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How Russia's trade with China influences carbon dioxide emissions in Russian regions

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Abstract

The Sino-Russian partnership has become one of the hottest issues in contemporary international politics. Significantly, the highest potential is in the movement of both countries to Carbon Neutrality. China pursues the goal to reach its carbon peak by 2030, aiming to achieve net-zero carbon dioxide emissions. The Russian government is also involved in new programs concerning emissions reduction. The two countries plan to collaborate on a new level of responsibility and transregional interconnection. The paper aims to analyze the influence of Russia's trade with China on carbon dioxide emissions in Russian regions. The authors present a review of carbon dioxide emissions between the two countries, explore the processes of trade in several categories of products and outline forward forecast tendencies. The paper uses complicated forecasting modeling in Python to assess the prospects of trade collaboration between Russia and China untill 2030. It makes forecasts of the volumes of carbon dioxide emissions and environmental trends till 2030. The research results show that the highest levels of emissions are observed in the industries "Mineral products", "Chemical products" and "Animal husbandry and fishing products and services", while "Wood works and furniture", and "Agriculture products and services" produce considerably fewer emissions.

Keywords
trade collaboration, Russia, China, carbon neutrality, low carbon dioxide emissions, carbon emission reduction strategies.

JEL: JEL F53, F64, O11.

1. Introduction

The emission of greenhouse gases as a fundamental cause of global climate change is currently on the BRICS countries' agenda (Panibratov et al., 2022) (Steblyanskaya et al., 2021b). With increased environmental awareness in recent years, the greenhouse effect has attracted worldwide attention. It is necessary to formulate different measures to prevent and control CO_2 emissions according to the national conditions of different countries (Wang and Wang, 2020). In keeping with the UN Environment Program, from 2008 till 2018, anthropogenic greenhouse gas emissions increased by 1.5% per year and reached 55 billion tons of carbon dioxide equivalent ($CO_2 - eq$) in 2018. The Paris Climate Accord calls for urgent CO_2 reductions.

Carbon neutrality refers to achieving net zero carbon dioxide emissions. The balancing of the emissions of carbon dioxide is possible through its removal or by eliminating emissions (the transition to the "post-carbon economy") (Porfiriev et al., 2020). Between 1990 and 2017, CO_2 emissions associated with energy consumption increased 1.6 times in the global economy. The main driver was the growth of the global GDP by 2.1 times. The world population had grown by only 1.4 times, which means an increase in average per capita CO_2 emissions against the background of an increase in the average per capita energy consumption due to the improved quality of life. The main limiting factor for CO_2 emissions may be the reduction in the energy intensity of the world GDP by 35% (Chong et al., 2022). An essential conclusion is that even with low economic growth rates and weak investment activity, a large-scale reduction of CO_2 is unrealistic. Policy in this area cannot be separated from the general socio-economic development strategy that should be regarded as its organic component, which is entirely consistent with the priorities of the UN Sustainable Development Goals (SDGs) and the Paris Agreement (Bobylev & Grigoryev, 2020; Lian et al., 2020).

The paper aims to present a research into the Russian trade collaboration with China towards carbon emissions reduction that focused on estimating how much carbon dioxide was released into the atmosphere in Russia (imports from Russia to China) and China (imports from China to Russia).

The paper structure is as follows. The second chapter of the paper is a theoretical background literature review concerning international cooperation between China and Russia. The third part represents sample and data, and methodological background. The fourth part is presenting results concerning emissions levels in Russian regions. In the fifth part, the authors give some concluding remarks.

2. Literature review

Trade policy is represented by the state's measures to regulate trade and investment relations with other countries. It plays a significant role in ensuring the effective use of external factors in the national economy. To improve the competitiveness and dynamics of economic development it is necessary to use the most effective regulation tools of foreign trade, and achieve greater openness in the national economy (Arapova & Isachenko, 2019).

The Sino-Russian partnership has become one of the hottest issues in contemporary international politics (Fu, 1997; Yurong et al., 2017; Lo, 2020), where the market price certainly plays a considerable role. In the Sino-Russian relationships, some de facto distribution of power has occurred whereby Russia continues to enjoy its role as a provider of the net security umbrella in Central Asia. At the same time, China acts as the regional economic integrator (Nadeem & Ayub, 2021). Market trends are also significant, the trade scale should be expanded, and the price should also be consolidated. Today, only 2% of the world's shipping passes through the Arctic Sea route, and it is expected that by 2030 the index will reach 5%. At the same time, Russia's cargo volume in the Arctic increased significantly in 2017. Some researchers believe that by 2023-2025, 5-15% of China's trade will be transported by the Arctic Sea (Malle, 2017; Steblyanskaya, 2018). The dynamics of Russia's foreign trade with China can be seen in **Fig. 1.**

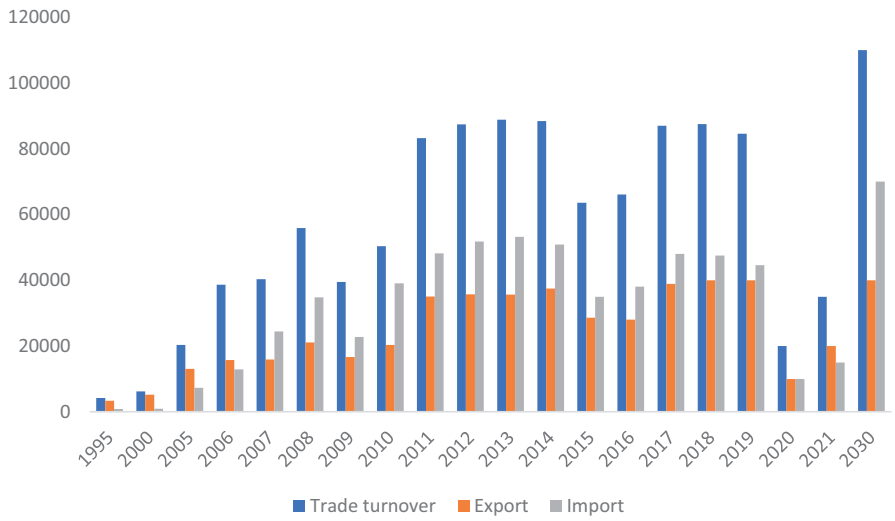

Fig. 1. Dynamics of Russia's foreign trade with China (USD. mln). *Source:* (Steblyanskaya et al., 2021)

While in Russia the government has not invested in the CO_2 reduction, only using current expenses to eliminate environmental disasters (Steblyanskaya et al., 2021),

China makes a great effort to achieve carbon neutrality by 2060 (Guan, 2008; Zhang, 2019). China needs to understand its carbon neutrality status and then scientifically plan a path to achieve carbon neutrality (Niu et al., 2021). However, it would be hard to achieve carbon neutrality goal for China, because energy consumption and carbon dioxide emissions continue to increase. China needs new technologies, innovations and green products (Zhao et al., 2022). Local governments in China implement environmental policy and become the beneficiaries of index ratings. Excessive carbon emissions pollute the environment, resulting in negative externalities. According to Wang and Wang (2020), the emission trading mechanism for sulfur dioxide has had no control effect on sulfur dioxide emissions. Liu et al. (2016) established that China's Sulphur dioxide emission trading policy model incorporated numerous subsystems, indicating that the program's contribution to total Sulphur dioxide emission control would increase steadily (beginning in 2011). Many scientists used a time-recursive dynamic general equilibrium model to examine the macroeconomic implications of restricting China's carbon dioxide emissions (Liu, 2012; Liu, 2013; Liu, 2015). However, few researchers are involved in investigating the problems of collaboration trade and how the collaboration trade between the countries may influence the Sino-Russia relationship. As the largest energy consumer and greenhouse gases (GHG) emitter globally, China is looking for ways to meet the challenges it faces in the process of its growth with the help of green economy (Chen et al., 2017). The potential capacity of the Chinese economy is enormous; however, the essential question is how to trade in line with carbon neutrality goals (Qi et al., 2016; Roach, 2017).

Jia Linjuan analyses the efficiency of Russian trade policy in relation to Chinese provinces with a focus on achieving carbon neutrality (Jia Linjuan, 2013). Ke Yan, Zhao Guanyi, and Wang Lei Their showed that the competitiveness of Russian coal in the East Asian market would be further improved if Russia took care of the carbon dioxide reduction policy. The authors analyzed the trends and flows of the Russian coal exports with a view to carbon neutrality and provided decision-making support for further promoting China-Russia energy cooperation and ensuring both countries' energy security (Ke Yan et al., 2021). Han points out that China and Russia have launched a new round of games around the critical issue of "carbon neutrality", which will become the area of China's and Russia's strategic cooperation and, at the same time, trade competition between the countries. He identifies ways to strengthen cooperation between China and Russia in the field of low-carbon energy; these include the creation of a mechanism for cooperation in the field of low-carbon energy, deepening cooperation and capacity building within the framework of the interface of the EAEU and the "Belt and Road" project, strengthening bilateral exchanges and cooperation in the field of low-carbon energy technologies, the use of multilateral organizations for coordination between China and Russia (Han et al., 2021). Ying maintains that the Chinese-Russian policy of carbon emissions reduction, transferred from the national to the regional level, must have targeted cooperation (Ying, 2020). Yet, theoretical research concerning how Russian-Chinese trade influences the carbon neutrality of the Russian regions and Chinese provinces is minimal.

3. Methodology

The study is based on statistical data concerning production output in Russia and China by industry, the volume of carbon dioxide emissions in Russia and China by industry, and the volume of trade between Russia and China by industry and region. Only direct greenhouse gas emissions are taken into account. Carbon dioxide forecast modeling was done using the Python program 3.4 (Scellato, 2013).

- The Paper uses the following Russian data sources:
- Export from Russia to China database[1] Data from the Russian Bureau of Statistics[2]
- Belt and Road Data[3]

The Chinese data sources used in the present research are:

- Environmental, economic and social data from the 1970-2018 China Environmental Statistics Book and data from the China Bureau of Statistics[4]
- Environmental, economic and social data from the 1970-2018 China Environmental Statistics Book and EPS Database[5]

The authors determine the share of emissions (tons) per unit of gross output. Because statistical data are given in national currencies, all financial data were converted into USD to unify calculations. This makes it possible to estimate the amount of China's and Russia's carbon dioxide emissions per 1 USD of GDP in different industries. A linear regression model was used for every China and Russia industry to predict trade volumes. The carbon dioxide emissions volume was predicted considering environmental trends.

The research based on interstate trade between Russia and China estimated how much carbon dioxide emissions was released into the atmosphere in Russia (imports from Russia to China) and China (imports from China to Russia). The main research task is to determine how it can be possible to balance carbon dioxide between Russia and China. If the balance is negative, then the carbon dioxide emission shifts beyond the state borders, passing the problems associated with it on to the trading partner. If the balance is positive, the products associated with carbon dioxide production shift to the seller country.

This method of assessing interstate trade allows us to consider greenhouse gas emissions in the China-Russia's system. The idea is that in this system, the two countries could benefit from each other. It does not matter whether it is China or Russia that will achieve carbon neutrality first, but there is a need to be sure that one country in the system will support the other in this achievement. For example, if all greenhouse emission-related production is removed from one country, greenhouse

1 https://ru-stat.com/date-Y2014-2014/RU10000/export/CN
2 https://rosstat.gov.ru/
3 http://eng.greenbr.org.cn/shuju.gbp_data_asean.do?m=empty
4 https://data.stats.gov.cn/search.htm?s=%E4%B8%AD%E4%BF%84%E8%B4%B8%E6%98%93
5 http://olap.epsnet.com.cn/

gas emissions could be carried by the other country. To achieve positive effects for the countries' ecology, it is essential to ensure a balance of carbon dioxide in international trade that would minimize emissions throughout both countries, or ensure maximum absorption of emissions, for example, due to many forest areas in the producing country. The possibility of using green technologies must be taken into account.

4. Results

The results of research show that the highest level of emissions is observed in the "Mineral products" industry. the second and third places belong to "Chemical products" and "Animal husbandry and fishing products and services". Such industries as "Wood works and furniture", and "Agriculture products and services" have a very low emissions level (see **Fig. 2**).

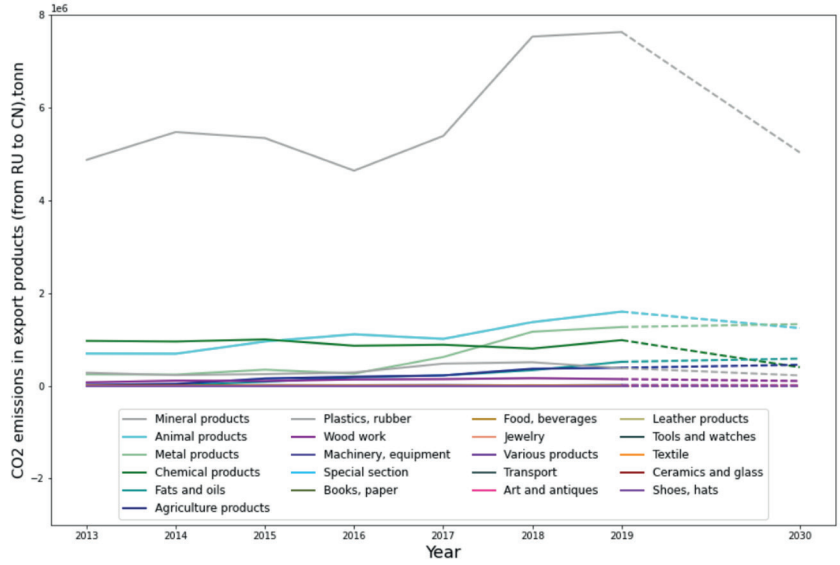

Fig. 2 CO_2 emissions in export products (from Russia to China). *Source*: the authors' calculations

The primary emissions of chemical industry enterprises include carbon monoxide, nitrogen oxides, sulfur dioxide, ammonia, organic substances, hydrogen sulfide, chloride and fluoride compounds, and dust from inorganic industries. In the graph, we can see the forecast for reducing emissions in the chemical industry. The reduction is planned to be achieved by processing carbon dioxide into large-capacity chemical products and synthetic fuels.

The share of mineral products in the structure of Russia's exports to China in 2020 fell by 65.45%; the share of wood and paper products fell by 8.75%. Industries with less significant shares are food products and agricultural raw materials; these fell by

8.07% of the total volume of Russian exports to China; metals and products made from them - by 6.07% of Russia's total exports to China. The industries with the smallest shares - machinery, equipment and vehicles – fell by 4.60% of Russia's exports to China and the chemical industry products - 3.83% of Russia's exports to China. In imports, industries that produce the highest CO2 emissions are "Mineral products", "Machinery and equipment repair services", "Chemical products" (see Fig. 3).

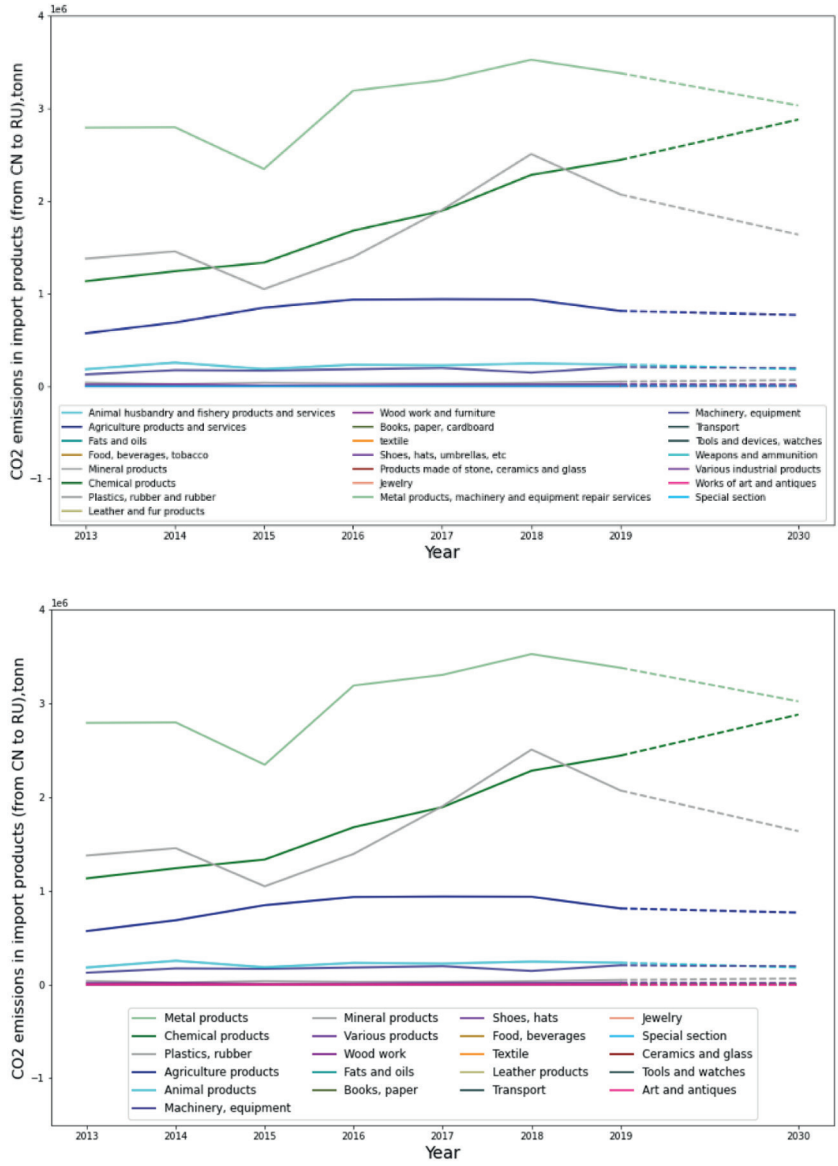

Fig. 3 CO_2 emissions of industries producing import products (from Russia to China). *Source:* the authors calculations

Emissions of mechanical engineering enterprises are characterized by the presence of carbon monoxide, sulfur dioxide, dust, nitrogen oxides, and harmful substances such as xylene, toluene, acetone, gasoline, butyl acetate, hexavalent chromium, lead. In the authors' view, the growing exports of chemical products from China to Russia contribute to the achievement of carbon dioxide balance between countries. In this regard, the growth of exports of chemical products leads to a reduction in greenhouse gas emissions in Russia because the level of emissions from the production of similar chemical products in China is lower than in Russia, due to the difference in technology.

CO2 emissions export and import forecast see in Fig. 4.

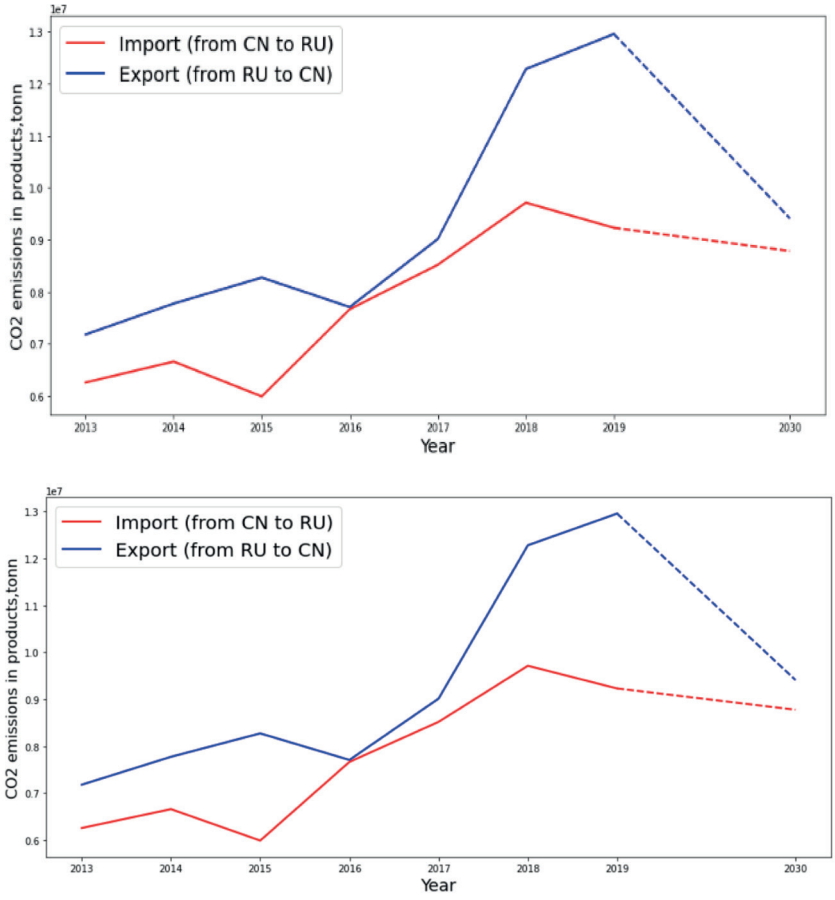

Fig. 4 CO_2 emissions export/import (Ru- Russia, CN- China). *Source:* the authors' calculations

In Fig. 4 we see that the observed decline in exports from Russia to China has been planned. China has stablished a goal to achieve carbon neutrality and developed a set of measures to attain this goal, including the purchase of green technologies and development of trade based on green investments. Russia is still lagging behind

in this matter, which means that, unless it brings enterprises into compliance with environmental standards, the trade with the PRC is likely to be reduced in the nearest years.

Figures 5-9 show CO2 emissions analysis in exports/imports of products. The authors observed the situation with CO2 emissions in every Russian region and carried out an analysis of how trade with China influenced regional emissions.

According to the current policy, China's companies are allowed to buy goods produced only in compliance with the ecological standards. CO2 emission in export products in 2013, 2019 and 2030 can be seen in Fig. 5-7.

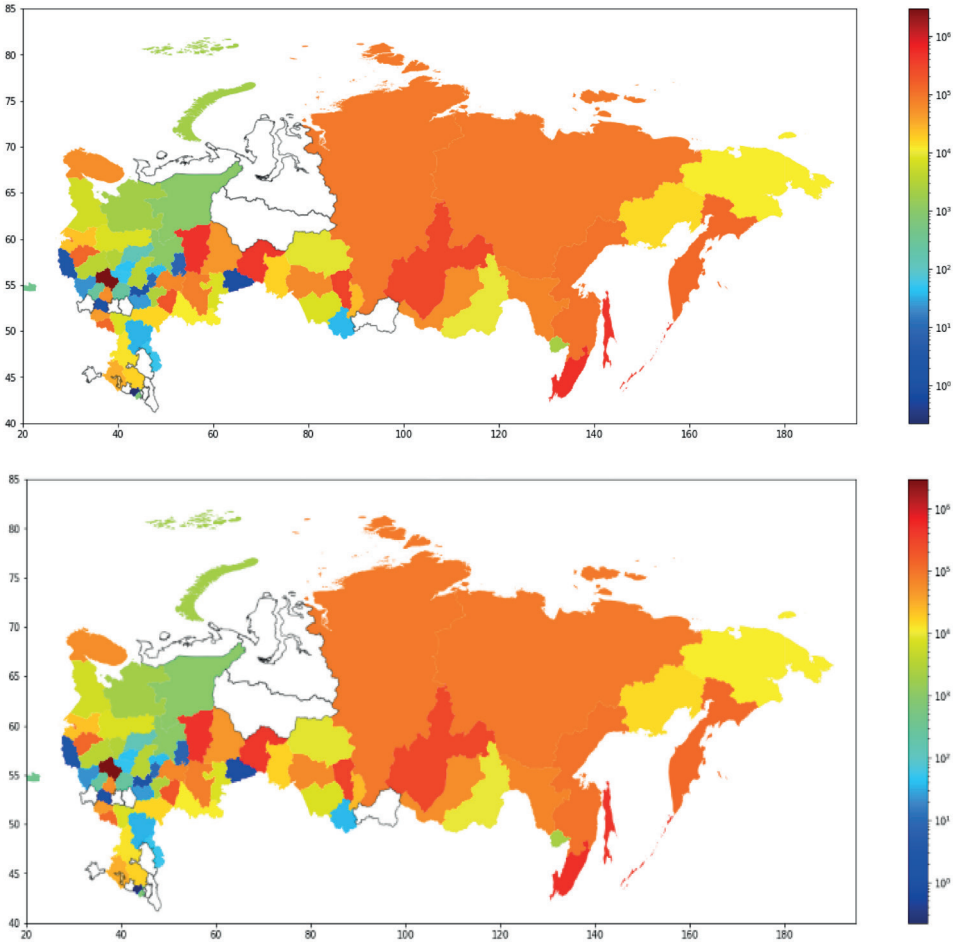

Fig. 5 CO_2 emissions ∈ exportproducts ∈ 2013. *Source:* the authors' calculations

As we see in Fig. 5 it is historically based on the trade between Eastern regions of Russia with China.

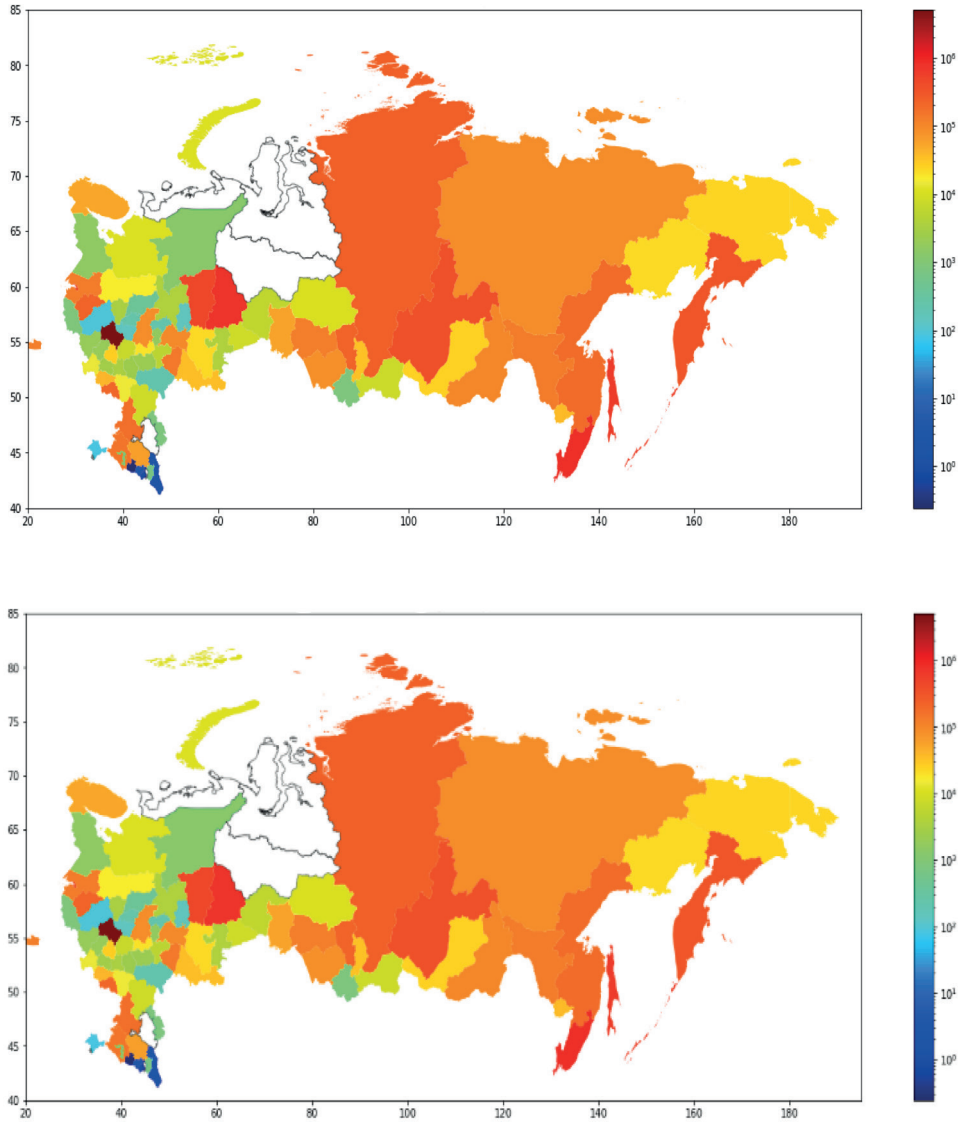

Fig. 6 CO_2 emissions ∈ exportproducts ∈ 2019. *Source:* the authors' calculations

The regions with the highest indicators of trade with China are Primorsky Krai, Tyumen Region, Irkutsk Region, Sakhalin Region, Khabarovsk Territory (Tsvigun, 2016).

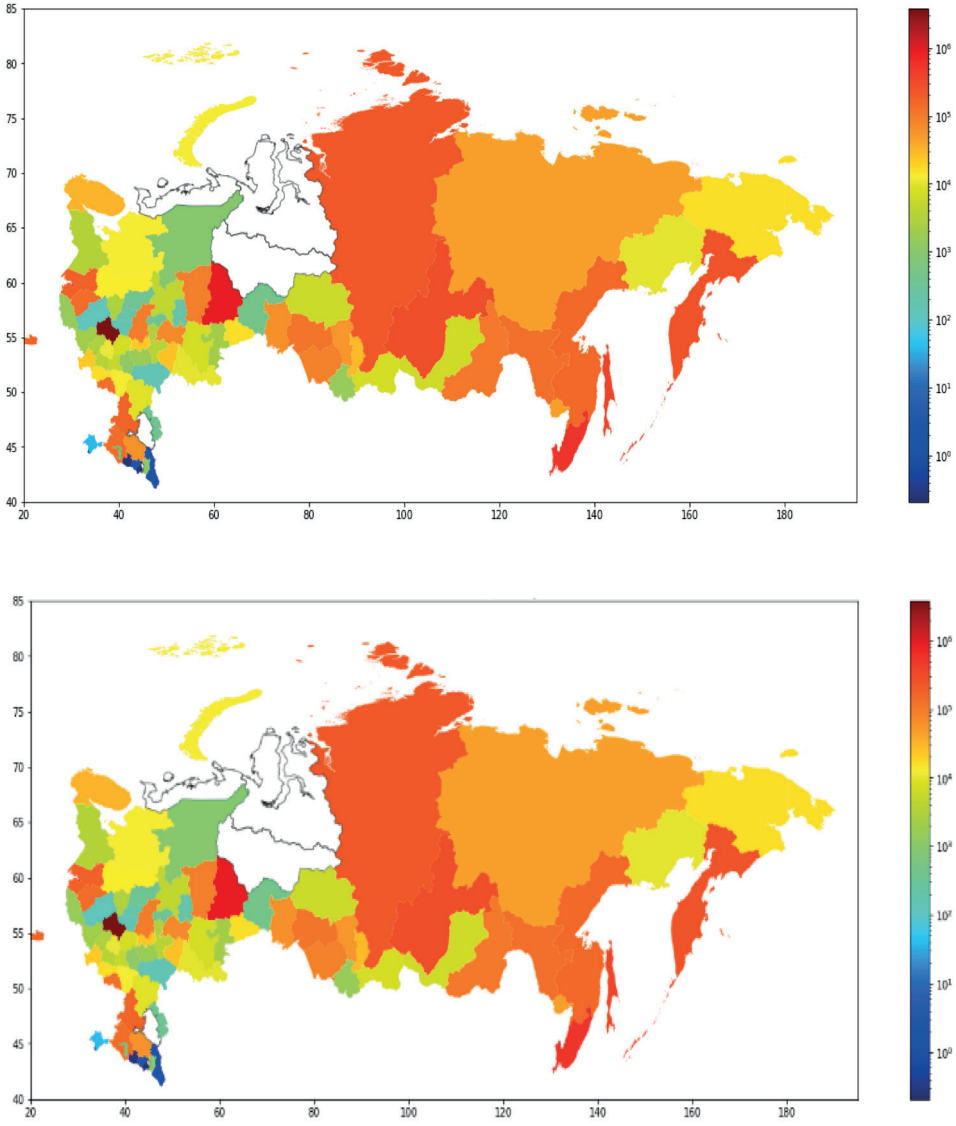

Fig. 7 CO_2 emissions ∈ exportproducts ∈ 2030. *Source:* Authors' calculations

About 70 Russian regions have trade collaboration with China (Suslov, 2016). According to the information at the beginning of this year, China ranks 23rd among investors in Russia (the accumulated volume of foreign direct investment (FDI) is $2.2 billion). Real estate transactions account for $1 billion, financial and insurance activities - $0.9 billion, manufacturing - $0.2 billion. The key regions receiving investments are Moscow (45%), the Trans-Baikal Territory (24%) and the Krasnodar Territory (17%). It is worth noting that, in addition to the bilateral format, joint integration projects with the Eurasian Economic Union (EAEU) are being promoted

by the initiative "One Belt, One Road". This is also stated by the Strategic Directions of developing the Eurasian economic integration until 2025. The high level of CO2 emissions in export products in Primorsky Krai, Tyumen Region, Irkutsk Region, Sakhalin Region, Khabarovsk Territory mean that these regions export more raw materials to China. For example, the low CO_2 emissions in import products in the Murmansk region mean that the consumption of imported goods from China is low in this region.

Carbon dioxide emissions in import products are shown in **Fig. 8, 9.**

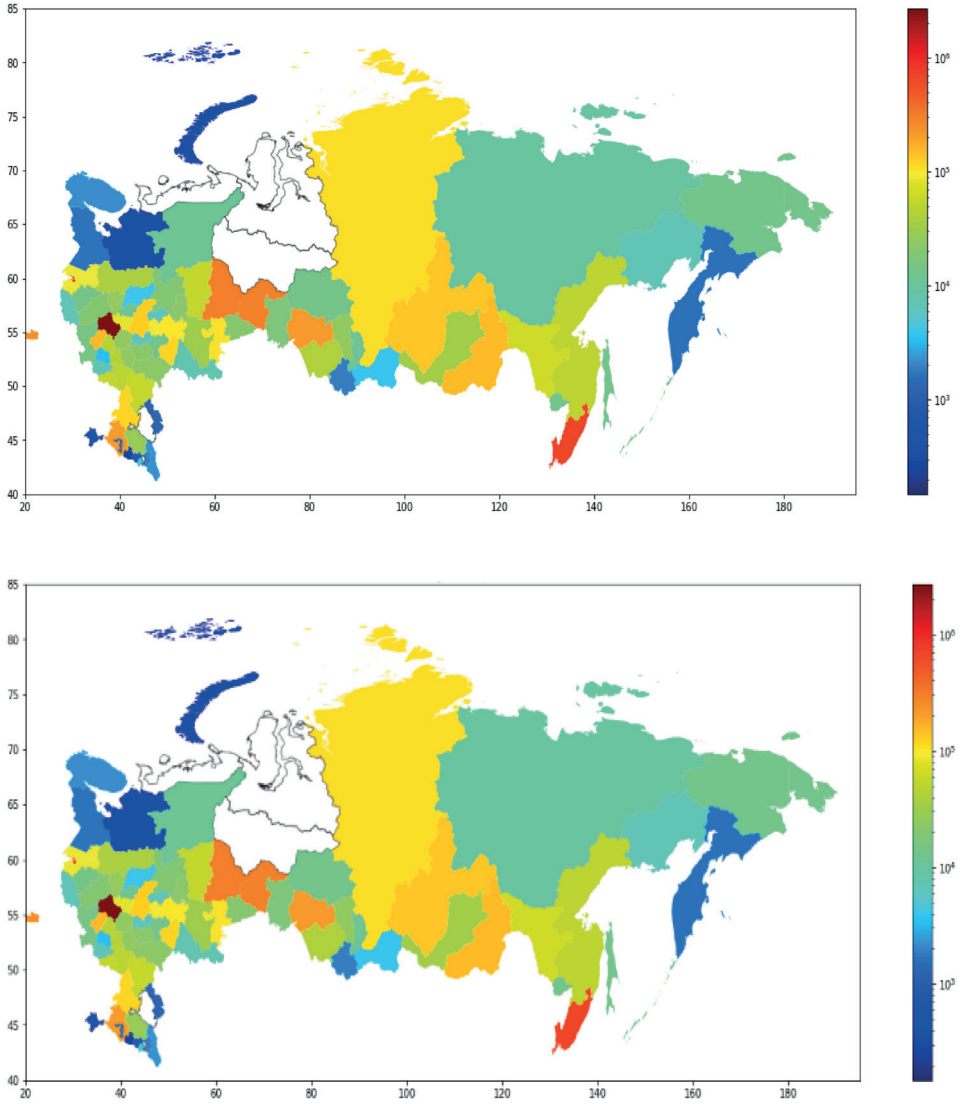

Fig. 8 CO_2 emissions ∈ importproducts ∈ 2019. *Source:* Authors calculations

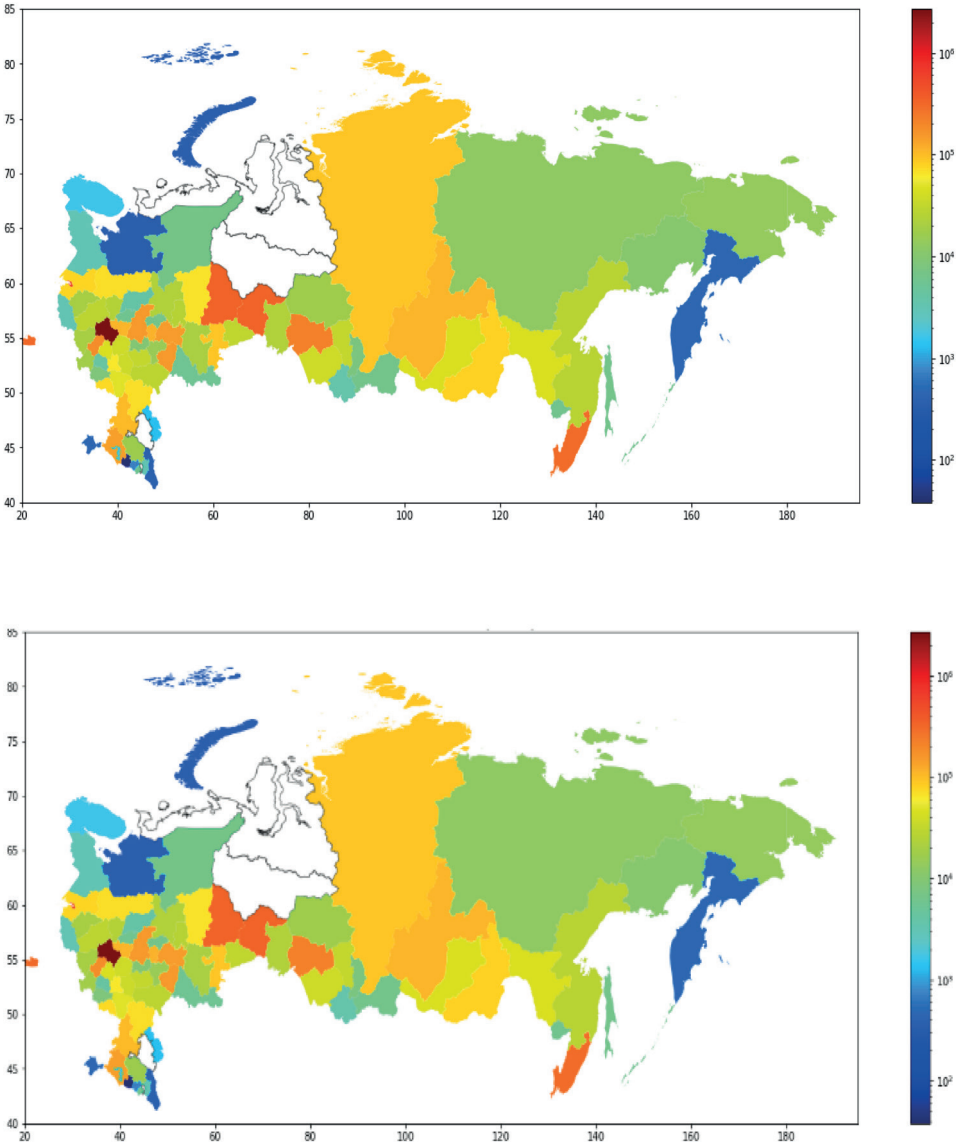

Fig. 9 CO_2 emissions ∈ importproducts ∈ 2030. *Source:* the authors calculations

Shu Jueting, the spokesperson for the China Ministry of Commerce, said that to increase economic cooperation with Russia, China planned to actively promote the development of e-commerce. She also confirmed that the two countries' authorities intend to increase the annual bilateral trade turnover to $200 billion in the future, since "there are favorable trends" for this. Balance of CO_2 animal husbandry see in **Fig. 10, 11.**

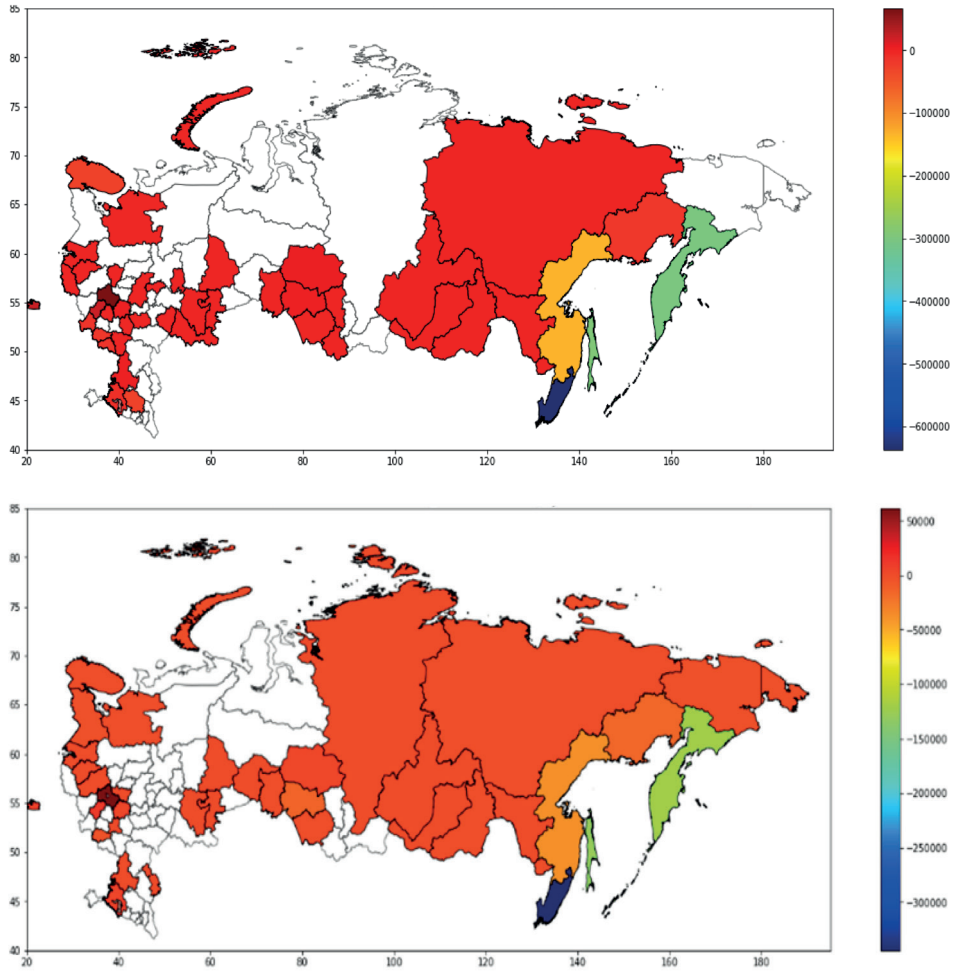

Fig. 10 The balance of CO_2 animalhusbandry ∈ 2019. *Source*: the authors calculations

The efforts of the global community to prevent climate change are mainly focused on reducing carbon dioxide (CO_2) emissions. At the same time, methane (CH_4), nitrous oxide (N_2O) and other greenhouse gases (not containing CO_2) released during crop and animal husbandry activities also contribute to global warming. Agriculture contributes to the increase in carbon dioxide emissions by expanding the area of land use and reducing the space of CO_2 absorption mechanisms (forests, organic soils). Animal husbandry and especially ruminants are the largest sources of direct emissions and the major cause of land-use changes. Synthetic fertilizers also contribute a lot to direct emissions from agriculture. It is necessary to use an individual approach to every region to reduce emissions. The use of technologies and practices that increase factor productivity will simultaneously reduce emissions and ensure food security. At the same time, productivity growth in the crop sector has a positive effect on food security, while productivity growth in the livestock sector contributes more to mitigating the

consequences of agricultural activities. Policy measures in the field of mitigation of the negative impact of agriculture should be aimed at reducing subsidies for high-waste industries (ruminants), materials (inorganic fertilizers) and energy (fossil energy sources), as well as improving the efficiency of food processing and distribution (reducing associated losses and waste). It is necessary to increase support for the conservation of existing carbon sinks, such as through the effective use of regulatory instruments or financial incentives. To achieve the goal of mitigating the negative impact of agriculture, international coordination of national targets is necessary. For example, the following target parameters are used: emissions per unit of input, emissions per unit of physical output, emissions per unit value of production, emissions per unit of value- added (Blandford, D. & K. Hassapoyannes, 2018).

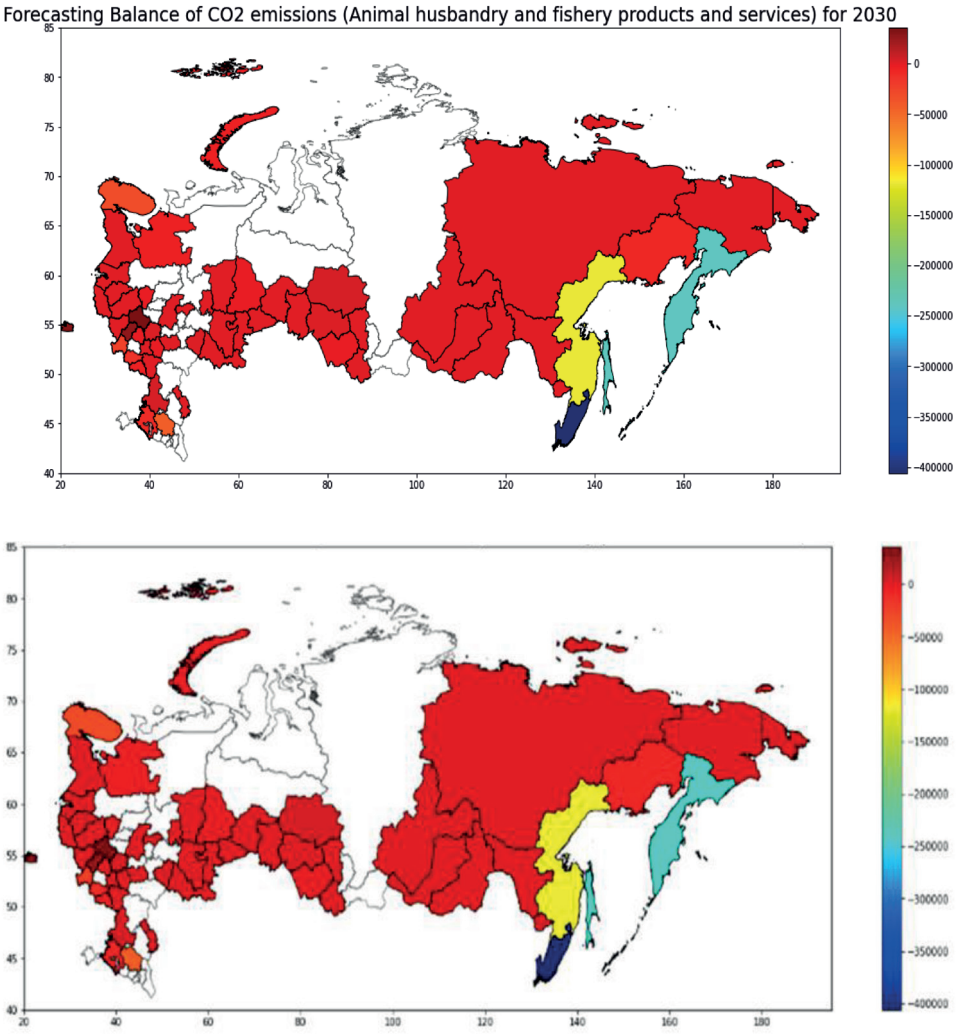

Fig. 11 The balance of CO_2 animalhusbandry ∈ 2030. *Source*: the authors calculations

In general, the forecast for Russian oil exports is optimistic. To a large extent, the price dynamics will reflect the willingness of OPEC countries to pursue a coordinated policy in relation to sanctions. The not so strict position of the new US administration regarding restrictive measures against Chinese goods may also influence the dynamics of oil consumption (Arsky, 2021). Balance of CO_2 emissions Mineral products see in **Fig. 12, 13.**

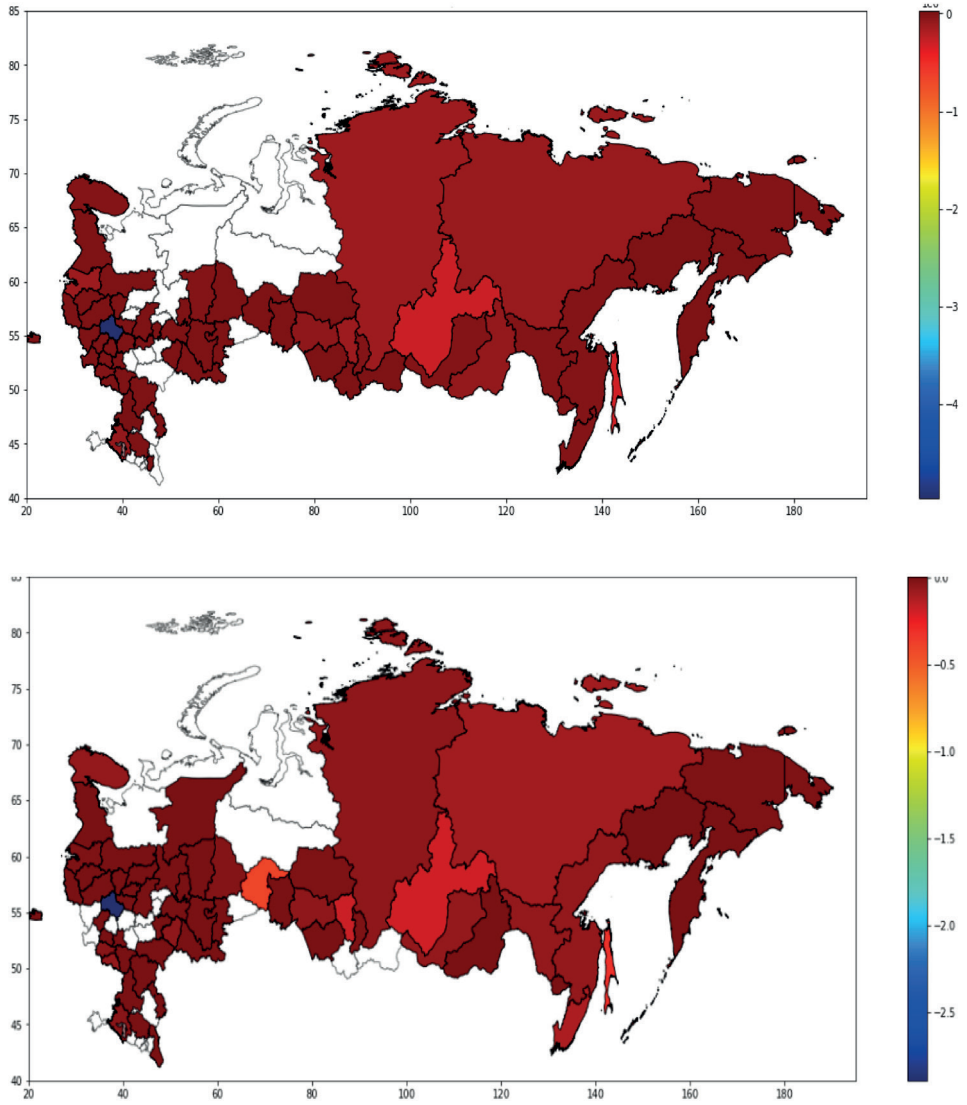

Fig. 12 The balance of CO_2 emissions Mineral products, 2019. *Source*: the authors calculations

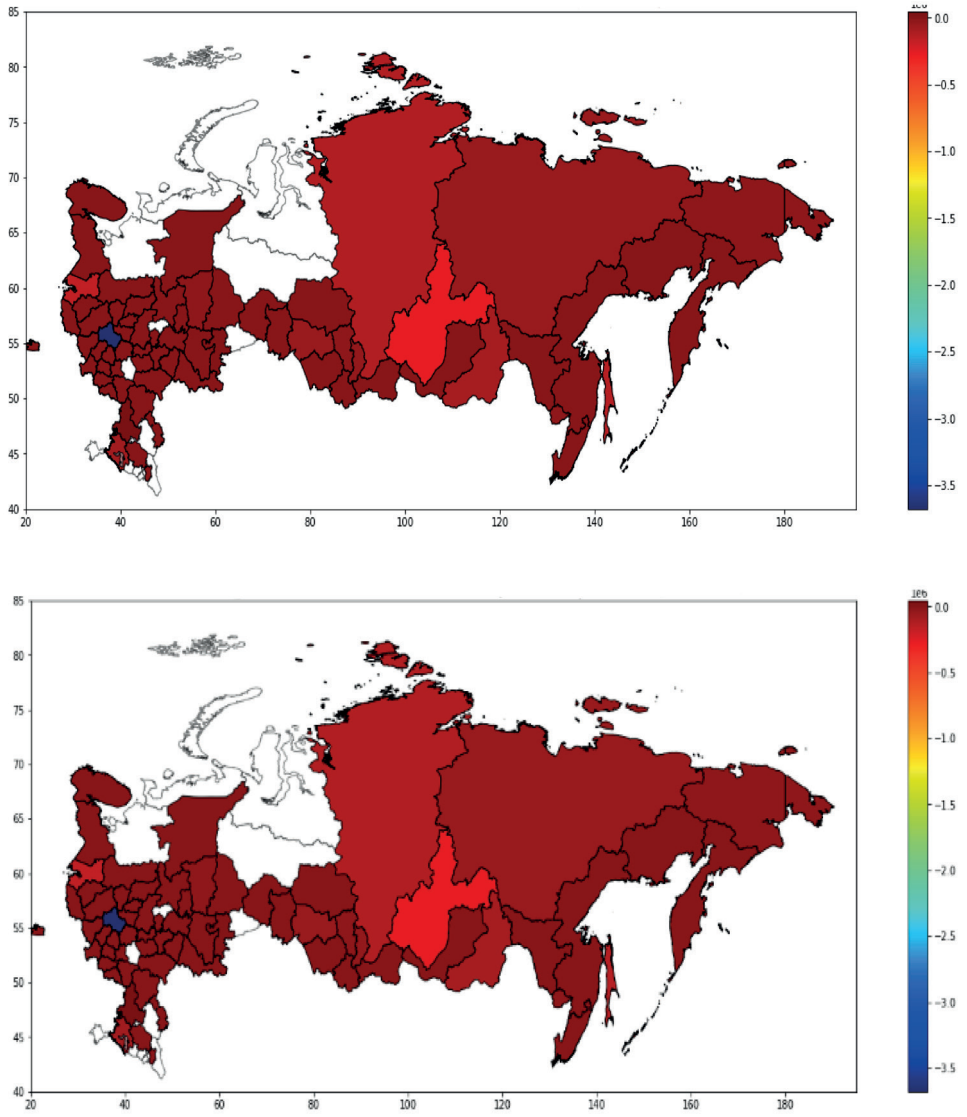

Fig. 13 The balance of CO_2 emissions Mineral products, 2030. *Source*: the authors calculations

The need for new technological equipment for Russian industrial enterprises ensures a high share of export in the future (Shirov, 2018). It is necessary to consider the complexity factors affecting the world demand for petroleum products used as fuel and as a raw material for the synthesis of polymers (Arsky, 2021). Balance of CO_2 emissions Chemical products see in **Fig. 14, 15.**

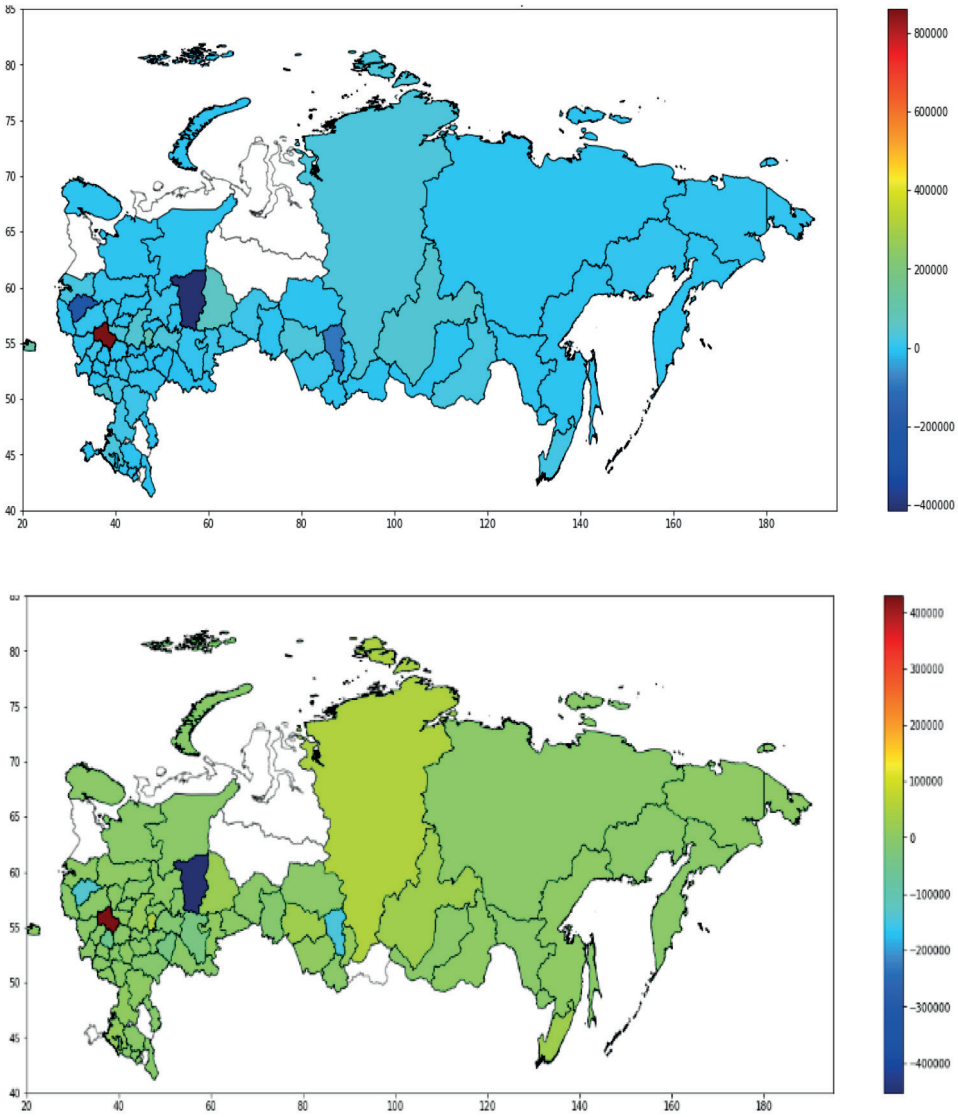

Fig. 14 The balance of CO_2 emissions Chemical products, 2019. *Source*: the authors' calculations

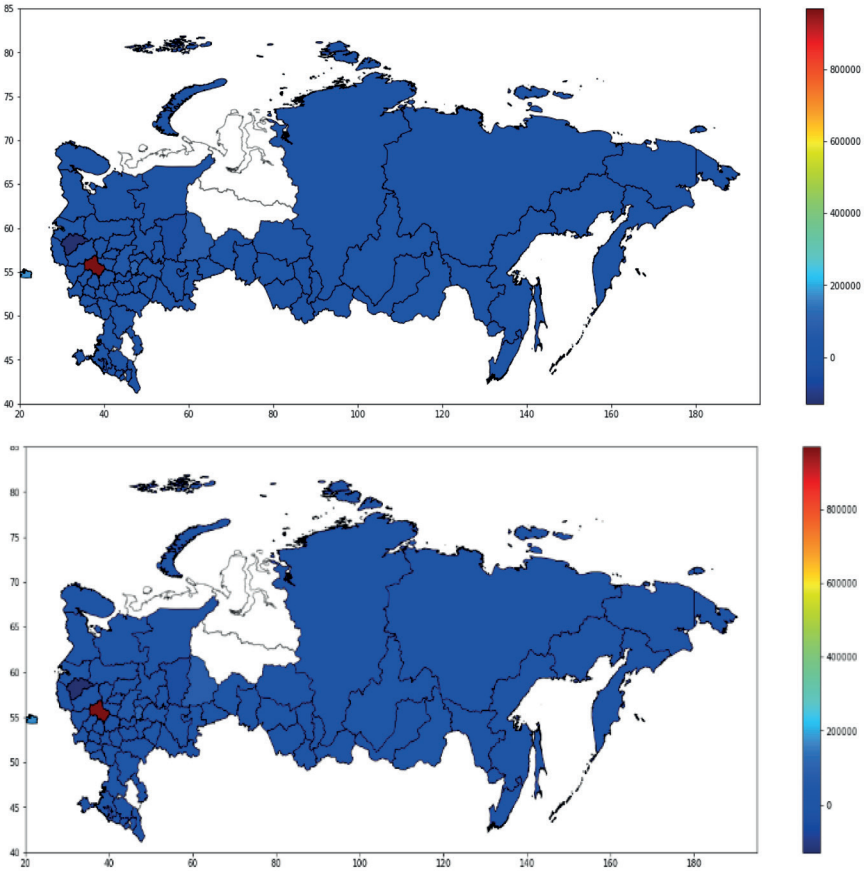

Fig. 15 The balance of CO_2 emissions Chemical products, 2030. *Source*: the authors' calculations

The balance of CO_2 emissions in Plastic, and rubber see in **Fig. 16, 17.**

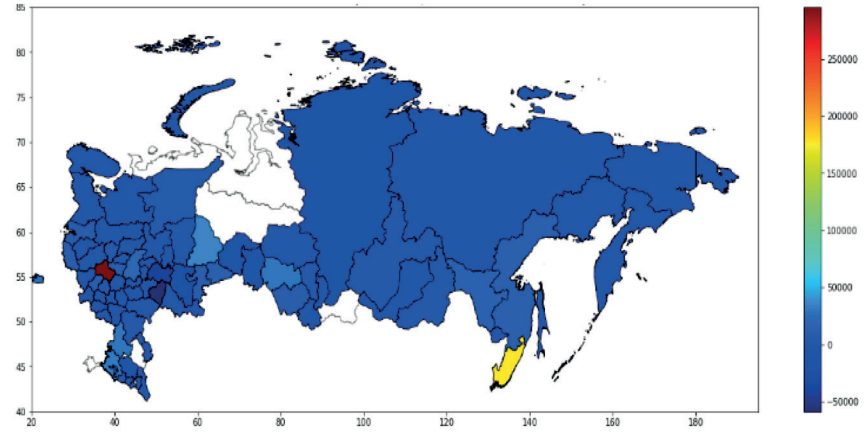

Fig. 16 The balance of CO_2 emissions ∈ Plastic, rubber 2019. *Source*: the authors' calculations

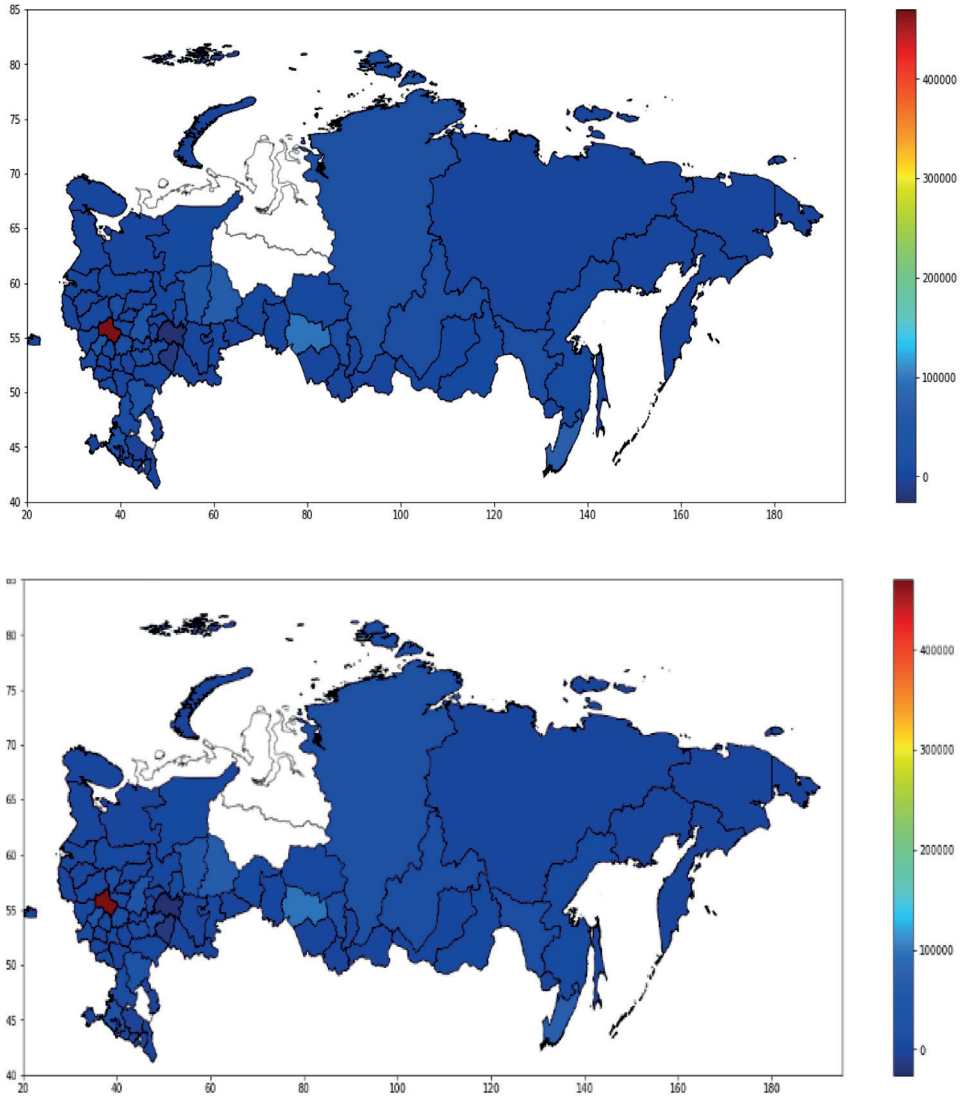

Fig. 17 The balance of CO_2 emissions ∈ Plastic, rubber 2030. *Source*: the authors' calculations

The balance of CO_2 emissions in Metal products, machinery and equipment see in **Fig. 18, 19.**

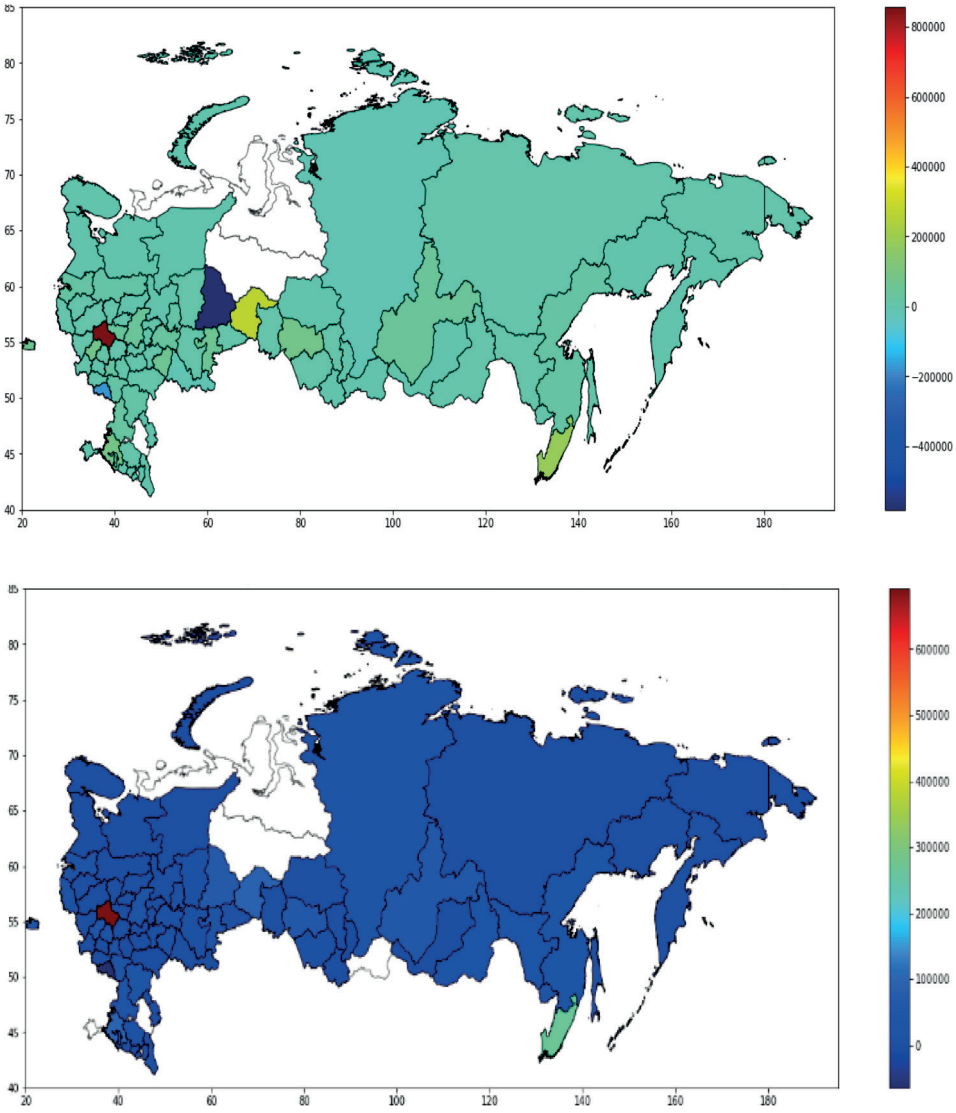

Fig. 18 The balance of CO_2 emissions in Metal products, machinery and equipment, 2019. *Source:* the authors' calculations

The mechanical engineering industry is a primary source of growth in the Chinese economy. The revenue from the export of products of this industry is more than $2.5 billion. Chinese engineering and local markets have a significant impact on the global development of the heavy industry. China's vigorous industrial growth creates outstanding opportunities for foreign manufacturers of equipment and engineering products who can, among other things, provide their services as experts and investors.

In 2019-2020, domestic metallurgical companies faced a severe drop in prices of copper, aluminum, and steel. In particular, it was caused by the pandemic of coronavirus infection and a reduction in trade with China — one of the primary consumers of metal in the world. Experts predict that the recovery of business activity in China will contribute to the positive dynamics of metal prices in 2021-2024 (Arsky, 2021).

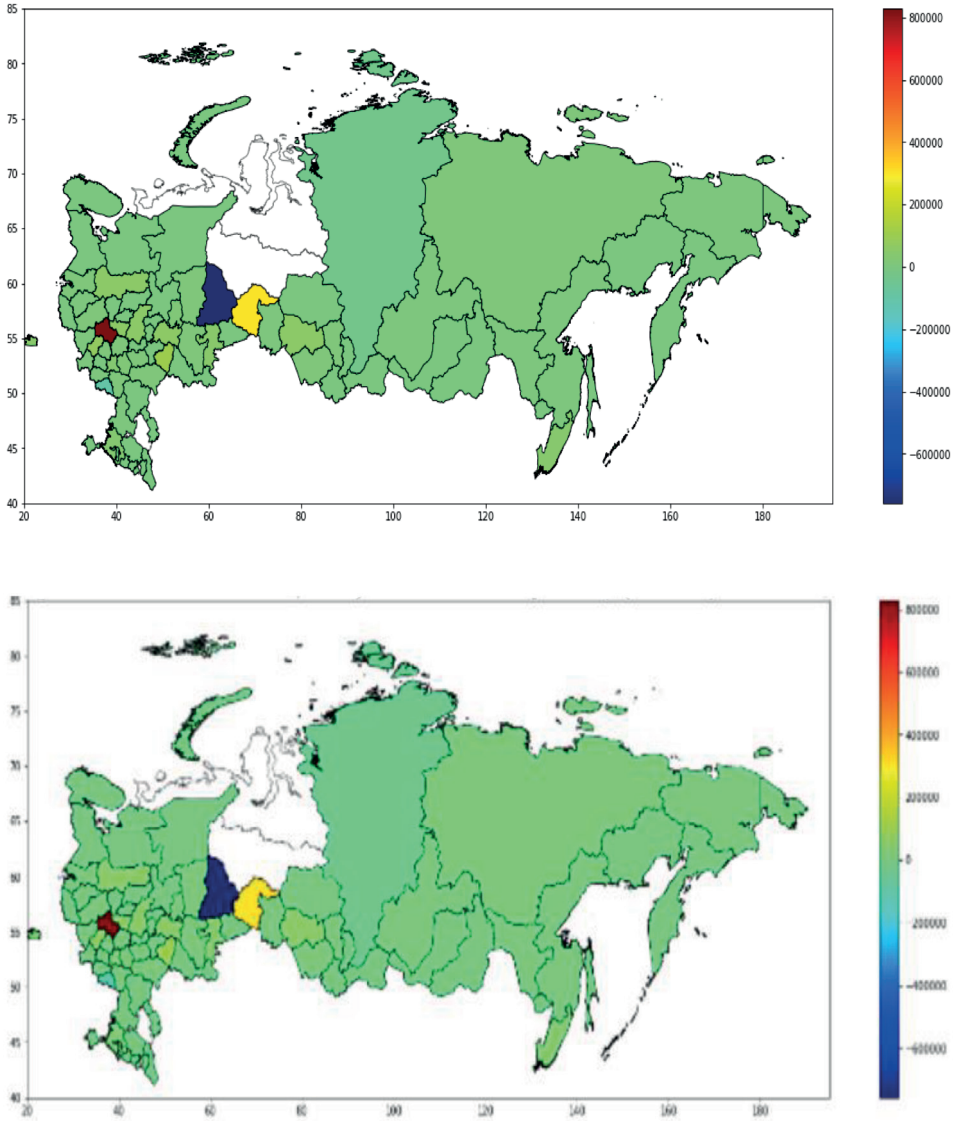

Fig. 19 The balance of CO_2 emissions in Metal products, machinery and equipment, 2030. *Source:* the authors' calculations

The gradual recovery of industrial production in China led to a correction in copper prices from the minimum levels of $4.6 thousand per ton, recorded in March 2020. The latest economic data from China indicate a steady recovery in the Chinese construction and manufacturing sectors in the second quarter of 2020. Among the incentives for the current recovery dynamics of the Chinese economy are fiscal and monetary measures, which were announced at the National People's Congress at the end of May 2022. They include support for the construction, engineering and railway industries, which are traditionally large consumers of copper.

Russia and China's trade turnover is still based on the "old economy" (energy and heavy industry). New areas of cooperation have emerged only recently, mainly due to structural changes in the Chinese economy, where urban consumers are gradually becoming a new driver of growth. Such new directions include cross-border e-commerce, trade in agricultural products, tourism, the development of financial infrastructure and the expansion of the use of national currencies in mutual settlements. Lastly, the green vector of cooperation is gradually becoming the leading one in economic interactions between countries. In this regard, it is advisable to identify the main drivers for possible collaboration between Russia and China in innovative green technologies, which can adjust the proportions of mutual trade with the leading role of state regulation.

5. Conclusions

The research has produced several important results.

Firstly, the authors have proved the conclusions of Hsiung et al. (2021) that China and Russia now view the environmentally-oriented interaction as a core dimension in the present and future development of their strategic partnership. The research showed that China and Russia's carbon dioxide emissions balance is unstable. Efforts to improve this balance are hampered by Russia's increasing international isolation and by the changes in China's trade regulations aimed at supporting environmentally-oriented businesses that operate in compliance with strict ecological protection rules. Regrettably, the research revealed the trend for the increase in purchases of harmful products by China from Russia.

Secondly, Russia and China's trade turnover is still based on the products of the "old economy" (energy, heavy industry). New areas of cooperation have emerged only recently, mainly due to structural changes in the Chinese economy, where urban consumers are gradually becoming a new driver of growth. Such new directions include cross-border e-commerce, trade in agricultural products, tourism, the development of financial infrastructure and increased use of national currencies in mutual settlements.

Thirdly, the green vector of cooperation is gradually becoming the leading one in economic interactions between the countries. In this regard, it is advisable to identify the main drivers of possible collaboration between Russia and China in the innovative green technologies, which can adjust the proportions of the mutual trade with the leading role of state regulation.

The energy sector will remain critical for the application of "green technologies" in the medium term. The rational use of low-carbon production and alternative energy sources can reduce the use of oil and coal (especially in China after 2030-2035). The two countries are gradually replacing their obsolete coal-fired thermal power plants with more economical power units and cogeneration facilities, reducing fuel losses during extraction, use and transportation. This will improve the situation with atmospheric air pollution. Cooperation in renewable energy sources is also seen as promising, for example, the creation of solar energy collection complexes. Considering the interaction of China and Russia in the Arctic, it seems promising to develop wind energy technologies in the coastal zone in the conditions of continuing changes in the Arctic Ocean regime.

Another critical area is "green construction". Cooperation in eco-building construction technologies, reduced resource consumption, meeting special requirements for comfort and rationality, and minimization of environmental impact should be most beneficial. Technological cooperation may concern the development of thematic scientific networks on the problems of ventilation, heat recovery, geothermal heat pumps, wastewater treatment and energy-saving automation.

It is necessary to draw the attention of government officials to the reconstruction of existing production facilities, creation of cross-border clusters, the use of environmental technologies in new production facilities and to the creation of alliances between Russian and Chinese industrial parks. Such cooperation can transform into cross-border partnerships of "ecotechnoparks" in the future. Collaboration between Russia and China ecotechnoparks has yet to be developed. Among the residents of ecotechnoparks there could be not only industrial enterprises and enterprises engaged in waste management, but also research organizations involved in the search for opportunities to organize new industrial relations between enterprises, to obtain new types of products from waste, educational institutions and centers for educating the population about safe waste management. The Russian and Chinese firms may develop a network of enterprises to carry out the reclamation of the land disturbed by mining operations and develope advanced technologies for storing overburden and host rocks in the dumps.

We assume that a wide field of regional bioeconomic will be formed based on the agro-industrial complex of Russian and Chinese border regions. It should be emphasized that what is meant here is not only obtaining substances and extracts from cereal crops and animal products, but also creating a systemic technological transformation in conditions of significant agri-climatic changes. It is necessary to strengthen the set of cross-country competences for deep processing of local raw materials, to foster and encourage environmentally responsible businesses, to focus on introducing environmental technologies, land reclamation, soil protection, and new digital agricultural technologies.

To develop the mechanisms for cooperation between Russia and China on the low-carbon agenda, it is advisable to synchronize incentives for reorienting capital flows to finance sustainable environmental development of the regions. It is

necessary to coordinate the interaction between the regional authorities and giant corporations in order to take account of environmental, social and energy factors in production strategies, to provide the resource corporations with incentives to introduce energy and resource-saving technologies in the investment projects in the Far East.

In the course of the research, however, the authors encountered the following difficulties:

1. A significant limitation is the lack of data on the regions of the Russian Federation for an extended period. The lack of data affects the completeness of the information received. There are very few studies on the impact of trade between Russia and China on carbon dioxide emissions in Russian regions.
2. This paper's statements imply that the trade between the two countries can be a zero-sum game. Although the possibility of using green technologies was not considered in detail, we took account of the green economy development and reduction of emissions in our forecasts. However, it does not change the general situation with harmful production in Russia.
3. There are no standard regulations or strategic programs on reducing carbon emissions between Russia and China.

Future research will involve an analysis of China and Russia's mutual collaboration toward attaining carbon neutrality by 2060 with particular attention to the limitation areas.

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