MACROECONOMIC APPROACH TO JUSTIFICATION OF TRANSPORT PROJECTS

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ABSTRACT

The article examines approaches to justification of transport projects in advanced economies, provides assessment models used in the analysis of investments in the development of transport infrastructure. The advantages of inland waterway transport (low costs for transportation of bulk cargoes, low expenses for maintenance and repair of infrastructure, environmental friendliness, safety) are actualized in the justification of the expediency of transferring part of the cargo flows from bulk cargoes to land transport. The results of calculations of the multiplicative effect are presented on the example of the project of the development of water transport in the river basins of the European part of Russia are given.

Keywords: water transport, transport project evaluation models, macroeconomic substantiation, multiplicative effect.

Background. *Advanced economies have rich experience in the methodology of assessing large-scale transport projects, megaprojects in the field of transport infrastructure. In the work of K. P. Glushchenko references to methodological approaches are made, applied primarily in the EU countries, to assess the effectiveness of large investment projects and it is stated that proposals for their development are based on the results of analysis conducted by authoritative research groups [3, p. 93]. He is sure: domestic assessments of the effectiveness of large investment projects should be based on the experience of developed countries.*

Objective. *The objective of the author is to consider macroeconomic approach to justification of transport projects.*

Methods. *The author uses general scientific methods, comparative analysis, economic evaluation.*

Results.

Project assessment models

Researchers at PwC PricewaterhouseCoopers analyzed the decisions of five leading countries – the UK, Australia, Japan, Sweden, Canada in the field of transport projects, investment mechanisms, the use of quantitative and qualitative assessment models. The models summarized in the study [5, p. 9] and structurally presented in Table 1 include the analysis of economic efficiency (costs and benefits), analysis based on multiple criteria, analysis of economic impact, cost-effectiveness analysis.

Presented models are important tools throughout the decision-making process on investing funds, they provide a balance of quantitative and qualitative evaluation indicators. It is also necessary to emphasize that in Table 1 there is no financial assessment model presented in the study, it is based on the calculation of costs and benefits for a particular organization. PwC specialists explain its «withdrawal» by the fact that carrying out only a financial analysis for transport projects is not enough, since it does not take into account general economic costs and benefits at the level of the region or the country.

The results of the research showed that the evaluation of projects using the above models provides an integrated approach to justification of efficiency, and the use of an integrated methodology systematically allows decision-makers (transport officials) to choose and prioritize investing in various project options when measuring benefits.

Summarizing the foreign and domestic experience, K. P. Glushchenko offers three main approaches to assessing the effectiveness of large investment projects (LIP):

- *microeconomic – cost-benefit analysis [3, p. 95];*
- *multicriteria – a set of different methods of multi-criteria optimization (different for different countries); indicators that characterize the measurement of efficiency, can be – numerical, ordinal, qualitative [4, p. 40];*
- *macroeconomic – evaluation of the contribution of LIP to GDP change, using the multiplier, indirect contribution of the project is calculated by increasing demand in the chain of interconnected industries and increasing final consumption [4, p. 42].*

Developing the accumulated experience, the specialists of the Center for Strategic Research fund argue in their study that the calculation of the effectiveness of infrastructure projects based on the definition of direct effects and costs does not give objective results, since the majority of estimates are of an indirect nature and remain unaccounted for, which substantially underestimates the real integral efficiency [6, p.18]. In the case of rail transport, the study examines:

- *direct effects;*
- *multimodal effects;*
- *external (induced) effects [6, p. 30–32].*

A tool is proposed for assessing the externalities in the implementation of infrastructure projects in railway transport and the assessment model, structurally presented in Table 2. That is, there is a clear departure from direct effects.

«A Favorable Way» in Macroeconomics

Turning to consideration of the macroeconomic approach to justification of the project for development of inland water transport (IWT), it should be noted that recently the positions of IWT have been weakened. This is due to the presence of «bottlenecks» on inland waterways that do not provide the minimum required depth of four meters within the United Deep Water System, limiting the fleet's throughput. The situation does not allow using the traditional competitive advantages of inland waterway transport: low costs for transportation of river cargo, low maintenance costs, environmental friendliness, safety.

The calculations of the Federal Agency for Maritime and River Transport presented in the materials of the meeting of the Presidium of the State Council on development of inland waterways held on September 15, 2016 in Volgograd justify the expediency of liquidating the limiting areas in the United Deep Sea System of the European part of Russia, which implies the growth of operational and financial indicators of fleet in 1,5 times, to increase the number of jobs in the industry, to attract an additional freight base and will help to reduce the cost of transportation. By 2020, the need for transportation of goods only from north to south along the river Don will be about 18 million tons, this is without increasing

Table 1

Assessment models used in the analysis of investment projects for development of transport infrastructure

	Assessment model	The essence of the model	The model is most effective under the following conditions
1.	Analysis of economic efficiency (cost-benefit ratio)	The model is based on the calculation of costs and benefits, this allows to assess how the project will affect the interests of society and the economy.	1. The economic costs and benefits for the entire population, and not only the interested party, are taken into account. 2. An optimal balance between costs and benefits at the level of finance, economy, social sphere and environmental protection is provided. 3. A comparative analysis of the costs and benefits of different models, capital raising scenarios, and project management strategies is conducted.
2.	Analysis based on multiple criteria	The model is based on comparing different options for project implementation in terms of achieving the objectives and applying measurable criteria.	1. The set goals go beyond economic and financial tasks and include such issues as security, accessibility, environmental friendliness. 2. It is difficult to quantify the main advantages and benefits. 3. Interaction with stakeholders is established, criteria are jointly developed and responsibilities for final results are clearly distributed.
3.	Analysis of economic impact	The model is based on an assessment of how the project will affect the life of population and the company's activities in its region from an economic perspective.	1. The degree and nature of economic impact and its specificity at the regional level are analyzed. 2. The impact of the project on the main economic indicators is assessed: GDP, real consumption, income, investment, employment, income to the state budget, interest rates, exchange rate, terms of the transaction. 3. The analysis is performed using a computer simulation program.
4.	Cost-benefit analysis	The model is based on the evaluation of the benefits of the project not in terms of money, but in other indicators, for example, public benefit.	1. It is difficult to quantify the benefits. 2. Similar solutions for solving problems are evaluated.

Table 2

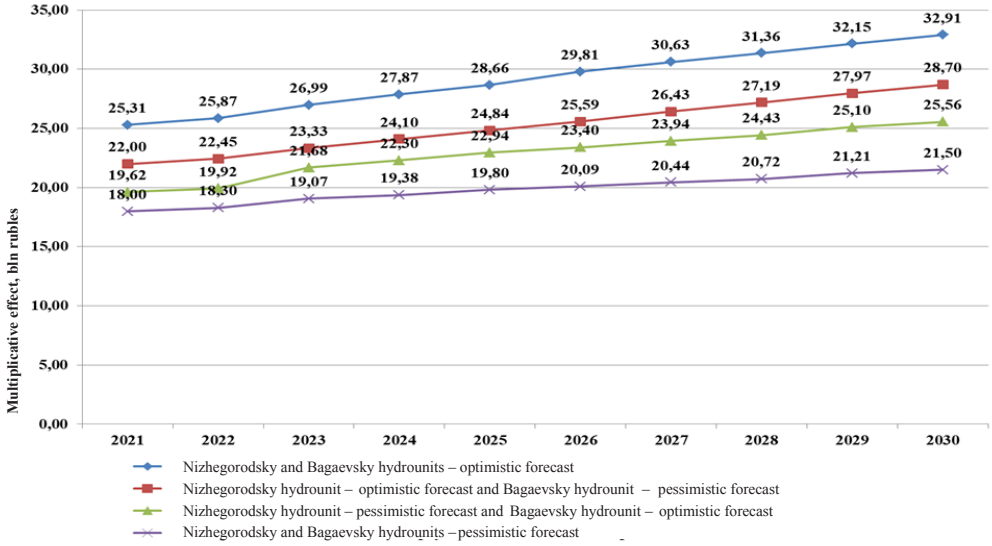
Toolkit for assessing externalities in implementation of infrastructure projects in rail transport

№	Model	Assessment of external effects
1.	Cross-sectoral balance sheet model with breakdown by FO	General economic effects from elimination of bottlenecks. Budgetary effects. Multiplicative effects of investment demand.
2.	General equilibrium model with breakdown by FO	Influence of transport costs on GDP growth. Consequences of the transition to RAB-tariffs for the economic growth. General economic effects from implementation of projects.
3.	Econometric models	Influence of HSR projects on investment growth. Influence of acceleration of suburban railway traffic on economic growth of agglomerations. Economic effects. Increased transportation security.
4.	World model of container transportation	Forecasting of container transit.

freight traffic in the direction of the Crimea. There are prospects of increasing cargo flows with development of the international transport corridor «North-South» between the countries of Europe and India, Iran through Astrakhan region along the inland waterways of Russia. In addition, there are potential opportunities for redistributing cargo flows from land-based modes of transport to inland waterways.

When planning any large-scale projects within the framework of an industry strategy, an important role is played by an assessment of their expected effectiveness. Problems in this assessment are due to the fact that the forecast calculations are based on the planned indicators most often without taking into account possible changes in the future, without attempts to try on different development scenarios.

For example, the evaluation of the sub-program «Inland Water Transport» of the Federal Target Program «Development of the Transport System of Russia (2010–2020) » was carried out on quantitative and qualitative indicators of public, commercial and budgetary efficiency. In the form of a key quantitative indicator, the integral discounted effect was used, and payback indicators of the planned measures taking into account discounting embodied the quality. Taking into account the large number of investment



Pic. 1. Multiplicative effect of the development of water transport in the river basins of the European part of Russia in four variants of forecasts.

projects included in the subprogram and the preliminary nature of working out the majority of them, the efficiency indicators were determined on the basis of expert estimates of the payback periods of a number of projects, their share in total expenditures was taken into account. At the same time, the calculation parameters were based on economic growth rates until 2010, which could not but undergo changes in the conditions of a dynamically changing and politically biased global market.

In our opinion, it is expedient to calculate the economic justification of programs and projects at the sectoral level in the current situation through the multiplier effect. The multiplier (in macroeconomics) is a numerical coefficient that indicates the change in the final development index, taking into account the growth of investment or production in the analyzed activity. Production and investment multipliers can consider macroeconomic analysis.

The multiplicative effect is the product of the multiplier on the change in the volume of production, investment, and other key indicators of the industry's development. It reflects the effect of increasing the indicators in the analyzed form of activity, taking into account its contribution to economic dynamics [8, p.150–151].

The method of integrating the effect

Let's consider the methodology for calculating the multiplier and the multiplicative effect of the Institute for Economic Forecasting of the Russian Academy of Sciences (INP RAS). It is based on the application of «costs-release» tables as an instrument linking the basic indicators of economic development, infrastructure, both industrial and technological, among themselves. The peculiarity of calculations in the methodology: the analysis of updated cost statistics at several levels, the first – types of economic activity, the second – sectoral complexes, the third level – investment projects.

Scientists offer two multipliers – investment and production. The investment arises with the growth of investments in a certain sector of the economy and extends to other types of economic activity, it shows an overall increase in output with an increase in investment in fixed assets.

The production multiplier demonstrates the expected change in output parameters and the dynamics of income with growth in output, it shows the magnitude of the change in gross output in the economy with an increase in the output of a separate type of economic activity.

The integral multiplicative effect is the annual growth of some macroeconomic indicator of the economic development results (gross output, GDP, budget revenues) or regional economy (gross output, gross regional product, regional budget revenues), which is generated by the cumulative increase in production and investment within the framework of investment projects [8, p.151–152].

In general form, the integral multiplicative effect can be written in the form of the formula [8, p.161–162]:

$$Total\ Mul = \sum_{i=1}^{TB} \frac{Inv(i) \cdot InvMul}{(1+d)^{i-1}} + \sum_{i=TB+1}^{TB+TF} \frac{Out(i) \cdot OutMul}{(1+d)^{i-1}}, \quad (1)$$

where Total Mul – integral multiplicative effect;

InvMul – investment multiplier;

OutMul – production multiplier;

d – discount rate;

Inv(i) – volume of capital investments in year i;

Out(i) – volume of production in year i;

TB – term of the project;

TF – term of the project.

If a special temporary investment structure is not set, the calculation is different:

$$Inv(i) = \frac{InvT}{TB},\ 1 \le i \le TB, \quad (2)$$

$$Out(i) = OutN * (1-a)^{i-TB-1},\ TB+1 \le i \le TB+TF, \quad (3)$$

where InvT – total volume of capital investments within the project;

OutN – nominal volumes of production after full commissioning of the created capacities;

a – depreciation rate.

In [8], the values of investment (2, 16) and production (1, 43) multipliers for the Russian economy «transportation and storage» were compiled using the methodology of INP RAS based on Rosstat data for 2013.

To justify the expediency of transferring part of the freight flows of highly-taxed goods (metal, grain, fertilizers, sulfur, etc.) from rail to inland waterway, it is important:

1. To bear in mind the calculations of the Federal Agency for Maritime and River Transport on the lower costs of IWT in comparison with the railway when transporting metal for distances of 200 km, for grain from 250 km, for fertilizers from 250–300 km.

2. To consider the advantages of IWT in low expenses for maintenance and repair of infrastructure: 1,6 times lower per 1 ton·km than railway transport.

3. To take into account the advantages of IWT for environmental friendliness: the specific indicator of carbon dioxide emissions in inland water transport is 20 % of the emissions from railway.

4. To take into account the advantages of IWT for safety: the level of accidents on inland waterways (in monetary valuation) is lower than in rail transport, twice.

To justify the expediency of transferring part of the cargo traffic of bulk cargo from road transport to IWT, it is important:

1. To take into account the calculations of the Federal Agency for Maritime and River Transport on the lower costs of IWT in comparison with road transport for the carriage of dry cargoes at distances from 200–300 km.

2. To consider the advantages of IWT in low costs for maintenance and repair of infrastructure: 4.3 times lower per 1 ton·km than in the road sector.

3. To take into account the advantages of IWT for environmental friendliness: the specific indicator of the release of carbon dioxide in inland water transport is 5 % of emissions on the road.

4. To take into account the advantages of IWT for safety: the level of accidents on inland waterways (in monetary valuation) is 14 times lower than on motor transport.

Multiplier and forecast

It is necessary to improve the methodology for calculating the integral multiplicative effect proposed by the INP RAS in accordance with formula (1) and the availability of various forecasting options. Due to the fact that the transfer of part of the cargo flows from land-based modes of transport to inland waterways during the navigation period does not imply large financial investments, but it allows increasing the fleet's load, only the production multiplier is to be calculated. And it is necessary to think about it first of all.

In the calculations, the discount rate will remain as high as 13 percent, as in the sub-program «Inland Waterway Transport». The increase in traffic volumes after the planned transfer of part of the cargo flows from «land» to inland water transport is determined by expert means, the settlement period is 2021–2030. The results of the expected multiplicative effect with favorable development of the situation in the river basins of the European part of Russia are shown in Pic. 1 in four variants of the forecasts.

1. Nizhegorodsky and Bagaevsky low-pressure hydrounits – optimistic forecast: commissioning of hydrounits in accordance with the sub-program dates at the end of 2020; increase in additional volumes of traffic in Volga-Baltic, Volga, Kama, Volga-Don, Azov-Don basins and transfer part of the bulk transportation volumes from land-based modes of transport to inland waterways during the navigation period.

2. Nizhegorodsky low-pressure hydrounit – optimistic forecast: commissioning of the hydrounit in accordance with the timing of the sub-program at the end of 2020; increase in the volume of dry cargo shipments in the Volga-Baltic, Volga, Kama basins due to organic growth and the transfer of part of the volume of transportation' from land-based modes of transport to inland waterways. Bagaevsky low-pressure hydrounit – a pessimistic forecast:

commissioning of the hydro power unit with a delay from the schedule of the subprogram – at the end of 2022; only a barely noticeable increase in the additional volumes of traffic in the Volga-Don, Azov-Don basins, taking into account the small organic growth and the transfer of an insignificant part of the bulk transportation volumes of inland water transport.

3. Nizhegorodsky low-pressure hydrounit – a pessimistic forecast: commissioning of the hydrounit with a delay from the schedule of the subprogram – at the end of 2022; a barely noticeable increase in the additional volumes of bulk cargo transportations in the Volga-Baltic, Volga, and Kama basins, taking into account the small organic growth and the transfer of insignificant traffic to inland waterways. Bagaevsky low-pressure hydrounit – optimistic forecast: commissioning of the hydrounit in accordance with the sub-program dates at the end of 2020; an increase in the additional volume of bulk cargo transportations in the Volga-Don, Azov-Don basins, taking into account organic growth and the transfer of part of the volume of transport to inland water transport.

4. Nizhegorodsky and Bagaevsky low-pressure hydrounits – pessimistic forecast: commissioning of hydrounits with a delay from the timing of the subprogram – at the end of 2022; an insignificant increase in additional traffic volumes in Volga-Baltic, Volga, Kama, Volga-Don, Azov-Don basins, taking into account very little organic growth and a similarly limited amount of transport for inland waterway transport.

Based on the results of calculations of the multiplicative effect of the development of water transport in the river basins of the European part of Russia, one should note the unevenness of its dynamics in the period 2021–2030 for each of the four variants of the forecasts. In the first of them – an optimistic option for both hydrounits, the multiplicative effect is greatest. In the second and third versions, the optimistic and pessimistic forecasts alternate in the range of probable assumptions for each position. The fourth option – a total pessimistic forecast – has the lowest multiplicative effect, respectively.

Presumably, the tactics of such forecasts are not only an illustration of the possibility to approach the realities of today's economic life. The principle of the multiplier itself is clearly shown, which, in fact, is called for and demonstrated by the methodology.

Conclusion.

The macroeconomic approach for economic justification of development of water transport in the river basins of the European part of Russia is new and can be used in practical activities when elaborating development programs and projects at the federal level.

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