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Anti-Russian Sanctions Impact: Aftermath of a Reduction in Foreign Trade and Production Growth in the Russian Federation

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ABSTRACT

There are technological, economic, transport links in the production, storage and delivery of goods in the contemporary economy. Therefore, the appearance of a new or an increase in the volume of production of an existing product requires changes in the production of other products, linked with this one through the technological chains. Statistical data and models of input-output balance allow us to trace such chains of connections and calculate the volumes production of different goods. This paper contains the results of a study of intersectoral chains of influence of bans and restrictions imposed on Russian exports. The study shows the reduction in the export of some goods has a negative effect on the output of a number of other goods. The decrease in imports has a similar effect. The author also shows calculations' results of the growth impact on the output of different goods and services on changes in the scale of other types of goods production and services in the Russian economy.

Keywords: cross-industry relations; exports; imports; volume of goods and services production; input-output balance; growth rates ratio

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IMPACT OF THE EXPORT AND IMPORT BAN ON RUSSIAN OUTPUT

Large-scale anti-Russian sanctions imposed by countries unfriendly to the Russian Federation[1] prohibit the export of a wide range of Russian goods[2,3] [1]. Foreign researchers differ in their assessment of the impact of barriers, prohibitions, and restrictions on Russia's foreign trade on gross domestic product, gross value added and output of individual products in the Russian Federation [2–6].

Taking into account the inter-industry relations existing in the economy of the Russian Federation, let us estimate the production of which products would be affected by a decrease in exports of ten domestic products. The estimate is based on the data of the intersectoral balance of the Russian Federation for 2019, presented on the website of the Federal State Statistics Service of the Russian Federation (Rosstat).[4] It contains 61 products (OKPD 2) and 61 industries (OKVED 2).

[1] The list of foreign states and territories committing unfriendly acts against Russia was approved by RF Government Decree No. 430-d of 05.03.2022. URL: http://publication.pravo.gov.ru/Document/View/0001202203070001; URL: http://government.ru/docs/46080/; The Government has expanded the list of unfriendly foreign states. Decree of the Government of the Russian Federation of 20.07.2022 No. 1998-d. URL: http://government.ru/docs/46080/; The government has added to the list of countries and territories unfriendly to Russia. URL: https://tass.ru/politika/16196295?utm_source=yxnews&utm_medium=desktop

[2] URL: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4548

[3] URL: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/international-relations/restrictive-measures-sanctions/sanctions-adopted-following-russias-military-aggression-against-ukraine_en

[4] URL: https://rosstat.gov.ru/statistics/accounts (accessed on: 20.05.2022).

The products and services with a significant share of exports in the volume of their production, presented by Rosstat in the "Table of Domestic Product Use at Basic Prices for 2019", which are subject to numerous bans and restrictions imposed by countries unfriendly to Russia, were selected for analysis (*Table 1*).

Inter-sectoral linkages were estimated for the reduction of exports of the seven products and services presented in Table 1 (products of mining industries; coke and oil products; chemicals and chemical products; vehicles and equipment, other; finished metal goods, except for machinery and equipment; air and space transport services), as well as exports of agriculture and hunting, food, drinks and tobacco products, land, and pipeline transport services. Each export was reduced by 10 per cent and reductions were calculated for all other products and services (59 items). It was assumed that in each calculation only one group of products and services decreased in exports.

The calculations showed that in the 2019 inter-industry relationships, the largest drop in exports and gross utilised product in Russia occurs when exports of mining and quarrying products decrease. These maximum values are taken as 100%.[5] A fall by the same relative value of Russia's basic metals exports reduces total Russian exports by 35.7 p.p. and gross utilised product by 31.8 p.p. less than a fall in mining and quarrying exports (100.0–64.3 = = 35.7; 100.0–68.2 = 31.8). Of the products shown in *Table 2*, the smallest decrease in exports of air and space transport services was observed, 19.1% and 19.5% respectively, compared to a decrease in exports of mining and quarrying products.

The products in question are ranked in the following order by the drop in total output (from maximum — to minimum):

- Mining and quarrying products;
- Coke and refined petroleum products;
- Basic metals;
- Foodstuffs, beverages and tobacco products;
- Chemicals and chemical products;
- Means of transport and equipment, and other vehicles;
- Land and pipeline transportation services;
- Agriculture, forestry and fishing products and services;
- Fabricated metal products, except machinery and equipment;
- Air and space transport services.

A decrease in the exports of each of type of goods under study causes a decrease in the outputs of a number of other products. These products and services have been identified by the calculations made. Thus, when exports of mining and quarrying products decrease, the output of coke and refined petroleum products, machinery and equipment not included in other groupings; land transport and transport via pipelines services, warehousing and support activities for transportation services fall in the first place. A decline in the exports of transport facilities and equipment entails a decrease primarily in the outputs of base metals, fabricated metal products (except for machinery and equipment), computer, electronic, optical, and electrical equipment, as well as machinery and equipment not included in other groupings.

A reduction in exports of various products and services affects the size of output of some of the same products. Examples are given in *Table 3*.

[5] Relative values are sufficient to illustrate the correlation of forces of inter-branch chains of influence and to show decision-makers in the Russian Federation what they should pay attention to when working out development options in conditions of external attempts to isolate the Russian Federation from the world markets of goods, services, and finance. The author deliberately does not provide absolute figures here, so as not to enable the analysts, hostile to Russia, to assess the damage of the anti-Russian sanctions.

Table 1

The share of product exports in the volume of its use and in total exports from Russia in 2019, %

Product	In the volume of product usage	In the total volume of Russian exports
Mining and quarrying products	49.9	31.7
Chemicals and chemical products	46.5	5.5
Coke and refined petroleum products	37.3	13.8
Basic metals	36.3	9.9
Air and space transport services	34.5	2.0
Means of transport and equipment, and other vehicles	30.7	2.7
Finished metal products, except machinery and equipment	20.6	2.0

Source: compiled by the author according to Rosstat's data. URL: https://rosstat.gov.ru/storage/mediabank/tri-2019.xlsx

Table 2

Estimated rates of reduction in the volume of exports of the Russian Federation caused by a decrease in goods exports and services in question by the same specified amount, % (the maximum decline = 100%)

Product	Export	The volume of product usage
Mining and quarrying products	100.0	100.0
Coke and refined petroleum products	92.6	98.9
Basic metals	64.3	68.2
Chemicals and chemical products	45.3	47.6
Means of transport and equipment, and other vehicles	28.0	30.6
Fabricated metal products, except machinery and equipment	19.6	20.6
Air and space transport services	19.1	19.5

Source: compiled by the author according to Rosstat's data. URL: https://rosstat.gov.ru/storage/mediabank/tri-2019.xlsx

DECLINING IMPORTS AND FALLING OUTPUT

The bans, restrictions and sanctions imposed by unfriendly countries on the Russian Federation apply to a large group of goods and services imported by Russia. Our research has shown that, all other things being equal, if imports of products and services decrease by a given number of times, sectors with the highest share of imports in the total volume of goods in use suffer more. There is a mathematical proof of this argument:

Let us denote the total output of industry g at a time t by $Xg(t)$. Let us express it as the sum of imported goods $Ig(t)$ and everything else $Yg(t)$:

Table 3

Products and services in the top five goods in terms of the rate of decline in output caused by a decrease in exports of certain products

Exportable products and services	Products and services produced
Mining and quarrying products, coke and refined petroleum products	Land transport and transport via pipelines services; water transport services, rental, and leasing services
Chemicals and chemical products, basic metals	Mining and quarrying products; land transport and transport via pipelines services; electricity, gas, steam, and air-conditioning
Agricultural and hunting products and services, foodstuffs, beverages, tobacco products	Fishing and aquaculture products; paper and paper products; chemicals and chemical products
Chemicals and chemical products, air, and space transport services	Coke and petroleum products; warehousing and auxiliary transport services; mining and quarrying products

Source: compiled by the author.

$$Xg(t) = Yg(t) + Ig(t). \quad (1)$$

Here $Yg(t)$ — is the volume of intermediate consumption (without imported products) plus gross value added.

Let's assume that at the next point in time $t + 1$ the volumes of imported products of each industry g ($g = 1, 2, \ldots, n$) have changed by a factor of k. Then the output growth index at a time $t + 1$ will be as follows:

$$Vg(t + 1) = Xg(t + 1)/Xg(t) = \\ = Yg(t)/Xg(t) + k * Ig(t)/Xg(t). \quad (2)$$

In this expression, $Ig(t)/Xg(t)$ — is the share of imports and $Yg(t)/Xg(t)$ — is the share of the remaining output in total output. Let us denote them by $dIg(t) \in [0, 1]$ and $dYg(t) \in [0, 1]$ respectively. Since the sum of these fractions is 1, it follows from $dIg(t) + dYg(t) = 1$ that: $dYg(t) = 1 - dIg(t)$.

Inserting this representation $dYg(t)$ into expression (2), we obtain:

$$Vg(t + 1) = 1 - dIg(t) + k * dIg(t) = \\ = 1 - dIg(t) * (1 - k). \quad (3)$$

Correspondingly, for the sector j, we have:

$$Vj(t + 1) = 1 - dIj(t) + k * dIj(t) = \\ = 1 - dIj(t)*(1 - k). \quad (4)$$

It follows that

$$Vg(t + 1) - Vj(t + 1) = \\ = [dIj(t) - dIg(t)] * (1 - k). \quad (5)$$

In case when imports of goods decrease (i.e., $k < 1$), it follows from the equation (5) that the output change index g will be smaller than the output change index j (i.e., $Vg(t + 1) < Vj(t + 1)$ и $Vg(t + 1) - Vj(t + 1) < 0$) if and only if $dIg(t) > dIj(t)$.

In other words: for a given rate of import reduction, the reduction in output will be greater in the industry with the larger share of imports in total output.

The first seven industries with the largest share of imports in total output use, according to data provided by Rosstat in the "Table of domestic product use in basic prices for 2019", are shown in *Table 4*.

Given the existing inter-industry linkages and process chains in the production and usage of products, a reduction in output in one industry entails a reduction in production in a number of other industries.

Table 4

Industries with the share of imports in the total volume of product use of over 10% and not more 1%

The industry	Share of imports in total product usage, %
Share of imports more than 10%	
Production of motor vehicles, trailers, and semi-trailers	21.6
Manufacture of rubber and plastic products	16.2
Manufacture of basic pharmaceutical products and pharmaceutical preparations	16.2
Production of computers, electronic and optical products	15.6
Manufacture of beverages, tobacco products	13.8
Air and space transport activities	13.7
Manufacture of electrical equipment	11.8
Water transport activities	10.5
The share of imports is no greater than 1%	
Coke and refined petroleum products production	1.0
Electricity, gas, and steam supply; air conditioning	1.0
Real estate activities	0.9
Activities of households as employers; undifferentiated activities of private households to produce goods and services for own consumption	0.0

Source: compiled by the author according to Rosstat's data. URL: https://rosstat.gov.ru/storage/mediabank/tri-2019.xlsx

Let us consider such chains of inter-industry linkages.

FORWARD AND BACKWARD LINKAGES IN THE PRODUCTION OF GOODS AND SERVICES

Achieving the desired degree of economic independence of the Russian Federation has become particularly urgent in 2022. This required the creation and development of a number of critically important industries, changes in the sectoral and territorial structure of output, the use of new methods of economic and social management, improvement of the business climate and improvement of legislation.

As it was noticed above, by virtue of objective existence of technological, economic, transport connections in the production, storage and delivery of products created in a human society, the appearance of a new product or increase of the production volume of the already existing goods require changes in the production of other goods, even the ones that are not used directly at its creation.

For example, the production of microprocessors requires sand, neon, palladium, clean air control systems, electrochemical deposition systems, washing chambers, laboratory oxidation chambers, power supply systems, photolithography and other technological equipment, special

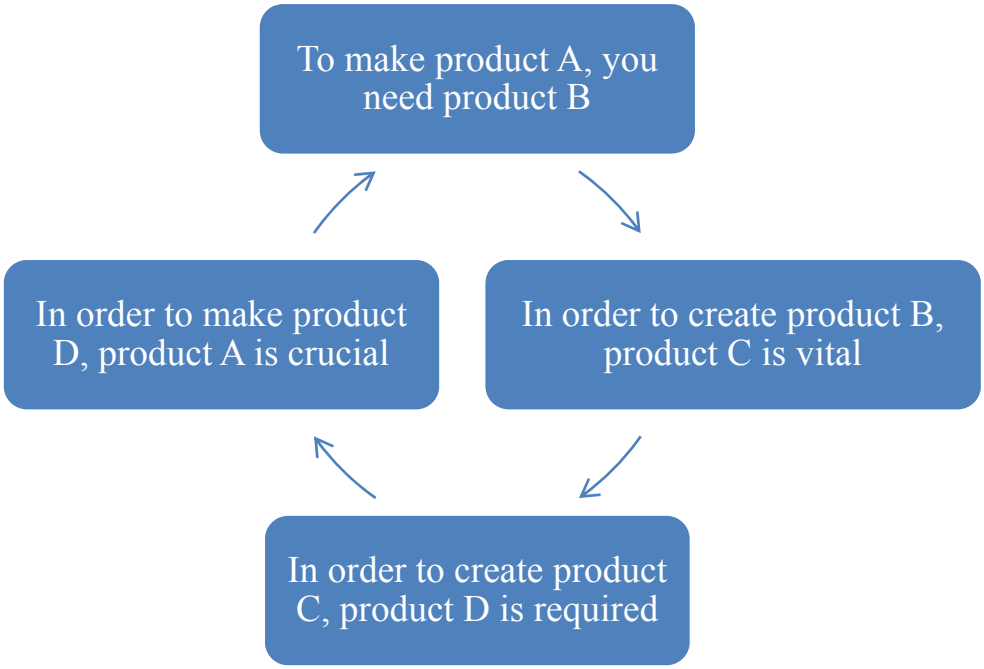

Fig. **An example of the technological link in the goods production**

Source: compiled by the author.

protective suits for workers, etc. Also, it is necessary to build factories for production of microprocessors, to form the developed system of location and delivery of all necessary things to producers and designed products to consumers.

As a result, manufacturing of microchips in Russia, apart from technology, specialists, investments, multifaceted support from the state, will require development of science, engineering, mining, chemical and light industries, ferrous and nonferrous metallurgy, machine building, construction, transport, warehousing, etc. Moreover, changes in the structure and volume of each ingredient required for microprocessors will entail a long chain of changes in the structure and volume of other products. For example, palladium requires nickel, silver, and copper sulphide ores. And for the production of processing equipment, we need ferrous and non-ferrous metals and composite materials, machines and equipment, logistic links and even microprocessors. It is like a closed-loop spiral (infinity or lemniscate), where in order to increase the production of a commodity, one must also increase, among other things, the output of the commodity itself (see *figure* below).

Input-output models allow to study such interlinks, chains and connections and help to calculate volumes of different items outputs [7–9].

OPPORTUNITIES FOR GROWTH

Below are some results of calculations of growth in output of goods, caused by the increase in the size of production of 16 types of products and services recorded by Rosstat, presented in the "Table of utilisation of domestic products in basic prices for 2019". These products (*Table 5*) will be referred to as "initial" or "estimated products". The choice of these products and services is due to two circumstances — all of them: a) are important for socio-economic development of the Russian

Table 5

16 initial goods and services

Product	Share in total output, 2019, %
Agricultural and hunting products and services	2.6
Mining and quarrying products	7.8
Foodstuffs, beverages, tobacco products	3.9
Coke and refined petroleum products	4.5
Chemicals and chemical products	1.5
Basic pharmaceutical products and pharmaceutical preparations	0.3
Rubber and plastic products	0.5
Basic metals	3.3
Computer, electronic and optical products	0.7
Motor vehicles, trailers and semi-trailers	1.2
Repair and installation of machinery and equipment	0.6
Building and construction services	5.5
Air and space travel services	0.7
Information technology products and services, software development services; consulting and similar IT services	1.0
Public administration and military security services; compulsory social security services	4.5
Human health activities	2.0

Source: compiled by the author according to Rosstat's data. URL: https://rosstat.gov.ru/statistics/accounts

Federation in the current environment; b) are affected by anti-Russian sanctions, bans and restrictions on imports and exports.

Calculations have shown that increases in the production of each initial product occur simultaneously with the expansion in output of a number of other products and services. Thus, growth in agriculture and hunting products and services is associated with an increase in the production of chemicals and chemical products, paper and paper products, with the development of fishing and aquaculture, with the expansion of land and pipeline transportation services, and scientific, technical, and veterinary services, and entails increases in foodstuffs, beverages, and tobacco output. Increases in the volume of software products and software development services, consulting and similar information technology services are accompanied by increases in computer repair services, personal and household goods, telecommunication services, postal and courier services, employment and recruitment services, and real estate-related services.

An increase in one part of these products and services is necessary to ensure growth in the initial product, while the other is a consequence of increase in its output. There are goods and services that grow with the growth of many of the initial products (see *table 6*).

Based on the results of the calculations, the initial products are divided into two groups.

Table 6

The first five products most frequently encountered in calculations, the production expansion of which occurs with the growth of the initial 16 types of goods and services

Product	Share in total output, 2019, %
Mining and quarrying products	7.8
Coke and refined petroleum products	4.5
Chemicals and chemical products	1.5
Manufactured metal products, except machinery and equipment	1.2
Land and pipeline transport services	3.6

Source: compiled by the author according to Rosstat's data. URL: https://rosstat.gov.ru/statistics/accounts

The first includes those activities whose output increase by *r %* requires a smaller, than *r,* increase in the output of all other activities. According to the calculations, this group includes, for example, extraction of natural resources; crop production, animal husbandry, hunting and provision of services in these fields; production of computers, electronic and optical products; development of computer software and consulting services; production of motor vehicles, trailers and semi-trailers.

The second group includes activities whose output growth by *r* percent requires the growth of a number of other activities by more than *r* percent. Thus, according to calculations, in order to increase the production of food, beverages, tobacco products by *r* percent, it is necessary to expand the output of products and services of agriculture and hunting, as well as fish and other products of fishing and fish farming, services related to fishing and fish farming by more than *r* percent. In the case of construction, there were 18 such activities. And for the growth of services in the field of public administration and military security, compulsory social security services by *r* percent, it is necessary to increase the output of 27 types of economic activities by more than *r* percent. The *Table 7* contains examples of products and services from the second group.

The third result from the calculations shows that the existing inter-sectoral linkages in the supply of products limit a possible scope of some products output expantion. Thus, the data from the "Table of Domestic Product Use at Basic Prices for 2019" by the Federal State Statistics Service of the Russian Federation (Rosstat) has allowed in calculations for an increase in the production of pharmaceuticals and materials used for medical purposes by no more than 2.5%; repair and installation services for machinery and equipment — by 3.0%, computer, electronic and optical equipment — by 3.5%, and the output of software products and software development services; consulting and similar services in information technology; information technology services — by slightly more than 4%.

At the same time the Rosstat data used in the calculations can raise by 8–10% (the upper limit of growth rates of output of products and services was set at 10%). The output of such products as "coke and refined petroleum products", "foodstuffs, beverages and tobacco

Table 7

The increase in the volume of some goods and services output which requires a faster growth in the production of other goods and services than they have

The initial product	Products and services that need to grow faster than the initial products
Human health services	Drugs and materials used for medical purposes
Rubber and plastic products	Chemicals and chemical products
Food products, beverages, and tobacco	Agriculture and hunting products and services Fish and other products of fishing and fish farming; services connected with fishing and fish farming
Repair and installation of machinery and equipment	Machinery and equipment not included in other classifications Means of transport and equipment, and other vehicles
Buildings and construction work	Other non-metallic mineral products Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials Fabricated metal products, except machinery and equipment 15 other products and services
Public administration and military security services; compulsory social security services	Postal and courier services Buildings and construction services Telecommunications services Basic pharmaceutical products and pharmaceutical preparations Human health services 22 other products and services

Source: compiled by the author.

products", "agriculture and hunting products and services", "motor vehicles, trailers and semi-trailers".

MAIN RESULTS OF THE RESEARCH

In May 2022, Heli Simola, a senior economist at the Bank of Finland's Institute for Economies in Transition (BOFIT), which specialises in analysing the Russian economy, published calculations based on the Asian Development Bank's (ADB) 2019 inter-regional input-output table. They showed that the developed countries' "a ban on imports from Russia hits hardest the commodity branches such as mining, oil refining and wood-processing the hardest" [5, p. 7]. These are followed by metallurgy and water transport.

Our results revealed not only the most sensitive commodity groups to the reduction in exports, but also the products and services related to them by technological chains, as well as the products and services whose production reacts markedly to the decline in exports of many types of goods. Knowledge of such dependencies and the strength of influence makes it possible to calculate the effects of various types of restrictions and bans on exports and imports of products and services. Usually such bans, restrictions and sanctions constrain the economic development of a country, which requires the creation and expansion of domestic production, and a change in the structure and geography of external economic relations.

Because of the technological, logistical and economic (business) chains of interdependence in the production, transport and consumption of the products created by society, changes in each element of those chains affect a number of other elements as

Table 8

Average annual growth rates of some types of goods in 2023–2025, % (baseline forecast)

Manufacturing	2022 Assessment	2023–2025 Forecast
Computers, electronics, and optical products	103.4	101.8
Electrical equipment	94.4	101.3
Machinery and equipment, not included in other groupings	102.9	102.8
Motor vehicles, trailers, and semi-trailers	58.0	106.4
Other vehicles and equipment	100.7	103.0

Source: compiled by the author according to the Forecast of the socio-economic development of the Russian Federation for 2023 and for the planned period of 2024 and 2025.

well. This is a meaningful explanation of the following result: the increase of production of one of the products represented in the input-output balance sheet occurs simultaneously with the increase of output of some other products and services.

The technologies for producing a given quantity of a product determine the ingredients, quantities and ratios needed to create that product. As a product is scaled up and its characteristics change, some products may require more inputs than others. As a result, output of some ingredients may need to be increased by more, while others may need to be increased by less.

Accordingly, the two types of products and services have been identified by the calculations. An increase in the growth rate of the first type of products and services entails a smaller increase in the growth rate of all other products and services. If the growth rate of the second type of product and service increases, there are products that should be scaled up at a faster rate.

The indicators of the input-output balance record the actual input and output volumes that exist in the country. They, in their turn, were formed under the influence of objective economic laws, technologies used, and the established socio-economic system. The indicators of an input-output balance include neither the transition to mass application of principally and radically new technologies of production, delivery to the consumer and use of products and services, nor fundamental changes in the structure and volume of exports and imports, nor change of socio-economic formation. Therefore, the data recorded in the "Table of Domestic Product Use in Basic Prices for 2019", compiled by Rosstat, allow only for evolutionary changes in the size of output of products and services. For some products it is 1–2%, for others 3–5%, and for others it is slightly more.

It is therefore not by chance that in the Forecast of Social and Economic Development of the Russian Federation for 2023 and for the planning period 2024 and 2025 [10] the growth rates even for critical products are within the limits that coincide with our calculations (*Table 8*).

It is important that the calculations based on input-output balances help to identify the set of activities most conducive to the country's economic development and to overcoming sanctions pressures.

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REFERENCES

1. Guarascio F. EU to propose import ban on Russia coal, chemicals, wood — source. Reuters. Apr. 05, 2022. URL: https://www.reuters.com/world/europe/eu-propose-new-sweeping-sanctions-against-russia-worth-billions-euros-source-2022–04–05/ (accessed on: 29.07.2022).
2. Felbermayr G., Mahlkow H., Sandkamp A. Cutting through the value chain: The long-run effects of decoupling the East from the West. Kiel Working Paper. 2022;(2210). URL: https://www.ifw-kiel.de/fileadmin/Dateiverwaltung/IfW-Publications/-ifw/Kiel_Working_Paper/2022/KWP_2210_Cutting_through_the_Value_Chain/KWP_2210.pdf
3. Langot F., Malherbet F., Norbiato R., Tripler F. Strength in unity: The economic cost of trade restrictions on Russia. VoxEU column. April 2022. URL: https://voxeu.org/article/economic-cost-trade-restrictions-russia (accessed on: 17.06.2022).
4. Mahlstein K., McDaniel C., Schropp S., Tsigas M. Potential economic effects of sanctions on Russia: An Allied trade embargo. VoxEU column. May 2022. URL: https://voxeu.org/article/potential-economic-effects-allied-trade-embargo-russia (accessed on: 03.06.2022).
5. Simola H. Trade sanctions and Russian production. Bank of Finland. BOFIT Policy Brief. 2022;(4). URL: https://helda.helsinki.fi/bof/bitstream/handle/123456789/18406/bpb2204.pdf?sequence=1
6. Pestova A., Mamonov M., Ongena S. The price of war: Macroeconomic effects of the 2022 sanctions on Russia. VoxEU.org. April 15, 2022. URL: https://voxeu.org/article/macroeconomic-effects-2022-sanctions-russia (accessed on: 02.05.2022).
7. Granberg A. G. Dynamic models of the national economy. Moscow: Ekonomika = Economics; 1985. 240 p. (In Russ.).
8. Shatilov N. *F*. Analysis of the dependencies of socialist extended reproduction and the experience of its modeling. Novosibirsk: Nauka = Science; 1974. 250 p. (In Russ.).
9. Baranov A. O., Gordeev A. V. The evaluation of the impact of national projects on the development of the Russian economy using a dynamic input-output model. *EKO: vserossiiskii ekonomicheskii zhurnal = ECO All-Russian Economic Journal.* 2019;(10):94–114. DOI: 10.30680/ECO0131–7652–2019–10–94–114 (In Russ.).

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