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STRATIFICATION APPROACH TO RESEARCH BORDER ECONOMY

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K e y w o r d s: stratification, territorially-oriented branch structure of economy, the region's potential, regional resource, stratification indicators, methods of stratification, models of stratification, infrastructure elements of the border economy.

A b s t r a c t

Stratification of the border economy has important scientific value. It is the question of division of the border economy into striations. The stratification of potential and resources of the border region is used in the article. Eight levels of striations are identified: the natural and economic conditions of the border region; the integrity of reproduction base of the border region; the level of development and territorially-oriented branch organization of productive forces; the degree of completeness of production and power cycles; the production and economic specialization of the border region; the level of infrastructure provisions in the border region; the trade and commercial potential of the border region and development of new management forms in the border region.

The indicators and a set of possible methods of the assessment of each of the eight levels of striations are suggested by means of the econometric instruments.

PODEJŚCIE STRATYFIKACYJNE DO BADAŃ NAD EKONOMIĄ PRZYGRANICZNĄ

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S ł o w a k l u c z o w e: stratyfikacja, terytorialno-branżowa struktura gospodarki, potencjał regionu, zasoby regionu, czynniki stratyfikacji, metody stratyfikacji, modele stratyfikacji, elementy infrastruktury gospodarki przygranicznej.

A b s t r a k t

Ważne znaczenie naukowe ma stratyfikacja gospodarki przygranicznej – podział gospodarki przygranicznej na warstwy. W artykule wykorzystuje się stratyfikację potencjału i zasobów regionu

przygranicznego. Wyodrębnia się osiem warstw: naturalne i ekonomiczne warunki regionu przygranicznego, kompleksowość bazy reprodukcyjnej regionu przygranicznego, poziom rozwoju i organizacja terytorialno-branżowa sił produkcyjnych, stopień ukończenia cyklów produkcyjno-energetycznych, produkcyjno-gospodarcza specjalizacja regionu przygranicznego, poziom zabezpieczenia infrastrukturalnego w regionie przygranicznym, handlowo-komercyjny potencjał regionu przygranicznego i wysoki poziom rozwoju nowych form gospodarowania w regionie przygranicznym. Jako aparat ekonometryczny zaproponowano wskaźniki i metody oceny każdej z ośmiu warstw.

Introduction

The representatives of „positive" integration considered a number of problems which are connected with the practical calculations of the border processes. Up to date, there have not been any specific methods in scientific literature, which would allow to carry out specific calculations with respect to the border economy from the point of view of neighboring regions' interests. We offer the stratification approach, which allows to single out a number of indicators described by the complex indicators during the research process of a border situation. The striations are the division of the border market space into the eight integrated blocks or parts. This technique is also important to further carry out stratification of the regional characteristics, which allows a researcher to identify the layers according to the stratification criteria that are exclusively necessary for the research, with the subsequent formation therefrom of further integration indicators.

The most important criteria distinguished in the stratification description of the border situation are the following: the natural and economic conditions; the integrity of reproduction base; the level of development as well as territorial and branch (structural) organization of production forces; the degree of completeness of production and power cycles; the production and economic specialization; the level of infrastructure provisions; the trade and commercial potential; the development of new management forms.

Methodology of stratification of economic space of territories

While carrying out research into the regional socio-economic system of border territories, it is important to develop the indicators which have to become the criteria of stratification. It should be taken into account that the detailed stratification will provide the most flexible result concerning further stages of research. On the other hand, too detailed partitioning of the resources and potential of the border territories will result in insignificant indicators, and they, as a matter of principle, contain little information.

Research into natural and economic conditions of the border region

This research has the introductory and descriptive features of the border analysis. A set of qualitative research data is indicated herein as a matter of principle, including: a geographical position – with the indication of the nearest border regions; in addition – in case of the description of the border region – the neighboring states, the relations between these states.

The geological structure, a variety of vegetation (the latter indicator is arguable – for some kinds of activity specific or absolute indicators of certain types of vegetation are of crucial importance) is of qualitative nature.

Some part of indicators under consideration belongs to the category of nature-climatic conditions. Thus, for example, the average annual air temperature in the tcp region is an important indicator for determination of agricultural potential, interests of the tourist industry (in some cases the average temperature could be presented according to season or month in the form of a graph). Apart from the temperature factor, it is possible to distinguish the following:

– average annual norm of precipitation lcp (a similar geographical representation is possible);
– natural energy potential (of wind power, tides, rivers);
– average quantity of sunny days per year:

$$K_{\text{sun average}} = \frac{Q_{\text{suuny days}}}{365}$$

The graphic data on the total solar energy and total solar radiation could be additionally presented.

The resource characteristic of the region (which often contains the above-mentioned indicators of climatic resources) is another quantitative set of resource layers:

– mineral and raw;
– flora;
– fauna.
– land;
– water;

Mineral and raw resources are the source of a raw component of the regional production, and therefore require a more detailed study.

It is necessary to stratify the mineral and raw potential of the border region on each type of the developed and potential raw materials ready for development and to submit data in the following manner.

The general stocks of resources are represented by way of an absolute expression in units of measurement.

A degree of the developed fields of raw materials is calculated using the following formula:

$$R_{ddi} = \frac{R_{di}}{R_{pi}},$$

where:

R_{di} – quantity of raw materials in the source developed for production,

R_{pi} – potential quantity of raw materials of this type in the border region.

Share of a regional resource on a state/global level:

$$R_{ddi} = \frac{R_{pi}}{R_{gi}} \cdot 100\%,$$

where:

R_{gi} – potential quantity of raw materials of this type in the state (a similar indicator is adequate from the point of view of the world security with a resource).

The resource share on the state and global level is adequate in terms of competitiveness of sources of a resource on the state/global arena. Degree of lands of i appointment in the total quantity of land resources:

$$S_{di} = \frac{S_i}{S_{\text{region}}},$$

where:

S_i – area of the land of i appointment in the border region,

S_{region} – total area of land grounds of the region.

The ratio of usage of lands to destination:

$$S_{\text{extend of target use } i} = \frac{S_{\text{use } i}}{S_i},$$

where:

$S_{\text{use } i}$ – area of the earth which is really used by i appointment of geographical settlements within borders of land grounds, intended for using i.

The extent of idle time or inappropriate use of land resources is defined as:

$$S_{\text{idle time}} = 1 - S_{\text{extend of target use } i}.$$

For the description of vegetable resources, each specific type of a resource is considered in nominal terms. The fauna description is given in a similar manner. The security level in the border region is considered in terms of water resources according to the following formula:

$$S_{\text{extend of water}} = \frac{S_{\text{water}}}{S_{\text{region}}},$$

where:
S_{water} – total area of all water resources in the border region.

The security of the border region by the type of water resources – in nominal and relative expression is similarly considered.

Index of regional consumption of a resource:

$$ri_i = \frac{Q_{\text{use } i}}{Q_{\text{potental } i}},$$

where:
$Q_{\text{use } i}$ – volume of use of a resource in the region's borders (intermediate + final consumption) i resource in a year,
$Q_{\text{potential } i}$ – volume of production of i resource in a year.

Integrity of reproduction base of the border region

The main objective of the research of integrity of reproduction base of the border region is the definition of the region's ability to develop at its own expense. The development happens at the expense of internal resources, domestic markets and within the region's own territory.

In reality, the level of reproduction base of the border region is characterized by the degree of development of the regional markets, i.e.:

- consumer goods market;
- means of production market;
- financial resources market;
- human resources market.

The consumer goods market is characterized by a set of the stratified indicators. The inflation ratio to consumer goods and services as well as regional consumer basket $Q_{\text{consumer basket}}$ is expressed in nominal values. A degree of availability of a consumer basket is defined in the following manner:

$$Q_{\text{individual consumer basket}} = \frac{Q_{\text{consumer basket}}}{Q_{\text{standard consumer basket}}},$$

$Q_{\text{standard consumer basket}}$ – size of a standard consumer basket.

The ratio of volume of household expenses and the wage amount (minus taxes)

$$Q_{\text{individual household expenses}} = \frac{Q_{\text{household}} \cdot k}{q_{\text{populace}} \cdot \Sigma_k W_k},$$

where:

k – corresponds to branch average (k – number of branches),
W_k – average on branch k a wage (minus taxes),
Q_{populace} – volume of the populace of the region,
$Q_{\text{household}}$ – gross volume of household expenses of the population of the region.

The average level of production is characterized by the following ratio with respect to each branch k – index of the average rate of production:

$$Q_{\text{index of the market of means of production}} = \frac{\Sigma_i Q_{\text{residual profit } i\ k}}{Q_{\text{gross means of production } k}},$$

where:

$Q_{\text{residual profit } i\ k}$ – residual profit of the enterprise i involved in k of the branch,
$Q_{\text{gross means of production } k}$ – gross limit of average level of production for branch k of the organizations in the region.

The financial resources market is characterized by number of institutes and establishments in the financial and credit sphere. The contribution of integrity of reproduction base of the region to value is made by the following ratio:

$$N = \frac{n_b}{n_a},$$

where:

n_b – average percent of depository investment of funds in a bank,
n_a – average volume of dividends per share of the organization in the region.

The human resources market is expressed in nominal units according to average wages with stratification on all branches of the region.

One of the main parts of the research into the labor market is natural unemployment rate, which can be presented as the sum of indexes of frictional and structural unemployment:

$$L_{\text{unemployment}} = \frac{L_{\text{frictional unemployment}} + L_{\text{structural unemployment}}}{Q_{\text{employed workers}}},$$

where:

$L_{\text{frictional unemployment}}$ – number of the frictional unemployed in the region,
$L_{\text{structural unemployment}}$ – number of the structural unemployed in the region,
$Q_{\text{employed workers}}$ – total amount of labor in the region.

It is necessary to perform branch stratification of requirements of the regional production for the structural description of the labor market.

Level of development and territorial and branch (structural) organization of productive forces

While researching the regional socio-economic system using this criterion, it is necessary to perform stratification of leading branches in the border region with the following parameters.

The labor productivity is recognized as:

$$P_{lp} = \frac{Q_{pr}}{Q_{ipp}},$$

where:

Q_{pr} – volume of output and realization of branch production,
Q_{ipp} – number of industrial production personnel involved in the industry.

Capital productivity in branch:

$$F_o = \frac{Q_{pr}}{\Sigma_i F_i},$$

where:

F_i – average annual cost of the fixed business assets of the enterprise i.

Retirement rate of the equipment in the branch:

$$K_{rr} = \frac{\Sigma_i \; Q_{\text{leaving } i}}{\Sigma_i \; Q_{\text{beginning } i}},$$

where:

$Q_{\text{leaving } i}$ – quantity of the equipment left by the enterprise i in the branch for the measured period,

$Q_{\text{beginning } i}$ – quantity of the equipment of the enterprise i at the beginning of the measured period.

Coefficient of renewal of the equipment in the branch:

$$K_{\text{renewal}} = \frac{\Sigma_i \; Q_{\text{entered}}}{\Sigma_i \; Q_{\text{period end } i}},$$

where:

Q_{entered} – quantity of the equipment introduced by the enterprise i in the branch for the measured period,

$Q_{\text{period end } i}$ – quantity of the equipment of the enterprise i at the end of the measured period.

Thus, it is possible to define increment rate of the equipment in the branch:

$$K_{inn} \frac{\Sigma_i \; Q_{period\ end\ i} - \Sigma_i \; Q_{\text{beginning } i}}{\Sigma_i \; Q_{\text{beginning } i}}.$$

Apart from the share characteristics of the border region, the analysis of the production structure of the region is also important.

The coefficient of innovation of the border regional industry is defined as:

$$K_{inn} = \frac{\Sigma_i \; Q_{\text{sep } i}}{\text{GRP}},$$

where:

$Q_{\text{scp } i}$ – volume production in the border region of the science-consuming production of the enterprise i (i – all of the innovative enterprises in the region).

Production coefficient of the average rate of production:

$$K_{pmp} = \frac{\Sigma_i \, Q_{\text{pr}}}{\text{GRP}},$$

where:

Q_{pr} – production volume of the enterprise i in the border region achieving the average rate of production.

Degree of completeness of production and power cycles

The branch stratification of the regional industrial organizations is made and a number of coefficients are defined. The coefficient of completeness of the regional production determines the volume of production passable within the limits of the region's full production and energy cycle as well as satisfying the final internal and external demands.

$$K_{\text{pec}} = \frac{\Sigma_i \, Q_{\text{end pec } i}}{\text{GRP}}$$

where:

$Q_{\text{end pec } i}$ – volume of the complete production and energy cycle of the enterprise in the branch i (or in the whole region).

The share of the enterprises in complete production and energy cycle is defined as:

$$K_{\text{enterprise compl. pec}} = \frac{Q_{\text{enterprise compl. pec}}}{Q_{\text{enterprise}}} \cdot 100\%,$$

where:

$Q_{\text{enterprise compl. pec}}$ – number of the regional enterprises with the complete production and energy cycle,

$Q_{\text{enterprise}}$ – number of the industrial enterprises in the border region.

It is possible to stratify the share of the enterprises in the complete production and energy cycle on the leading regional production branches.

$$K_{\text{enterprise compl. pec } i} = \frac{Q_{\text{enterprise compl. pec } i}}{Q_{\text{enterprise } i}} \cdot 100\%,$$

where:
i – branch index.

Coefficient of the region's own energy:

$$K_{\text{own energy}} = \frac{Q_{\text{own energy}}}{Q_{\text{energy consumption}}},$$

where:
$Q_{\text{own energy}}$ – volume of energy resources produced in the region,
$Q_{\text{energy consumption}}$ – total amount of energy consumed in the region.

$$Q_{\text{energy consumption}} = Q_{\text{produce energy}} + Q_{\text{imp energy}}.$$

where:
$Q_{\text{imp energy}}$ – volume of energy resources imported to the region.

The coefficient of energy resources imported to the border region is defined by the following ratio:

$$\gamma_{\text{energy}} = \frac{Q_{\text{imp energy}}}{Q_{\text{produce energy}} - Q_{\text{exp energy}} + Q_{\text{imp energy}}},$$

where:
$Q_{\text{exp energy}}$ – volume of energy resources exported from the region.

Industrial and economic specialization of the border region

For drawing up a branch portfolio of the border region, it is necessary to investigate the extent of influence on the economic situation of the leading production branches of the region. The share of the branch i in structure of gross domestic product of the border region is defined by the following ratio:

$$Q_{I\ \text{branch}}{}^{i} = \frac{Q_{\text{branch } i}}{\Sigma_i\ Q_{\text{branch } k}} \cdot 100\%,$$

where:
$Q_{\text{branch } i}$ – total volume of output of the branch i.

The coefficient of export of production or coefficient of marketability of the regional production for the branch i is defined as:

$$\gamma_{v.i} = \frac{v_i}{\Sigma_k \, Q_{\text{branch } i.k}}.$$

Index of export of a regional resource:

$$re_i = \frac{Q_{\text{exp. } i}}{Q_{\text{potential } i}},$$

where:
re_i – index of export of a regional resource,
$Q_{\text{exp. } i}$ – volume of export of a resource outside the limits of the border region.

Import coefficient (an import share of the general consumption of production in the border region):

$$\gamma_{w.i} = \frac{w_i}{\Sigma_k \, Q_{\text{branch } i.k} - w_i + v_i},$$

where:
v_i – volume of export of production of the branch i,
w_i – volume of import of production of the branch i.

Then, the coefficient of import can be defined as:

$$\gamma_{v+w.i} = \frac{v_i + w_i}{\Sigma_k \, Q_{\text{branch } i.k}}.$$

In case of failing to supplement the import (that is production import which is produced in the border region isn't developed), the coefficient of import will assume an air:

$$\gamma_{w.i} = 1 \text{ on branch}$$

It is possible to add balance between export and import with a share of the enterprises which are guided by release of export production:

$$K_{Iv} = \frac{K_v}{K_{\text{enrerprise}}} \cdot 100\%,$$

where:
$K_{\text{enterprise}}$ – number of the industrial enterprises in the border region,
K_v – enterprises in the branch which are guided by release of export production.

In order to assess the potential of the border and the regional export of production in the branch within the state, it is worth estimating localization coefficients or production specializations. The coefficient of localization of production in the branch i of the border region can be defined as:

$$K_{\text{loc}.i} = \frac{Q_{\text{branch } i}}{\Sigma_i Q_{\text{branch } i}} + \frac{Q_{\text{state branches } i}}{\Sigma_i Q_{\text{state branches } i}} = \frac{Q_{\text{ind branches}} \cdot \Sigma_i Q_{\text{state branches } i}}{100 \cdot Q_{\text{state branches } i}},$$

where:

$Q_{\text{state branches } i}$ – gross limit of the branch i in the state.

Level of infrastructure provided in the border region

The main characteristics – the existence of the infrastructure subsystems counted in 1000 organizations in the branch presents Figure 1.

Infrastructure subsystem in the border region	– investment companies – sanitary and quarantine points – developer organizations – existence of frontier transitions and customs posts – trade and customs areas – consulting and audit – advertising and information services – recruiting and headhunting – auction organizations – consumer committees and societies – associations and unions of industrialists, businessmen – insurance companies – credit organizations – pension funds

Fig. 1. The main characteristics of the infrastructure elements are adequate in 1000 organizations

For each of the directions:

$$K_{\text{regulatory infrastructure}} = \frac{K_{\text{infrastructure}}}{K_{\text{enterprise}}},$$

where:

$K_{\text{infrastructure}}$ – number of organizations in the border region of the i subsystem infrastructure.

The standards of infrastructure provided in the border region are the absolute amounts of expenses of regional authorities as well as industrial and commercial structures and development of objects of infrastructure.

Then, the share of expenses of regional administration (or market structures of the region) is defined by ensuring the proper level of infrastructure of i of the branch based on the following ratio:

$$K_{\text{infrastructures of expenses of } i} = \frac{K_{\text{expenses of infrastructures of } i}}{K_{\text{expenses of authorities}}},$$

where:

$K_{\text{infrastructures of expense of } i}$ – expenses of regional authorities (or market structures of the border region) on infrastructure of i of the branch,

$K_{\text{expenses of authorities } i}$ – general expenses of authorities (or market structures of the border region) on the branch i.

Trade and commercial capacity of the border region

The indicators of trade and commercial capacity of the border region show the possibility of market development of the regional economy. The potential depends on the extent of development of institutes and establishments of market infrastructure in the border region.

The branch stratification of indicators of trade and commercial potential allows to allocate a number of regional characteristics. The growth (decrease) within the domestic market is defined by the growth coefficient:

$$K_{\text{growth}} = \frac{Q1_{\text{internal } i}}{Q2_{\text{internal } i}},$$

where:

$Q^1{}_{\text{internal}}{}^{i}$ – volume of the domestic regional market of the branch i at the end of the studied period,

$Q2_{\text{internal } i}$ – volume of the domestic regional market of the branch i at the beginning of the studied period.

In case when $K_{\text{growth } i} < 1$, it indicates the development and growth of the branch i.

A specific weight of the industrial products in the general commodity weight is defined by the following ratio:

$$Q_{\text{industrial products}} = \frac{Q_{\text{industrial products}}}{Q_{\text{goods}}},$$

where:
$Q_{\text{industrial products}}$ – volume of industrial products in the region,
Q_{goods} – total amount of the goods made in the region.

The possibilities of trade and commercial potential which can be put into action are appropriate to group of ratios – as a branch (TCP_i) and as regional ($\text{TCP}_{\text{region}}$) characteristic.

$$\text{TCP}_i = \text{P}_{\text{industry}} - x_i,$$

where:
P_{industry} – gross capacity of the branch i in the regional industry,
x_i – gross consumption in the region, including intermediate consumption and final consumption of the branch i of y_i:

$$x_i = \sum_j x_{ij} + y_i,$$

where:
x_{ij} – volume of production expenses in the branch i for the needs of the branch j.

Failure to supplement import of production:

$$\text{TCP}_{\text{region}} = \sum_{i=1}^{N} \text{TCP}_i - \sum_{j=N+1}^{M} Q_j - A,$$

where:
i – branch of production in the region,
j – branches not supplementing import, where production is imported into the border region,
z – goods imported to the region in large numbers owing to favorable economic conditions, $z_1(1...N) = i$, $z_2(N+1...M) = j$,
Q_j – volume of goods of the branch j,
A – volume of the regional reserve and insurance funds.

In case of the supplemented import:

$$TCP_{region} = \sum_{i=1}^{N} \text{TCP}_i - \sum_{j=N+1}^{M} Q_j + \sum_{i=1}^{N} (Q_z - Q_{z1}) + \sum_{j=N+1}^{M} (Q_z - Q_{z1}) - A.$$

Development of new forms of management in the border region

It is one of the most important criteria in the analysis of the regional economic situation. The indicator displays development trends of the regional production such as differentiation and diversification.

The main indicators are connected with the results and efficiency. The result of introducing a new form of management (branch) is the following:

$$E_i = x_i - Ex_i,$$

where:
Ex_i – general expenses of introduction of the new form of management.

The gains on credit and financial resources connected with the new elements are defined in the following ratio:

$$K_{\text{turn } i} = \frac{Q1_{\text{turn}}}{Q2_{\text{turn}}},$$

where:
$Q1_{\text{turn}}$ – gains on credit and financial resources in the beginning of the studied period;
$Q2_{\text{turn}}$ – gains on credit and financial resources in the end of the studied period.

The new leading forms of the border cooperation are unique and stratification research needs to be done into all of the new elements. The research has to include the cost of capitalization of the joint companies, growth rates of dividends as the ratio of growth rates of inflation and stocks of the joint company.

Conclusion

Stratification is a rather new instrument of research of the border situation. The application of its techniques will allow to divide the indicators of the studied border region into striations (layers). It will also provide an opportunity to use a stratification set of regional border characteristics for further research. This technique sets as the purpose the detailed description of the border region. The indicator striations (layers) that are further allocated

should be used to define the integrated characteristics of development of the border economy as well as to create the integrated model of the social and economic situation of the border region.

The ultimate and main objective is to create the strategy of the border region with the aforementioned set of values at a level which will allow to maximize the constructed functional values of efficiency of the border economy.

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