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# Assessing the resilience of Russian regions in the context of import localization

# Evaluación de la resiliencia de las regiones rusas en el contexto de la localización de las importaciones

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## Abstract

As exemplified by the constituent entities of the Volga Federal District, Russian Federation, the authors test various methods and assess the resilience of the regions to the transformation of foreign economic relations. The proposed toolkit is based on the developed methodological approach providing a dichotomous analysis of resilience within the framework of two key components: vulnerability and the effectiveness of economic recovery. The results of testing the developed approaches allow the construction of a resilience matrix for the constituent entities of the Volga Federal District and determine their development potential in the context of systemic transformations.




***Keywords***: Resilience, Economic Development, Vulnerability, Macroeconomic Shock, Budget Sustainability.


## Resumen

A partir de las entidades constituyentes del Distrito Federal del Volga, Federación Rusa, los autores prueban diversos métodos y evalúan la resiliencia de las regiones a la transformación de las relaciones económicas exteriores. El conjunto de herramientas propuesto se basa en el enfoque metodológico desarrollado que proporciona un análisis dicotómico de la resiliencia en el marco de dos componentes clave: la vulnerabilidad y la eficacia de la recuperación económica. Los resultados de la prueba de los enfoques desarrollados permiten la construcción de una matriz de resiliencia para las entidades constituyentes del Distrito Federal del Volga y determinan su potencial de desarrollo en el contexto de las transformaciones sistémicas.


***Palabras claves:*** Resiliencia, Desarrollo económico, Vulnerabilidad, Choque macroeconómico, Sostenibilidad presupuestaria.

## Introduction

Economic theory is concerned with sustainable development. The study of these socioeconomic dynamics can focus on different subjects. Under the generally accepted approaches adopted at the Earth Summit under the auspices of the UN in Rio de Janeiro in 1992, sustainable economic development should be understood as development that meets the needs of the present, without compromising the ability of future generations to meet their needs (Rio declaration on environment and development, 2016). In a more extensive interpretation of this concept, sustainable development is defined as economic growth combined with high living standards assessed in the context of social and environmental well-being (Korchagina, 2012). Under this approach, the study of the sustainable development of socioeconomic systems with due regard to potential internal and external impacts relates to corresponding indicators. These usually include indicators that assess the system's economic, social, environmental, and institutional potential (Bobylev et al., 2011; Little Green Data Book, 2009).

The theory of economic dynamics and sustainable development includes a similar direction with different content (economic security). The doctrine of this scientific research focuses on the factors that ensure sustainable economic dynamics in the context of changing internal and external factors. According to one of the founders of the approach under consideration, V. Pareto, economic security should be understood as a combination of three key processes formed under internal and external factors: economic development, stability of state regulation, and the defense capability of the state (Miller, Karpov, 2017).

Another direction affecting the sustainable development of economic systems is the theory of resilience. It is based on models that reveal the sensitivity of economic systems to macroeconomic shocks, both internal and external (Pilipenko, 2011). This specific direction not only determines the research subject, which differs from the theory of sustainable development and the concept of economic security but also focuses on the corresponding methodological approaches.

## Literature review

The economic theory review demonstrates the differentiation between the considered approaches regarding the research perspective and the selection of methodological tools. If the first two directions of economic theory are developed in methodological terms, resilience is a relatively new economic trend. The scientific community lacks a consistent methodology for studying resilience.

The theory of resilience is rooted in studies by E. Hill et al. (2008), R. Martin (2012), B. Fingleton et al. (2012), R. Lagravines (2015), V.V. Klimanov et al. (2019), M.R. Safiullin et al. (2023), N.N. Mikheeva (2021), M.Yu. Malkina (2020), O.V. Kuznetsova (2023), V.E. Seliverstov (2013), V.N. Lazhentsov (2013), and V.N. Leksin and B.N. Porfirev (2017).

The theory of the resilience of economic systems has been developed by such Russian scholars as B.S. Zhikharevich, V.V. Klimanov, and V.G. Marach (2020). They propose to consider this category following the following functional characteristics:

– resilience as the economic system's ability to resist shocks,

– resilience as the economic system's ability to respond and adapt to changes,

– resilience as the economic system's ability to recover equilibrium.

Depending on the type of shock, the information, statistical, and methodological bases are determined, including methodological tools for the empirical assessment of the resilience of economic systems.

We should pay attention to the work by Klimanov, Kazakova, and Mikhailova (2019). In their opinion, the indicators assessing economic resilience measure the stability of the budget system in a crisis and its ability to recover. The key hypothesis is that regions with better parameters of budget efficiency are more resistant to shocks.

Analyzing the study of methodological tools for assessing the resilience of economic systems outside of Russia, it is necessary to mention S. Christopherson et al. (2010), J. Carlson et al. (2012), R. Martin (2012), etc.



The work by K. Foster (2007) is considered one of the fundamental studies on the issue. Foster develops a methodological tool for calculating the Resilience Capacity Index based on the aggregation of several indicators assessing the resilience of territories. Foster proposes to measure resilience from two perspectives (Figure 1):

– Preparation Resilience,

– Performance Resilience.

Relying on this conceptual approach, Foster constructs a resilience matrix of regional economic systems, where the upper right cell characterizes the highest level of resilience in a complex form.

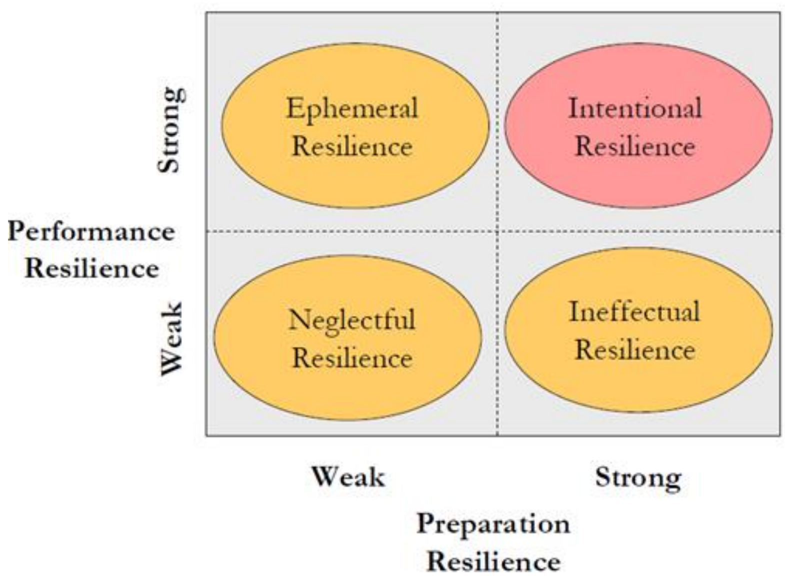



**Figure 1.** Matrix approach to the resilience of regional economic systems
Source: developed based on data from Foster (2007)

To test the proposed methodology, regional resilience is measured based on the following system of statistical indicators (Table 1).

**Table 1.** Methodological basis for the empirical basis of studying regional resilience

| No. | Statistical indicators | |
|---|---|---|
| | Preparation Resilience | Performance Resilience |
| 1 | Structure of the economy | Population change |
| 2 | Infrastructure | Income per capita |
| 3 | Development institutions | Poverty rate |
| 4 | | Employment growth |



Source: developed based on data from Foster (2007)

Several Russian scholars (Klimanov et al., 2019; Malkina, 2020) use this methodological approach with amendments based on a comparison of the resilience of regional economic systems in the direction "Readiness – Performance Resilience". Within the framework of this paradigm, the research focuses on descriptive analysis and comparison of statistical data.

To develop methodological approaches to the resilience of regional systems, we present our concept. It is based on the synthesis of the approaches with additional modernization of the existing toolkit.

## Methodologies and Data

Our approach is based on the concept and methodology proposed by Foster and supplemented by the practice of measuring the processes by Russian scientists. It is proposed to build a resilience matrix at the intersection of two measurement axes "Vulnerability" – "Performance Resilience" (Figure 2). The fundamental difference from Foster's methodology is that we measure regional resilience within the framework of assessing the economic system's dependence on institutional and market changes in the external environment determining foreign trade operations. It is important to focus not on the economy's readiness for possible perturbations but on its vulnerability to possible transformations in the external environment. This paradigm is most justified within the framework of systematizing key trends and risks of disrupting the sustainable development of the Russian economy in the context of the 2022 sanctions.

Following this logic, the direction characterizing the readiness of the regional economic system for macroeconomic shocks is assessed through the degree of integration into global value chains. This indicator is designed to assess the risks and vulnerability of regional development with due regard to the possible localization of transnational cooperation ties. This indicator is due to the focus on sanction shocks, including import restrictions and the disruption of international supply chains, which destroys operating business cycles at the levels of the national and regional economies. This largely determines economic systems' vulnerability and readiness to withstand external changes.



It is advisable to assess the direction of regional performance resilience within the framework of modernization of the approach proposed by Foster (2007). The set of indicators used for the empirical assessment of regional resilience is as follows:

I. Quality of life of the region's population:

– Real accrued wages,

– Population size,

– Poverty level,

– Employment of the population.

II. Regional budget sustainability:

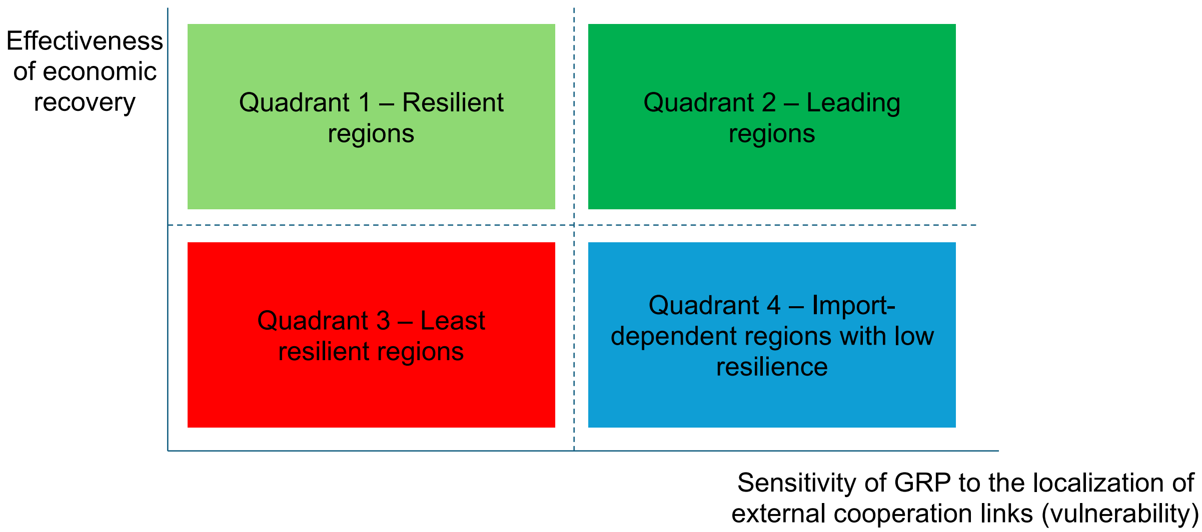
– Surplus/deficit of the consolidated budget of the constituent entity of the Russian Federation.

This approach to measuring performance resilience of regional resilience complies with the approaches used by Foster (2007), Zhikharevich, Klimanov, and Maracha (2020), and other scientists.

Depending on the inclusion of constituent entities in a quadrant, state support and regional economic management mechanisms are determined to ensure the most effective adaptation to macroeconomic shocks, including sanctions on the national economy.



Based on this methodological approach, we present an algorithmic concept for implementing a sequence of actions for empirical assessment and analysis of the resilience of a regional economic system.




1 – Regions with a high level of resilience due to a low level of import dependence

2 – Regions with a high level of integration into economic supply chains of imports and a high coefficient of resilience to sanction shocks

3 – Import-dependent regions with a low level of readiness for sanction shocks

4 – Regions with a low level of foreign trade cooperation ties and a low level of resilience

**Figure 2.** Concept of the resilience of a region based on the matrix of distribution of resilience parameters in the directions “Vulnerability” – “Performance Resilience”

Source: developed by the authors

Considering that the fundamental feature of the approach is the search for and assessment of regional import dependence as the most important characteristic of its vulnerability, the algorithm for assessing this component, which determines the sustainability of economic development, is presented below.

The methodological basis for this stage of the study is the construction of non-linear models assessing the impact of the correction of foreign supply chains (imports) on the economic dynamics of the region in the short term. A formalized algorithm for implementing this stage is presented in Figure 3.



Step 1. Identification and assessment of critical imports of final and intermediate goods imported from unfriendly countries into the region

Critical imports of goods that can be substituted through the reorientation of supply chains for similar products from friendly countries (Group 2.1)

Critical imports of goods for which there is no or very little possibility of substituting them by friendly countries (Group 2.2*)

Step 2. Simulation modeling of the growth dynamics of economic sectors vulnerable to critical imports (groups 2.1, 2.2) of goods from unfriendly countries

Step 3. Dynamic modeling of the impact of the correction of import supplies of final and intermediate consumption goods in the studied regional sectors of the economy on the sustainability of their development

Step 4.1 Modeling the impact of regional economic growth directions as a result of restricting critical imports by product groups (Group 2.1)

Step 4.2 Modeling the impact of regional economic growth directions as a result of restricting critical imports by product groups (Group 2.2)

Step 5. Cumulative assessment of the possible changes in the growth rate of the gross regional product within the development potential of individual sectors of the economy that are most vulnerable to critical imports (groups 2.1, 2.2)

Step 6. The impact of possible changes in the economic dynamics of the national economy of the Russian Federation within the framework of the correction of critical imports in the context of the regions under study

*Critical imports are divided into two groups:

2.1 Imported goods for which there is an opportunity to reconfigure the geography of supplies within the framework of expanding trade relations with friendly countries: current suppliers of similar products.

2.2 Imported goods supplied from unfriendly countries which are difficult to replace with supplies from friendly countries based on the low values of current supplies.

**Figure 3.** Algorithm for studying the impact of critical imports on the prospects for regional economic growth and GDP dynamics

Source: developed by the authors

This algorithm is thoroughly tested in our publication (Kuznetsova, 2023), whose main results are presented below.

Following our paradigm for resilience, along with an empirical assessment of a region's vulnerability, the most important mechanism that forms the dichotomous concept of resilience research is the assessment of the potential for effective recovery.



As a methodological basis for this state of resilience (performance resilience), this paper uses the tools proposed by M.Yu. Malkina (2020). In a generalized form, the sequence of determining the integral value of resilience of a region in the considered direction of resilience is assessed as follows:

1. In the context of each analyzed indicator, a linear regression is constructed with the inclusion of the time factor. The period of the time series is determined by pre-crisis values (formula 1).

$$\hat{y} = \alpha + \beta t + e \tag{1}$$

where

$\hat{y}$ is the predicted value,

$\alpha$, $\beta$ are regression coefficients,

$t$ is the time factor,

$e$ is the regression error.

2. The predicted value of the indicator in the crisis phase is determined (in relation to sanctions shocks, 2014 and 2022).

3. The region's resilience index is calculated in the direction of "Performance Resilience". The predicted value of the analyzed indicator by linear regression is compared with its actual level observed in the post-crisis (recovery) period (formula 2).

$$Ri = \frac{\hat{y}}{y}\text{-}1 \tag{2}$$

where

$Ri$ is the value of the i indicator participating in the construction of the aggregate value of the integral resilience index,

$\hat{y}$ is the predicted value of the index during the crisis,

$y$ is the actual value of the index during the crisis.

4. For each analyzed indicator, the values are normalized using formula 3 to bring them to a scale range from 0 to 1.



$$Rinorm = \frac{Ri - Rmin}{Rmax - Rmin} \tag{3}$$

If a decrease in the indicator indicates an increase in the efficiency of resilience processes, the values are normalized according to formula 4.

$$Rinorm = \frac{Ri - Rmax}{Rmin - Rmax} \tag{4}$$

4. The integral value (*R*integral) of the resilience index of a region is based on the calculation of the arithmetic mean of the partial values of the normalized analyzed indicators (*Ri*norm).

The indicators used to assess the resilience of regions in the performance resilience direction are presented in Table 2.

**Table 2.** Indicators used to assess the resilience of regional economic systems in the direction of "Performance Resilience"

| No. | Indicator |
|---|---|
| **Quality of life of the region's population** | |
| 1 | Real accrued wages |
| 2 | Population size |
| 3 | Poverty level |
| 4 | Employment of the population |
| **Fiscal sustainability of the region** | |
| 4 | Surplus/deficit of the consolidated budget of a constituent entity of the Russian Federation |

Source: developed by the authors

This approach to measuring the considered component of resilience (performance resilience) of the regional industry complex complies with the approaches used by Foster (2007), Zhikharevich, Klimanov, and Maracha (2020), and others.

## Results and discussion

To optimize the results and consider the significant volume of the statistical base subjected to the survey, the assessments are presented as exemplified by the Republic of Tatarstan with the subsequent projection of the tested methodological tools onto the constituent entities of the Volga Federal District.



The systematization and processing of data on the region's vulnerability to import supplies in the context of a wide range of product groups has brought the following results (Table 3). The obtained estimates were formed within the framework of the proposed methodological toolkit based on the assessment of critical and non-critical imports of goods and services (Figure 3).

The obtained estimates are the basis for conducting subsequent research to determine the impact of the disruption of foreign trade supply chains on the sustainability of regional economic growth. The algorithm for further research is presented in Figure 4.

**Table 3.** Distribution of imports supplied to Tatarstan, in accordance with their criticality from the viewpoint of ensuring the economic security of the region's development, million USD

| Non-critical imports | Possibility of import substitution from friendly countries | Critical imports | |
|---|---|---|---|
| | | 80.0 | 01 – Live animals |
| | 23.2 | | 04 – Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included |
| 23.0 | | | 27 – Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes |
| | 66.2 | | 29 – Organic chemicals |
| | | 87.3 | 38 – Miscellaneous chemical products |
| | 193.8 | | 39 – Plastics and articles thereof |
| | 27.3 | | 40 – Rubber and articles thereof |
| | 73.1 | | 73 – Articles of iron or steel |
| | 7.3 | | 82 – Tools and implements |
| 36.8 | | | 83 – Miscellaneous articles of base metal |
| | 212.1 | | 85 – Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles |
| 878.8 | | | 87 – Vehicles other than railway or tramway rolling-stock,and parts and accessories thereof |
| | | 72.4 | 90 – Optical, photographic, cinematographic, measuring, checking, precision, medical, or surgical instruments and apparatus; parts and accessories thereof |
| 68.5 | | | 94 – Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; prefabricated buildings |
| 1007.03 | 603.1 | 239.7 | Total |
| 54.4 | 32.6 | 13.0 | Share of the import category in the total volume supplied from unfriendly countries, % |

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

Step 1. Identification and comparison of the commodity code listing of imported goods with OKVED 2

Step 2. Simulation modeling of the growth dynamics of economic sectors as a result of disruption of supply chains of critical imports

Step 3. Modeling predictive estimates of the correction of the economic growth of individual sectors of the economy on the dynamics of the region's GRP (dynamic analysis)

**Figure 4.** Algorithm for assessing the region's dependence on critical imports based on its impact on the slowdown of GRP

As exemplified by the identified types of economic activity classified as critical imports ("Other chemical products"), a brief implementation of the proposed algorithm is presented (Figure 4). The key task is to determine the regressors in non-linear functions characterizing the influence of the commodity code listing on the development of the core type of economic activity, with a predictive assessment of the GRP dynamics. The consistent implementation of this approach in the context of the above-mentioned critical imports allows one to determine the cumulative effect in the form of an aggregated forecast of GRP as a result of the correction of import supplies. Under the commodity code listing "Other chemical products", the sequence of calculations can be presented as the following actions:

Step 1. The commodity code listing "Other chemical products" corresponds to OKVED (Russian Classification of Economic Activities) "Production of chemicals and chemical products".

Step 2. The impact of this commodity code listing on OKVED "Production of chemicals and chemical products" is calculated within the framework of a non-linear function:

$$\mathrm{PC} = 1.151 * CI^{0.0096} \qquad (5)$$

where

PC is the production of chemicals and chemical products, annual growth rate,

CI is the import of goods under the commodity code listing "Other chemical products", billion rubles.

Step 3. The impact of the predicted change in the growth rate of the type of economic activity under study on the dynamics of GRP is assessed as follows:

$$\mathrm{GRP} = 1.015 * \mathrm{PC}^{1.0023} \quad (6)$$



where

GRP is the gross regional product of Tatarstan, growth rate in % to the previous year,

PC is the production of chemicals and chemical products, growth rate in % to the previous year.

The results of this equation can be interpreted as follows: an increase in the annual growth rate in the “Production of chemicals and chemical products” sector of 1% leads to an increase in GRP of 1.0023%. According to the previously obtained data, the localization of critical imports from unfriendly countries under the commodity code listing “Other chemical products” (group 2.2) creates prerequisites for a decrease in the “Production of chemicals and chemical products” sector by 0.96%. The predicted decrease in GRP may amount to 0.962%.

Guided by the presented research algorithm, similar estimates were obtained for other sectors of the economy of Tatarstan included in the riskiest group in terms of the level and profile of the supplied commodity code listing from unfriendly foreign countries (Table 4).

Based on the presented tools for assessing a region’s vulnerability to critical imports (group 2.2), similar assessments were made for other regions of the Volga Federal District (Table 5)

**Table 4.** Dependence of the growth dynamics of GRP of Tatarstan on the possible adjustment of the growth dynamics of economic sectors included in the critical group

| HS Code | OKVED-2 | Elasticity coefficient in a non-linear function | Estimated growth rates in the economic sector, % | Estimated growth rates of GRP*, % |
|---|---|---|---|---|
| **Critical imports (group 2.2)** | | | | |
| Live animals (HS Code 01) | Volume of agricultural production of all agricultural producers | 0.567 | -0.37 | -0.20979 |
| Miscellaneous chemical products (HS Code 38) | Production of chemicals and chemical products | 1.0023 | -0.96 | -0.962208 |
| Optical instruments and apparatus... (HS Code 90) | Production of computers, electronic and optical products | 0.439 | -0.293 | -0.128627 |
| **Total expected decline in the dynamics of GRP** | | | | **-1.300625** |
| **Critical imports (group 2.1)** | | | | |
| Dairy produce; birds' eggs... (HS Code 04) | Food production | 0.9102 | -0.43 | -0.391386 |
| Organic chemicals (HS Code 29) | Production of chemicals and chemical products | 1.0023 | -0.66 | -0.661518 |
| Plastics and articles thereof (HS Code 39) | Production of rubber and plastic products | 1.0056 | -1.62 | -1.629072 |
| Rubber and articles thereof (HS Code 40) | Production of rubber and plastic products | 0.8823 | -1.93 | -1.702839 |
| Articles of iron or steel (HS Code 73) | Production of finished metal products, except machinery and equipment | 0.896 | -0.71 | -0.63616 |
| Tools and implements (HS Code 82) | Production of electrical equipment | 1.00221 | -0.31 | -0.3106851 |
| Electrical machinery and equipment… (HS Code 85) | Production of computers, electronic and optical products | 0.239 | -1.16 | -0.27724 |
| **Total expected decline in the dynamics of GRP** | | | | **-5.6089001** |
| **Total reduction in GRP (calculated for all analyzed sectors of the economy)** | | | | **-6.9095251** |

*Calculated as the value of the regressor of formula 4 and the predicted value of the decline in the growth dynamics in the economic sector.

Source: developed by the authors

**Table 5.** Gross regional product by the constituent entities of the Russian Federation (2021) (in current prices; million rubles). Calculated based on critical imports (group 2.2) which are difficult to replace with supplies from friendly countries due to the low values of current supplies

| No. | Constituent entity | GRP | Share in GDP, % | Estimated growth rates of GRP, % | Estimated rate of decline in GDP, % |
|---|---|---|---|---|---|
| 1 | Republic of Bashkortostan | 2,000,037.9 | 1.7 | -1.08 | 0.018 |
| 2 | Republic of Mari El | 221,991.0 | 0.18 | -0.39 | 0.001 |
| 3 | Republic of Mordovia | 298,023.1 | 0.25 | -0.71 | 0.002 |
| 4 | Republic of Tatarstan | 3,454,700.0 | 2.85 | -1.3 | 0.048 |
| 5 | Udmurt Republic | 841,936.2 | 0.69 | -0.84 | 0.006 |
| 6 | Chuvash Republic | 392,957.9 | 0.32 | -0.71 | 0.002 |
| 7 | Perm Krai | 1,740,525.3 | 1.44 | -1.21 | 0.017 |

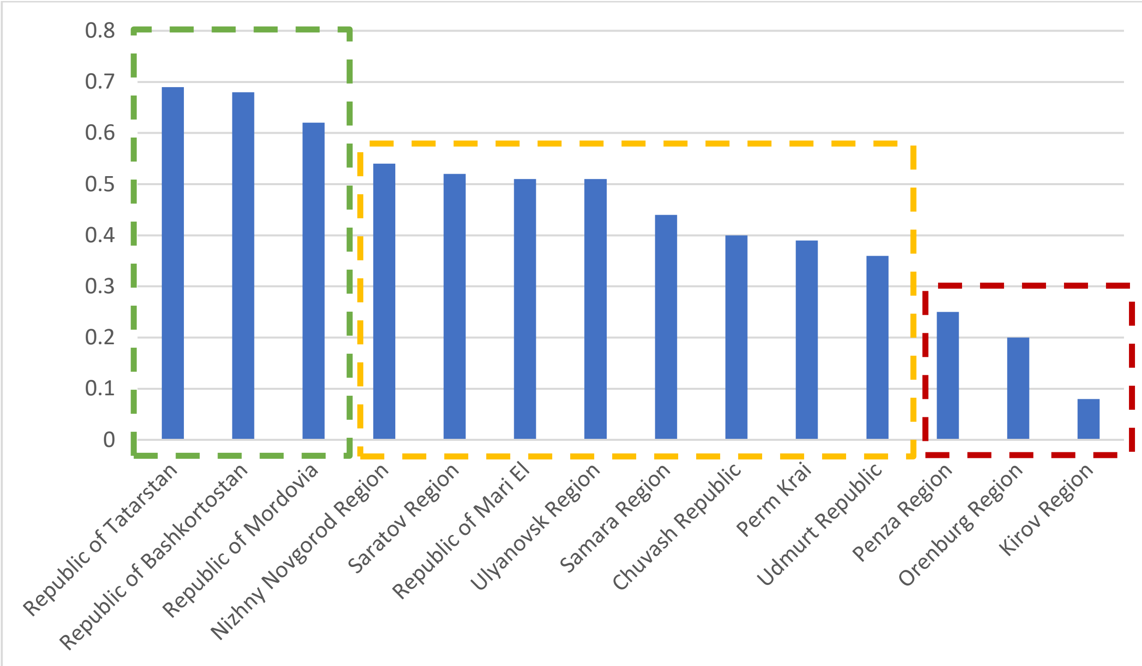
| No. | Constituent entity | GRP | Share in GDP, % | Estimated growth rates of GRP, % | Estimated rate of decline in GDP, % |
|---|---|---|---|---|---|
| 8 | Kirov Region | 481,407.0 | 0.40 | -0.52 | 0.002 |
| 9 | Nizhny Novgorod Region | 1,888,121.4 | 1.56 | -1.59 | 0.025 |
| 10 | Orenburg Region | 1,394,280.3 | 1.15 | -0.68 | 0.008 |
| 11 | Penza Region | 537,290.0 | 0.44 | -0.49 | 0.002 |
| 12 | Samara Region | 2,122,537.2 | 1.75 | -1.66 | 0.029 |
| 13 | Saratov Region | 1,005,800.9 | 0.83 | -0.95 | 0.008 |
| 14 | Ulyanovsk Region | 498,806.3 | 0.41 | -1.09 | 0.004 |
| | **GDP of Russia** | **121,182,987.5** | **100.0** | | **0.173** |

Source: developed by the authors based on the Federal State Statistics Service data from Kuznetsova (2023) and Seliverstov (2013)



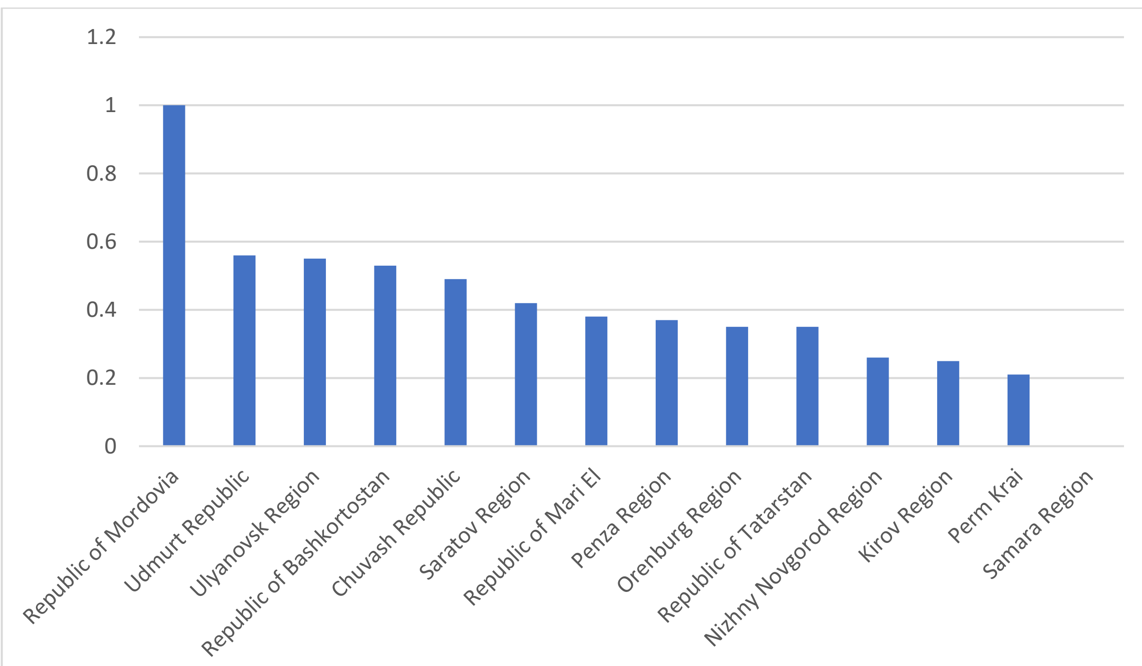
Having determined the values that assess the vulnerability of the constituent entities of the Volga Federal District to import restrictions, we present the parameters characterizing the efficiency of their recovery with due regard to the impact of external shock impulses following the proposed research algorithm (Figure 2).

In conformity with the proposed approach, which involves comparing the predicted value of the analyzed indicator by linear regression with its actual level in the post-crisis (recovery) period, we implemented the corresponding calculations. The results of assessing the integral values (*R*integral) of the resilience index of regions by the synthesized parameter of performance resilience based on the arithmetic mean of the partial values of the normalized analyzed indicators (*Ri*norm) are presented in Figures 5 and 6.




Source: calculated by the authors

**Figure 5.** Integral index of efficiency of restoration of the constituent entities of the Volga Federal District by the parameter "Quality of life of the population of the region" (*Ri*norm$_{\text{quality of life}}$) (in descending order)



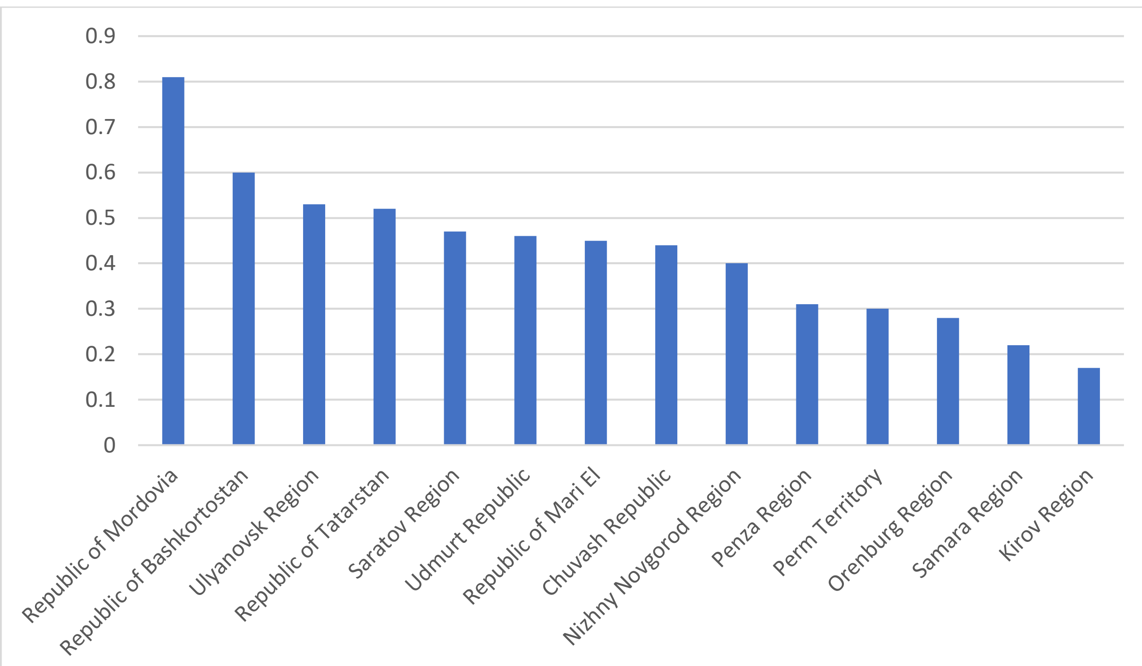

Source: calculated by the authors based on data from the Unified Interdepartmental Statistical Information System (n.d.)

**Figure 6.** Integral index (*R*integral) of recovery efficiency of the constituent entities of the Volga Federal District for the parameter "Budget sustainability" (*Ri*norm$_{\text{budget sustainability}}$)

The methodically calculated indices are within the range from 0 to 1. The proximity of the integral resilience index of a constituent entity of the Russian Federation means the maximum resilience in the direction under consideration. If the indicator tends to zero, the region's resilience in terms of recovery efficiency in the context of a crisis is weak compared to other entities.



The results revealing the specific response of regional economic systems to external sanction shocks in the context of two manifestations of resilience (quality of life of the region's population; budget efficiency) lay the basis for constructing the integral resilience index for performance resilience. This research stage was based on the assessment of the geometric mean value of the obtained partial indices of resilience. The calculation results are presented in Figure 7.




Source: calculated by the authors based on data from the Federal State Statistics Service, the Unified Interdepartmental Statistical Information System

**Figure 7.** Integral values of the resilience index of the constituent entities of the Volga Federal District (R integral)

According to the proposed research algorithm, the estimates obtained allow us to move on to the resulting estimates and conclusions that reveal the specific formation of system-forming elements of resilience in the regions.

In conformity with the proposed tools (Figure 2), this process is implemented within the framework of constructing a matrix of distribution of the parameters of regional resilience in the direction of "Vulnerability" – "Performance Resilience". The results of testing this approach in the regions of the Volga Federal District are presented in Figure 8.

The coordinate space is divided based on the methods of cross-sectional data (the x-axis (potential for a decrease in the region's GRP as a result of the localization of critical imports): 0.93; the y-axis (performance resilience): 0.42).

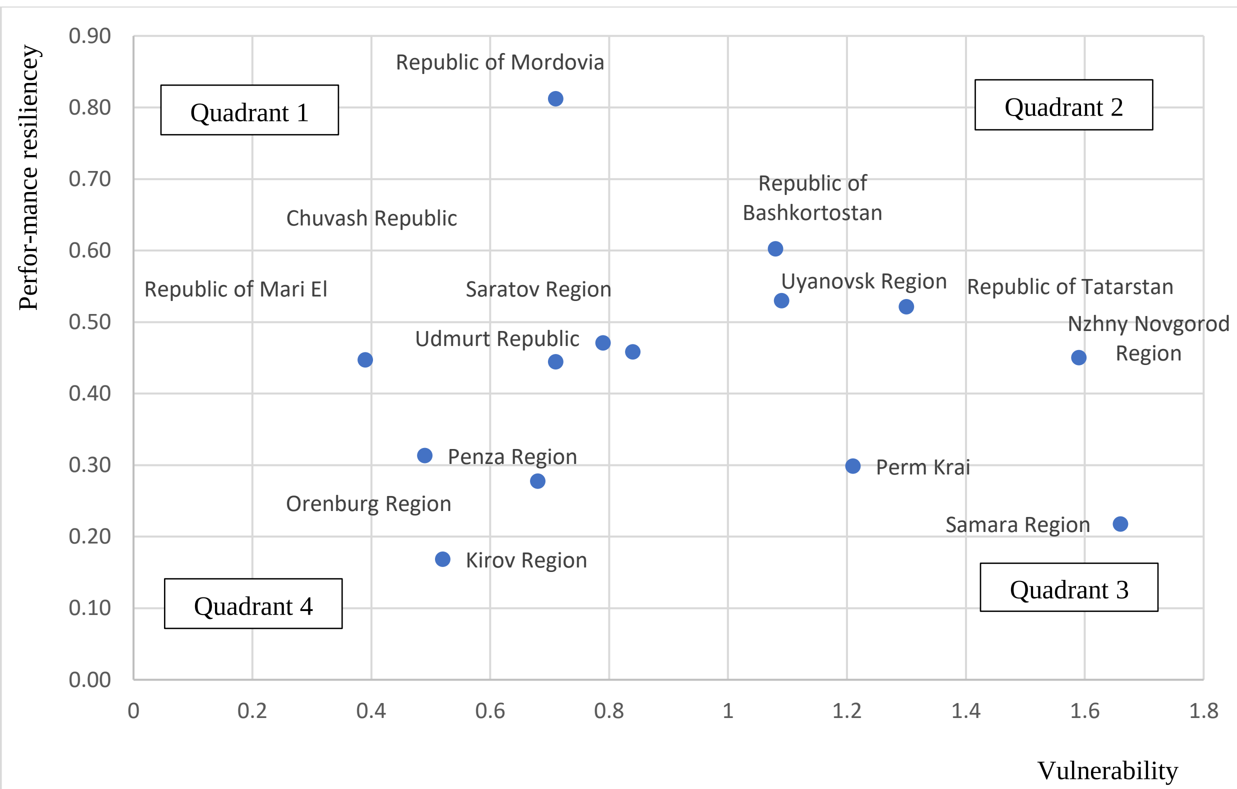



**Figure 8.** Matrix of distribution of resilience parameters of the constituent entities of the Volga Federal District in the direction of "Vulnerability" – "Performance Resilience"

Source: developed by the authors

The results reveal the features of the resilience of the constituent entities of the Volga Federal District in the direction of searching for intersections of parameters that assess, on the one hand, the vulnerability of the region in terms of the localization of critical imports and, on the other hand, its readiness to withstand macroeconomic shocks. Through comparison, we can group regional economic systems in accordance with the common features of their resilience. This contributes to understanding the prospects for sustainable development of regions in the context of systemic transformations and building an appropriate state policy to even regional deviations.

The analysis allows us to identify regions by the degree of their readiness to withstand macroeconomic external shocks. The assessments show that five regions out of 14 in the Volga Federal District are in the zone of increased risk in terms of resilience. The Perm Krai and Samara Region belong to the category of regional systems with a high level of foreign economic cooperation with unfriendly countries. Unlike the constituent entities included in quadrant 2, whose integration into export-import operations is also high, these entities demonstrate a moderate recovery potential in the context of systemic transformations in 2022. This may be due to several institutional reasons and structural features of their economy. Regardless of this analysis, the developed tools allow showing problem areas in regional development in the context of crisis manifestations. Through these assessments, the need for measures to increase the efficiency of such socioeconomic systems is also manifested. However, this type of strategic analysis requires additional attention and is not included in the tasks set in this study.

## Conclusion

Based on the study results, our conclusions predetermine the search for solutions to develop measures and mechanisms for reducing destructive consequences for regions in the context of macroeconomic shocks. Understanding the main parameters of resilience following its two key characteristics forms the potential for forecasting regional development and determines the methodological basis for the effective management of regional socioeconomic systems in the context of major transformations.

The proposed research toolkit can be supplemented and developed from the standpoint of the methodological and indicative base used in assessing the corresponding manifestations of regional resilience. Based on a dichotomous paradigm for studying meso-level economic systems' resilience, the proposed toolkit can form the core and methodological basis applicable to the subject and introduce a new impetus in resilience theory.



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