ORIGINAL PAPER

DOI: 10.26794/2587-5671-2022-26-6-6-16
UDC 336(045)
JEL L10, O30

Forecast of the Impact of the Railway Container Transportation Market on the GDP of the Russian Federation

Ch.V. Astvatsaturova, N.A. Kazakova
Plekhanov Russian University of Economics, Moscow, Russia

ABSTRACT

The relevance and practical significance of the is caused by pervasive impact of container transportation on the economy of the Russian Federation, which is reflected in the State strategy for the development of the transport industry. Expansion of the network of multimodal transport and logistics hubs for handling container cargo should increase their capacity, ensure the growth of transit cargo and the inflow of private Russian and foreign investments in rail transport. The purpose of the research is to develop a forecast for the rail container transportation market in the Russian Federation and estimate its impact on GDP using mathematical and statistical tools based on publicly available information base. The research methodology included the following stages: industry analysis, identification of trends and their assessment; development of a regression model for market forecasting, taking into account the identified factors and information available in the public domain; assessment of the impacts of factors on GDP; taking into account the development risks of the rail container transportation market. Industry analysis, a systematic approach and graphical methods were used to refine the methodology for forecasting the container transportation market by rail in the Russian Federation. The article shows that the key factors influencing the forecast of the development of the rail container transportation market are: advantages over other modes of transport in speed, quality, convenience and cost of cargo delivery; growth of containerization cargo base; transit prospects for developed and developing countries. Based on the data of Rosstat and JSC "RZD", the regression model was built for the dependence of the volume of the Russian Federation's GDP on the dynamics of the rail container transportation market, which allowed to predict the increase of GDP by 2025 compared to 2022 by 20.4% due to the growth of the rail container market, in in particular, due to imports by 55.2%, due to exports by 77.8%, and transit through the Russian Federation by 101.3%. The practical significance of the study is to assess of industry trends and risks in the short and medium-term implementation of the development strategy for the transport industry of the Russian Federation, which allows to substantiate the investment attractiveness of the industry.

Keywords: forecast; impact on GDP; rail container trasportation; industry analysis; investments; regression model

For citation: **Astvatsaturova Ch.V., Kazakova N.A. Forecast of the impact of the railway container transportation market on the GDP of the Russian Federation.** ***Finance: Theory and Practice.*** **2022;26(6):6-16. DOI: 10.26794/2587-5671-2022-26-6-6-16**

INTRODUCTION

In the global market, the share of container transportation is quite high, especially between the USA, Europe and Asia. Today, cargo delivery is mainly by sea, with shortages ranging from 45 days or more, as well as significant disruptions, such as in March 2021 in the Suez Canal. In April 2022, Container Trade Statistics (CTS) estimated the global demand for container transport at 4.3 mln TEU, which is 4% less than the year before, and only 1.5% higher than the level of April "pre-pandemic" in 2019.[1] The growth of the cargo base and containerization, i.e. the switch of cargo to containerized transport from other modes of transport and railway rolling stock, are the key determinants of the dynamics of the rail container transportation market. The advantages, and thus the prospects, of the rail market in developed and developing countries are due to the acceleration of the time and cargo's delivery quality by rail, as well as the multimodality of transport, by containerization of the goods carried. Containerization allows to effectively carry out the process of transportation, loading and unloading, storage of goods, providing a significant advantage over carriage in wagons.

Since the beginning of 2022, due to the geopolitical and economic situation, the container transportation market has also undergone significant changes. So, first a partial and then a complete stop of cargo traffic with Finland, the Baltic countries and some European countries required a response in the form of a change of standard delivery routes, a reorientation of goods "to the East" (in particular, Russia-China) and geographical expansion of shipments. In addition, the suspension of the activities of large container carriers such as Maersk, MSC and CMA CGM, the suspension of transit traffic led to a short-term shortage of containers in the Russian Federation. According to JSC "RZD", the decrease in transit traffic between China and Europe in the future may lead to a fall in transit container traffic on the results of 2022 by 25%.[2] In general, the situation in the container transport market today depends to a greater extent on the sanctions restrictions of the outside world and the adaptability of Russian operators and carriers in the area of 1520.

The aim of our study was to develop a forecast of the rail container transportation market in the Russian Federation using industry analysis and mathematical and statistical tools based on publicly available information base. The practical significance of the results is due to the significant impact of container transportation on the economy of the Russian Federation, and the State strategy for the development of the transportation industry, aimed at the creation and loading of a network of multimodal transport and logistics hubs for the processing of containerized cargos, which will increase the average commercial speed of the movement of goods on railway transportation and, in turn, will lead to an increase in transit cargo and the inflow of private Russian and foreign investments. Local businesses will benefit from faster delivery times, local logistics companies will be able to optimize their own costs, increase asset turnover and reduce delivery time to end users.

The author's approach to forecasting the rail container market is based on the hypothesis that the rail container market in the Russian Federation will continue to grow despite the pandemic, as it has a number of progressive opportunities and prospects for trade among countries. Advantages over other modes of transport are speed, quality, convenience and cost of delivery.

Perspective directions, models and methods of forecasting development of various branches of economy are considered

[1] InfraNews. URL: https://infranews.ru/logistika/containeri/59734-spros-na-kontejnernye-perevozki-zamedlyaetsya-cts/ (accessed on 20.10.2022).

[2] RBC. URL: https://www.rbc.ru/business/03/10/2022/633ae33e9a79475367f13340 (accessed on 20.10.2022).

in the works A. A. Shirova, B. N. Porfiryeva, V. V. Ivantera, D. E. Sorokina, M. N. Uzyakova, M. A. Fedotova and other scientists [1–4]. In order to find the most appropriate approaches to forecasting the volume of the rail container transportation market in the Russian Federation, we have analysed the tools used by Russian and foreign scientists. Among these are studies by A. Stuart and M. Kendell, which suggested a variable approach to forecasting future values, and gave a detailed description of the general theory of regression and the methods of constructing multiple linear regression and estimating the correlation of the analyzed factors [5–7]; R. Fisher's methods for comparing general variances of two independent samples, described in his work "Statistical methods for researcher workers"[3]; paradigm of industry analysis J. S. Bain [8]; methodology for forecasting industry risks using coefficients based on standard deviation, that proposed by A. Damodaran.[4]

During the research, we have also taken into account the work on forecasting of cargo transportation of Russian and foreign authors: Y. Wang, X. Chen, Y. Han, S. Guo [9], which considered the methodology for estimating cargo and passenger transportation by elasticity coefficients and the impact of the results on China's gross domestic product; V. Lukinsky [10], evaluating the condition of the cargo base and infrastructure in the Russian Federation and proposing an analytical platform for cargo management in multi-level terminal logistics systems; A. N. Sakhanova, Y. Zh. Akhmer [11], describing the forecasting methodology using time-series econometric models. For the purposes of this research, were also of interest the following articles by scientists A. I. Orlov [12], E. Yu. Samysheva [13], I. L. Beilin [14], considering the use of econometric methods and digital modelling in forecasting economic processes. We used regression analysis to develop forecasts of container rail transportation in the Russian Federation: A. A. Sazonov [15], A. G. Kunitsyna, L. A. Vinskovskaya [16], O. V. Moskvichev, E. E. Moskvicheva, D. V. Vasiliev [17], A. R. Kurtikova [18].

As a result of the review, we concluded that existing traffic forecasting methodologies are generally based on counterparty data and order volumes, which are only applicable at the company level.

Having studied the available data of Rosstat[5] and JSC "RZD"[6] to assess the prospects of container transportation development in the Russian Federation, the authors selected regression modeling based on the forecast of import, export and transit as an effective indicator — GDP growth of the Russian Federation (in billion rubles) due to the comparable growth in the volume of rail container transportation.

Thus, to realize the purpose of our research and confirmation of the hypothesis, industry analysis, identification of factors and risks of development of the market of rail container transportation, justification of statistically significant indicators of exports, imports and transit of goods, estimation of their impact on gross domestic product by regression model was used.

RESEARCH METHODOLOGY

Our research consisted in developing a forecast of the rail container transportation market in the Russian Federation in the post-COVID-2019 and the current geopolitical situation using industry analysis and mathematics and statistical tools based on regular publicly available information and reliable sources. The research was based on the data of official statistics of Rosstat and JSC "RZD" for 2018–

[3] URL: https://www.scribd.com/document/58873576/Fisher-R-a-1925-Statistical-Methods-for-Research-Workers?language_settings_changed=English (accessed on 25.10.2022).

[4] Website A. Damodaran. URL: http://pages.stern.nyu.edu/~adamodar/. (accessed on 25.10.2022).

[5] Rosstat official website. URL: https://rosstat.gov.ru/ (accessed on 25.10.2022).

[6] JSC "RZD" official website. URL: https://www.rzd.ru/ (accessed on 25.10.2022).

2022, our mathematical calculations, as well as analytical scientific materials from open sources. A model of multiple linear regression has been built, on the basis of which the short-term forecast of growth of the volume of rail container transportation market up to 2025 has been made.

The method of forming the forecast of the market of rail container transportation in the Russian Federation in the post-COVID-2019 and the current geopolitical situation consists of several stages: industry analysis, trend identification and assessment; development of a regression model for market forecasting based on identified factors and publicly available information; assessing the impact on GDP; taking into account the development risks of the rail container transportation market. Industry analysis, system approach and graphical methods used to refine the methodology of forecasting the market of containerized transport by rail in the Russian Federation.

The study is based on an understanding of trends in the development of the container transportation market in rail transport of the Russian Federation, justification of forecast values, identification of current problems and consideration of perspective directions of development of the container transportation market [19–21]. When constructing the equation of multiple linear regression as a dependent factor Y is the volume of GDP of the Russian Federation, which reflects the market value of all goods and services. Import, export and transit of container transportation by rail are selected as factors that influence on GDP.

The built regression model was used for the short-term forecast of the market of rail container transportation in the Russian Federation up to 2025.

It should be noted that, as part of the research, the authors have found that there are risks that are difficult to predict and could have a significant impact on changes in volume rail container traffic, such as, for example, the destruction of railroad tracks as a result of a natural disaster, the introduction of a new package of sanctions by unfriendly countries, the reduction of public and private investment in railway infrastructure in the Russian Federation. To take into account difficult-to-predict risks, an expert method has been proposed, which will allow to rank these risks by the degree of their critical importance. Their accounting in the forecast can be realized as a risk adjustment based on an expert risk matrix.

TRENDS, FACTORS AND RISKS OF THE DEVELOPMENT OF THE RAIL CONTAINER TRANSPORTATION MARKET

The completed analysis proves that the rail container transportation market has grown steadily over the past five years, despite certain difficulties that arose in 2022. The geopolitical situation in the beginning of 2022 corrected optimistic forecasts of shippers, but, according to experts, in 2022 we can get into the so-called "zero dynamics": partial loss of European market compensated by geography of delivery to Asian countries. Experts note that the demand for containerized goods, regardless of external situations, has a number of advantages over carriage in wagons. First of all, there are no requirements for the type of cargo, as well as the ability to carry out loading and unloading operations in ports, in sorting stations, container terminals and storage without unnecessary costs for additional equipment [22].

Speed — is an important factor in the transport of goods. For comparison: it will take about 30 days to move cargo overland from Asian ports to European ports. If the transport is carried out through the Suez Canal, the delivery time can reach 45 days. And the transit of containerized goods by rail through the territory of the Russian Federation currently leaves 12 days, and by 2024 will be reduced to 7 days.

In 2018, by the Decree of the President of the Russian Federation No. 204 from 07.05.2018 approved the "Integrated plan for the modernization and expansion of backbone infrastructure" until 2024, the main thrust of which — is the modernization and development of transport infrastructure, namely — modernization of railway infrastructure, creation of a backbone network of multimodal transport and logistics hubs and transport corridors of the Russian Federation, such as "West — East", "North —South", "Europe — Western China". This became one of the drivers of the growth of the container transportation market in Russia.

In 2018, the container transportation market grew by 14.3% compared to the previous year[7] mainly due to the growth of international transport. In addition, in the freight transport market there has been an upward trend of purchasing covered wagons against the background of their reduction in the cargo base. At the same time, according to research by IPNM (the Institute of problems of natural monopolies), contractors increasingly prefer to use containers instead of covered wagons, as they are more attractive in terms of tariffication and multimodality.

2019 year was marked by a gradual recovery from the financial crisis, an attempt to stabilize the exchange rate of the ruble in the currency market, as well as the growth of selected macroeconomic indicators, while the growth dynamics of the economy are low. For container transportation, the environment was much more favourable: increase of transhipment port capacity, realization of the first stages of the program of development of the Eastern polygon, increase of capacity of Baikal-Amur and Trans-Siberian railway, etc. As a result, Russia's container market rose by 9%, or 5.2 million twenty-foot equivalent unit (TEU). Growth was mainly driven by land transport, transit and containerization of supply chains.

Despite restrictions in early 2020 due to pandemic and border closures between countries, according to CTS,[8] global container market contraction was less than 1%. In general, 2020, despite the COVID-19 and problems in many industries in different countries, demonstrated the growth of container transportation in the Russian Federation and around the world. For the Russian Federation in 2020, despite the global crisis associated with COVID-19, signaled the growth of the container traffic by 11.5%, or up to 5.8 million TEU. In the first place, this happened due to the switch of cargo flow from sea transport to rail, mainly in the direction of Asia — Europe — Asia, including direction "Silk Road". Overland transit through the Far East and containerization of domestic transport in the country also developed. In addition, this growth is supported by a sharp increase in imports from China to the EU of medical products. As a result, in 2020 the growth rate of the volume of transport in the transit direction Asia — Europe — Asia through Russia reached a record 52%. A total of 750 thous. TEU were transported.

The first half of 2022 slowed down the positive trend of growth of freight traffic in Russia as a whole. According to estimates of some experts, the Russian container transport market is expected to fall by 13–18% at the end of the year, the world — by 2%.[9] As noted above, this is primarily due to the disruption of the usual logistics chains, the need to build new routes, many foreign companies that were the largest shippers on the Russian railway network left the market, and there were some difficulties in making payments to banks abroad.

[7] According to EY data. URL: https://ru.investinrussia.com/data/file/ey-transportation-services-2019-rus.pdf (accessed on 25.02.2022).

[8] RZD-partner. URL: https://www.rzd-partner.ru/logistics/news/mirovoy-spros-na-konteynernye-perevozki-v-iyule-byl-na-urovne-proshlogo-goda/ (accessed on 25.10.2022).

[9] Forbes. URL: https://www.forbes.ru/biznes/476277-fesco-ocenila-padenie-rynka-kontejnernyh-perevozok-v-rossii-v-13–18-po-itogam-goda (accessed on 25.10.2022).

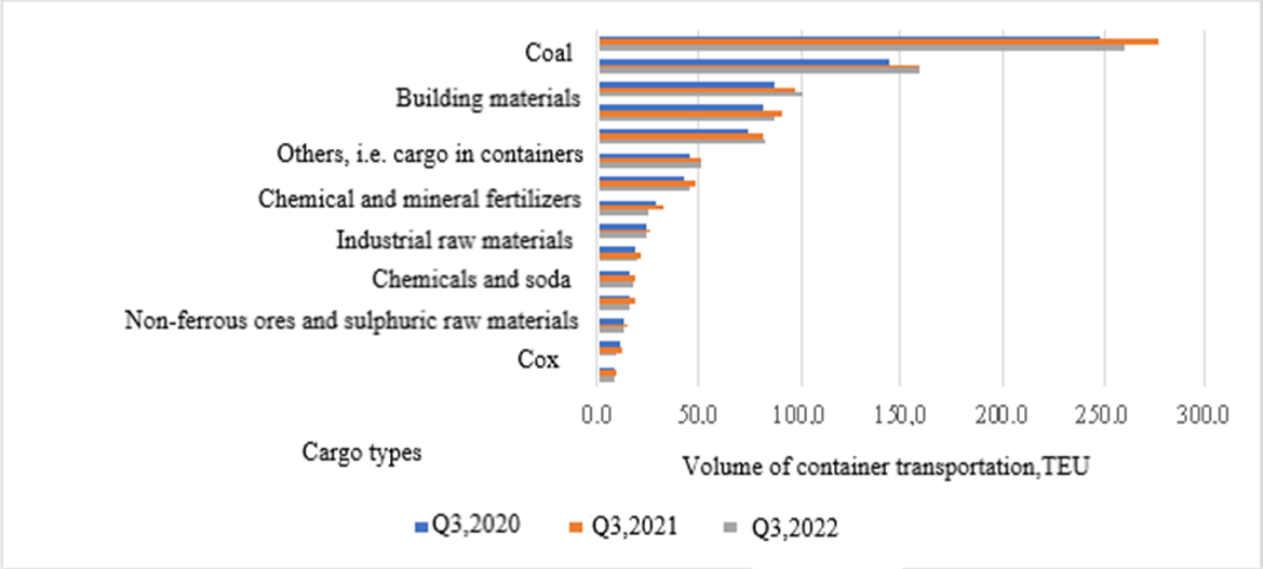

Fig. 1. **Dynamics of the volumes of container freight transportation by rail in the Russian Federation by type of cargo in the Q3 of 2020–2022, TEU**

Source: compiled by the authors.

However, there are certain risks of slowing down the growth of containerized transportation without necessary subsidies for container shipments, pricing policies and tariffication of individual maritime and railway operators, Late implementation and modernization of infrastructure projects (the complicated situation with the shipments from the Eastern polygon, the prospect of electrification of the Baikal-Amur Mainline just indicates the need for preventive research of current problems). In the Q3 of 2022, the volume of traffic decreased by 3.7%, or 34.7 million TEU, compared to the same period in 2021.

On *Fig.1* presents the dynamics of volumes of container freight transportation by rail in the Russian Federation by types of cargo for the Q3 of 2020–2022.

Negative developments for all types of freight in containers by rail, except transportation of oil and petroleum products, construction and other cargoes. The decrease in traffic was due to the withdrawal of foreign companies and investors and the imposition of sanctions by unfriendly countries, which resulted in the suspension of transport on conventional logistics routes.

EXPORT, IMPORT AND TRANSIT OF GOODS, ESTIMATION OF THEIR IMPACT ON THE VOLUME OF GDP BY THE REGRESSION MODEL OF FORECASTING

To construct the regression model, we used the results of industry analysis, assessment of trends and factors influencing the level of rail container transportation in the Russian Federation. The GDP of the Russian Federation, influenced by the activities of the rail container industry, was selected as an indicator. As independent factors — indicators of import, export and transit of container transport by rail on the railway network [26, 27].

Based on the existing data on the volume of the rail container transportation market for 2018–2022, as well as on the trends of the container market, we have made the equation of multiple linear regression using the MS Excel and the "Data Analysis" package with a view to forecasting rail container traffic for the period until 2025.

Using MS Excel tools, statistically significant factors have been determined, which have the most influence on the

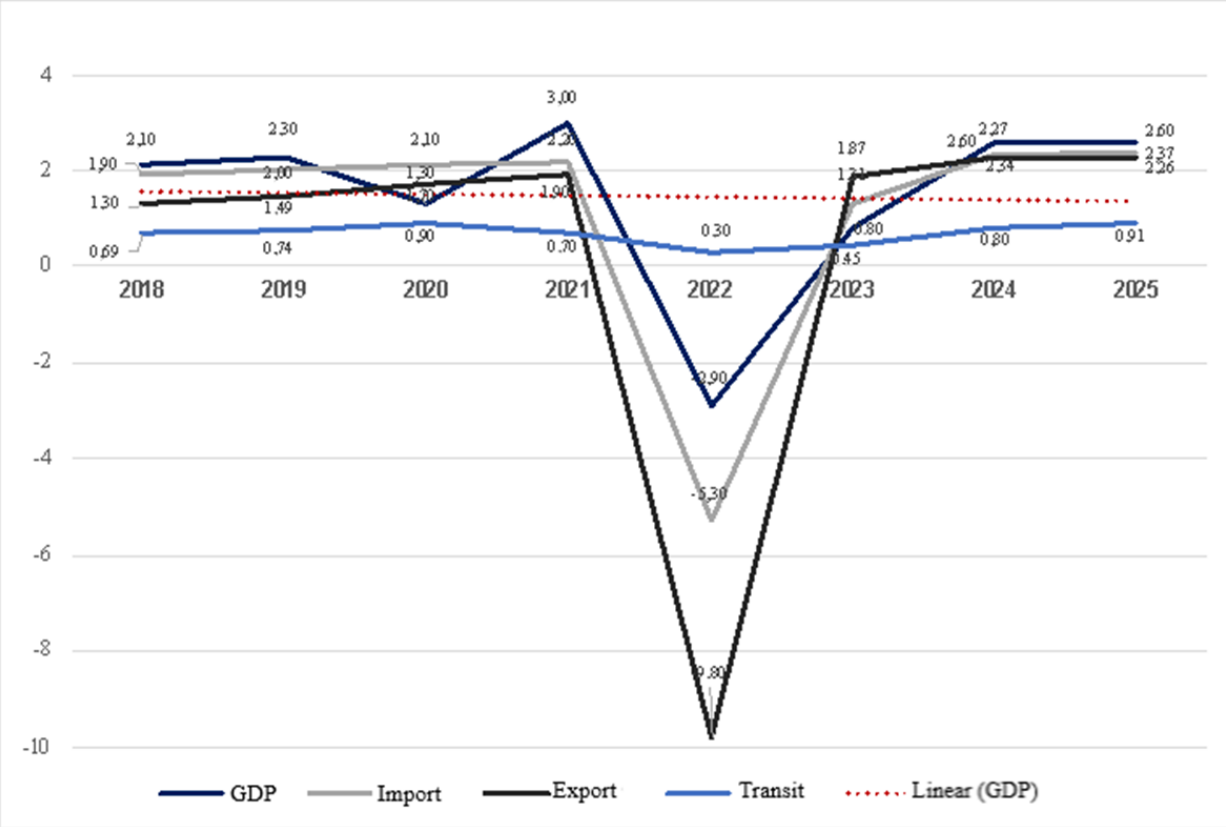

Fig. 2. **Actual and forecast data on the volume of imports, exports and transit of rail container transportation in the Russian Federation, TEU**

Source: compiled by the authors.

volume of GDP in the Russian Federation — the volume of import, export and transit. Domestic transportation has no significant impact on the country's GDP. These intermediate results lead to the conclusion that the Russian Federation plays the role of a global distribution hub: the State, due to the convenience of its geographical location, as well as the availability of quality rail infrastructure plays a key role in the global supply chain [19]. At the same time, despite the decline of certain indicators in the 9 months of 2022 due to the current geopolitical situation, according to various experts, in a few years the industry will return to the initial growth trend.

As a result, the multiple linear regression equation characterizing the dependence of the volume of GDP of the Russian Federation on the dynamics of the rail container transportation market is as follows:

$$Y = -6,47 + 8,05x_1 - 2,03x_2 - 6,2x_3, \quad (1)$$

where Y — GDP of the Russian Federation;

x_1 — volume of rail container transportation imports in the Russian Federation;

x_2 — volume of rail container transportation exports in the Russian Federation;

x_3 — volume of rail container transportation transits in the Russian Federation.

The statistical significance of this model is confirmed by the calculated Fisher' criterion (F_{fact} = 11.6), which exceeds its theoretical value (F_{table} = 0.21), and value R ~ 0.98 [26]. Using statistics on the volume of import, export and transit of rail container transportation, we make a forecast these factors up to 2025 (*Fig. 2*).

Thus, as a result of our research and graphical representation of the values of factors it is possible to conclude about "drawdown" on the basis of the results of 2022 the cargo transportation in general. At

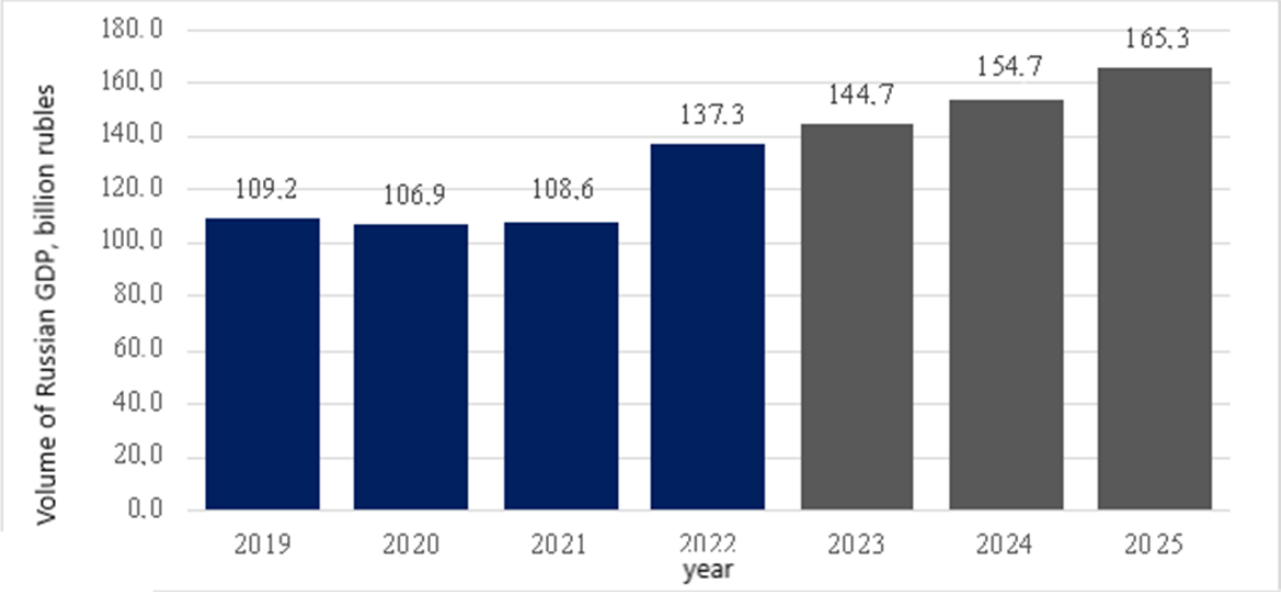

Fig. 3. **Actual and forecast values of GDP in the Russian Federation, bln rub.**

Source: compiled by the authors.

the same time, by 2023, the growth trend is expected to resume for imports (+55.2% in 2025 against 2022), exports (+77.8% in 2025 against 2022) and transit (+101.3% in 2025 against 2022).

On *Fig. 3* presented a forecast of the GDP of the Russian Federation for the period 2023–2025, taking into account the influence of the volumes of rail container transportation.

Based on the forecasted data, the Russian Federation's GDP by 2025 will be 165.3 billion rubles (+20.4% against 2022), which is a significant increase, given the instability in the foreign and domestic market.

INTERPRETATION OF RESULTS, ASSUMPTIONS AND RISKS

Based on the results of the industry analysis and forecast, we have concluded that container transportation will grow by 2025 based on the dynamics of import, export and transit of goods, despite the current difficulties of building new logistics chains, introduction package of sanctions against the Russian Federation, as well as the withdrawal of large foreign companies and investors from the Russian market. In addition, consideration should be given to the possibility of amendments due to factors not considered in the model, such as the increase in shipping container, in particular due to port development plans in the Far East and Sakhalin. In addition, risk groups may influence the outcome of the forecast, with which the rail container transportation market may be faced.

Among the difficult-to-predict risks are also political ones (change in the direction of development of cargo transportation in the country, possible introduction of new sanctions by unfriendly countries), regulations (tightening of the rules for the transportation of different types of cargo, higher tariffs for the transportation of goods in containers), natural disasters (railway accidents due to a natural disaster can lead to a significant disruption of supplies), investment (lack of sufficient financing for the transport and logistics industry, departure of foreign investors), which in general may lead to stagnation of the cargo transportation market. Risk adjustment to the forecast of rail container traffic and GDP of the Russian Federation based on the expert risk matrix can be used to take into account the difficult-to-predict risks to understand the degree of impact and the level of possible damage.

According to experts, the most significant are investment risks and force majeure risk [27]. In order to reduce the significant financial losses resulting from the non-delivery of containerized goods, it is necessary to ensure a sufficient presence of private investors in the railway infrastructure of the transport and logistics industry.

CONCLUSION

The research made it possible to substantiate trends in the development of the rail container transportation market in the Russian Federation, based on the following forecasts:

- the decline in the growth rate of cargo transportation in 2022 is due to foreign factors, but Russian cargo carrier and operators were able to adapt to the difficult geopolitical and economic situation, this allowed partially to level the drop and find suppliers in the world market new customers and new delivery routes;
- the growth of rail container transportation in the Russian Federation in 2025 compared to 2022 due to imports by 55.2%, exports— by 77.8% and transit — by 101.3%;
- the growth of the Russian Federation' GDP by 2022 relative to 2020 by 20.4% due to the growth of rail container transportation in the Russian Federation, by building new transport and logistics routes (reorientation of goods "to the East").

The key factors underpinning these forecasts are: increase speed of cargo handling in containers through the establishment of a backbone network of multimodal transport and logistics hubs in the Russian Federation; transition to a three-stage model of tariffication for a container train depending on the route, speed and technical characteristics; increase competition among container operators; containerization up to 90% of bulk cargo; digitalization of documentation during the ordering and delivering of goods.

REFERENCES

1. Ivanter V.V., Porfiryev B.N., Sorokin D.E., Eskindarov M.A., Maslennikov V.V., Shirov A.A. et al. How to boost the development of the Russian economy: Priority actions (suggestions for the Main activities of the state until 2024). *Finance: Theory and Practice*. 2018;22(S 7):4–15.
2. Porfiryev B.N., Shirov A.A., Uzyakov M.N., Gusev M.S., Shokin I.N. The main directions of socio-economic development of Russia in 2020–2024 and for the period up to 2035. *Studies on Russian Economic Development*. 2021;31(3):245–253. (In Russ.: *Problemy prognozirovaniya*. 2020;(3):3–15.).
3. Fedotova M.A., Tazikhina T.V., Nadezhdina Y.V., Raeva I.V. Problems of determining the cost of collateral in the conditions of implementation Basel II, III Standards in Russia. *Journal of Reviews on Global Economics*. 2018;7:662–667. DOI: 10.6000/1929–7092.2018.07.60
4. Kazakova N., Shuvalova E., Chemarina A., Nikanorov A., Kurochkina I., Sokolova E. The mechanism for creating an effective international strategic alliance in the field of air transportation. In: Kabashkin I., Yatskiv I., Prentkovskis O., eds. Proc.18th Int. conf. on reliability and statistics in transportation and communication (RelStat'18). (Riga, 17–20 October, 2018). Cham: Springer-Verlag; 2019:704–713. (Lecture Notes in Networks and Systems. Vol. 68). DOI: 10.1007/978–3–030–12450–2_67
5. Kendall M.G., Stuart A. The advanced theory of statistics. Vol. 1: Distribution theory. 2nd ed. London: Charles Griffin & Co., Ltd.; 1963. 433 p.
6. Kendall M.G., Stuart A. The advanced theory of statistics. Vol. 2: Inference and relationship. London: Charles Griffin & Co., Ltd.; 1961. 676 p.
7. Kendall M.G., Stuart A. The advanced theory of statistics. Vol. 3: Design and analysis, and time series. London: Charles Griffin & Co., Ltd.; 1966. 552 p.
8. Bain J.S. Relation of profit rate to industry concentration: American manufacturing, 1936–1940. *The Quarterly Journal of Economics*. 1951;65(3):293–324. DOI: 10.2307/1882217

9. Wang Y., Chen X., Han Y., Guo S. Forecast of passenger and freight traffic volume based on elasticity coefficient method and grey model. *Procedia — Social and Behavioral Sciences*. 2013;96:136–147. DOI: 10.1016/j.sbspro.2013.08.019
10. Lukinsky V., Lukinsky V. Designing the analytical base for optimal allocation of stocks in supply chains. *Transport and Telecommunication*. 2018;19(4):346–355. DOI: 10.2478/ttj-2018–0029
11. Sakhanova A.N., Akhmer Y. Zh. Forecasting based on econometric models (time series analysis). *Mezhdunarodnyi zhurnal gumanitarnykh i estestvennykh nauk = International Journal of Humanities and Natural Sciences*. 2017;(3–2):165–170. URL: http://intjournal.ru/wp-content/uploads/2017/04/Sakhanova.pdf
12. Orlov A.I. High statistical technologies and econometrics in controlling. *Rossiiskoe predprinimatel'stvo = Russian Journal of Entrepreneurship.* 2001;2(5):91–93. (In Russ.).
13. Samysheva E. Yu. Econometric techniques in modern economics. *Rossiiskoe predprinimatel'stvo = Russian Journal of Entrepreneurship*. 2010;(10–2):44–49. (In Russ.).
14. Beilin I.L. Innovative approaches in digital modeling of regional economic processes. *Voprosy innovatsionnoi ekonomiki = Russian Journal of Innovation Economics*. 2019;9(2):361–382. (In Russ.). DOI: 10.18334/vinec.9.2.40499
15. Sazonov A.A. Application of regression analysis in forecasting. *Nauchnye issledovaniya i razrabotki molodykh uchenykh.* 2015;(7):201–204. (In Russ.).
16. Kunitsyna A.G., Vinskovskaya L.A. Forecasting using regression analysis. *Dostizheniya nauki i obrazovaniya = Achievements of Science and Education.* 2020;(9):17–19. URL: https://cyberleninka.ru/article/n/prognozirovanie-s-pomoschyu-regressionnogo-analiza (In Russ.).
17. Moskvichev O.V., Moskvicheva E.E., Vasiliev D.V. Overview of Russian and foreign methodic experience in the development of container transportation. *Vestnik transporta Povolzh'ya = Bulletin of Transport of the Volga Region*. 2020;(1):77–78. (In Russ.).
18. Kurtikova A.R. Container transportation on the space Asia-Europe-Asia. Routes and barriers. In: Logistics — Eurasian bridge. Proc. 16th Int. sci.-pract conf. (Krasnoyarsk-Yeniseysk, April 28 — May 01, 2021). Krasnoyarsk: Krasnoyarsk State Agrarian University; 2021:343–346. (In Russ.).
19. Titov G.B. Problems of forecasting and planning the demand for rail transportation. *Nauchno-tekhnicheskie vedomosti Sankt-Peterburgskogo gosudarstvennogo politekhnicheskogo universiteta. Ekonomicheskie nauki = St. Petersburg State Polytechnical University Journal. Economics.* 2009;(6–1):50–54. (In Russ.).
20. Bendall H.B., Stent A.F. A scheduling model for a high speed containership service: a hub-and-spoke short-sea application. *International Journal of Maritime Economics*. 2001;3(3):262–277. DOI: 10.1057/palgrave.ijme.9100018
21. Bohács G., Frikker I., Kovács G. Intermodal logistics processes supported by electronic freight and warehouse exchanges. *Transport and Telecommunication*. 2013;14(3):206–213. DOI: 10.2478/ttj-2013–0017
22. Bowersox D.J., Closs D.J. Logistical management: The integrated supply chain process. New York: McGraw-Hill Book Co.; 1996. 752 p.
23. Box G.E.P., Jenkins G.M. Time series analysis: Forecasting and control. San Francisco, CA: Holden-Day; 1976. 575 p.
24. Brockwell P.J., Davis R.A. Introduction to time series and forecasting. 2nd ed. New York: Springer-Verlag; 2002. 449 p.
25. Krüger N., Vierth I. Precautionary and operational costs of freight train delays: A case study of a Swedish grocery company. *European Transport Research Review*. 2015;7(1):6. DOI: 10.1007/s12544–015–0155–7
26. Lai X., Chen Z., Giri B., Chiu C.-H. Two-echelon inventory optimization for imperfect production system under quality competition environment. *Mathematical Problems in Engineering*. 2015:326919. DOI: 10.1155/2015/326919
27. Maraš V., Konings R., Radmilović Z., Davidović T. Towards the optimal solution of feeder container ships routing with empty container repositioning. *Journal of Maritime Research*. 2012;9(3):11–20.

ABOUT THE AUTHORS

Christina V. Astvatsaturova — postgraduate student, Department of Financial and Economic Security, Plekhanov Russian University of Economics, Moscow, Russia
Corresponding author
https://orcid.org/0000-0002-4043-7958
ast.ch@yandex.ru

Natalia A. Kazakova — Dr. Sci. (Econ.), Prof., Plekhanov Russian University of Economics, Moscow, Russia
https://orcid.org/0000-0003-1499-3448
axd_audit@mail.ru

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 01.03.2022; revised on 15.03.2022 and accepted for publication on 27.05.2022.
The authors read and approved the final version of the manuscript.