ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 32(1), 2023

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ASSESSING THE IMPACT OF INVESTMENT PROJECTS FOR THE DEVELOPMENT OF INLAND WATERWAY TRANSPORT ON SOCIAL AND ECONOMIC INDICATORS IN REGIONS[5]

Currently, when preparing substantiating materials for investment projects to be included into governmental programs of the Russian Federation, no assessment is performed of the project's impact on social and economic indicators of constituent entities of the Russian Federation, where the investment project is implemented, such as the GRP, the volume of export and shipment of products of own production, reducing the social inequality and unemployment, increasing the total factor-based productivity. Our research hypothesis is the assumption of the positive impact of implementing governmental investment projects on the indicators of social and economic development in constituent entities of the Russian Federation. Therefore, the purpose of our research is to assess the impact of implementing investment projects for the development of inland waterway transport infrastructure, that are financed from the federal budget, on the social and economic development indicators in constituent entities of the Russian Federation. In our study, we assessed the impact of implementing investment projects for the development of inland waterway transport infrastructure on the social and economic indicators of constituent entities of the Russian Federation using the Difference-in-Differences method and the probabilistic and quantitative assessment of the impact of implementing investment projects on social and economic indicators of constituent entities of the Russian Federation using the Bayesian modelling. The calculations presented in this paper showed that the use of the Bayesian modelling method to assess the probability of the investment projects impact on the indicators of social and economic development in constituent entities of the Russian

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[5] The paper has been prepared in line with to the state order of the Ministry of Science and Higher Education of the Russian Federation No. FSSW-2020-009.
This paper should be cited as: *Belkin, Y. D., Matsuev, A. N., Ryzhakova, A. V., Sedova, N. V. (2023). Assessing the Impact of Investment Projects for the Development of Inland Waterway Transport on Social and Economic Indicators in Regions. – Economic Studies (Ikonomicheski Izsledvania), 32(1), pp. 92-108.*

Federation will allow, before making a decision to launch an investment project, to have an idea about its economic effects for the region. The suggested methodological approach to assessing the impact of investment projects on the social and economic development of regions can be used in the practical activities of public authorities at the stage of selecting investment projects and assessing capital investments.
Keywords: governmental investment projects; regional economy; impact on regional social and economic indicators; quantitative assessment; Difference-in-Differences method; Bayesian modelling
JEL: C11; C15; C51; E15; H54

1. Introduction

The relevance of the research topic is due to the need to solve the problems accumulated in the development of inland waterway transport infrastructure through implementing investment projects with state participation with limited federal budget funds available.

According to Bryan, J. (2006), ensuring the sustainable and efficient functioning of the transport system is the most important area of the governmental economic policy (Bryan et al., 2006). The transport system largely determines the level and dynamics of economic development both of individual regions and the country in general.

Haezendonck, E. (2007) emphasizes that the very nature of the transport sector significantly complicates assessing the effects of investment projects on the social and economic development of a region and the country in general, as the transport sector development is not a direct source of GDP and GRP growth, but it eliminates infrastructural restrictions for the development of other sectors of the economy (Haezendonck, 2007). This feature of the transport sector is more expressed in the nature of inland waterway transport, given the lack of feasibility and, often, the impossibility of creating the related infrastructure along most of the inland waterways running through uninhabited areas. Rogers, P. J. (2000) believes that the use of governmental programs as part of the development of various industries (including the transport one) helps to increase the competitiveness of domestic products (Rogers, 2000).

From the period of establishing the Russian state to the start of the widespread use of railway transport, the inland waterway transport was the most important mode of transport for our country.

Currently, the state of this industry as a whole can be described as depressive: the moral and physical obsolescence of navigable waterworks, that of the service fleet, and the deterioration of inland waterways. This state of the industry is due to regular underfunding of its infrastructure development, as well as non-market patterns of distributing freight flows between various modes of transport. There are some natural restrictions in inland waterway transport as freezing and termination of navigation in the winter months in certain areas of the network and restriction of transport routes due to the geographical location of rivers.

At the same time, there are opportunities to get out of this situation and to reach significant growth in freight and passenger turnover, as the industry has the following relative advantages:

- a low cost of transportation of goods and passengers, due to the lack of significant expenses for maintaining the inland waterways infrastructure (unlike other types of transport, on inland waterway transport, the maintenance of the infrastructure of inland waterways is carried out at the expense of the Russian Federation, and not shippers or other owners of transport infrastructure) and the low cost of operating vessels (due to technical characteristic of vessels);
- a high carrying capacity, as well as the possibility of carrying oversized cargoes;
- the ability to transport goods to hard-to-reach areas of the Far North and equivalent territories, often being the only way to deliver goods and passengers.

2. Data and Methods

According to the Federal State Statistics Service (Rosstat), the freight turnover by inland waterway transport on a commercial basis in Russia amounted to 66.0 billion ton-kilometres in 2021.

Table 1 shows the actual volumes of freight turnover in the Russian Federation by modes of transport and the specific weights of each mode of transport in the total freight turnover.

According to official data provided by Rosstat of Russia, the share of inland waterway transport in the total freight turnover in the Russian Federation amounted to 1.2% in 2021, taking into account pipeline transport.

Table 1. Freight turnover in the Russian Federation in 2000-2021 by modes of transport

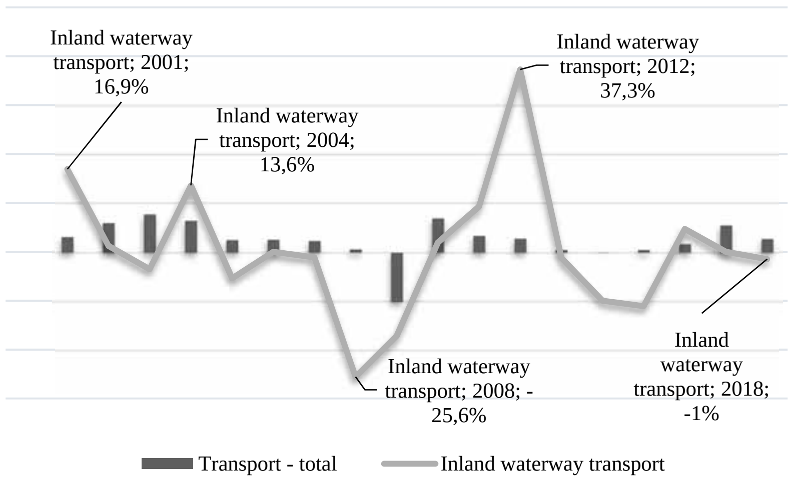
Mode of transport	2000		2005		2010		2015		2021	
	bln t-km	Specific weight, %	bln t-km	Specific weight, %	bln t-km	Specific weight, %	bln t-km	Specific weight, %	bln t-km	Specific weight, %
Transport – total	**3,638**	**100.0**	**4,676**	**100.0**	**4,752**	**100.0**	**5,108**	**100.0**	5644	**100.0**
railways	1,373	37.7	1,858	39.7	2,011	42.3	2,306	45.1	2598	46.0
motor vehicles	153	4.2	194	4.1	199	4.2	247	4.8	259	4.6
pipelines	1,916	52.7	2,474	52.9	2,382	50.1	2,444	47.8	2668	47.3
marine ships	122	3.4	60	1.3	100	2.1	42	0.8	45	0.8
inland water-ways	**71**	**2.0**	**87**	**1.9**	**54**	**1.1**	**64**	**1.3**	**66**	**1.2**
aviation	2.5	0.1	2.8	0.1	4.7	0.1	5.6	0.1	7.8	0.1

However, it should be noted that, with an increase in the total freight turnover in the Russian Federation by 1.6 times, the share of inland waterways decreased by 1.6 times.

During the studied period from 2000 to 2021, the freight turnover by inland waterway transport in the Russian Federation was decreasing by an average of 0.4% per year.

Figure 1 shows the growth rate dynamics of the freight turnover in general by modes of transport and by inland waterway transport (IWWT) in 2000-2021.

Figure 1. Growth rate of freight turnover in the Russian Federation



The main reason for significant fluctuations in the IWWT freight turnover is the nature of the main cargo transported: the bulk of goods transported by IWWT is raw materials for the construction sector, which causes significant fluctuations and instability in the cargo transportation volume, given the large dependence of the construction sector's growth dynamics on the economic situation in the country.

According to Rosstat, the passenger turnover of inland waterway transport in Russia amounted to 0.6 billion passenger-kilometres in 2021.

Table 2 shows the actual passenger turnover in the Russian Federation by modes of transport and the specific weights of each mode of transport in the total passenger turnover.

According to official data provided by Rosstat of Russia, the specific weight of the inland waterway transport in the total passenger turnover in the Russian Federation amounted to 0.1% in 2021.

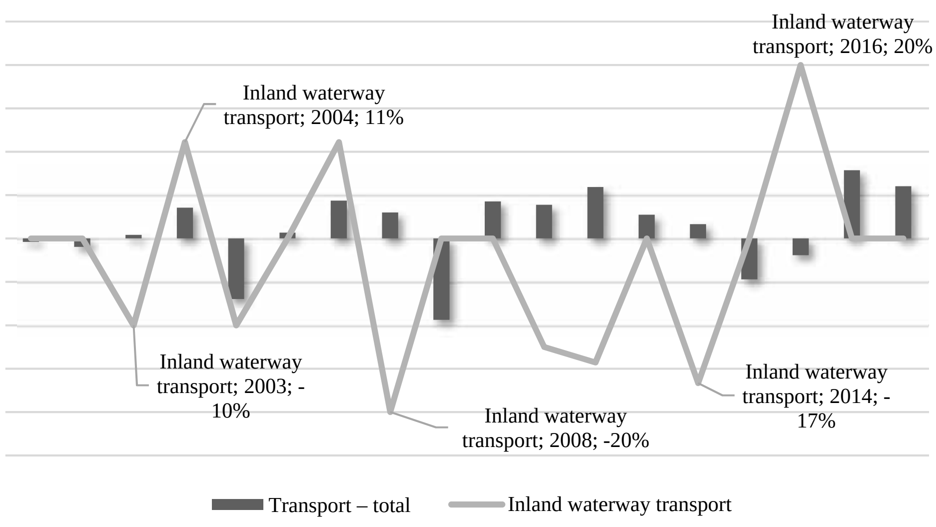
It should be noted that, with an overall increase in the passenger turnover by 1.2 times, the share of passenger turnover by inland waterway transport in the total passenger turnover decreased by 2 times.

We have found that, over the studied period of 2000-2021, the passenger turnover of inland waterway transport in the Russian Federation was decreasing by an average of 2.3% per year.

Table 2. Freight turnover in the Russian Federation in 2000-2021 by modes of transport

Mode of transport	2000		2005		2010		2015		2021	
	bln passenger-km	Specific weight, %	bln passenger-km	Specific weight, %	bln passenger-km	Specific weight, %	bln passenger-km	Specific weight, %	bln passenger-km	Specific weight, %
Transport – total	**496.2**	**100.00**	**473.3**	**100.00**	**484. 0**	**100.00**	**530.0**	**100.0 0**	**594.4**	**100.00**
railway	167.1	33.68	172.2	36.38	138. 9	28.70	120.6	22.75	129.5	21.79
autobus	173.7	35.01	142.3	30.07	140. 6	29.05	126.3	23.83	122.9	20.68
passenger taxi	0.2	0.04	0.1	0.02	0.3	0.06	0.3	0.06	0.4	0.07
tramway	25.1	5.06	13.5	2.85	6.7	1.38	4.8	0.91	3.9	0.66
trolleybus	28.1	5.66	15.0	3.17	7.1	1.47	6.0	1.13	4.7	0.79
subway	46.9	9.45	43.4	9.17	42.4	8.76	44.6	8.42	45.4	7.64
marine vessels	0.1	0.02	0.09	0.02	0.06	0.01	0.06	0.01	0.06	0.01
inland waterways	**1.0**	**0.20**	**0.9**	**0.19**	**0.8**	**0.17**	**0.5**	**0.09**	**0.6**	**0.10**
aviation	54.0	10.88	85.8	18.13	147. 1	30.39	226.8	42.79	286.9	48.27

Figure 2. Passenger turnover growth rate in the Russian Federation



The main reason for the significant fluctuations in the IWWT passenger turnover is the very nature of these transport services. Given that most of the passengers transported are tourists, any fluctuations in the economic growth of the Russian Federation, including the people's income level, significantly affect the IWWT passenger turnover.

The decrease in the freight and passenger turnover by inland waterway transport is due to the following reasons:

- the existence of sections (“bottlenecks”) limiting the throughput capacity;
- the obsolescence of the river fleet (both cargo and service vessels);
- the lack of modern loading and unloading facilities;
- underdeveloped intermodal transport and logistics centers;
- the prioritization of federal budget expenditures in favour of other modes of transport (Afanasiev et al., 2010) [4,5].

In this paper, as the subject of our research, we have chosen federal government bodies carrying out investment activities to develop the waterway transport infrastructure financed from the federal budget. We are considering the infrastructure that, under Russian law, is classified as federal property only.

A large part of the inland waterway transport infrastructure has been created during the existence of the USSR and needs significant modernization, taking into account wear and tear, the territorial displacement of economic centres, and climatic changes affecting the possibility of navigation. We should especially note the importance of waterways of The Unified Deep-water System of European Russia (the length of which in the Russian Federation is over 6.5 thousand km) for the national and regional economy, since they are serving about 70% of the total freight turnover, including exports and imports.

In accordance with the Geneva Agreement of January 19, 1996, signed and ratified by the Russian Federation in 2000, the Unified Deep-water System of the European part of the Russian Federation is included in the most important inland waterways of international importance, while the Russian Federation has undertaken to maintain a guaranteed depth of 4 meters of ship traffic throughout this Unified Deep-water System.

However, in some areas of “bottlenecks”, the guaranteed depth is no more than 3.2 m.

The presence of limiting sections hinders the development programs of businesses in the sector.

E.g. according to data provided by consignors, the losses of shipping companies due to incomplete use of the carrying capacity only along the limiting section in the Nizhny Novgorod Region are about 5.9 bln rubles per year.

At the same time, construction of inland waterway transport infrastructure is very expensive and requires a willingness to wait for a long time for the project payback period.

Therefore, taking into account the existence of significant infrastructure problems, federal executive authorities are faced with the need to select investment projects for investment, such investment projects being located in various regions and aiming at solving different tasks.

In this context, the choice of an investment project is based on the general needs of the inland waterway transport system, without taking into account the impact of implementing such investment projects on the social and economic development of constituent entities of the Russian Federation.

Meanwhile, the federative constituent entities' interest in implementing an investment project largely determines the probability of completing such a project on time, its cost, and its scope of work.

Assessing the social and economic effects of investment projects in the field of transport infrastructure on the development of Russian regions is an urgent, both practical and scientific problem, because of allocating a significant amount of federal budget funds for such investment projects in the context of a constant budget financing shortage and a large number of constituent entities of the Russian Federation (Bretschneider and Reuterswärd, 2002; Siluanov et al., 2011) [6,7].

In addition, the results of calculating the effects for a region are necessary for considering the investment project at the level of governments of constituent entities of the Russian Federation. Since a large part of investment projects are implemented without involving constituent entities of the Russian Federation in any form, understanding the importance and necessity of such projects for the region's development reduces the time for its implementation due to the region's participation in resolving the issues within its competence (the speed of solving land issues; issues related to connection to power grids, etc.).

For this purpose, we suggest to use an economical and mathematical model for assessing the effects of implementing investments projects for the inland waterway transport infrastructure development on the social and economic indicators of constituent entities of the Russian Federation using the Difference-in-Differences method and an economic and mathematical model for probabilistic and quantitative assessment of the effects of implementing investment projects on the social and economic indicators of constituent entities of the Russian Federation using the Bayesian modelling.

It should be borne in mind that when implementing investment projects financed by the federal budget, federal executive authorities are responsible for solving sectoral issues of federal importance.

One example of such a sectoral issue of federal importance is the existence of limiting sections on inland waterways (Akaev et al., 2019; Stufflebeam et al., 2000) [8,9].

When solving this issue, the government of the Russian Federation does not consider an individual region with such a limiting section; it considers as a whole not only the inland waterway system, but also the transport system in general, taking into account the interconnection between modes of transport.

Nevertheless, the issue of assessing the impact of investment projects on the social and economic indicators of constituent entities of the Russian Federation is important for understanding the effects of such investment projects in the context of specific results, considering that the transport infrastructure itself is not a source of economic growth, but its natural limiting factor. At the same time, there is a significant problem requiring a methodological solution that is related to a feature of the transport industry, namely the existence of transit freight traffic.

E.g., if a constituent entity of the Russian Federation has no major consignors, the construction of a waterway hub to ensure the throughput of an inland waterway in the territory of such an entity will provide no significant direct economic benefits to the region.

Therefore, we need to conduct an assessment of the impact (actual or intended) of an investment project on the social and economic indicators of constituent entities of the Russian Federation 4, such as:

- Gross Regional Product;
- unemployment rate;
- Gini coefficient;
- amount of investments per capita;
- volume of fixed assets;
- shipment of mined minerals;
- shipment of the manufacturing sector products;
- labour productivity index;
- volume of exports.

It should be noted that all the above indicators of social and economic development of constituent entities of the Russian Federation, in general, are not specific efficiency and development indicators of the transport system; however, they are required to assess the impact of investment projects with state participation (Klimenko et al., 2016; Bukhvald et al., 2019). However, this assessment does not include indicators that directly characterize the transport system in general and the inland waterway transport in particular, namely, the fright traffic by modes of transport, the freight turnover, the average carriage time, the transport intensity of the economy, the length of paved roads, the length of railways, the length of inland waterways with the illuminated environment and with guaranteed depths of navigation, etc.

These indicators are directly assessed by the federal executive bodies when deciding to include an investment project into a draft state program of the Russian Federation to allocate budget funding; and they are included into industry policy documents, such as strategies, governmental programs, federal projects, and departmental target programs (Zaporozhan, 2016; Melnikova, 2019).

3. Model

The goal of our study is to determine the impact of investment projects financed from the federal budget on the social and economic indicators of the relevant region, as assessed by executive authorities of constituent entities of the Russian Federation.

In order to confirm the stated hypothesis about the positive impact of implementing investment projects on the social and economic indicators of constituent entities of the Russian Federation, we find it is necessary to carry out this assessment in two areas: assessing the impact of previously implemented investment projects and assessing the probability and level of impact of investment projects at the stage of their initiation.

To assess the impact of previously implemented investment projects, in this paper, we propose a model based on the difference-in-differences method (hereinafter referred to as DID) (Rubin, 1974; Bertrand et al., 2004; Abbring et al., 2004).

In this research, the experimental group is limited to the regions participating in the subprogram “Inland Waterway Transport” of the federal target program (FTP) “Development of the Transport System in Russia (in 2010-2021)”. It should be noted, that FTP includes a large number of different investment projects aimed to maintain the depth of the waterway, to maintain the width of the road, to overcome thresholds, to repair and modernize locks, to purchase service vessels.

According to this method, the elements that have been absolutely randomly not affected, have been selected into the control group (Maddala et al, 1976; Minchenko, 2012; Tsygankov, 2009).

For the sake of objectivity in selecting initial data for calculations, the Subprogram does not include:

- unfinished projects under which, before 2018 (inclusive), only preparation of design and cost estimate documents was carried out;
- projects financed from extra-budgetary sources;
- projects implemented in the territory of several constituent entities of the Russian Federation (construction of a transport and service fleet, etc.) – due to the impossibility of its territorial distribution (a ship was built in the territory of one region, but it is operated in the territory of several regions, depending on the current tasks) (Tsygankov, 2009);
- projects implemented in the territory of Moscow, the Moscow Region, Saint Petersburg, and the Leningrad Region to obtain the most objective data, taking into account the specifics of these regions (a large number of other factors affecting socio-economic indicators, due to their status as centres of economic activity in the Russian Federation and metropolitan regions. These factors will not allow an objective assessment of the impact of investment projects in the field of inland waterway transport, including due to the cost of these projects);
- projects implemented in the territory of Sevastopol and the Republic of Crimea due to their inclusion in the Russian Federation after launching the Subprogram.

In addition, when compiling statistics, we have taken into account changes in the list of constituent entities of the Russian Federation upon segregation (exclusion) of federal districts from regions and territories (Shuvalov, 2008).

In view of the above, Table 3 shows the amounts of actual financing of investment projects under the IWWT Subprogram of the Federal Target Program for Transport System Development by constituent entities of the Russian Federation.

Table 3. Actual Financing of the Subprogram, in a million rubles

Region	Total	2010	2011	2012	2013	2014	2015	2016	2017	2021
Volgograd Region	9,076.5	837.4	803.6	224.4	192.7	1,169.4	994.3	1,079.6	1,550.0	2,225.1
Vologda Region	12,251.8	1,153.1	1,272.0	2,008.2	2,227.7	2,588.3	1,550.3	806.2	338.1	307.9
Kaliningrad Region	126.0		19.8	40.0	66.2					
Krasnoyarsk Territory	2,246.4	187.6	190.5	74.7	18.0	129.3	218.4	222.4	525.5	680.0
Nizhny Novgorod Region	6,334.7	461.3	417.0	562.4	1,056.8	740.7	314.2	780.9	981.4	1,020.0
Novosibirsk Region	2,999.9	393.2	306.9	373.0	95.2	201.9	422.3	378.8	337.6	491.0
Perm Territory	5,091.8	420.0	284.1	1,027.5	955.5	583.3	174.1	1.0	180.0	1,466.3
Republic of Karelia	8,789.7	498.3	791.8	2,059.1	1,462.2	916.1	1,463.7	865.6	277.1	455.8
Rostov Region	1,520.3	33.3	289.7	341.9	160.0	378.9	218.6	97.9		
Samara Region	252.5	252.5								
Saratov Region	92.8	92.8								
Khabarovsk Territory	41.5	41.5								
Total	**48,823.9**	**4,371.0**	**4,375.4**	**6,711.2**	**6,234.3**	**6,707.9**	**5,355.9**	**4,232.4**	**4,189.7**	**6,646.1**

Based on Table 3, we have created an experimental (test) group of regions (including those regions where investment projects of the Subprogram are implemented) and a control group of regions where investment projects were not implemented under the Subprogram (other regions were analyzed taking into account the exclusion of the above-listed regions).

Subject to the requirements of the mathematical research methods selected for the statistical sample scope, the study period is 2005-2018, that is, taking into account the period preceding the observed phenomena (the Subprogram implementation).

A graphical representation of the difference-in-differences method is shown in Figure 3, a program that is measured as the difference in the differences of the resulting variable: (P2 – S2) – (P1 – S1).

Figure 3. Graphical representation of the difference-in-difference method

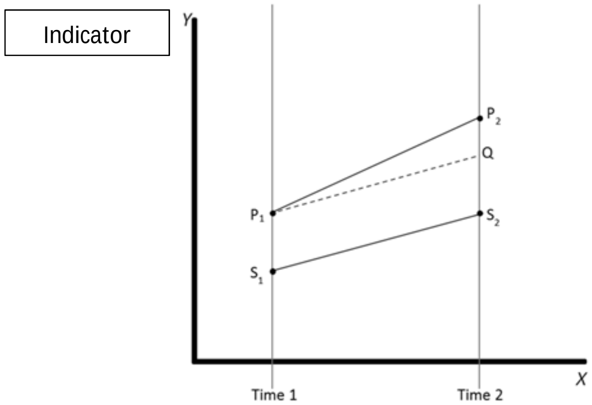


Table 4 shows this calculation.

Table 4. Calculation using the difference-in-difference method

Indicator	Experimental group			Control group			D3
	2005-2009	2010-2021	D1	2005-2009	2010-2021	D2	
GRP (log10)	5.1666	5.5134	0.3468	5.0646	5.4361	0.3715	**-0.0248**

In accordance with the provisions of the difference-in-differences method, based on the data obtained, we shall draw a conclusion about the negative impact of implementing investment projects on the increase in the Gross Regional Product.

In order to confirm the results obtained, the author carried out a calculation using special software (Stata, R).

Table 5 provides detailed data on the calculation, including the main statistical indicators.

Table 5. Calculating the impact coefficient of participation in the Subprogram on the GRP in the experimental group

GRP	Coef	Std. Err.	T	P>|t|	[95% Conf. Interval]	
Y2018	0.3715202	0.37659	9.87	0.000	0.2971014	0.4459391
Part	0.1020772	0.0670147	1.52	0.130	-0.030352	0.2345065
Y2018Part	-0.0247546	0.0947731	-0.26	0.794	-0.210379	0.1625286
_cons	5.064556	0.0266289	190.19	0.000	5.011934	5.117178

The positive value of the "Y2018" variable in the column of Coef., which is equal to 0.3715202, means that the values of the GRP indicator in general for all regions tended to grow during the study period.

The value of the "Part" variable in the column of Coef., that is equal to 0.1020772, means that the regions participating in the FTP also grew on average during the period under investigation, but their growth rates were noticeably lower than the average growth rates of all regions in general.

As we can see, the value of the “Y2018Part” variable coefficient, describing the impact of implementing investment projects on the GRP, are equal to the previous calculation results performed using aggregated means. That is, according to the data obtained, the very fact of a region’s participation in the FTP is a negative factor in its social and economic development.

In the statistical analysis, one shall take into account the values of the verification coefficients that confirm the possibility of describing a model as corresponding to reality.

In this calculation, the F-test coefficient is equal to 0.000, which allows for further calculation of the determination coefficient.

According to the calculation made in a special software (Stata, R), the determination coefficient (R2) is equal to 0.44, which may mean that the resulting regression model explains only 44% of the average GRP growth in the regions of the experimental group, whereas 56% of GRP growth cannot be explained by the model (there are other factors).

The next stage in assessing the consistency of the resulting regression model is estimating the p-value coefficient (P>[t]), which is also a verification coefficient and shows the probability that the values of the variables are equal to zero.

In this calculation, the coefficients in both variables are above 0.1, which also proves the inconsistency of this model.

Given the above, we should supplement the model with other variables that affect the GRP indicator, with which the verification coefficient of determination is more than 0.50, as well as the value of the p-value coefficient (P> [t]) is less than 0.1.

4. Assessment of the Model for the Subprogram Impact on the GRP, Taking into Account Additional Variables

To build a regression model that meets the required statistical parameters (such as the determination coefficient), we added the variables to the above model.

Table 6 shows the results of the calculation performed in a special software (Stata, R) that allows to process large arrays of statistical data and to obtain the analysis results using the Difference-in-Differences method.

Table 6. Calculating the coefficient of the impact of social and economic development indicators on the GRP in the experimental group

GRP	Coef	Std. Err.	T	P>|t|	[95% Conf. Interval]	
Y2018	0.161681	0.201041	8.04	0.000	0.1219342	0.2014279
Un	-0.0095609	0.0171576	-0.56	0.578	-0.0434824	0.0243606
Gini	0.1828552	0.0890856	2.05	0.042	0.0067281	0.3589823
Inv	0.6795414	0.0374742	18.13	0.000	0.6054529	0.7536299
Assets	-0.1486371	0.037612	-4.00	0.000	-2.2221068	-0.0751674
Min	0.0330149	0.0093129	3.55	0.001	0.0146029	0.0514269
Ind	0.04811	0.020779	2.32	0.022	0.0070287	0.0891912
Labor	-0.5772923	1.046659	-0.55	0.582	-2.646594	1.49201
Exp	0.0737259	0.0145217	5.08	0.000	0.0450157	0.1024361
Part	0.0043522	0.024289	0.18	0.858	-0.0436684	0.0523728
Product of variables	-0.0000023	0.0000187	-0.12	0.902	-0.0000392	0.0000346
_cons	3.378419	2.092953	1.61	0.109	-0.7594611	7.5163

The explanation of the abbreviations in Table 6:

- Y2018 – Dummy is a variable indicating the period before or after the start of the implementation of the FTP;
- Un – the unemployment rate;
- Gini – the Gini coefficient;
- Inv – the amount of investments per capita;
- Assets – the volume of fixed assets;
- Min – the shipment of mined minerals;
- Ind – the shipment of the manufacturing sector products;
- Labor – the labour productivity index;
- Exp – the volume of exports;
- Part – dummy is a variable that characterizes the region's participation in the FTP.

By analogy with using a model without additional variables, before considering the calculation results, we shall assess the model consistency.

According to the method used, the first critical coefficient is the F-test coefficient equal to 0.000, which allows for further calculation of the determination coefficient.

In turn, the determination coefficient (R2) is equal to 0.9359, which may suggest that the resulting regression model explains 93.6% of the average GRP growth of the regions in the experimental groups, which is interpreted as the model consistency with real data and efficiently illustrates the functional dependence between the variables.

It is common to apply an additional adjusted factor – R2, which uses unbiased variance estimates.

In this calculation, the adjusted determination coefficient is equal to 0.9309, which allows us to consider the model as acceptable and proceed to further calculations.

The next stage in assessing the model consistency with real data is estimating the p-value coefficient (P>[t]).

We have highlighted the variables for which the p-value coefficient (P> [t]) is within the normal range (<0.1).

As other variables (Un and Labor) do not meet the requirements for the p-value coefficient, we shall exclude them from the assessment; Y2018 and Part are dummy variables; so, they are not taken into account in the calculation.

Therefore, we shall perform the calculation without taking into account the above variables (Un and Labor) and, if necessary, we will apply additional exceptions and carry out repeated calculations of the model.

The final calculation results are shown in Table 7.

The F-test coefficient is equal to 0.0000.

The determination coefficient is equal to 0.9237.

The adjusted determination coefficient is equal to 0.9199.

This means that the suggested model explains 92.0% of the change in the growth rate of the gross regional product.

Table 7. Calculating the Impact Coefficient of Social and Economic Development Indicators on the GRP in the Experimental Group, Taking into Account the Excluded Indicators

GRP	Coef	Std. Err.	T	P>|t|	[95% Conf. Interval]	
Y2018	0.1112283	0.0170477	6.52	0.000	0.0775323	0.1449243
Gini	0.2310515	0.0949181	2.43	0.016	0.0434388	0.4186643
Inv	0.7579541	0.0341505	22.19	0.000	0.69044531	0.8254551
Assets	-0.1464791	0.0389377	-3.76	0.000	-2.2234427	-0.069516
Min	0.0481767	0.0094522	5.10	0.000	0.0294937	0.0668598
Ind	0.1052007	0.0181092	5.81	0.000	0.0694065	0.140995
Part	0.0048244	0.035467	0.30	0.010	-0.0435528	0.0521285
Product of variable	0.0000086	0.0000817	0.11	0.099	-0.0001528	0.0001707
_cons	1.707307	0.1887575	9.04	0.000	1.334213	2.0804

In addition, all the suggested indicators meet the control parameter of the p-value coefficient (P> [t]): less than 0.1.

The value of the _cons variable, which is equal to 1.707307, describes the GRP growth, provided that the values of the variables used in the model are set to zero.

5. Results

Therefore, we can draw the following conclusions about the impact of the following social and economic indicators on changes in the growth rate of the gross regional product, these indicators being, in turn, affected by the implementation of investment projects included into the FTP:

- the Gini coefficient has a positive effect on GRP growth; in turn, the implementation of investment projects has a positive effect on improving the Gini coefficient;

- an increase in the amount of investments in fixed assets has a positive effect on the GRP growth; in turn, the implementation of investment projects has a positive effect on the growth of investment amount;

- an increase in the volume of fixed assets has a negative effect on GRP growth; in turn, the implementation of investment projects has a positive effect on the growth of fixed assets. Apparently, this pattern is explained by accumulating obsolete fixed assets that do not increase the added value of finished products;

- an increase in the shipment volume of mined minerals has a positive effect on the GRP growth; in turn, the implementation of investment projects has a positive effect on their shipment volume growth, creating opportunities for their transportation at a relatively low cost;

- an increase in the shipment volume of manufacturing industry products has a positive effect on the GRP growth; in turn, the implementation of investment projects has a positive effect on their shipment volume growth, creating opportunities for their transportation at a relatively low cost;

The total effect is positive (taking into account the negative effect of the increase in the value of fixed assets), but virtually insignificant: 0.0000086.

So, we obtained data on the impact of implementing the Subprogram “Inland Waterway Transport” of the FTP for the transport system development from its launch until 2018.

Therefore, we find it is necessary to use the Difference-in-Differences method to assess the effectiveness of investment projects for aggregated economic development indicators.

To assess the probability of the investment project’s impact on the social and economic indicators of constituent entities of the Russian Federation at the stage of making a decision on their implementation, we need to carry out calculations based on the Bayesian modelling.

We have developed an economic and mathematical model for probabilistic and quantitative assessment of the effects from implementing investment projects on social and economic indicators of constituent entities of the Russian Federation using the Bayesian modelling (Meyer, 1995).

The use of the Bayesian modelling method to assess the probability of investment project impact on social and economic indicators of constituent entities of the Russian Federation will allow, before making a decision on launching an investment project, to have an idea of its economic effects for the region (Florens et al., 1996; Sornn-Friese, 2003).

In accordance with the above-described Bayesian modelling method, we have calculated the probability of changes in social and economic indicators of constituent entities of the Russian Federation under the effect of implementing investment projects with state participation for the development of inland waterway transport infrastructure.

Table 8 shows the results of calculating the impact of the region's participation in the FTP on the social and economic indicators of the regional development.

Table 8. Calculating the Probability of the FTP Impact on Social and Economic Indicators

Dependent indicator	Median	Lower limit value	Upper limit value	Note
Gross Regional Product	9.2%	0.5%	18.0%	Positive effect
Unemployment rate	-6.7%	-15.5%	2.5%	Positive effect
Gini coefficient	-0.6%	-5.4%	4.4%	Positive effect
Amount of investments per capita	16.8%	7.5%	25.5%	Exceeding the deviation of control indicators
Volume of fixed assets	33.6%	28.5%	38.7%	Positive effect
Shipment of mined minerals	16.9%	-3.7%	36.6%	Positive effect
Shipment of manufacturing industry products	9.5%	1.2%	16.3%	Positive effect
Labor productivity index	1.6%	-3.7%	6.7%	Positive effect
Volume of exports	7.2%	-2.8%	16.9%	Positive effect

6. Conclusion

Therefore, we can conclude that implementing the FTP investment projects in a region will result with a probability of 95% in increasing the GRP of such a region within the range of 0.5% to 18.0% (the median posterior probability: 9.2%).

It should be noted that, in general, this result is consistent with the findings obtained through calculations using the Difference-in-Differences method.

Therefore, this paper assessed the impact of implementing an FTP investment project on the social and economic indicators of the constituent entity of the Russian Federation where such an investment project is implemented.

The data obtained in the course of this study can be used by federal executive authorities, executive authorities of constituent entities of the Russian Federation to assess the effectiveness of implementing an investment project when including it in a state program of the Russian Federation or that of a constituent entity of the Russian Federation.

This method can be used in relation to investment projects under other state programs, which allows us to draw a conclusion about its scientific, functional, and practical significance for the system of implementing governmental capital investments.

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