value. A concise depiction of this solution is provided in Figure 1.

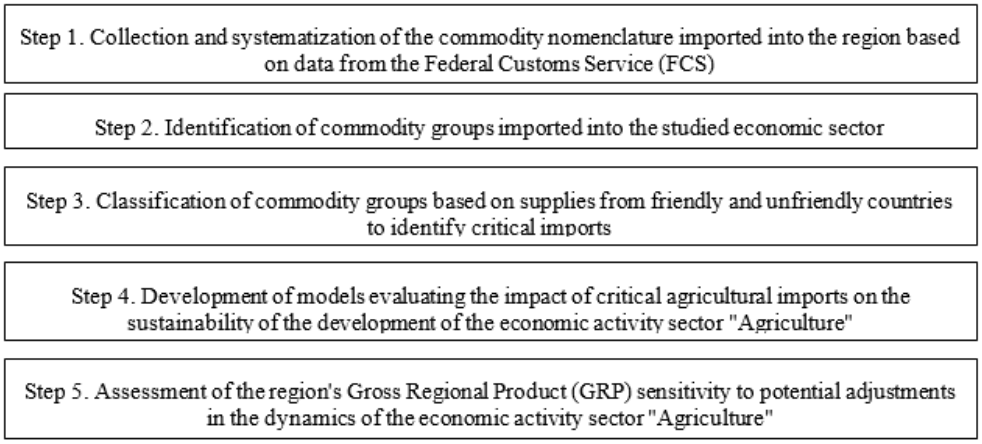

Figure 1: Methodological toolkit for assessing the impact of import dependence of the studied sector ("Agriculture") on the economic growth resilience of the region
Source: Developed by the authors

To clarify the proposed methodology, several explanations are necessary. Given that the Federal Customs Service (FCS) database includes a large dataset on regional import supplies, it is deemed reasonable to use parameters from the commodity nomenclature of imported goods with a share exceeding 0.5% of the total regional imports. This step filters out statistically insignificant import items. However, it should be noted that this approach is open to criticism, as low-volume imports can play a significant role in fostering sustainable development processes in both industries and the region overall. Recognizing this fact, and given that the commodity nomenclature of imports to the Republic of Tatarstan includes approximately 100 items sourced from over 150 countries, focusing on minor items would complicate the model and its subsequent interpretation. Moreover, in the context of globalized economic relations, specialized imports can often be replaced by adjusting the geography of supply chains.

Further clarification is required regarding the concept of critical imports (Step 3). In this study, critical imports are defined as those imported in 2021 from unfriendly countries (as per the current classification of foreign jurisdictions), whose replacement with supplies from friendly countries is challenging due to the absence of such supplies in previous periods (classification code 1). However, if the potential exists to replace imports from unfriendly jurisdictions with similar products from friendly countries, such imports will also be classified as critical but assigned classification code 2.

The analysis is based on data from the Federal Customs Service (n.d.), detailing imports into the Republic of Tatarstan, broken down by 97 commodity categories and 150 countries engaged in foreign trade with residents of the Republic of Tatarstan in 2021.

2 RESULTS AND DISCUSSION

Guided by the proposed methodological solutions, the table below presents the results of statistical data analysis revealing key parameters of foreign product supplies to the region, categorized by friendly and unfriendly countries in 2021 (table 1).

This period was chosen to identify the import dependence of the region and its economic sectors during a period of heightened geopolitical tensions that triggered transformations in foreign economic activity. Based on the filtering criterion of imported products comprising at least 0.5% of the total import volume, the final sample includes 14 major product groups accounting for a cumulative share of 79.1% of the region's gross imports.

Table 1: Distribution of import supplies by criticality for the region, million USD

	01 - Live animals	04 - Dairy products; eggs; honey; animal-derived food products	27 - Mineral fuels, oil, and products of their distillation; bituminous substances; mineral waxes	...	90 - Optical, photographic, cinematographic, measuring, control instruments, etc.	94 - Furniture; bedding; lighting equipment; prefabricated constructions	Total	Share of import category from unfriendly countries in total imports (%)
Critical Import (Code 1)	80,0			…	72,4		239,7	13,0
Critical Import (Code 2)		23,2		…			603,1	32,6
Non-critical Import			23,0	…		68,5	1007,03	54,4

Source: Developed by the authors based on data from the Federal Customs Service of the Russian Federation

According to the obtained estimates, in the Republic of Tatarstan, the product category "Live Animals" (product code TN 01) falls under the critical import classification (Group 1). Other product categories contributing to the added value of the agricultural sector in the region are not included in this classification. Consequently, all further research iterations will focus on identifying the dependence of sustainable development in the "Agriculture" economic activity on disruptions in critical import supplies that contribute to the added value of this sector.

Following the developed methodological framework, the key task is to determine the values of regressors in a nonlinear function characterizing the impact of identified critical imports ("Live Animals") on the developmental trajectory of the "Agriculture" sector. This will be followed by constructing a forecast assessment of GRP dynamics under potential adjustments.

The sequence of calculations and methodological iterations involves two key steps:

Step 1. The impact of "Live Animals" (TN 01) on the agricultural sector (classified under OKVED) is calculated using a nonlinear function:

$AI = 1{,}151 * CI^{0{,}0036}$ (1)

where:

AI (Agricultural Industry): Annual growth rate of "Agriculture";

CI (Critical Import): Import of "Live Animals," measured in billion rubles.

The parameters of statistical significance meet standard thresholds (R^2=0.71; $p<0.05$).

Step 2. The impact of projected changes in the growth rate of the studied economic activity on GRP dynamics is assessed as follows:

$GRP = 1{,}015 * AI^{1{,}0024}$ (2)

where:

GRP: Gross Regional Product of the Republic of Tatarstan, growth rate (% year-on-year);

AI (Agricultural Industry): Growth rate of "Agriculture" (% year-on-year).

The statistical significance of the resulting equation also meets standard requirements (R^2=0.71; $p<0.05$).

The results of the equation can be interpreted as follows: a 1% increase in the annual growth rate of the "Agriculture" sector leads to a 1.0013% increase in GRP. However, based on earlier estimates, the localization of critical imports from unfriendly countries under the "Live Animals" product category (Group 1) is expected to cause a 0.36% reduction in the growth rate of the "Agriculture" sector. This, in turn, could lead to a projected decrease in GRP of approximately 0.361% (Figure 2).

Figure 2: Impact of critical imports on the agricultural sector's stability and Tatarstan's GRP
Source: Developed by the authors

The research demonstrates that despite external cooperation disruptions due to escalating sanctions, the agricultural sector in Tatarstan remains relatively stable. The only critical import for this sector is "Live Animals" from unfriendly countries. The restrictions on these imports have a moderate impact on agricultural stability.

However, given the strategic importance of livestock development in Tatarstan, identifying new import substitution mechanisms for this product group is critical. As this group is the sole critical

import in the sector, it becomes a priority for strategic development under ongoing economic transformations.

The study highlights the shock resilience of Tatarstan's agricultural sector from the perspective of resilience theory. The findings suggest that the region faces moderate risks to sustainable agricultural development amid the evolving geopolitical landscape. While "Live Animals" are classified as critical imports, localization does not lead to critical changes in agricultural growth or GRP dynamics.

However, considering the recent stagnation in cattle numbers (Figure 3), risks associated with import restrictions on "Live Animals" may intensify, posing threats to the sustainable development of Tatarstan's agricultural sector.

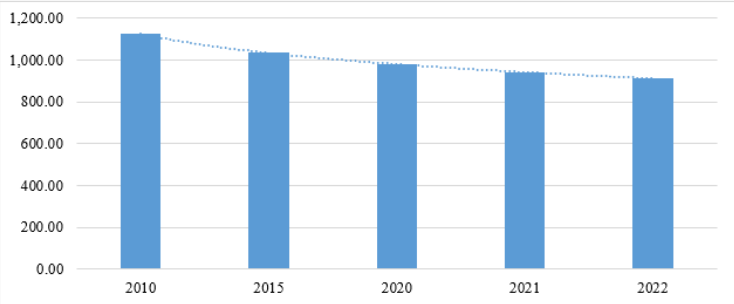

Figure 3: Cattle numbers (all categories; end of year; thousand heads), Republic of Tatarstan
Source: Rosstat (n.d.)

An explicit confirmation of the emerging trends is that as of the beginning of the first quarter of 2024, there were 613,000 head of cattle in the region. This figure represents a decrease of 6,000 head compared to the start of the same year (Income from livestock farming in Tatarstan increased by 19%, n.d.).

3 CONCLUSIONS

Summarizing the results, the proposed toolkit for assessing the resilience of regional-sectoral complexes, and the analysis of the agricultural sector of the Republic of Tatarstan conducted based on it, provide a foundation for developing priority directions for its development. The identified critical import group for the agricultural sector of the region highlights the need to design both operational and strategic measures to enhance its shock resilience under systemic transformations caused by sanctions imposed on the Russian economy by several Western countries.

These measures should include the development and implementation of import substitution programs adapted to the prevailing conditions, as well as other development directions, such as diversifying the geography of critical import supplies. This approach will not only ensure the continued intensive development of livestock farming in the region but also create a basis for sustainable growth dynamics in the agricultural sector as a whole.

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