Effect of the State Policy of Shipbuilding Development on Sea Freight

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***Abstract*—In the 2000s, the federal authorities, realizing the importance and significance of the shipbuilding industry, its effect on the economy, took a whole range of measures for prospective development of the industry that shall meet the needs of the national economy in cargo shipping. The purpose of the paper is to determine the effect of measures of state shipbuilding support on the volume of sea and inland water cargo shipping.**

To achieve this goal, the paper provides a comparative analysis of the development of the transport system of Russia as a whole and its individual structural components based on the official statistics. The obtained results are rechecked using linear and nonlinear second-order polynomial models.

As a result of the study, it was found the absence of statistically significant patterns that reflect the increase in cargo shipping by sea and inland water transport. Consequently, the increase in government support for shipbuilding and the active development of the seaports infrastructure have not significantly effected on cargo shipping yet. At that time, the negative trend of reduction in sea freight traffic was overcome in 2017 that should be considered as a positive point, indicating the presence of certain prerequisites for subsequent growth.

Keywords—industry, shipbuilding, maritime transport, seaports, infrastructure

I. Introduction

In the current economic conditions, the state pays great attention to supporting the shipbuilding industry, seaports development, which is due to the importance of this industry for the economic and social system of the country. If Russia wants to claim the role of a developed power, then the support of high-tech industries, which include shipbuilding, becomes inevitable although it requires of the state a significant amount of financial resources, primarily at the federal management level.

Currently, scientists from different cities actively study various aspects of shipbuilding development, problems of production cost reduction [1, 12, 16], pricing of products and services of shipbuilding enterprises [2, 11, 17], information and communication support for shipyards [3, 10], improvement of shipbuilding management efficiency [5, 7, 14]. The papers affecting certain geographical aspects of the shipbuilding production development deserve high estimation [6, 13] At the same time, insufficient attention is paid to the problem of effectiveness of state policy on shipbuilding development in terms of the relationship between the shipbuilding industry, sea shipping and logistics port infrastructure [3]. We only note the paper [9], which is devoted to the specific topic — coastal shipping.

The purpose of this paper is to determine the effectiveness of measures relating the government support for shipbuilding based on the analysis of sea shipping data. It is necessary to determine how the measures for development of the shipbuilding industry and Russian seaports implemented over the last 10–15 years have effected on the volume of cargo transported by sea.

There is a relationship between the maritime transport, shipbuilding industry and the dynamics of port infrastructure development. It is logical to assume that measures of state support for shipbuilding and seaports infrastructure development someway effect on the volume of cargoes transported by water. Consequently, an increase in government support for shipbuilding and development of seaports shall promote the increase in the volume of cargo transportation.

Assessment of government support measures efficiency is an important and significant national economic problem. However, to assess the efficiency of such decisions, it is difficult to find the appropriate criterion. The fact is that there is no generally accepted criterion for the government support measures efficiency, since the taken decisions have different horizon period and are aimed at achieving different economic and social results. At the same time, the dynamics of sea and inland water shipping can be considered as one of the possible criteria of the state support efficiency, since the main task that the civil shipbuilding should solve both in the current period and long-term perspective is to ensure the national economic needs for cargoes shipping, creation of conditions for the maritime trade development.

II. Material and methods.

The paper is based on data from the Federal State Statistics Service, which reflect the results of functioning the system of sea and river cargo transportation from 1990 to 2017.

The regression analysis was used as the main research method. The initial analysis shall be carried out using linear regression models in the following form (1):

$$y=ax+b \tag{1}$$

where a is a regression parameter; b is a free term of the regression equation independent of the factor under consideration; y – a dependent variable (volume of cargo

transportation); x – an independent variable (year of observation).

To assess the obtained results, we use the determination factor that is a variance fraction of the dependent variable being explained by the considered dependence model that is explanatory variables and functions as a universal measure of the dependence of one random variable on many others (1 indicates the presence of a strong dependence, 0 - the absence of dependence). In particular, for the paired linear regression model, the determination factor is equal to the square of the usual correlation factor between y and x.

The obtained results are supplemented by the use of second-order polynomial models in the following form (2):

$$y=a_2x^2+a_1x+b \quad (2)$$

III. Results

The statistics analysis indicates that despite the increase in the state support and the development of port infrastructure, there is no increase in the volume of cargo transportation by sea and inland water transport.

It is a good practice to check the obtained results based on the analysis of statistical factors using regression analysis methods. It is worth to use regression models for a period of 2000–2017, since it was precisely in 2000 within the framework of the transport system of the Russian Federation as a whole, the negative trend for decrease in the volume of cargo transportation, which was observed in the previous period and was caused by a general decrease in business activity across the entire national economics was broken due to the transformation of economic conditions.

The results obtained based on the simulation is be presented in the form of Table 1.

TABLE I. Simulation for development of transport and its subsystems in 2010-2017

Transport types	Simulation results			
	Linear model		*Second-order polynomial model*	
	Model type	*R2*	*Model type*	*R2*
Transport, total	-21.298x + 50982.6	0.04	$-3.24x^2 + 13023.012x - 13075837.9$	0.148
Rail	-0.75x + 2873.8	0.002	$-1.87x^2 + 7529.148x - 7577591.361$	0.912
Marine	-1.512 x+ 3068.1	0.22	$-0.0142x^2 + 56.059x - 55292.741$	0.345
Inland water	0.036 x+ 50.7	0	$-0.07313x^2 + 294.084x - 295519.390$	0.055

The maximum value of the determination factor for linear regression models as applied to individual structural components of the transport system is 0.22 for maritime transport, which does not allow to conclude that there is a pronounced statistical dependence between the variables under consideration when using models of this type and to make a short-term forecast.

In relation to second-order models, the following results are obtained. The regression model for freight volumes of the entire transport system of Russia as a whole based on the data of 2000–2017 has a determination factor of 0.15 that allows to conclude that there is no significantly pronounced statistical relationship between the variables under consideration.

The determination factor of the second-order model for maritime transport equal to 0.35 indicates a certain statistical relationship between these parameters. At the same time, such factor does not allow to make a firm conclusion what the further dynamics of sea cargo transportation will be.

For inland water transport, the determination factor (0.05) indicates the absence of a stable statistically significant relationship.

Thus, the analysis of statistical dependences obtained based on the second-order regression models confirms the conclusion that there are no pronounced trends in the development of cargo transportation by sea and inland water transport.

To compare different modes of transport and check models functionality, the author presents the second-order polynomial model for railway transport. The determination factor of this second-order polynomial regression model is 0.912 that is a reflection of pronounced statistical dependence. Therefore, the use of second-order polynomial models in other structural components of the transport system allows to obtain statistically significant results, which confirms the very possibility of using such models.

IV. Discussion

Since the 2000s, the government of the Russian Federation has been implementing a whole range of measures aimed at the development of shipbuilding and the seaports modernization. In particular, the system of seaports of the Baltic basin was substantially modernized, new ports of Primorsk and Ust-Luga were established, Kozmino – in the Far East, Taman – in the Black Sea, the construction of which is currently proceeding. Initially, the construction of new ports was aimed at solving the problem of increasing the export opportunities of oil companies. Subsequently, ports were established for a wide range of cargoes.

The construction of the port of Ust-Luga was the greatest importance for the development of Russian maritime transport. Officially, the port construction was started as early as in 1993. However, in fact, work began much later. The first coal terminal started operating in this port in 2003, but a significant increase in cargo turnover has been observed only since 2006. In 2014, the port of Ust-Luga exceeded the port of Primorsk in terms of cargo turnover and became the largest Russian port in the Baltic Sea. In this case, unlike Primorsk, Ust-Luga is a universal port, where there were 12 operating terminals for transshipment of various types of cargo at the beginning of 2017, which provides favorable opportunities for further increase in traffic volumes [3].

In this regard, the following question arises: how does the development of port infrastructure and measures of state support for shipbuilding affect the dynamics of cargo transportation by water? How effective are the implemented measures of state shipbuilding support?

Indeed, without the production of domestic ships and vessels, the renewal of their fleet, the development of sea and

river cargo transportation are not possible. In turn, the development of production of such capital-intensive shipbuilding products in modern Russian economic conditions can be ensured only through state support measures, involving federal funding.

This is due to the fact that in the current economic conditions, commercial banks do not have sufficient liquidity to finance investment projects in such a complex industry as shipbuilding, which is featured by a long payback period for investment projects and very significant needs for financial resources, and the possibilities of attracting own funds of business entities are also quite limited. Therefore, we note that, in general, cash deficiency is one of the main factors hindering development of manufacturing industry in the Russian Federation.

Note that the complexity of assessing the effectiveness of state support for shipbuilding is also due to the wide variety of products manufactured by shipbuilding enterprises [12].

Since the beginning of the 2000s, at the federal management level, a whole range of measures has been implemented that ensure the prospective development of shipbuilding and maritime transport, the elimination of the negative trends that were observed in the previous period. In particular, such fundamental regulatory acts have been adopted that determine the prospects for the shipbuilding industry development, such as the "Strategy for the development of the shipbuilding industry for a period up to 2020 and the future" (2007), the federal target program "Development of civil marine engineering for 2009-2016" (2008), "Strategy for the Maritime Activities Development of the Russian Federation" (2010). However, the most significant document was the state program "Development of shipbuilding and equipment for offshore fields development for 2013-2030", which was adopted in 2014 and substantially revised in 2017 [8].

As a result of implementation of these program documents, it was possible to significantly increase the volume of shipbuilding enterprises production, which should be considered as a positive trend. Therefore, it is necessary to determine how the measures taken by the government have affected the development of sea cargo transportation, taking into account the general trends for development of the entire transport system of the Russian Federation (Table 2) [15].

TABLE II. CARGOES TRANSPORTATION BY TRANSPORT TYPES

Transport types	**mln. tons**					**2017, % by**	
	1990	***2000***	***2010***	***2015***	***2017***	***1990***	***2010***
Total transport	19265	7907	7750	7898	8071	41.9	104.1
including:							
Rail transport	2140	1047	1312	1329	1384	64.7	105.5
Road	15347	5878	5236	5357	5404	35.2	103.2
Pipeline	1101	829	1061	1071	1138	103.4	107.3
Maritime	112	35	37	19	25	22.3	67.6
Inland water	562	117	102	121	119	21.2	116.7
Air	2.5	0.8	1.1	1.0	1.3	52.0	118.2

The Federal State Statistics Service, while publishing data on cargoes transportation, identifies 6 structural components of the transport system: rail, road, pipeline, sea, inland water and air. All these structural components have significant differences in operating conditions, except for maritime and inland water transport, the operating conditions of which are quite similar. In accordance with the methodological explanations of Rosstat for all types of transport, except for automobile, the volume of transported cargoes is shown at the time of departure. In motor transport, the transported cargoes are counted at the time of arrival. The unit of observation in the cargo transportation statistics is the shipment, i.e. a cargo batch, the transportation of which is drawn up by the shipping contract [15].

Table 2 shows that in 2017, compared with 1990, the cargoes transportation by all means of transport decreased by 58% that is more than 2 times. However, this decrease occurred in full in the 90s of the last century. In the subsequent period, cargo traffic began to increase. So, compared with 2000, the increase in cargo traffic in 2017 was 2.1%, and compared with 2010 ¬– 4.1%. The largest decrease in cargo transportation compared to 1990 was observed in the segments of automobile (65%), sea (78%) and inland water transport (78%).

This decrease in cargo traffic is due to the general drop in business activities in the Russian Federation, and the decrease in the level of gross domestic product. At the same time, since 2000, the GDP growth rate has significantly exceeded the growth rate of cargo traffic. In our opinion, this dynamics is due to the development of shadow economic activity not taken into account by the Federal State Statistics Service. The increase in cargo transportation in the reporting period is observed in the segments of railway (32.2%), pipeline (37.3%) and air (62.5%) transport. These are the transport types which are easier to control for state bodies due to the nature of their activities. Indeed, rail and pipeline transportation in the Russian Federation is carried out by state companies OJSC "Russian Railways" (OJSC "RZD".) and OJSC "Transneft". Therefore, it can be assumed that the reporting provided by the business entities of these types of transport to the tax authorities and state statistics bodies is more reliable.

On the contrary, in the field of motor transport there are a large number of business entities of various organizational and legal forms and property category that provide reports of various degree of reliability to the federal state statistics authorities. To the greatest extent, the problem of the inaccuracy of statistical and tax reporting is typical for small businesses. In our opinion, a low degree of reliability of data relating cargo transportation by road is the main factor contributing to the difficult to explain the dynamics of the development of the transport system in general.

At the same time, in our opinion, the factor of inaccuracy of statistical reports in stable economic conditions can be neglected, taking the shadow economic activity unaccounted by Rosstat as a constant value. Then, changing in shadow economic activity becomes possible in case of any transformations in the economic situation or in the system of traffic control.

In 2017 the main share in the cargo transportation structure was in motor transport - 67.0%, railway transport - 17.1% and pipeline transport - 14.1%. The share of sea and inland water transport accounts for 1.8% in total which does not reduce their significance in the national economy for the transportation of certain categories of cargoes.

Note that during 2010–2017, the share of certain types of transport in the structure of cargo transportation did not undergo a significant change, unlike in the previous period. Therefore, we can conclude that as a result of the transformation processes in the Russian economy observed in 1990–2010, there were changes in the structure of cargo transportation by certain types of transport expressed in decreasing the share of motor transport with increasing the share of rail and pipeline transport. In the subsequent period, the current structure of cargo transportation remains stable despite the imposition of sanctions and counter-sanctions, changes in the rules for regulating the road transportation market in accordance with the needs of the country national economy that developed during the period of the market economy. Indirectly, this indicates the stabilization of the Russian economy, which has a positive impact on the performance of business entities in the transport sector.

On describing the dynamics of the maritime transport development, it should be noted that volume of cargoes transported within a period of 1990–2000 decreased from 112 to 35 million tons. The negative trend continued in the subsequent period. In 2015, the volume of cargo transportation by sea reached its minimum and was only 19 million tons.

According to the author, this trend is due to the fact that ship owners seek to optimize business taxation and reduce the tax burden, and therefore register the vessels in countries with a low tax level (countries with a flag of convenience).

As well as note that the Federal State Statistics Service is guided by data on the transportation of cargoes provided by business entities that are tax residents of the Russian Federation. Consequently, the Rosstat does not taken into account the Russian cargoes transported by companies of other countries. For other types of transport besides maritime ones, this approach does not have a significant effect on the volume of cargo transportation, since foreign carriers cannot transport cargoes inside Russia.

The share of export traffic in the total volume of cargo transportation by road and rail is insignificant. Cargoes transportation by pipeline transport is carried out by Russian enterprises, and therefore they fall into the statistics of Rosstat. At the same time, the share of ships from foreign states is high in maritime transportation, a part of which is essentially Russian ships flying other flags. This leads to statistics distortion and decreasing the importance of sea shipping for the Russian economy. So, only the transshipment of oil and oil products in 2017 was more than 350 million tons in Russian ports, while the total sea shipping according to the Rosstat (Russian vessels) was only 25 million tons. This statistics feature should be taken into account when specifying structural features of the transport system of the Russian Federation.

Even more significant decrease in cargo transportation volumes was observed in the field of inland water transport. The volume of goods transported decreased from 562 million tons in 1990 to 117 million tons in 2000 and to 102 million tons in 2010. Thus, the total volume of cargo transportation decreased by more than 5 times. This has resulted in a significant change in the role of inland water transport in the structure of cargo transportation. The share of cargoes transported by inland water transport decreased from 2.9% in 1990 to 1.35 in 2010. In the future, it increased slightly, reaching 1.5% in 2017. In fact, we can speak of the negative trend in the sphere of cargo transportation by inland water transport, which could not be fully overcome in the 2010s, despite a set of measures taken at the federal level to support shipbuilding and modernize the water transport infrastructure.

V. Summary

As a result of the transformation processes in the Russian economy observed in 1990–2010, there were changes in the structure of cargo transportation by certain types of transport expressed in decreasing the share of motor transport with increasing the share of rail and pipeline transport. The current structure of cargo transportation remains stable in the subsequent period despite the imposition of sanctions and increasing the competition in world markets.

The state support measures for the shipbuilding industry, which have been actively implemented at the federal management level since 2010, have not been able to overcome the trend in decreasing the role and importance of sea and inland water transportation. The analysis performed by the author using linear regression models has not revealed the stable positive trends in the development of these structural components of the transport system of the Russian Federation.

At the same time, the statistics analysis allows to conclude that the trend of decreasing in the volume of cargo transportation by sea, which, in our opinion, is largely due to state support for shipbuilding, is coming to the end. There are good reasons to believe that the strengthening of state support in the future will help to completely overcome the consequences of the crisis of the 90s of the XX century in the transport system of Russia.

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