# STRUCTURAL ANALYSIS AND PREDICTIVE MODEL OF REGIONAL ECONOMIC GROWTH IN THE CONTEXT OF IMPORT LOCALIZATION

# ANÁLISE ESTRUTURAL E MODELO PREDITIVO DE CRESCIMENTO ECONÔMICO REGIONAL NO CONTEXTO DA LOCALIZAÇÃO DE IMPORTAÇÕES

# ANÁLISIS ESTRUCTURAL Y MODELO PREDICTIVO DE CRECIMIENTO ECONÓMICO REGIONAL EN EL CONTEXTO DE LOCALIZACIÓN DE IMPORTACIONES

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**Abstract.**

The article considers the import dependence of the Republic of Tatarstan in the structural context of imported product groups. The methodological basis is a descriptive analysis of empirical data characterizing the commodity structure of imports supplied to the region. Based on the assessments, the authors of the article have determined the bottlenecks that make the Republic of Tatarstan dependent on the import of goods. Economic and mathematical models have been constructed to assess the impact of the most critical imports supplied to the region on its economic sustainability. Furthermore, the study emphasizes the importance of balancing import substitution efforts with economic openness. Tatarstan's integration into global value chains, diversification of supplier countries, and strategies to reduce reliance on critical imports are vital for long-term economic sustainability.

**Keywords:** import substitution, economic growth, import dependence, region.

**Resumo**

O artigo considera a dependência das importações da República do Tartaristão no contexto estrutural dos grupos de produtos importados. A base metodológica é uma análise descritiva de dados empíricos que caracterizam a estrutura de commodities das importações fornecidas à região. Com base nas avaliações, os autores do artigo determinaram os gargalos que tornam a República do Tartaristão dependente da importação de mercadorias. Modelos económicos e matemáticos foram construídos para avaliar o impacto das importações mais críticas fornecidas à região na sua sustentabilidade económica. Além disso, o estudo enfatiza a importância de equilibrar os esforços de substituição de importações com a abertura económica. A integração do Tartaristão nas cadeias de valor globais, a diversificação dos países fornecedores e as estratégias para reduzir a dependência de importações críticas são vitais para a sustentabilidade económica a longo prazo.

**Palavras-chave:** substituição de importações, crescimento económico, dependência de importações, região.

**Resumen**

El artículo considera la dependencia de las importaciones de la República do Tartarista en el contexto estructural de dos grupos de productos importados. Una base metodológica es un análisis descriptivo de datos empíricos que caracterizam a estrutura de commodities das importações fornecidas à região. Con base en las evaluaciones, los autores del artículo determinan los gargalos que tornan a la República do Tartaristão dependiente de la importación de mercados. Modelos económicos y matemáticos foram construidos para evaluar el impacto de las importaciones y las críticas forjadas en la región de su sustentabilidad económica. Además, el estudio enfatiza la importancia de equilibrar los esfuerzos de sustitución de importaciones con una abertura económica. La integración del Tartaristão nas cadeias de valor global, la diversificación de los países fornecedores y las estrategias para reducir la dependencia de las importaciones son críticas para la sustentabilidad económica y el largo plazo.

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**Palavras-chave:** sustitución de importações, crecimiento económico, dependencia de importações, região.

## 1. INTRODUCTION

Import substitution is an integral part of the economic development strategy of most countries, including the Russian Federation. Despite the results, the import dependence of the constituent entities of the Russian Federation, especially industrial regions, is high and requires a detailed analysis of empirical data to determine and justify the best mechanisms for implementing the import substitution policy.

Considering theoretical aspects that determine the mechanisms and objectives of implementing the import substitution policy, it is necessary to highlight two main approaches: new Keynesian and structuralist (Simachev et al., 2016). The first approach is based on the need to replace imported products and ensure the development of local industries as part of achieving the goal of sustainable economic growth (Chenery & Syrquin, 1975; Eshtokin, 2021; Pokrovskaia et al., 2022). The second approach assumes the need to implement an import substitution policy to overcome the economic import dependence of peripheral countries on industrialized ones (Cristobal, 1990; Franko, 2007; Pashina, 2019; Prebisch, 1950). The structuralist approach is most often criticized since it is orthodox in nature, expressed in the attempt of states to bridge the gap from industrialized countries at any cost and thereby achieve self-sufficient economic development (Baer, 1972; Bruton, 1998; Moiseev, 2020). However, it neglects the most important aspects of the international division of labor, which often forms competitive advantages for national economic systems.

Currently, the policy of import substitution is implemented in both developing and developed countries. For developing countries, it ensures technological sovereignty and intensifies the processes of reducing the gap with world leaders (the structuralist concept). For developed countries, it is most often implemented with the aim of strengthening national economic priorities related to supporting local producers. The best example is the recent policy of the United States, which promotes the interests of national producers as part of the transfer of foreign production to the country (the new Keynesian concept of economic stimulation). In economic terms, this process is called reshoring (Simachev et al., 2016). The greatest impetus

for its implementation was formed during the administration of D. Trump in 2014-2019.

In Russia, import substitution and technological sovereignty have been carefully considered in recent years. A significant acceleration occurred in introducing restrictions on the national economy starting in 2022. Based on the theoretical basis for its implementation, it is necessary to state the dominance of the structuralist state policy of import substitution. Stimulating the processes of reducing import dependence fits into the strategy of creating domestic analogs of foreign products and strengthening technological sovereignty.

Despite the measures implemented in Russia in the field of import substitution, there are still no large-scale results (Guliev, 2020; Ovsiichuk & Pavlova, 2022; Shpilkina et al., 2022). This is especially true for industrial regions. In 2022, the dependence of some regional economic systems on the supply of foreign products and services was very high. In this regard, a crucial task is to identify import dependence on a regional basis to implement adaptive import substitution strategies corresponding to real needs.

The article aims to empirically analyze the import dependence of regional economic systems (as exemplified by the Republic of Tatarstan) and identify the most popular areas of import substitution policy. The objective predetermines the need to solve the following tasks:

- To assess the dependence of Tatarstan on the supply of foreign goods, technologies, and services;
- To conduct a structural analysis of imports into the region;
- To analyze the most vulnerable positions of the region in terms of its dependence on imports of critical foreign goods;
- To use methods for constructing non-linear functions and build models that assess the impact of critical imports into the regional group on the dynamics of GRP;
- To develop a concept for the implementation of import substitution mechanisms with due regard to the identified bottlenecks that increase the risks of disrupted economic growth.

## 2. METHODS

The methodological basis for studying the impact of restrictions on the imports of goods and raw materials is the descriptive analysis of data from the Federal Customs Service, the Federal State Statistics Service, and territorial bodies of the Federal State Statistics Service, as

well as methods of systematization, aggregation, and data decomposition. The most important methodological tool is used to identify future patterns in the sustainable development of the regional economy and develop directions for implementing the import substitution policy based on the new Keynesian doctrine and the obtained empirical data.

Figure 1 visualizes the algorithm for studying the sustainable development of the regional economic system in the context of systemic transformations, i.e., restrictions on the supply of foreign goods and raw materials and disruption of logistics and cooperative external relations.
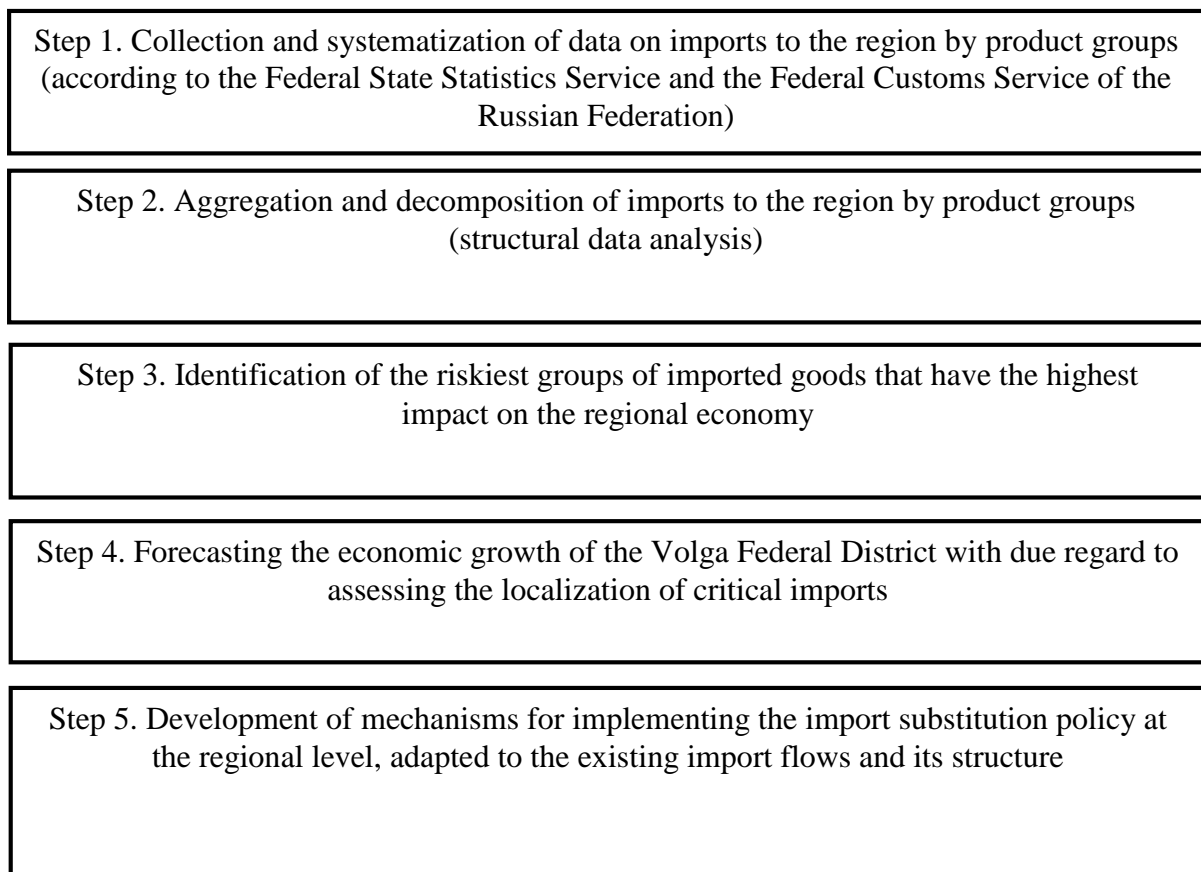
> **Step 1.** Collection and systematization of data on imports to the region by product groups (according to the Federal State Statistics Service and the Federal Customs Service of the Russian Federation)

> **Step 2.** Aggregation and decomposition of imports to the region by product groups (structural data analysis)

> **Step 3.** Identification of the riskiest groups of imported goods that have the highest impact on the regional economy

> **Step 4.** Forecasting the economic growth of the Volga Federal District with due regard to assessing the localization of critical imports

> **Step 5.** Development of mechanisms for implementing the import substitution policy at the regional level, adapted to the existing import flows and its structure

**Figure 1.** Algorithm for structural analysis and study of the region's import dependence and development of forecast estimates of economic growth
Source: compiled by the authors

## 3. RESULTS AND DISCUSSION

According to the customs statistics, the foreign trade turnover in Tatarstan amounted to

17 billion 545 million USD in 2021, i.e., it increased by 42% compared to 2020. Tatarstan accounts for about a third (28.5%) of the total trade turnover of the Volga Federal District. The exports increased by 38.4% and reached 12 billion 73 million USD, while the imports grew by 50.3% and equated to 5 billion 472 million USD (Figure 2).
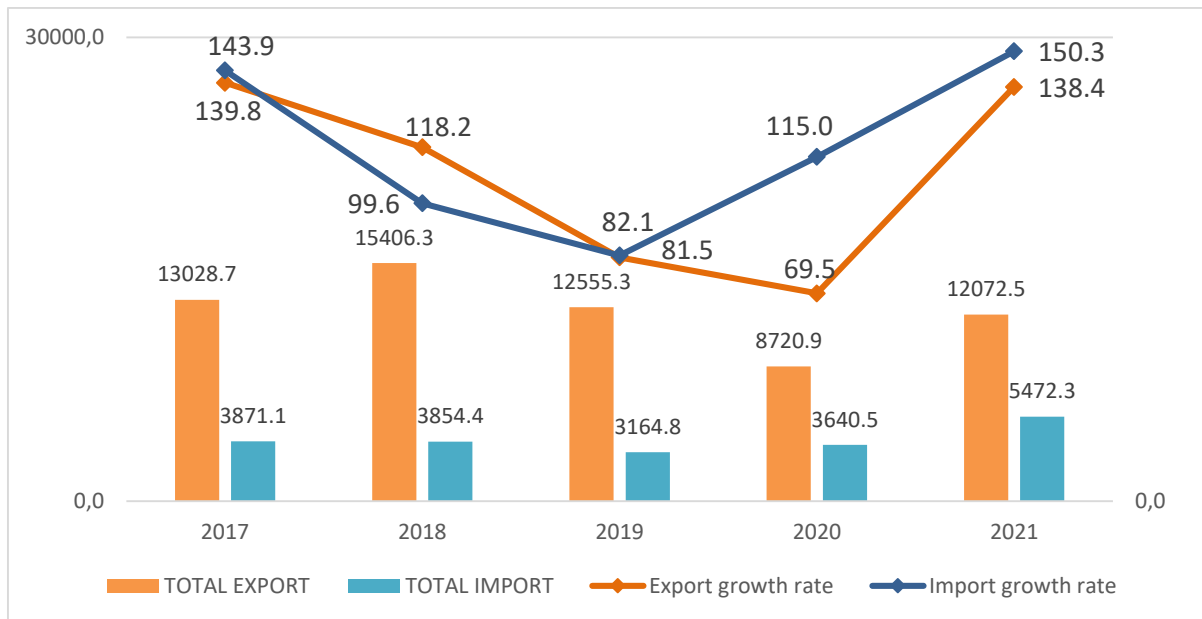


**Figure 2.** Dynamics of exports and imports of the Republic of Tatarstan, million dollars
Source: Volga Customs Department (2022)

As in previous years, the trade balance in Tatarstan for 2021 was positive and amounted to 6 billion 600 million USD. From 2017 to 2021, imports grew at a faster pace than exports (203% vs. 130%).

In 2021, 175 countries were trade partners of Tatarstan, including 150 countries for exports and 134 countries for imports (Figure 3).
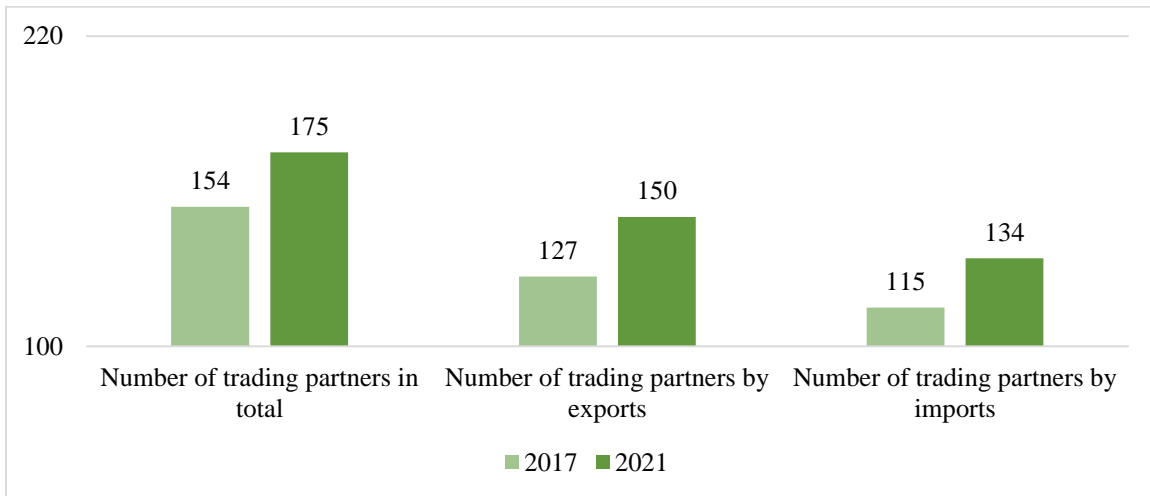
**Figure 3.** Number of trading partners of the Republic of Tatarstan, including non-CIS states and former Soviet republics

Source: Volga Customs Department (2022)

At the end of 2021, the main trading partners were non-CIS countries. Their share of trade turnover reached 88%, including 85% in exports and 94% in imports. For comparison, the same values were 87, 86, and 90% in 2017, respectively (Figure 4).
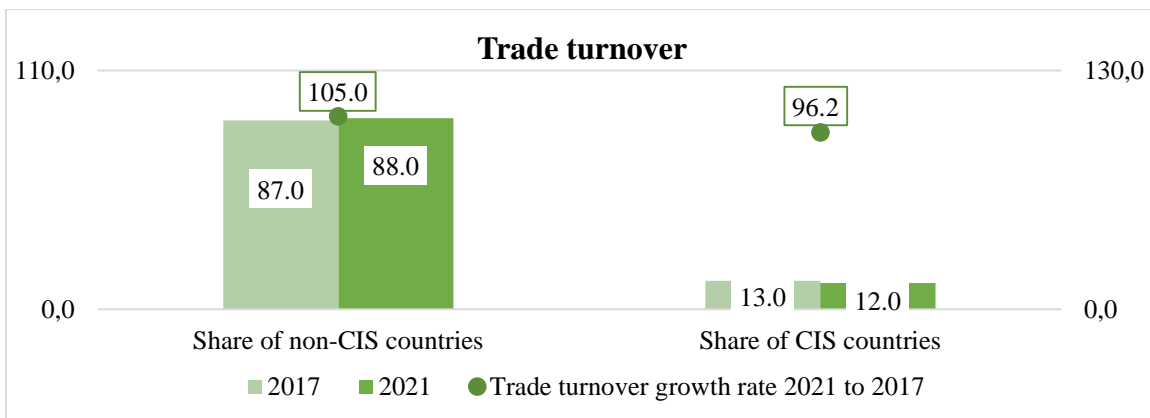
**Figure 4.** Structure of foreign trade in the Republic of Tatarstan by country, % of total
Source: Volga Customs Department (2022)

If we consider the trade turnover with non-CIS countries, imports grew at a faster pace than exports. From 2017 to 2021, exports from non-CIS countries increased by 1.3 times and imports by 2.1 times. The trade balance remains positive (Figure 5, Table 1).
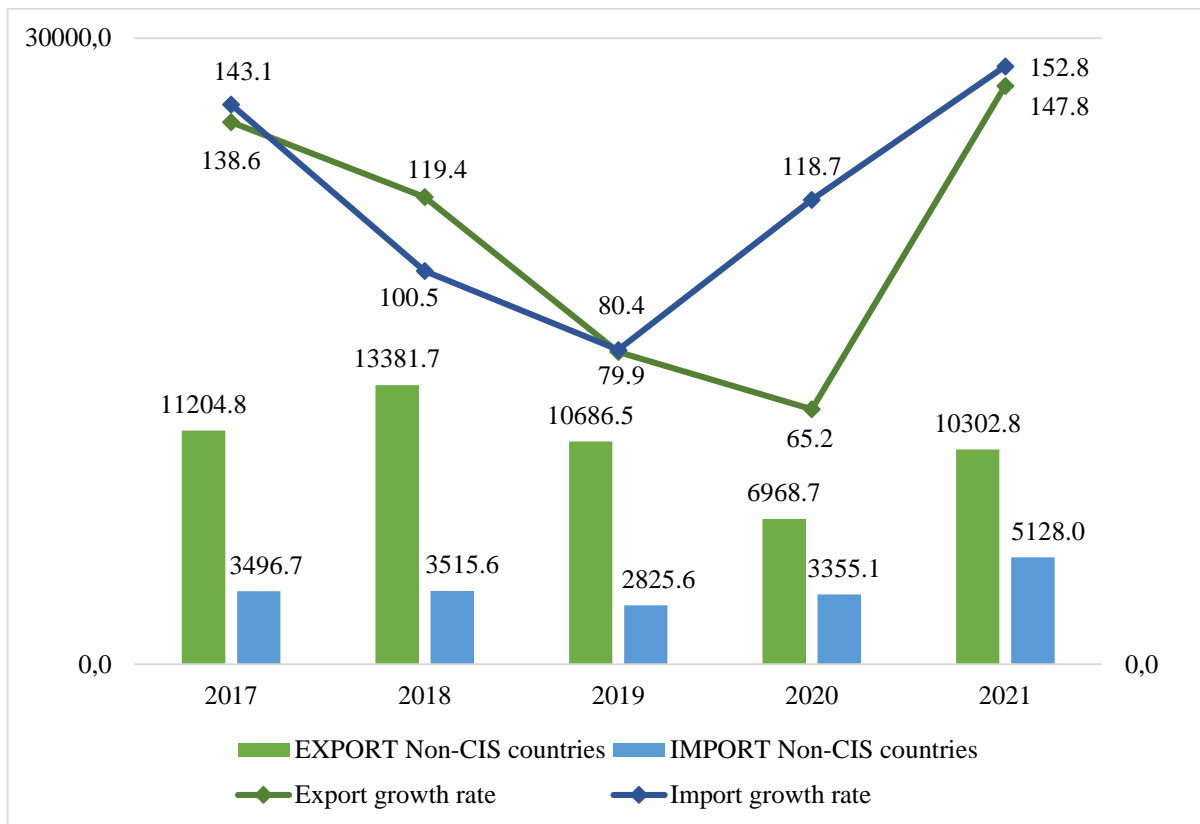
**Figure 5.** Dynamics of exports and imports of the Republic of Tatarstan with non-CIS countries, million dollars

Source: Volga Customs Department (2022)

As for the trade turnover of Tatarstan with the CIS countries, the growth rate of exports outpaced imports. In the period under review, exports to the CIS countries increased by 44% and imports by 40%. The trade balance is positive (Figure 6, Table 1).
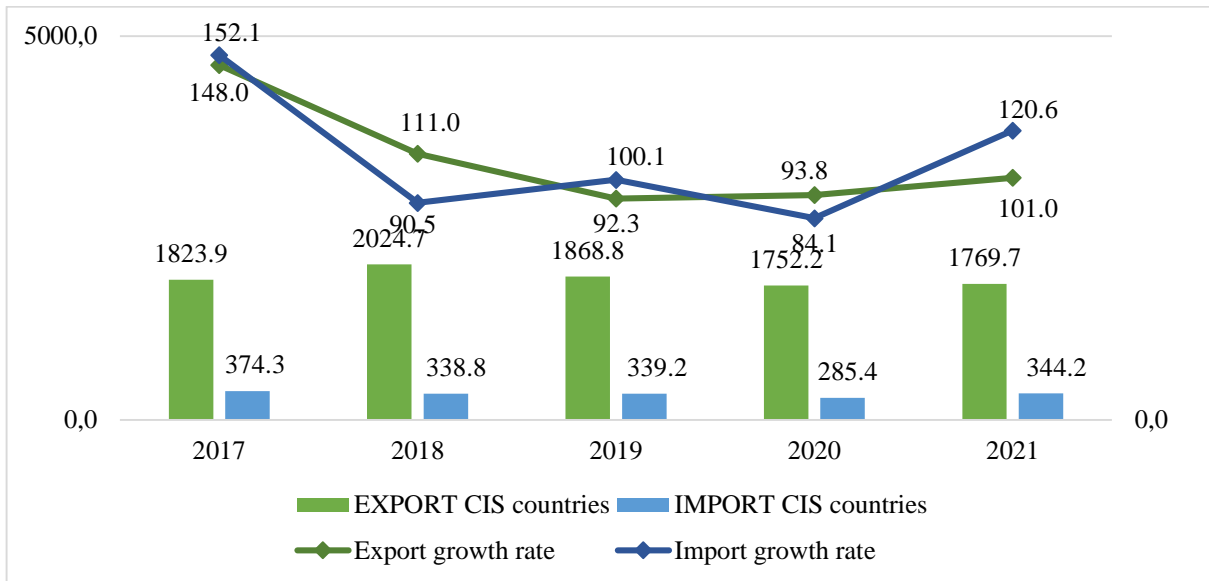
**Figure 6.** Dynamics of exports and imports of the Republic of Tatarstan with the CIS countries, million dollars

Source: Volga Customs Department (2022).

**Table 1**

Trade turnover of the Republic of Tatarstan, million USD

|  | 2017 | | | | 2021 | | | |
|---|---|---|---|---|---|---|---|---|
|  | Export | Import | Turnover | Balance | Export | Import | Turnover | Balance |
| **Total** | 13,028.7 | 3,871.1 | 16,899.7 | 9,157.6 | 12,072.5 | 5,472.3 | 17,544.8 | 6,600.3 |
| CIS countries | 1,823.9 | 374.3 | 2,198.2 | 1,449.5 | 1,769.7 | 344.2 | 2,113.9 | 1,425.4 |
| Non-CIS countries | 11,204.8 | 3,496.7 | 14,701.5 | 7,708.1 | 10,302.8 | 5,128.0 | 15,430.9 | 5,174.8 |

Source: Volga Customs Department (2022)

At the end of 2021, the share of exports in trade turnover with non-CIS countries amounted to 66.8% (compared to 76.2% in 2017). Accordingly, the share of imports increased by 9.4% during the period under review and amounted to 33.2% (Table 2).

**Table 2**
Structure of trade turnover in the Republic of Tatarstan

|  | Share of exports in trade turnover, % | | Share of imports in trade turnover, % | |
|---|---|---|---|---|
|  | 2017 | 2021 | 2017 | 2021 |
| **Total** | **77.1** | **68.8** | **22.9** | **31.2** |
| CIS countries | 83.0 | 83.7 | 17.0 | 16.3 |
| Non-CIS countries | 76.2 | 66.8 | 23.8 | 33.2 |

Source: Volga Customs Department (2022)

In 2021, the largest trading partners of Tatarstan were as follows:

**Where exporting**: Poland (21.6%); Netherlands (14.9%); Germany (5.9%); Slovakia (5.8%); Belarus (5.3%); Kazakhstan (4.8%); Hungary (3.0%); France (2.7%); Finland (2.0%); Bulgaria (1.9%); Turkey (1.8%); Denmark and Switzerland (1.7% each); Latvia, India, and Iran (1.5% each); Estonia (1.4%); Lithuania, China, and Uzbekistan (1.3% each); Belgium, Italy, and United Kingdom (1.2% each); Ukraine (1.1%); United States (1.0%).

**Where importing**: Germany (27.7%); China (15.8%); United States (8.3%); Turkey (6.2%); Italy (5.0%); Belarus (4.0%); Poland (2.1%); South Korea (2.0%); Belgium (1.9%); Czech Republic, France, and United Kingdom (1.8% each); Japan (1.7%); India and Mexico (1.6% each); Austria (1.5%); Canada (1.3%); Hungary (1.2%); Netherlands (1.1%); Spain and Slovakia (1.0% each).

More than half of the import products supplied to Tatarstan are machinery, equipment, and vehicles (FEACN groups 84-90; from 65 to 71% between 2017 and 2021), chemical products and rubber (FEACN groups 28-40; from 14 to 19%), metals and articles made therefrom (FEACN groups 72-83; from 6.2 to 7.0% in 2017-2021), and food products and agricultural raw materials (FEACN groups 01-24; from 1.2 to 1.9% in 2017-2021) (Figure 7).
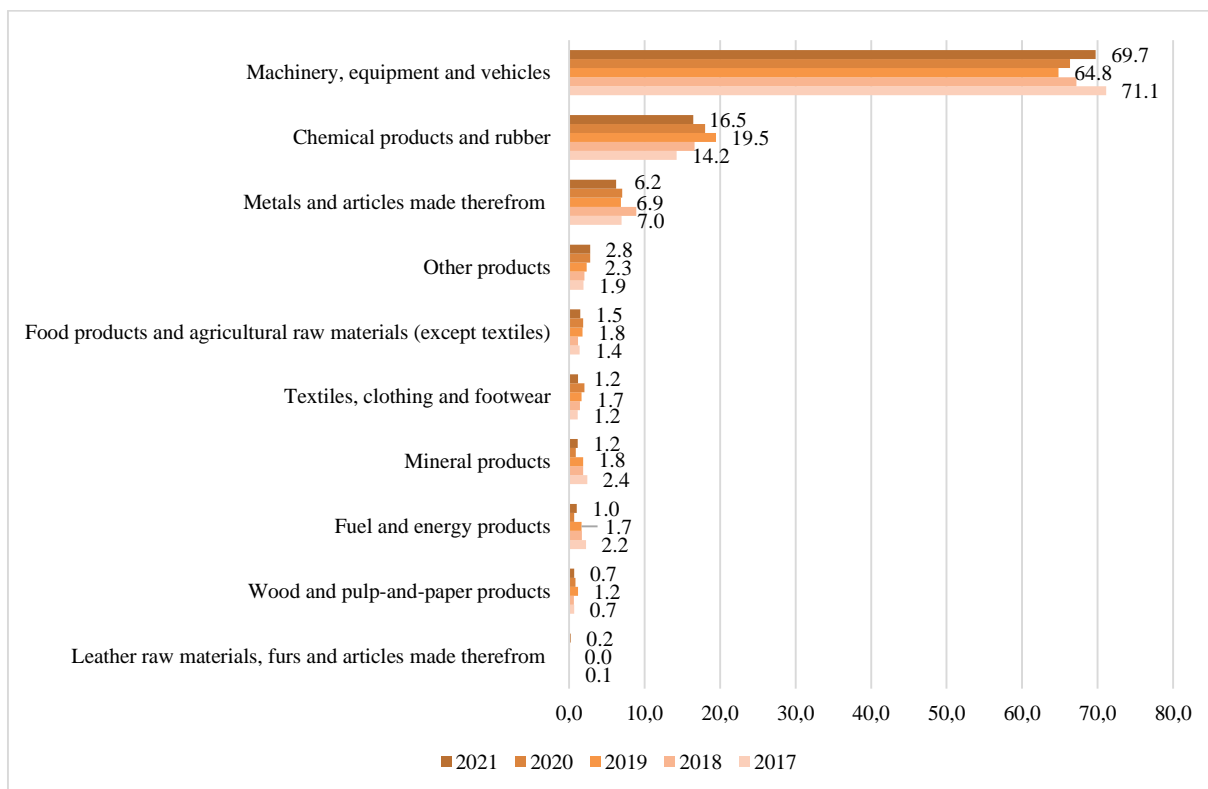
**Figure 7.** Import structure of the Republic of Tatarstan, % of total
Source: Volga Customs Department (2022)

The main imports of Tatarstan are 14 product groups, which account for over 90% of the region's imports (Figure 8):

- ✓ equipment and mechanical appliance (group 84) – 35.9%;
- ✓ means of land transport, except railway or tram (group 87) – 22.7%;
- ✓ electrical machines, equipment, and spare parts (group 85) – 8%;
- ✓ plastics and articles made therefrom (group 39) – 6.8%;
- ✓ organic chemical compounds (group 29) – 4.0%;
- ✓ ferrous products (group 73) – 3.1%;
- ✓ India rubber, synthetic rubber, and articles made therefrom (group 40) – 2.3%;
- ✓ optical instruments and devices (group 90) – 2.0%;
- ✓ furniture, bedding, and mattresses (group 94) – 1.9%;
- ✓ other chemical products (group 38) – 1.8%;
- ✓ mineral fuels, mineral oils, and products of their distillation; bituminous substances;

mineral waxes (group 27) – 1.0%;

✓ other products made of base metal (group 83) – 1.0%;

✓ aircraft, spacecraft, and spare parts (group 88) – 0.9%.

✓ tools, implements, cutlery, spoons and forks, and spare parts made of base metal (group 82) – 0.8%;
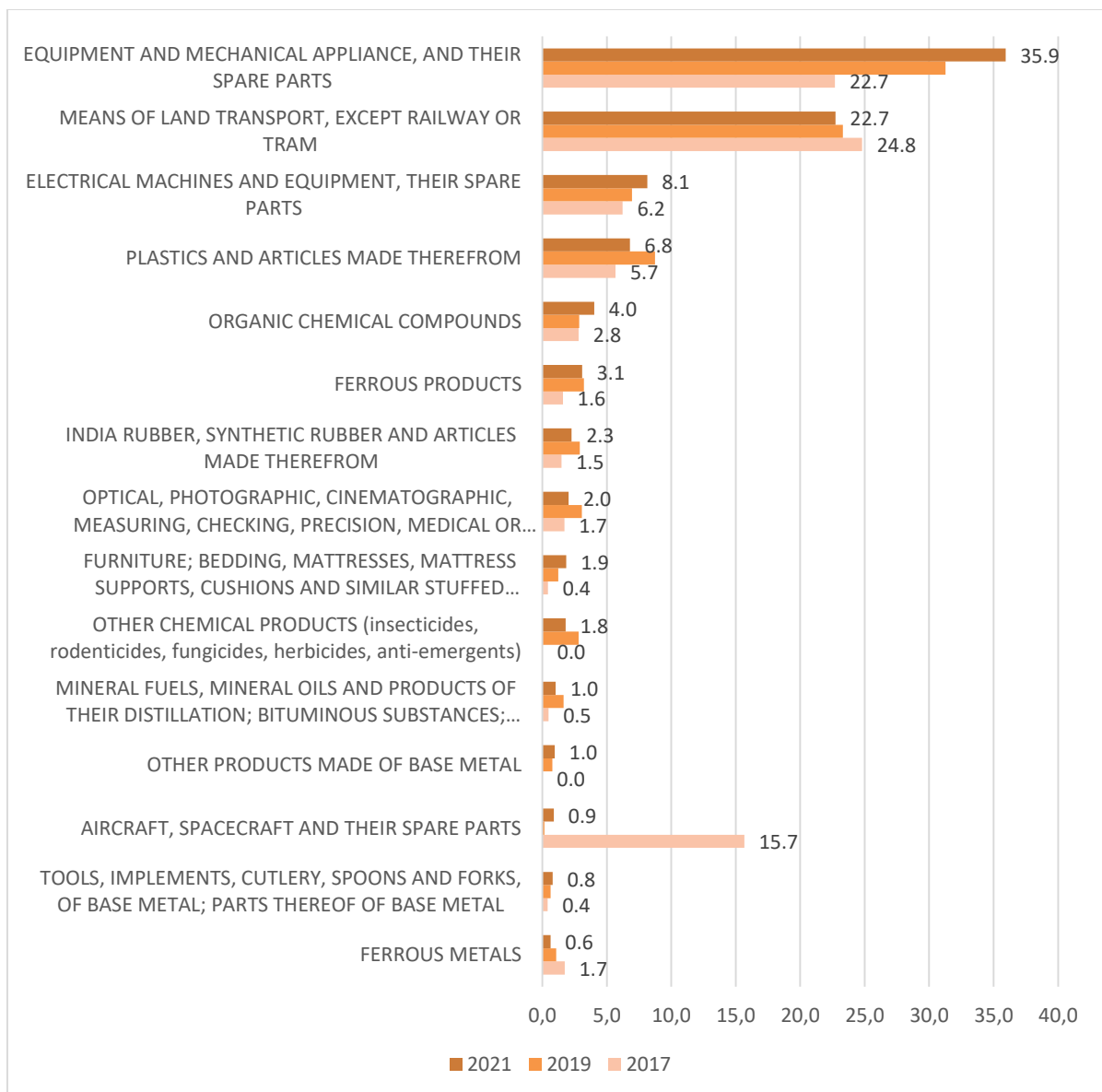
✓ ferrous metals (group 72) – 0.6%.



**Figure 8.** Main product groups imported to the Republic of Tatarstan, % of the volume of imports of the Republic of Tatarstan

Source: Volga Customs Department (2022)

The heterogeneous dependence on imports of individual product groups requires appropriate attention from government authorities and stipulates the need to develop adaptive and selective mechanisms for stimulating import substitution. The implementation of universal solutions common to all import-dependent sectors of the economy is vulnerable and limited. There is a need for fine-tuning government support measures with due regard to the most vulnerable positions characterized by the dependence of the region's economy on the imports of product groups with the largest share in overall supplies. Thus, the priorities of state support should be product groups supplied from the so-called unfriendly countries, which accounted for about 60% in Tatarstan at the end of 2021.

When developing an import substitution policy, it is necessary to conduct the structural analysis of data to enhance the adaptability of macroeconomic measures and to forecast the likely reaction to certain state regulatory measures in the field of import substitution policy. The idea of a massive reduction in the share of imports in the context of external pressure does not seem optimal.

In addition, an import substitution policy should be guided not only by quantitative indicators that reflect the volume of imports and their share in the economy, but also by qualitative parameters of dependence on the supply of foreign products. In methodological terms, an import substitution policy should consider gross data and focus on the micro level, i.e., at the level of product groups and items. This will allow identifying critical positions on import substitution, which will help determine the priorities of the state.

The analysis of imports in terms of their product range reveals the most popular directions for import supplies to the region and forms the basis for the development of government program measures in the implementation of adaptive and effective import substitution mechanisms.

Our results demonstrate a high level of import dependence of Tatarstan in several product groups. These are machines, equipment, and vehicles, chemical products, metals and articles made therefrom, food products, and agricultural raw materials.

Regarding the most popular items for importing, the riskiest groups requiring state support are:

I. Equipment and mechanical devices (35.9% of total imports), including:

- Machines, industrial or laboratory equipment with electrical or non-electric heating (excluding furnaces, chambers, and other equipment of heading 8514) – 21%;
- Conventional compression ignition engines – 17%.

II. Means of land transport, except railway or tram (22.7%), including:

- Spare parts and accessories of motor vehicles (88.4% of the total volume of this product group);
- Tractors (8.1%)
- III. Electrical machinery and equipment (8.1%), including:
- Insulated wires (including enameled or anodized), cables (including coaxial cables), and other insulated electrical conductors, whether or not fitted with connectors; fiber optic cables (18% of the total import volume of this product group);
- Boards, panels, consoles, desks, cabinets, and other bases, equipped with two or more apparatus (17%);
- Lighting or signaling equipment; electrical, (excluding articles of heading no. 8539), windscreen wipers, defrosters, and demisters; parts used in bicycles or motor vehicles (9.3%)
- IV. Plastics and articles made therefrom (6.8%), including:
- Ethylene polymers in primary forms (20.3% of all imports of this product group);
- Polyacetals, other polyethers, and epoxide resins in primary forms; polycarbonates, alkyd resins, polyallyl esters, and other polyesters in primary forms (18.5%);
- Plates, sheets, film, foil, tape, strip, and other flat shapes of non-cellular plastics, not reinforced, laminated, supported, or similarly combined with other materials (11.2%).

Our results show the region's most vulnerable positions from import supplies and lay the foundation for the simulation modeling of its impact on the sustainability of economic growth. From the methodological perspective, the problem is solved through constructing non-linear logarithmic models, where exogenous factors are parameters characterizing the range of import products that hold the most significant positions in the total volume of supplies from abroad. The gross regional product (GRP) of Tatarstan acts as an endogenous factor.

The sequence of calculations and estimates based on them are presented below. Dynamic series for 2010-2021 were used as the database. Priority was given to models that consider the non-linear nature of the relationship between critical imports and GRP growth parameters. This approach corresponds to the opinions of several scholars (Kuznetsova & Dmitrieva, 2022; Kwon, 2010; Shatskii, 2022; Vatolkina & Gorbunova, 2015).

The estimates and logarithmic model are demonstrated based on the relationship between the supplies of machinery and industrial or laboratory equipment to Tatarstan and the GRP. The results of constructing the model are presented in formula 1:

$$LnGRP = Ln(3.16) + 0.0112 * LnM \quad (1)$$

(t-statistic = 4.824; P-value for an exogenous factor is 0.0019)

where:

GRP, billion rubles;

M refers to machines and industrial or laboratory equipment supplied to the region, billion USD.

Having transformed the resulting equation from a logarithmic form into a power function, the following logarithmic model was constructed:

$$GRP = 1.145 * M^{0.0112} \quad (2)$$

According to the analysis, a reduction in imports of the commodity code "Machinery, industrial or laboratory equipment (FEACN code 84)" by 1% creates preconditions for a slowdown in the gross regional product of the Volga Federal District by 0.0112%. Thus, if we consider a negative scenario of a complete ban on foreign supplies of the goods in question (-100% of current values), the expected decrease in GRP might reach 1.12%.

Guided by the research algorithm, similar estimates were obtained for other commodity code listings supplied abroad and falling under the category of critical imports. Table 3 presents the main results of the calculations. If the equation for the required dependencies did not correspond to the criteria of statistical significance, the import product range under study was excluded from the analysis.

**Table 3**
Growth dependence of the gross territorial product of the Volga Federal District on critical imports

| No. | Commodity code listing | Regressor value in logarithmic function |
|---|---|---|
| I. | – Machinery, industrial or laboratory equipment... (21% of the total import volume of the considered enlarged group) | 0.0112 |
| | – Conventional compression ignition engines (17.0%) | 0.0039 |
| II. | – Spare parts and accessories of motor vehicles (88.4% of the total import volume of the considered enlarged group) | 0.0059 |
| | – Tractors (8.1%) | 0.0009 |
| III. | – Insulated wires (18.0% of the total import volume of the considered enlarged group) | 0.0011 |
| IV. | – Plates, sheets, film, foil, tape, strip, and other flat shapes of plastics (11.2% of the total import volume of the considered enlarged group) | 0.0009 |
| | – Polyacetals, other polyethers, and epoxide resins in primary forms (18.5%) | 0.0021 |
| | – Ethylene polymers in primary forms (20.3%) | 0.0024 |
| TOTAL | | 0.0284 |

Source: Volga Customs Department (2022)

These estimates demonstrate a potential drop in the GDP of Tatarstan in the case of a complete ban on critical imports by 2.84%. Although the main suppliers of these products were countries that imposed sanctions on the Russian economy, it is an unlikely scenario. This is due to an extensive list of mechanisms that help localize supplies of these product groups in the Volga Federal District: parallel imports or changes in the geography of supplies.

The obtained estimates determine the state priorities in the area of supporting sustainable regional development and import substitution. The use of standard solutions (beyond the control of the most critical groups of imported goods) can undermine the effectiveness of government policy aimed at reducing import dependence in the region. Thus, there is a need for the controlled adjustment of mechanisms and measures to stimulate import substitution, considering the specific features that have developed in the region.

The volume of import consumption does not necessarily mean a high level of import dependence. For example, a small share of product imports can be critical for the sustainable development of a particular industry and the economy if there are no analogs. When developing

an import substitution policy, it is necessary to be guided not only by cost and volume parameters but also by the essential characteristics of imports. Although imports of final and intermediate consumption goods, which have unique characteristics and no analogs, are rarely used in economic processes in the context of globalization, the quantitative parameters of dependence on imports lay the foundation for the implementation of an adaptive import substitution policy at the macro and meso levels.

While agreeing with the position of Ya. Dranev et al. (2014), it is worth mentioning that the policy of frontal import substitution aimed at maximizing added value in the country and focusing on the domestic producer has certain risks. First, they are associated with the restriction of the competitive environment and the swelling of the public sector against the private sector. The position of many Russian experts corresponds to this concept. It is determined by their desire to increase the level of technological sovereignty in the context of severe external pressure on the national economy. However, as international practice shows, an effective import substitution policy is associated with integration into global value chains, increasing economic openness, strengthening export potential, and attracting foreign investors. Considering the current situation in the Russian economy and limited transnational ties with several countries, which determine the increased risks of its sustainable development in the short and possibly medium term, it is crucial to find a reasonable balance between the desire for technological sovereignty and openness of the economy with due regard to a change in transnational supply chains and the creation of new international alliances (Falko et al., 2020; Simachev & Kuznetsov, 2014).

This position seems to be even more relevant since there are no domestic analogs for a wide range of goods and it is impossible to overcome import dependence within the framework of production reorientation in Russia. An emphasis in the import substitution policy should be laid on diversifying the geography of import supplies, changing supplier countries, and building up initiatives to reduce dependence on the most critical items. The policy of frontal import reduction will certainly be ineffective, impossible, and even destructive (Aksyanova et al., 2011; Safiullin et al., 2019).

## 4. CONCLUSIONS

The analysis of import dependence in the Republic of Tatarstan reveals a complex landscape of economic relationships and vulnerabilities. While the region boasts a positive trade balance and a significant increase in trade turnover, the rapid growth of imports poses challenges to its economic sustainability.

The study's economic and mathematical models provide valuable insights into the potential impact of import disruptions on the region's Gross Regional Product (GRP). These models underscore the need for proactive import substitution policies that consider the unique characteristics of each product group and prioritize those with the highest import dependence.

Furthermore, it is essential to strike a balance between import substitution and maintaining economic openness. Tatarstan's integration into global value chains, diversification of supplier countries, and efforts to reduce dependence on critical imports are crucial for long-term economic resilience.

### Acknowledgments

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