

Transport Complex in the Economic Development of the Region: Far East of Russia

A B Bardal ¹

¹ Economic Research Institute FEB RAS, Tikhookeanskaya St., 153, Khabarovsk, RUSSIA

E-mail: Bardal@mail.ru

Abstract. The influence of level of the transport infrastructure development on the economic growth of the territory is proved both in the theoretical and practical applied works.

The New Economic Geography postulates which fixed the nonlinear connection between the change in transport parameters (transportation costs) and the change in the scale of the economy (dynamics of economy structure, location of production facilities) were one of the latest. The impact of transport on economic development in terms of assessing the permeability of borders is studied in this article. A hypothesis that the presence of a branched transport network that ensures high permeability of borders and openness of the economy for interactions positively influences the economic development of the region is being tested.

Internal and external indexes for the Far East of Russia are estimated. Internal index is estimate the permeability of borders between the administrative subjects of the Russian Far East. External index is estimate the permeability of Russian-China border.

The permeability of the boundaries is estimated according to: 1) the generally accepted method and 2) the adjusted index proposed by the author. The proposed indicator takes into account a wider range of transport interactions and is calculated using modified weighting factors for individual modes of transport. The classical and adjusted permeability indexes for the Far East are calculated. As a result, one can draw a conclusion about the weak permeability of borders for most administrative subjects of the Far Eastern Federal District. The relatively low transport penetration of the region's external borders is revealed when interacting with China. The results show a high potential for growth in foreign economic interactions for the Russian Far East (for example, cooperation in the frame of the "One Belt and One Road" Initiative) and the importance of upgrading the system of checkpoints across the state border with China.

1. Introduction

Borders influence the scale of economic interactions. Decrease in barrier function of borders leads to expansion of economic interactions, formation of the general market space within regional trade. Decrease in a barrier role of borders according to the logic of many researchers has to have significant effect on spatial and economic development of the border countries and regions.

Transport serves the international interactions of the countries and also cooperation of regions within one country. An opportunity and conditions of cargo transfer and passengers directly influence territory economy. Transport can be an incentive or restriction of foreign trade of the country and interregional interactions within one country.

The Far East of Russia is the border area. Within his extensive territory and the water area there are sites of frontier with the China, North Korea, USA and Japan. The length of the border with one of the most dynamically developing countries of the world (China) is 4209.3 km, including both land (650.3 km) and water: river (3489.0 km) and lake (70.0 km) sections of the state border. The potential of international interaction of the region is high.



2. Literature review and research problem

Many publications have been devoted to the study of the features of the border regions development. The authors consider issues of cross-border cooperation and its institutions [1-4]; features of the economy of border regions [5-7]; social processes in adjacent border regions of countries [8, 9] and so forth. The consequences of applying different regimes to the construction of barrier (barrier) boundary function are considered in these papers,

The authors of most works suggest that the impact of the level of integration on the development of the economy can be assessed on the basis of the indicator “foreign trade quota”, which is calculated as the ratio of the volume of trade between the region and a neighboring country to the region GRP. The higher the volume of trade and the higher the share of trade in the added value of the regional economy, the stronger the neighborhood affects the development of the region. Therefore, reducing barriers to goods, services, people and capitals as international integration deepens should promote the development of mutual trade and investment ties and promote economic growth in the regions.

Examples of changing the regime and functions of state borders in countries of Europe and Asia are considered [10, 11]. In some works, situations that contradict the general pattern are considered. These include publications that study the state of the economies of the countries of the former USSR [12-16].

Some works is devoted to the study of the change in the barrier and contact functions of the boundaries [17, 18]. In trade models, national borders are tariff or non-tariff barriers to trade. The main result of traditional and recent trade models is that integration by reducing trade barriers increases international trade, which affects the international model of specialization in production. The related economic adjustments are due to the redistribution of factors of production between sectors within the country. Factors of production are generally considered to be completely mobile in countries and between sectors, while they are completely immobile on an international scale. Thus, countries have fixed factors, and trade serves as a substitute for mobility factors. In addition, transport costs do not exist either at the national or international level. Therefore, each country is effectively treated as one geographic location.

One can note the absence of works about the role and significance of state borders in the Russian Far East. The initial stage of any study of the economy of the border region is the assessment of the possibilities for border crossing (transparency of the border) and analysis of infrastructure provision.

The purpose of this work consists in assessment of permeability of borders of territorial subjects of the Russian Federation in the Far East. The hypothesis of weak permeability of borders of the region will be checked.

3. Research methods

The analysis of permeability of borders [18] assumes assessment of a potential possibility of crossing of border. At the same time any types of borders can be considered: a) frontiers between the countries (external borders); b) borders between administrative-territorial subjects within one country (internal borders).

As an indicator of permeability of borders between territories of i and j is accepted [19-20]:

$$R_{ij} = \frac{10}{l_{ij}}(2q_{ij} + a_{ij} + 0.5v_{ij}) \quad (1)$$

l_{ij} – the length of the boundary between the considered territories i and j ; q_{ij} , a_{ij} , v_{ij} – number of crossings of border between the considered territories by railways, highways and waterways, respectively.

Taking into account features of an economical geographical location of the Far East we offer correction of the presented indicator. Correction of the indicator included: 1) use of the weight coefficients defining the importance of means of transport in transportations; 2) acceptance in calculation of highways with a hard coating, roads of transitional type and dirt roads; 3) acceptance in calculation of the waterways having navigable potential.

The last point is especially important as northern areas of the Far East are characterized by existence of a set of river systems but only the few of them are suitable for navigation. Inclusion in

calculation of all rivers crossing borders won't give the chance to correctly estimate the potential of development of transport connection.

Weight coefficients for separate means of transport have been accepted by us proceeding from the developed structure of freight transportation in the region following the results of 2016 (on an indicator of volume of the transported freights).

The following formula has been used for calculations after correction:

$$C_{ij} = \frac{1000}{l_{ij}} (2q_{ij} + 0.5a_{ij} + 0.1k_{ij} + 0.2v_{ij})$$

a_{ij} ; k_{ij} ; v_{ij} – number of crossings of border between territories i and j by highways with a hard coating, highways with a covering of transitional type (soil), the waterways having navigable potential.

The basic data necessary for calculations are absent in sources of official statistics of “Rosstat”. Therefore, the necessary initial data on the extent of the boundaries were collected by the author independently using the tools of online cratography of Google Maps. An assessment of the potential of navigable river conditions was made on the basis of data from the Administrations of the Amur basins of inland waterways and Administrations of the Lena basins of inland waterways.

In work the following indicators were used: extent of lines of borders between territorial and administrative territorial subjects of the Russian Federation in the Far East (km); the extent of sites of frontier within certain subjects of the Far East (km); number of crossings of borders between territorial subjects of the Russian Federation in the territory of the Far East the railroads, highways, the rivers (unit); number of crossings of sites of frontier of the Russian Federation in the territory of the Far East the railroads, highways, the rivers (unit); volumes of transportations on means of transport (million tons).

4. Results

Assessment of permeability of borders of the Far East was made on two blocks. First, indicators of permeability of borders of territorial subjects of the Russian Federation in the Far East have been calculated. Features of the region are: territories, considerable on the area; focal nature of economic development; uneven system of resettlement; the transport network which is poorly developed in comparison with the central regions of the country.

Estimates of permeability of internal borders by the general and corrected procedure are as a result received (see Table 1).

Table 1. Borders Permeability Indexes for the subjects of the Russian Federation in the Far East.

Territorial subject of the Russian Federation	Calculated by the general procedure	Calculated by the corrected procedure
The Republic of Sakha (Yakutia)	0.017	0.570
Kamchatka Krai	0.042	0.482
Primorsky Krai	0.262	7.298
Khabarovsk Krai	0.066	2.990
Amur region	0.083	4.437
Magadan region	0.041	0.772
Sakhalin region	-	-
Jewish Autonomous Region	0.649	24.341
Chukotka Autonomous Okrug	0.069	0.772

The received estimates of permeability of borders of territorial subjects of the Russian Federation in the Far East several times are lower than similar for other regions. We won't take the central regions

differing in the small area and advanced transport network for comparison. However even regions comparable on the area and rather remote from capital agglomeration have bigger permeability of borders. For example, the permeability of borders of the Tyumen region calculated by the general technique 0.18 [20].

Comparing the results with GRP [22] we can conclude that the most effective interaction potential is used in Primorsky Krai. In Jewish Autonomous Region the high permeability of borders is the basis for realization of regional transit function. On the contrary, the low permeability of borders the Republic of Sakha (Yakutia) demonstrates non-use of interaction potential owing to backwardness of transport network.

Secondly, an assessment of permeability of external borders has been given. Cooperation with the People's Republic of China has gained new aspects after declaration in 2013 of an initiative of One Belt and One Road "One Belt and One Way". For regions of the Far East of Russia possibilities of development of international relations with the China have appeared. Within an initiative "One belt and one way" need of strengthening of interaction of the border provinces of the China with Russian regions is officially noted.

The permeability of frontiers can contribute to the successful development of cooperation. The estimates received on this block demonstrate insufficient use of potential of cooperation by border territories of two countries. The index of permeability of borders is in an interval 0.015-0.635.

Essential part of border with China in the territory of the Far East passes down the river. It gives the potential chance for interactions. However, today 15 border checkpoints (except for sea and air) operate at the border with the People's Republic of China, including one river point and seven mixed-mode points (transportation by car in winter and in summer by river vessels). Infrastructure for international interactions did not develop for a long time. Discussions about construction of bridges between Russia and China in the Jewish Autonomous Region (Nizhnelenskoye - Tungjiang) and the Amur Region (Blagoveshchensk - Heihe) have continued for a several decades. The projects of reconstruction of the river checkpoint Khabarovsk and the mixed checkpoint Pashkovo are discussing few years.

In the conditions of insufficiently developed infrastructure (including transport infrastructure) the stimulating function of frontier can't be acting fully.

5. Conclusions

By results of borders permeability index calculation for the administrative-territorial subjects of the Russian Far East we have confirmed a hypothesis about low permeability. Potential of a geographical location (considerable development of river systems) isn't used in a due measure. Regional highways and the railroads networks are concentrated in the southern part of the region. Northern and central territories have a poorly developed transport system. The permeability of borders for these territories is extremely low.

The permeability of external borders is extremely important now as the international cooperation with China actively develops. So the low permeability of frontier with the People's Republic of China within the Far East can become the limiting factor of the international cooperation in the long term.

The development of researches in this direction can be connected with specification of the data used in work, assessment of options of increase in permeability of borders and assessment of connection of permeability with economic development of the region regarding mathematical modeling.

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