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SPATIAL FEATURES OF SECTORAL DEVELOPMENT

Industrial Dependence on Imports in the Russian Economy: Regional Projection

D. Yu. Zemlyansky[a], * and V. A. Chuzhenkova[a], **

[a] *Russian Presidential Academy of National Economy and Public Administration, Moscow, 119571 Russia*

**e-mail: zemlyanskiy-dy@ranepa.ru*

***e-mail: chuzhenkova-va@ranepa.ru*

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Abstract—The key factors in the regional consequences of the sanctions imposed in 2022 on certain sectors of the Russian economy were disruption of supply chains and industrial relations with foreign companies. The significance of these factors for the regional economy can be assessed in terms of the indicator of production dependence on imports. The study revealed that low production dependence on imports is typical of the least developed federal subjects, which are poorly integrated into the international trade system, as well as for individual federal subjects specializing in the extraction of fuel and energy minerals, for which the import of certain technologies is more important than the mass supply of equipment and accessories. A high level of dependence is manifested in three types of regions: those specializing in machinery industry; those with international ports; and those where large investment projects are being implemented with foreign capital and/or significant purchases of foreign equipment. Although in 2020–2021 production dependence on imports had almost no effect on the overall dynamics of industry, in 2022 this factor again became significant and led to deterioration in the situation in the group of regions with the highest level of dependence on imports. The strengthening of the negative impact of production dependence on imports was, among other things, a consequence of Russia's import substitution policy over the past decade, aimed at directly replacing the supply of imported goods to the Russian market, primarily by localizing the final stages of production. At the same time, the absence of an incentivization policy to increase competitiveness in export sectors by developing own technologies and production of technological equipment can lead to technological blockage and a long-term industrial crisis in regions with medium and low production dependence on imports.

Keywords: Russian regions, regional development, import of products, Russian industry, production dependence on imports, import substitution, sanctions

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INTRODUCTION AND FORMULATION OF THE PROBLEM

The pressure from sanctions on the Russian Federation, which increased in 2022, is affecting the economic development of most of its regions. As well, the degree of impact differs in line with their specifics (the structure of the economy, external relations, production and logistics chains of the largest enterprises, and the role of foreign business in the economy and the labor market).

The sanctions imposed on the Russian Federation are not strictly territorial. Therefore, it is necessary to evaluate, first of all, the regional consequences of sectoral decisions. A significant role in the regional differentiation of consequences is played by two groups of sanctions impacts:

(a) disruption of logistics chains and industrial relations, primarily due to restrictions on imports to Russia from unfriendly countries;[1]

(b) direct consequences of restrictions on foreign trade with unfriendly countries.

In spring 2022, the departure of foreign companies from Russia was also considered one of the main risks (Zemlyansky et al., 2022). However, as of the end of 2022–beginning of 2023, according to the information available at the time of preparation of the article, there were no sharp negative changes associated with this factor in most sectors and regions (with some exceptions). The reasons for this are, first, the gradual transfer of ownership of relevant assets to Russian management; second, the relatively mild nature of the depar-

[1] Decree of the Russian Federation Government no. 430 of March 5, 2022. http://government.ru/docs/44745/. Accessed April 13, 2022.

ture (long-term suspension of activities while maintaining wages for employees); and third, the restart of even closed foreign production facilities in a fairly short time.

The objective of the study was to assess the scale of dependence of the economies of Russian regions on the potential impact of sanctions related to disrupted supply chains and restrictions on imports from unfriendly countries.

Analysis of *production dependence on imports* (hereinafter referred to as PDI) was chosen as the main approach in the study. This indicator is calculated as the share of imports in the expenses of enterprises for raw materials, materials, purchased semifinished products and components for the production and sale of products (goods, jobs, services).

It is important to note that the approach makes you to determine the scale of dependence on imports. In addition to large-scale restrictions, dependence on technology imports can also manifest itself, leading to blockages as a result of limited access to updating or purchasing new technologies, which may not manifest itself in the volume or increased share of purchases.

REVIEW OF PREVIOUS RESEARCH

Among all studies devoted to the dependence of the economies of countries and regions on the import of components and parts, two areas stand out: studies on assessing the effectiveness of the import substitution policy and on analyzing import dependence.

World science has accumulated extensive experience in studying the issues of import substitution policy in different countries. Argentine economist R. Prebisch proposed the concept of import substitution for the first time using structuralist scientific approach. In his opinion, the essence of import substitution policy is to provide active state support to certain sectors of the economy of "peripheral" countries (primarily in the light, textile, and engineering industries) and limit the import of finished products in order to overcome lags and reduce dependence on their parent countries (Prebisch, 1950, 1984).

The process of import substitution began most actively in Latin America in the mid-20th century. The Latin American model represents import substitution in the classical sense: substitution of imported for domestic product. As economists in (Bruton, 1998; Kwon, 2010; Simachev, 2016) note, the results of the import substitution policy in Latin American countries in the 1950s–1960s were positive, particularly for countries that already had an established industrial complex (e.g., Brazil, Chile, Mexico, etc.) (Amsden, 2007). The main positive effects were an increase in the share of manufacturing in the structure of the economy, investment (primarily foreign), quality of life, and the formation of an urban middle class (Kirillov, 2014; Simachev et al., 2016; Vasil'eva, 2016; Vatolkina and Gorbunova, 2015).

However, the protracted nature of protectionist measures, the lack of real competition and the lagging behind in the quality of manufactured products led to the fact that in the mid-1970s and early 1980s, the positive effects of the import substitution policy in Latin American countries gradually began to decline (Shamkhalov, 2019; Vasil'eva, 2016).

East Asian countries (Taiwan, Republic of Korea, Singapore, and Hong Kong) used an alternative import substitution policy model. Its peculiarity was to increase the country's export potential, for which the governments of the countries attracted investments in the production infrastructure and education, stimulated high-tech industries, and developed a comfortable business environment (Skvortsov and Skvortsova, 2015; V'etnamskaya ..., 2016).

In a report by the National Research University Higher School of Economics *Import Substitution in Russia: Models, Risks, and Room for Maneuver*,[2] there are five typical import substitution problems faced by countries using this mechanism: (1) time lags (it is unclear in which industry and when the effects will appear); (2) targeted sectors (long-term protectionism with respect to certain sectors of the economy does not always contribute to development); (3) low capacity of the domestic market; (4) problems in the development of donor industries (implementation of import substitution programs is expedient along the entire value chain of products), and (5) lobbying.

In general, the scientific literature is of the opinion that, at the level of the entire economy, a firm's access to foreign resources and semifinished products increases its productivity and competitiveness (Simachev et al., 2022). However, as A. Rodriguez-Claire notes, the "coupling effect" between an international investor and a firm that is a recipient of technology and foreign direct investment will be positive only if intermediate goods produced in Russia importing foreign investment are used (Rodriguez-Clare, 1996). In addition, as V.K. Fal'tsman (2015) demonstrates, import substitution is effective for the economy only if domestic products are competitive with respect to imported ones both in quality and price.

In the Russian scientific literature, a surge of studies on import dependence and import substitution began after 2014–2015 due to deterioration of the geopolitical situation and relations with foreign countries, which led to the imposition of sanctions and countersanctions. Basically, the studies consider not import dependence, but import substitution, which is associated with assessment of the effectiveness of programs and tools for developing the country's industry.

[2] Import Substitution in Russia: Models, Risks, and Room for Maneuver, HSE University, 2022 (unpublished materials).

Although most scientific studies on import substitution and import dependence in Russia were done in the last 8 years, since the beginning of the 2000s, questions have been raised about reducing imports of finished industrial products and switching to domestic production of parts and components by attracting foreign direct investment (FDI) into the industrial complex of the country. Since 2005, a large number of works have been published on the impact of FDI on the Russian economy as a whole and on the development of specific regions. For example, A.V. Kuznetsov (2008) and O.V. Kuznetsova (2016a, 2016b) consider the geographical and sectoral features of the distribution of FDI in federal subjects, fix the "neighborhood effect" in the inflow of FDI (the role of FDI from Finland and the Baltic States in the border regions), etc. M.Yu. Malkina (2017) analyzes the impact of FDI in the manufacturing sectors of the economy on interregional inequality. A.N. Mogilat (2015, 2017) and E.A. Fedorova and Yu.A. Barikhina (2015) show the impact of sanctions on the volume and structure of FDI in the real sector of the economy. Direct and indirect socioeconomic effects from FDI are considered by I.M. Drapkin et al. (2015) and E.A. Fedorova et al. (2015).

Economists at the National Research University Higher School of Economics identify several stages in the import substitution policy in Russia.[3] The first stage, from 2000 to 2008, is characterized by large projects with foreign participation in certain sectors (mainly oriented towards consumer goods). B.V. Kuznetsov and Yu.V. Simachev (2014) consider the development of the automotive industry through the introduction of a set of measures to reduce tax duties on the import of components as a relatively successful case of "sectoral structural policy." This led to the appearance of large new centers of the automotive industry in Russia (primarily in St. Petersburg and Kaluga and Kaliningrad oblasts), which significantly increased the industry's level of competitiveness, while at the same time reducing the amount of value added created by domestic enterprises.

The second stage took place in 2008–2013 and is associated with the introduction of anticrisis support measures and stimulation of demand for domestic products (e.g., the purchase of road construction and municipal equipment; a program of preferential car loans; a program for recycling vehicles; etc.). In parallel, since 2010, requirements on increasing localization of manufactured products have intensified in order to maintain customs and other benefits.

Since 2014, import substitution has been one of the priorities of the country's industrial policy, which was recorded in the law On Industrial Policy in Russia.[4] Subsequently, sectoral plans for import substitution were developed for certain types of economic activity; in addition, the Industrial Development Fund was created, which issues loans for the implementation of various projects in the field of import substitution.

To assess import dependence, two approaches are currently most often used. The first uses statistics from the System of National Accounts (SNA) and Federal Customs Service (FCS). For example, L.A. Strizhkova (2016), using expert assessments of small Input–Output tables and statistical form 1-business, assesses the import dependence of the economy in the main segments of the domestic market, assesses the import dependence of individual manufacturing industries, and estimates the total costs of imports in the value of final domestic products. In her study, key import-dependent sectors are identified: the engineering, chemical, and light industries. The author proposes to identify the "boundaries of import substitution"[5] in the sectors most dependent on foreign technologies and components and to incentivize development and production in country.

Ya.V. Rychkova and O.B. Sokol'nikova (2018) and V.K. Fal'tsman (2015) analyze the dynamics of import dependence in Russia using the difference in the coefficient of self-sufficiency in goods. The results of their calculations showed that the dynamics of the foreign trade balance coefficients for the 1998–2017 period in general, it indicates an unfavorable situation with the implementation of import substitution policy in Russia. The most import-dependent sectors are medicine, light industry, machinery industry, including electronics and machine tool building.

The second approach, proposed by O.B. Berezinskaya and A.L. Vedev (2015), is associated with estimating the share of costs for imported parts and components. More details about this approach can be found in the Materials and Methods

There are hardly any studies works that consider the impact of import dependence on the development of federal subjects, due to the lack of data. Most scientific articles devoted to Russian regions analyze projects and import substitution programs adopted in federal subjects. For example, L.A. Galkina and A.I. Sharipov (2016) consider regional features of the development of import substitution with a case study of Chelyabinsk oblast; Animitsa et al. (2015) use a case study of Sverdlovsk oblast.

In 2023, the Higher School of Economics published a study *Rating of Russian Regions by Import Dependence of Their Specializations* (2023), in which the authors assessed "the level of import dependence of a region's sectoral specialization as the sum of the sectoral import dependence indices weighted by the share of these industries in the total number of employees in federal subject." As well, they deter-

[3] Import Substitution in Russia: Models, Risks, and Room for Maneuver. HSE University, 2022 (unpublished materials).

[4] Federal Law no. 488-FZ of December 31, 2014 On Industrial Policy. http://www.kremlin.ru/acts/bank/39299. Accessed January 15, 2023.

[5] The maximum share of imports for each industry.

mined the sectoral index of import dependence as the share of direct and indirect imports from countries that announced sanctions against Russia in the total value of the final products of the sector (the source was Bank of Russia data). The shares of industries of specialization in the total number of employed by regions of Russia were taken from the report *Atlas of Economic Specialization of Russian Regions* by the same authors. The method from differs from other similar approaches by assessing the role of industries in employment, not in production. This approach, as well as the fact that in 2022 there was no significant reduction of employees in import-dependent regions identified by the authors, leaves room for discussion about the applicability of the approach used to assess the impact of import dependence on the dynamics of production and other social economic processes in federal subjects.

MATERIALS AND METHODS

Production dependence on imports in accordance with the approach proposed by O.B. Berezinskaya and A.L. Vedev (2015) is calculated as the ratio of costs of imported raw materials, materials, and purchased products to all costs for the purchase of raw materials, materials, semifinished products, and components for the production and sale of products (goods, jobs, services).

The source is Federal Service for State Statistics (Rosstat) information, placed in the data set "Costs for the Production and Sale of Products (Goods, Jobs, Services)," created on the basis of the statistical form 1-enterprise filled in by large and medium-sized businesses. Accordingly, a significant limitation in the interpretation of the results obtained is that data on small enterprises are not taken into account. As a result, the indicator is less relevant for federal subjects with a large share of small businesses in the economy (the capital region, North Caucasus territories, and coastal and border regions). In addition, use of the indicator prevents highlighting the role of unfriendly countries.

The Rosstat data cannot be used to construct a complete and continuous series of the PDI indicator, due to the transition to OKVED-2[6] in 2017. Therefore, for the analysis it is necessary to use two indicators: before and after 2016.

PDI until 2016 is calculated based on two indicators (and their corresponding Rosstat datasets): "Expenses for the Purchase of Raw Materials, Materials, Purchased Semifinished Products and Components for the Production and Sale of Products (Goods, Jobs, Services) for 2016"[7] and "Expenses for the Purchase of Imported Raw Materials, Materials, and Purchased Items for the Production and Sale of Products (Goods, Jobs, Services) for 2016."[8] The assessment for the period starting from 2017 uses one data set, which includes all the necessary indicators.[9]

It is necessary to note several limitations in the use of data on expenditures on imported raw materials, materials and equipment at the federal subject level. First, it is necessary to exclude the republics of Tyva, Ingushetia, and Chechnya from the analysis, for which the database does not contain information for individual years, and the published data raise questions about reliability (they can change by hundreds and thousands of times from year to year). Second, in the Republic of Crimea[10] and Sevastopol, there is no information for the period up to 2014. Third, for certain periods there is no information on the Nenets Autonomous Okrug, which is why the analysis must be carried out for Arkhangelsk oblast, including the Nenets Autonomous Okrug. To assess the dynamics of industrial production, we used data from the industrial production index, also based on Rosstat information.

DISCUSSION

Industrial dependence on imports grew rapidly in 2006–2013 simultaneously with the influx of FDI and a large number of investment projects by foreign companies and joint projects by Russian and foreign owners (Fig. 1). During this period, the share of import costs in the cost of materials and components for large and medium-sized businesses increased from 8.5 to 14.6%. From 2014 to 2016–2017,[11] against the backdrop of an overall investment crisis (Zubarevich, 2015) and a gradual transition to an import substitution policy instead of attracting foreign investment (Manturov et al., 2017), there has been a significant reduction in Russia's dependence economy on imports.

From 2016–2017 until 2020, the country experienced a slow growth in the indicator due to a number of projects with foreign participation (in particular, in machinery industry: e.g., the launch of a Mercedes-Benz plant in Solnechnogorsk, Moscow oblast, in 2019 with an investment of RUB 19 bln; in 2017, in the SEZ in Lipetsk oblast, the opening of a plant for the production of *Viessmann* boilers) and large projects with the purchase of foreign equipment (e.g., the pur-

[6] All-Russian classifier of types of economic activity (OKVED).

[7] EMISS. Data set. https://www.fedstat.ru/indicator/45412. Accessed September 15, 2022.

[8] EMISS. Data set. https://www.fedstat.ru/indicator/45410. Accessed September 15, 2022.

[9] EMISS. Data set "Costs for the Production and Sale of Products (Goods, Jobs, Services) since 2017." https://www.fedstat.ru/indicator/58552. Accessed September 15, 2022.

[10] In the article, Russia's borders are considered in accordance with the Constitution of the Russian Federation adopted by popular vote on December 12, 1993, with amendments approved during the All-Russian vote on July 1, 2020.

[11] It is problematic to accurately determine the "bottom" of the change in PDI due to the transition to another classification and changes in Rosstat's data collection method.

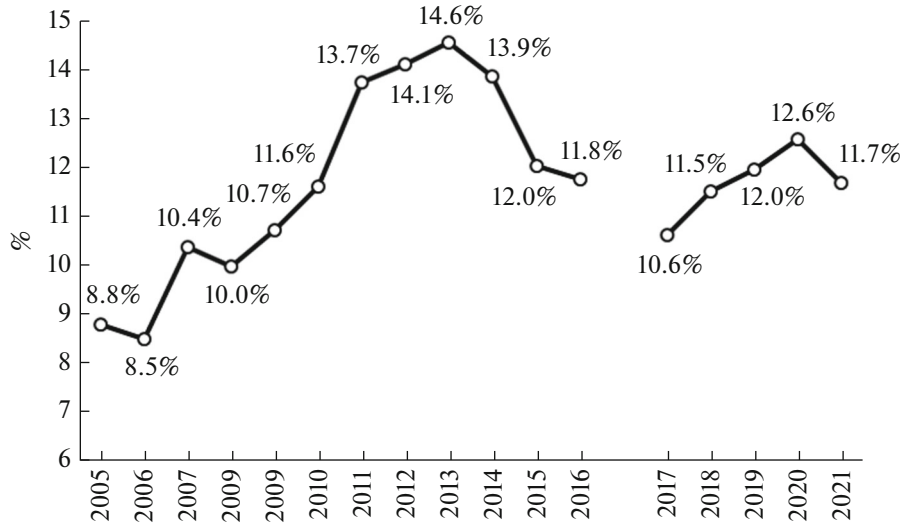

Fig. 1. PDI in Russia as a whole for all types of economic activity in 2005–2021.
Source: Compiled according to Rosstat data.

chase of Japanese *Takisawa* machine tools for the needs of the Kovrov Electromechanical Plant in Vladimir oblast) in different parts of Russia. In 2021, the indicator decreased due to the general introduction of restrictions as part of combatting the spread of COVID, even against an increase in the cost of imports to Russia (Knobel' and Firanchuk, 2022).

As a result, by 2021, the share of import costs in the total costs for materials, equipment, and components in Russia was 11.7% (or about 4.1% of all costs for the production and sale of products, goods, jobs, and services in Russia). For comparison, this figure is comparable to the cost of rent (3.8% of total costs), twice the cost of electricity (2.1% of total costs), and only three times less than wages (12.8% of total costs).

The main contribution to the increase in PDI in recent years has come from foreign-owned enterprises due to the expansion of volumes and role in imports. Although the share of foreign companies in the import of components and raw materials remains lower than that of Russian companies (38.4%), their PDI is much higher (32.5 vs. 8.1% in 2021, respectively).

PDI varies greatly across sectors of the economy. For the entire period under study, in Russia as a whole, it was high in fishing and fish farming, the food industry, the textile and clothing industry, pulp and paper production and publishing, the production of rubber and plastic products, and the production of electrical equipment. Of the branches of the social sphere, it is most significant in healthcare. It also remains low in agriculture, hunting and forestry, energy, construction, and education.

During the period of active inflow of foreign investments, dependence on imports increased the most in the production of vehicles and equipment (from 13.4% on average in 2005–2007 to 41.4% in 2012–2014), textile and clothing production (from 14.7 to 26 .9%), production of electrical equipment (from 16.4 to 23.7%), and wholesale and retail trade (from 7.7 to 17.1%).

After 2014, PDI decreased in most sectors, particularly fast in the production of clothing, textiles, tobacco, electrical equipment, and furniture production. A significant increase in dependence was primarily observed in the production of computers, electronic and optical products, administrative and related activities, and food production.

As a result, by 2017–2021, in Russia's economy, a number of types of economic activity with high PDI were distinguished (Table 1), among which are the production of tobacco products (dependence 66.4%), motor vehicles (47.5), medicines (47.3), textiles (30.1), clothing (26.5), printing (22.7), computers and electrical equipment (23.4 and 21.6% respectively), and rubber and plastic products. In some, more fractional sectors (more detailed OKVED-2 codes), the PDI is above 80%, among which are the production of consumer electronics (83.4% of all costs for raw materials, materials and purchased products), the production of LCD and plasma televisions (83%), the production of seat belts and airbags, their parts and body accessories (44.9%), etc. Almost all sectors of the industry show PDI at the level of more than 5%. In the social sphere, healthcare generally shows the greatest dependence (14.1%).

At the level of federal subjects, significant changes in PDI also occurred during the study period. In 2005–2007, in 29 federal subjects of Russia, the level of dependence did not exceed 5%, by 2012–2014 the number of such territories was reduced to 20 and subsequently remained practically unchanged. Most regions increased their dependence on imports pre-

Table 1. Production dependence on imports by certain types of economic activity in 2017–2021, %

Type of economic activity	2017	2018	2019	2020	2021
Agriculture, forestry, hunting, fishing and fish farming	5.5	5.5	5.5	4.7	6.5
Mining	5.9	5.5	5.7	7.3	5.2
Manufacturing	12.3	13.6	13.6	15.0	13.9
Food production	7.4	13.6	11.9	12.5	11.2
Beverage production	9.5	9.4	10.0	8.0	8.5
Manufacture of tobacco products	70.3	68.2	81.6	56.6	61.1
Textile production	35.0	34.0	30.3	28.8	25.9
Clothing manufacture	33.7	27.4	27.1	26.0	20.1
Manufacture of leather and leather goods	16.7	17.3	16.5	20.3	19.2
Woodworking and manufacture of wood and cork products, except furniture; manufacture of articles of straw and plaiting materials	8.5	7.9	8.2	8.3	9.6
Manufacture of paper and paper products	19.3	19.5	17.5	17.1	15.9
Printing and copying of information media	22.7	20.4	26.9	23.2	20.8
Production of coke and oil products	0.7	0.4	0.5	0.7	0.4
Manufacture of chemicals and chemical products	13.5	13.0	12.5	17.2	16.6
Production of medicines and materials used for medical purposes	46.3	49.5	51.6	41.0	49.7
Manufacture of rubber and plastic products	21.5	21.5	20.1	21.1	19.0
Manufacture of other non-metallic mineral products	11.4	14.2	13.5	12.4	12.1
Metallurgical production	9.5	11.3	12.1	11.2	9.9
Manufacture of finished metal products, except for machinery and equipment	7.9	7.1	5.0	5.5	6.1
Manufacture of computers, electronic and optical products	21.0	22.3	15.7	26.5	30.6
Production of electrical equipment	24.8	25.2	25.6	18.1	16.2
Manufacture of machinery and equipment not included in other groups	21.0	19.2	17.9	21.6	20.9
Manufacture of motor vehicles, trailers, and semitrailers	45.9	47.0	47.0	49.6	47.6
Manufacture of other vehicles and equipment	7.6	7.7	12.5	11.5	11.6
Furniture production	19.4	14.2	17.9	13.9	11.2
Manufacture of other finished products	7.2	7.6	8.7	9.9	10.0
Repair and installation of machinery and equipment	7.6	9.3	8.7	9.2	7.4
Provision of electricity, gas, and steam; air conditioning	1.5	1.8	0.8	1.0	5.1
Water supply; wastewater disposal, organization of collection and disposal of waste, elimination of pollution	3.0	2.8	6.1	1.9	1.0
Construction	4.5	4.5	4.3	3.9	4.0
Wholesale and retail trade; repair of motor vehicles and motorcycles	12.4	12.3	16.5	13.9	10.0
Transport and storage	4.4	3.8	3.5	4.0	3.8
Activities of hotels and catering establishments	9.6	1.1	2.1	3.7	1.1
Activities in the field of information and communication	4.6	16.3	16.0	18.7	7.9
Real estate activities	2.2	2.5	1.9	3.5	6.1
Professional, scientific, and technical activities	6.2	7.3	9.3	8.7	9.1
Activities administrative and related additional services	7.3	10.1	6.1	10.9	16.5
State administration and military security; social security	0.5	6.1	6.9	5.3	1.4
Education	3.5	1.0	1.1	n/a	1.5
Activities in health and social services	17.1	17.4	12.6	12.5	12.8
Activities in the field of culture, sports, leisure, and entertainment	9.2	4.5	0.4	7.0	5.8
Provision of other types of services	17.0	17.9	8.6	8.1	5.9

Source. Calculated by authors from Rosstat data.

cisely between 2005 and 2013: the indicator increased immediately in 53 subjects. After 2014, PDI in regions changed much slower. In 42 subjects, it decreased between 2012–2014 and 2019–2021. Whereas the number of regions with a dependence level of 5–10% over the study period was almost constant, with an indicator of 10–15% or more than 15%, it increased (in the first group from 14 in 2005–2007 to 20 in 2019–2021, and in the second, from 8 to 12) (Table 2). For the entire study period, the PDI indicator was above 15% in Kaliningrad, Magadan, Leningrad, and Moscow oblasts.

Traditionally, the lowest PDI is typical of regions specializing in the extraction of fuel and energy minerals (Tyumen oblast, KhMAO, YaNAO, Kemerovo oblast), for which dependence on imported technology suppliers is more important than the scale of purchases of components and equipment, and the least developed entities, poorly integrated into the international trade system (the republics of Kalmykia, Mordovia, Altai, North Ossetia-Alania, Kabardino-Balkaria, etc.).

A high PDI is typical of regions specializing in machinery industry (in particular, the automotive industry), which have international ports, where large investment projects are being implemented with the participation of foreign capital and/or with significant purchases of foreign equipment.

As the regional economies transformed, the level of dependence increased between 2005–2007 and 2012–2014 in Kaluga oblast, St. Petersburg, Primorsky krai (due to the creation of assembly plants and development of logistics), and the Chukotka Autonomous Okrug (due to metal ore mining). However, in these regions as the import substitution policy is implemented (due to commitments to localize manufactured products), the completion of individual projects or the decrease in the availability of imported equipment, PDI has been decreasing in recent years (e.g., in Kaluga oblast from 58.4% in 2012–2014 to 34.2% in 2019–2021, Chukotka Autonomous Okrug from 50.6% to 20.3%, and St. Petersburg from 23.1% to 13.3%).

As a result, by 2019–2021 the maximum level of PDI was in Kaliningrad oblast (76.5%), Primorsky krai (36.2%), Kaluga oblast (34.2%), Leningrad oblast (23.0%), Vladimir oblast (19.1%), Moscow oblast (18.7%), Samara oblast (15.8%), Ulyanovsk oblast (15.5%) owing to manufacturing industries, and in Magadan oblast (28.6%), Sakhalin oblast (25.0), Chukotka Autonomous Okrug (23.6), and Kamchatka krai (15.5%) due to the extractive industry.

In general, from 2005 to 2021, PDI increased the most in regions specializing in the automotive industry (in percentage points: Kaluga oblast, 23.3; Primorsky krai, 23.2; Ulyanovsk oblast, 10.4; Samara oblast, 9.4; Kaliningrad oblast, 8.0), and in the regions where investment projects are implemented in mining (Sakhalin oblast, 15.3; Zabaykalsky krai, 11.8; Chukotka Autonomous Okrug, 10.5). In most regions, the level of PDI has remained fairly stable in recent years.

Table 2. Distribution of federal subjects by PDI values, on average for period

Industrial dependence on imports in federal subject, %	Period		
	2005–2007	2012–2014	2019–2021
5 or less	29	20	19
5.1–10	28	29	28
10.1–15	14	19	20
15.1–20	5	1	5
20.1–25	0	2	2
25.1–30	0	2	2
30.1–35	1	1	1
35.1–40	1	0	1
Over 40	1	5	1
Total	79	79	79

Without taking into account the republics of Crimea, Ingushetia, Tyva, Chechnya, federal city of Sevastopol; Arkhangelsk oblast including the Nenets Autonomous Okrug.

Source. Calculated by authors from Rosstat data.

From 2005 to 2012, the dynamics of industrial production was to some extent associated with PDI. This was particularly evident in the years when foreign investment came to certain large (industrially significant at the level of the entire country) regions: e.g., in 2008 and 2011, the construction project of the Mazda Sollers Manufacturing Rus plant in Primorsky krai was implemented; in the Lipetsk SEZ in 2011, a project for Yokohama tire production; etc. However, after 2012, along with stabilization of dependence on imports and a further reduction in the inflow of foreign investment, the relationship between the dynamics of industrial production and PDI in regions has noticeably weakened (Fig. 2). After 2015, the direct and inverse correlation coefficients for the annual dynamics of the index of industrial production and PDI did not exceed 0.2 in any period.

In 2022, the situation began to change dramatically (Fig. 3). Since March 2022, as sanctions restrictions were introduced, the relationship between the dynamics of industrial production and PDI began to strengthen. At the same time, the higher the PDI at the end of 2021, the worse the production dynamics. At the end of January 2022, the correlation coefficient between the two indicators was –0.06, and over the period from January–March to January–December 2022, it increased from –0.16 to –0.47. At the same time, there was a general deterioration in the dynamics of industrial production. According to the latest Rosstat data, the index of industrial production in Russia as a whole decreased from 108.0% in January 2022 to 99.4% in January–December 2022 compared to the

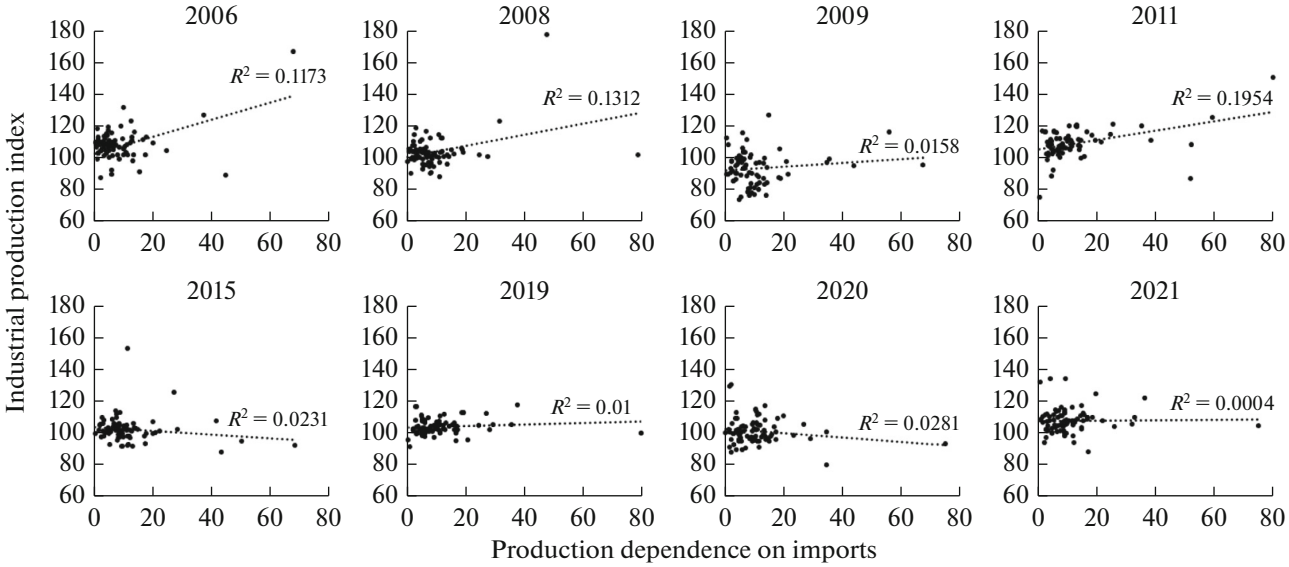

Fig. 2. Ratio of PDI (X axis) and index of industrial production to previous year (Y axis) in federal subjects in certain years from 2006 to 2021.

Point on graph indicates federal subject. Minus the republics of Tyva, Ingushetia, Chechnya, Crimea, and federal city of Sevastopol; Arkhangelsk oblast including the Nenets Autonomous Okrug.

Source: authors'calculations based on Rosstat data.

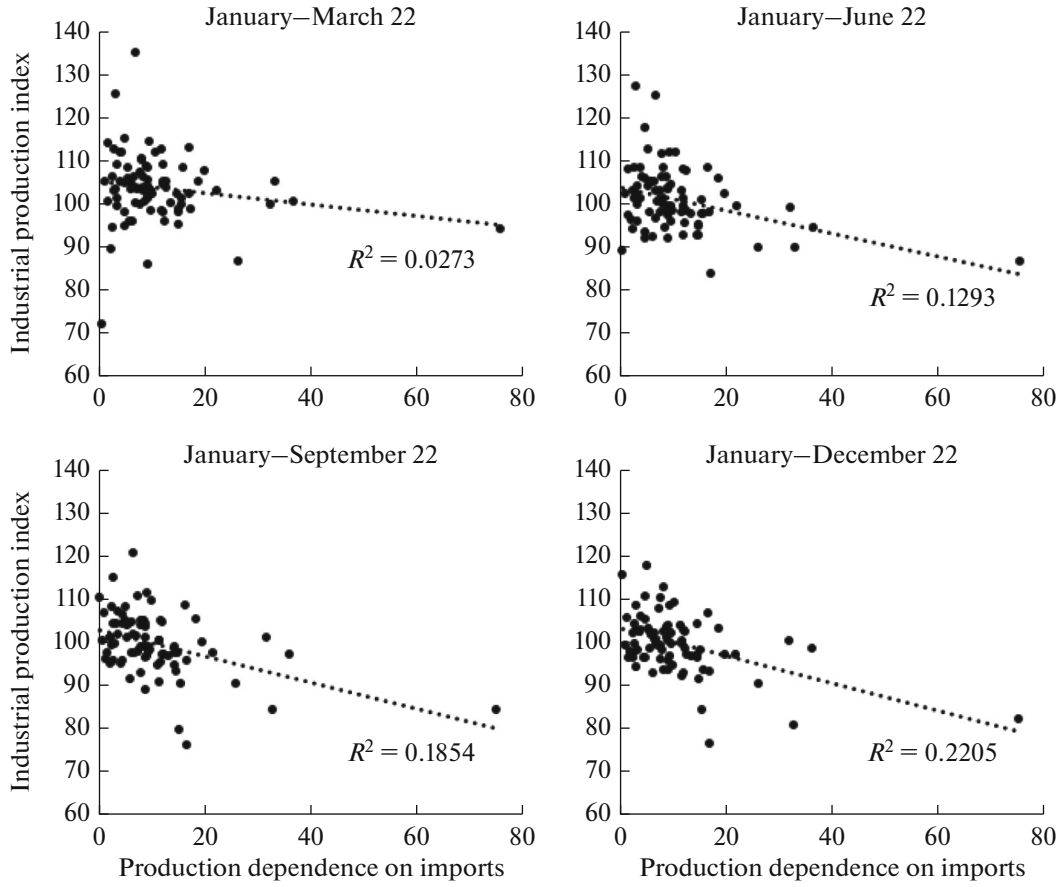

Fig. 3. Ratio of PDI in 2021 (%) and index of industrial production to previous year (%) in 2022 in federal subjects.

Point on graph indicates federal subject. Minus the republics of Tyva, Ingushetia, Chechnya, Crimea, and federal city of Sevastopol; Arkhangelsk oblast including the Nenets Autonomous Okrug.

Source: authors' calculations based on Rosstat data.

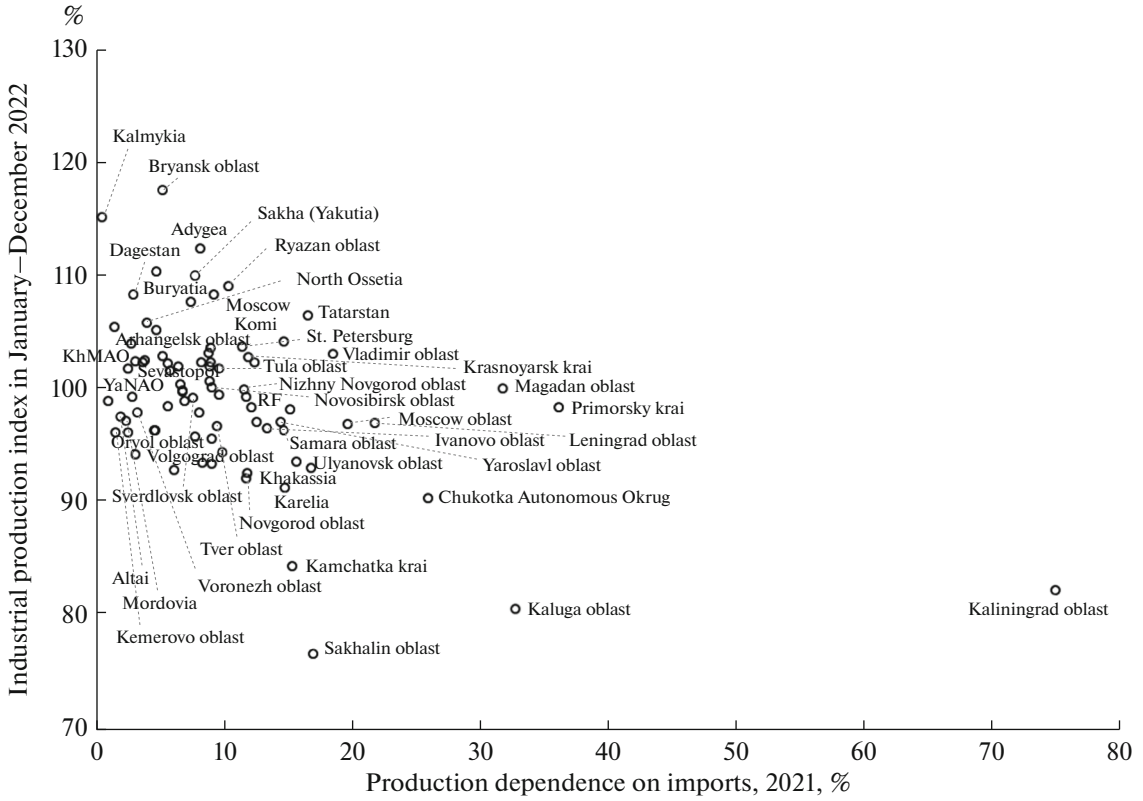

Fig. 4. The ratio of index of industrial production in January–December 2022 (%) and PDI in 2021 (%) for federal subjects.
Point on graph indicates federal subject. Minus the republics of Tyva, Ingushetia, Chechnya, Crimea, and federal city of Sevastopol; Arkhangelsk oblast including the Nenets Autonomous Okrug.
Source: authors' calculations based on Rosstat data.

same period last year. During the same period, the number of regions with negative industrial dynamics increased from 8 in 2021 and 19 in January 2022 to 46 in January–November and 42 in January–December 2022.

Other factors also influenced the dynamics of industrial production in the regions. Among the negative ones are restrictions on the delivery of various types of products from Russia by a number of foreign countries, logistical restrictions on exports, competition for the use of cargo infrastructure within Russia. Among the positive factors, the most significant were the rise in prices on world markets in the middle of the year, particularly for coal, nonferrous metals, and fertilizers; growth in the production of products of the military-industrial complex; etc. (Kaukin and Miller, 2022). At the same time, for the whole group of regions specializing in industries dependent on imports, PDI became decisive in determining the negative dynamics in 2022.

Among the regions with PDI greater than 20% in 2021, only Magadan oblast showed an increase in industrial production in January–December 2022 (0.2%), and out of 22 federal subjects with PDI of 10–20%, eight showed an increase (Zabaykalsky and Krasnoyarsk krais; Nizhny Novgorod, Vladimir, Ryazan, and Penza oblasts; the Republic of Tatarstan; and St. Petersburg) due to prices for product on global markets and increased production in the military-industrial complex. At the same time, out of 53 subjects with PDI less than 10%, only 23 showed a decline in industrial production under sanctions, and none of them showed a decline of more than 10% (Fig. 4).

The impact of PDI can be most clearly seen in the example of regions specializing in import-dependent industries, e.g., in the automotive industry (Fig. 5). Here, territories where automotive production until 2022 was represented mainly by foreign companies or enterprises with joint ownership (Kaliningrad and Kaluga oblasts) showed a strong decline in 2022. While the regions in which the automotive industry was mainly domestic and often associated with the military-industrial complex, respectively, with a low dependence on imports (Republic of Udmurtia, Nizhny Novgorod oblast), showed virtually no decline in the industry at the end of the year. Automotive regions with a more diversified overall structure of the economy stand apart, where, primarily due to high prices in the export industries of specialization (St. Petersburg, Tatarstan, Moscow) or development of the military-industrial complex (Nizhny Novgorod

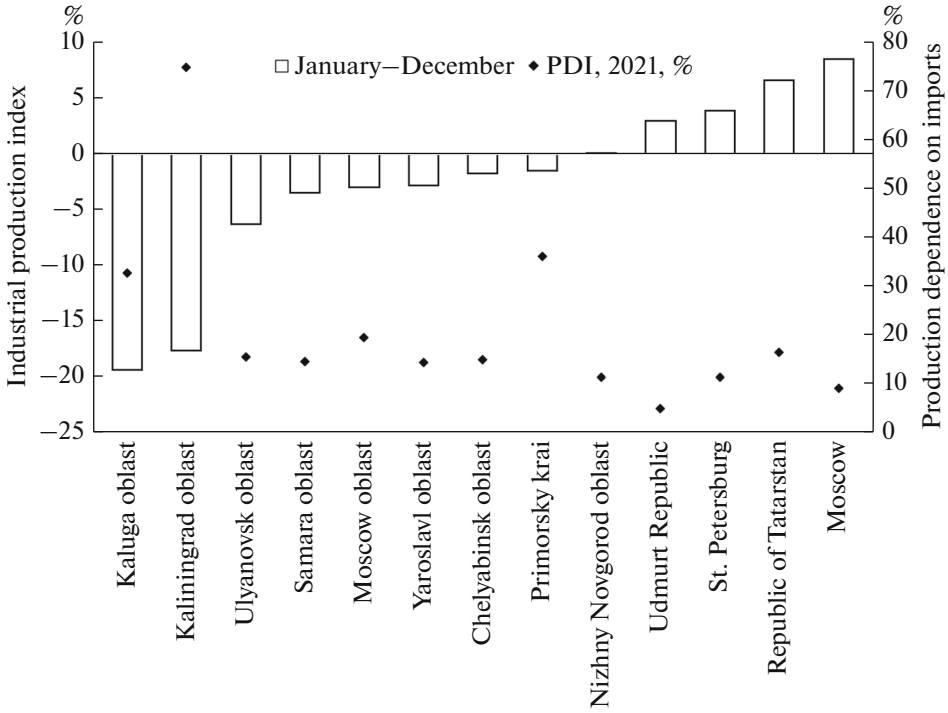

Fig. 5. Comparison of industrial production index in January–December 2022 (% compared to same period of previous year) and PDI in 2021 in regions specializing in production of vehicles, trailers, and semitrailers.
Source: authors' calculations based on Rosstat data.

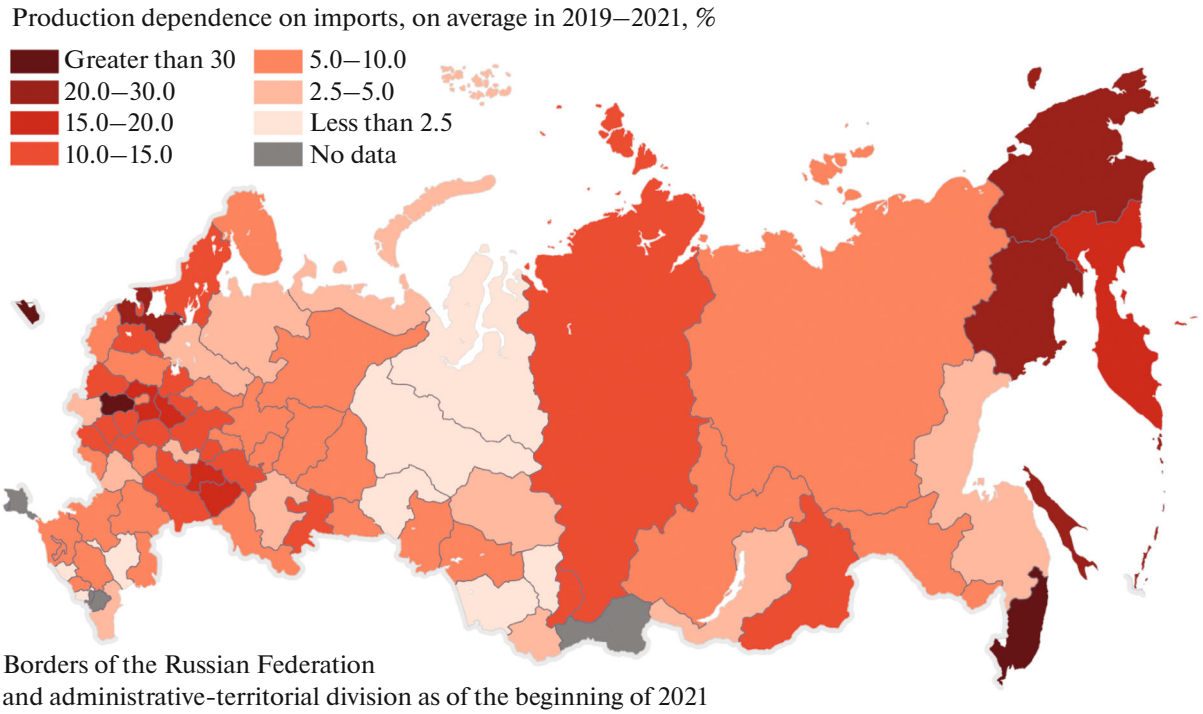

Fig. 6. PDI on average for 2019–2021.
Source: authors' calculations based on Rosstat data.

oblast, Republic of Udmurtia), the results in 2022 turned out to be positive.

CONCLUSIONS

One factor that influenced regional development dynamics in 2022 was restriction of foreign supplies of raw materials, materials, and components to Russia as a result of disrupted supply chains, direct trade restrictions, or departure of foreign companies from the Russian market.

The significance of this factor for regions can be assessed through the PDI.

As a result of end of the rapid inflow of foreign investment into Russia in the second half of the 2010s and subsequent gradual replacement of foreign by domestic suppliers in the implementation of the import substitution policy after 2015, the level of PDI in Russia turned out to be moderate by 2021. However, depending on the presence of foreign business, a set of industries with high PDI has developed. Among them are the production of tobacco products, vehicles, medicines, textiles and clothing, printing, and healthcare. Regional PDI is formed by the combination of these industries in a particular territory. The most acute problem of dependence persisted in federal subjects with a specialization in the automotive industry. The lowest level of PDI is typical of territories and regions most remote from external markets with a high share of SMEs and the shadow economy (this may partly be a statistical accounting problem): the republics of the North Caucasus and Siberia. In recent years, the level of PDI in regions has been gradually decreasing, but its territorial differentiation as a whole has remained stable (Fig. 6).

Whereas in the period before 2012 industrial growth and increasing PDI occurred synchronously (due to the positive impact on the dynamics of the inflow of FDI), after 2014 this factor was barely manifested in the regional differentiation of industrial dynamics. However, in 2022, against the imposed restrictions, the dynamics of industrial production in Russian regions began to increasingly correlate (inversely) with PDI. This indicates incomplete resolution of import substitution issues in most dependent industries and may be indicate gradual deepening negative trends in import-dependent sectors and regions.

Given that Russia's import substitution policy in the 2010s was carried out according to the Latin American model, through direct substitution of supplies of imported goods to the domestic market with a limited influx of modern technologies into the national industry, a high level of PDI can lead to protracted industrial crises in several of the most dependent Russian regions.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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