ORIGINAL PAPER

Contact: e.rogalska@interia.pl, University of Wamia and Mazury in Olsztyn, Department of Microeconomics, ul. Plac Cieszyński 1, 10-719 Olsztyn, Poland

Elżbieta Rogalska
University of Wamia and Mazury in Olsztyn, Poland

Multiple-criteria analysis of regional entrepreneurship conditions in Poland

Abstract

Research background: Building effective conditions for doing business and sup-porting entrepreneurs is currently considered as a basic growth determinant. It is a policy objective not only at the national level, but also an important factor influencing the competitive potential of regions and local communities. It is especially important in the case of Central European countries and regions that face the problem of closing development gap. Therefore, comparative research with regard to entrepreneurship conditions, especially at spatially lower aggregation level, can provide important background for proposing policy guidelines.

Purpose of the article: The main objective of the article is to analyse changes in disparities in regard to entrepreneurship conditions in Poland at NUTS 3 level in the years 2010 and 2015.

Methods: The entrepreneurship conditions are analysed based on 5 criteria. As a result, they are considered as a multiple-criteria phenomenon. Therefore, in the article the dynamic analysis was implemented, where taxonomic measure of development was assessed with TOPSIS method based on median vector Weber. The obtained taxonomic measure allowed to rank the NUTS 3 regions starting with the ones characterised with the best conditions for entrepreneurs to the ones with the worst conditions, to group then into relatively homogenous subsets, and finally to verify the changes in the disparities between the regions in the analysed period.

Findings & Value added: The research confirms that in spite of visible improvements significant disparities at the regional level in regard to entrepreneurial conditions should be

considered as an actual and important problem for regional policy in Poland. This factor can negatively affect the possibilities of reaching spatially sustainable growth objectives. From the long-term perspective, the disparities can still negatively affects social and political growth environment in Poland.

Introduction

After successful transformation, all Central European economies face a challenge of avoiding the middle income trap. Many international studies indicate that effective institutions, regional sustainability and good quality of entrepreneurial conditions have a crucial role in obtaining that aim (Agenor *et al*., 2012; Kaasa, 2016; Tvaronavičienė & Razminienė, 2017; Simionescu *et al.,* 2017; Meyer, 2018; Ślusarczyk & Grondys, 2018). The importance of entrepreneurial environment is also growing due to structural changes of global economy, where the growth in developed countries is not only dependent on traditional resources, but it is mostly related to entrepreneurial innovation potential supporting knowledge-based economy development (Madrak-Grochowska, 2015; Dima *et al*., 2018). These factors are especially important for Poland, which on the one hand, is the biggest country in Central Europe, thus, it is an economy with big potential for taking advantage of economies of scale. But on the other hand, Poland is commonly considered as the country facing the problem of regional divergence and significant regional disparities (Kuc, 2017; Bartkowiak-Bakun, 2017). In that case, improving entrepreneurship conditions cannot be only the objective of national policy, but it should be also the aim implemented at the regional and the local level.

The main objective of the article is to analyse the factors influencing entrepreneurship conditions in Poland at NUTS 3 level. The literature review provided in the article indicates that the entrepreneurial conditions should be considered as a multivariate problem, thus, they should be analysed with application of multiple-criteria analysis tools. The analysis was conducted for the years 2010 and 2015. The research period was limited by the availability of comparable good quality data at NUTS 3.

The article is a continuation of the Author's previous research. It started with application of zero-unitaristaion method for analysis of disparities between NUTS 3 regions (Rogalska, 2017). The method applied in this study can be considered as a simplified taxonomic approach, though useful and commonly applied tool for preliminary comparative regional research (Kukuła & Bogocz, 2014; Zygmunt, 2017). In the paper, Rogalska (2018) analyzed the similarities between NUTS 3 regions with application of Ward's method. In the case of the current article TOPSIS method based on

median vector Weber was applied (Rogalska, 2018b), which enabled to rank and group the analyzed regions.

The current contribution is structured as follow: first of all, in the literature review the importance of the research with regard to entrepreneurial conditions and its influence on growth is presented. The second part of the article presents in details the methodological approach taken in the empirical part of the article. Then, the results and their discussion are given. The article ends with conclusions, which stress policy guidelines and limitations of the current analysis.

Literature review

The literature concerning the economic role of entrepreneurship can be generally classified into research on the influence of this factor on growth process at different aggregation level, where a variety of econometric methods are used, and then comparative multiple-criteria studies, where the main objective is to provide information on the conditions faced by entrepreneurs in given countries or regions. Among the best known publications in that second field there are the reports published by international agencies and organizations that provide comparative results at the national level, such as Doing Business report prepared annually by The World Bank (2018) or index of economic freedom published by Heritage Foundation (2018). The current research can be placed in that approach, though it takes the national perspective at spatially low aggregation level.

Going back to the stream of the research on the effects of entrepreneurship conditions for growth one should start with recent bibliometric analysis and comprehensive literature review done by Urbano *et al.* (2018). The authors confirm that in spite of growing supply of the literature that has been seen for last twenty-five years, the research in the field is still of high importance for institutional economics, as it opens many new research questions with regard to factors conducive to entrepreneurship, which in turns supports economic growth. In this context one should relate to the research provided by Dilli *et al.* (2018) that concentrated on the problem of relations between institutions, types of entrepreneurship within the framework of "Varieties-of-Capitalism concept". Based on a set of institutional indicators which explain differences in entrepreneurship types at national level, they applied cluster analysis to show how 21 developed economies cluster around for distinct institutional settings, which then were related to different types of entrepreneurships with application of regression analysis. The most important conclusion from this research indicates that it is not

possible to indicate one "ideal" institutional pattern and conditions that would equally support different types of entrepreneurship. Therefore, the research confirms the need for permanent studies with regard to entrepreneurship types and conditions that is needed for proposing effective policy guidelines.

Yay *et al*. (2018) analyzed a bigger sample of economies at the national level in order to investigate the impact of formal institutions and institutions of governance on formal and informal entrepreneurship with application of unbalanced panel data for 54 economies in the years 2004–2012. The authors suggest that both formal institutions and governance can support formal entrepreneurship, however, the governance can be negatively related with informal entrepreneurship. Additionally, the research results can also indicate that financial development can increase the impact of institutions on formal entrepreneurship.

Balcerzak and Pietrzak (2016) and Balcerzak (2018) have analyzed entrepreneurship conditions at the national level in the European Union countries as one of the institutional aspects that builds institutional environment in the reality of knowledge-based economy. In the research, the authors applied TOPSIS method, where all intuitional aspects under consideration were treated as the once with similar importance for the whole institutional system (Balcerzak & Pietrzak, 2016). Then Balcerzak (2018) implemented an analysis based on entropy weights, which confirmed the role of entrepreneurship conditions in shaping institutional environment, though its importance for forming overall institutional conditions was lower than the role of labour markets, juridical system and competitive environment, but higher than the role of financial markets. This result can be considered as a different form the previously mentioned studies provided by Yay *et al*. (2018), which can be related to the concentration on the group of relatively developed economies, where the availability of capital for entrepreneurs is not such a big problem as in the case of developing economies.

The problem of entrepreneurial conditions and quality of business environment is also often analyzed for given countries in the context of obstacles and administrative burdens for growth of enterprises. Cepel *et al*. (2018) quantified factors that shape quality of the business environment in the SME segment and proposed the business environment quality index for the Czech Republic and Slovakia. In the research, they applied survey-based methodology. In spite of relative closeness and historical similarity of both countries, Slovak entrepreneurs gave the economic factors a higher role than Czech entrepreneurs. Slovak business representatives pointed to the higher importance of the Central Bank in establishing a stable business environment and the role of commercial banks in business financing. How-

ever, what can be considered as typical for all Central and Eastern Europe
an economies in both countries the evaluation of political factors was rela-
tively negative.

The context of growth obstacles for small and medium-sized business
was also analysed for Slovakia by Ivanová (2017) with application of sur-
vey methodology. The author concentrated on the problem of external fi-
nancing, resources for innovation and competitive advantages of Slovak
enterprises. She provided especially interesting, and to a high extent sur-
prising, results with regard to the issue of enterprise financing. In Slovakia,
in spite of the fact that a large group of companies suffers from difficulties
with accessing to external sources of financing, the smaller the enterprise,
for example measured with number of employees, the easier the access to
external sources of financing is reported.

Moving to the research concentrating on the role of entrepreneurship at
the regional level, Ohotina *et al.* (2018) analysed the quality of regional
entrepreneurial environment from the perspective of subjective, and subjec-
tive-objective methodologies for assessment of investment climate in Lat-
via's, Lithuania's, and Belarus's cross-border regions. The authors pro-
posed methodology based on multivariate approach that enables to group
and classify the analysed regions.

Pietrzak *et al.* (2018) applied Structural Equation Modeling methodolo-
gy in order to assess quality of entrepreneurial environment in Poland at the
regional level (NUTS 2) within the context of sustainability framework.
Their research confirms the process of improvement of entrepreneurial
conditions in the years 2010–2014 in most of the NUTS 2 regions. Howev-
er, the research also shows the dominance of the central region and stable
in time significant disparities between the NUTS 2 regions, which can indi-
cate that the policy objectives aimed at reaching regionally sustainable
growth are not met. Analogous results were obtained by Rogalska (2018c,
2018d), who applied Hellwig's method for research on the entrepreneurial
conditions in Polish NUTS 2 regions in the years 2011–2017, and cluster
analysis of entrepreneurial environment at the same spatial level (Rogalska,
2018e).

The short literature review provided confirms that in spite of relatively
big supply of research in the field, which can be characterized with a varie-
ty of methodological approaches, the problem of entrepreneurship condi-
tions, especially at the regional and local level, is still an important and
current research area. The next section is devoted to justification of multi-
ple-criteria perspective taken in the current paper and detailed presentation
of applied methodology.

Diagnostic variables, data and methodology

The entrepreneurship conditions are formed by many long- and short-term factors, which can be related to the institutional order of given economy and the current economic policy (Bednarz *et al*., 2017; Pietrzak *et al*., 2017; Fabuš & Csabay, 2018). Some of these factors, especially the ones influencing the specific role of human capital, such as general entrepreneurial skills or entrepreneurial risk taking willingness in a given country or region, are intangible. Thus they are very difficult to operationalize and measure (Cantaragiu *et al*., 2014; Hadad & (Drumea) Gauca, 2014; Tomovska Misoska *et al*., 2016; Duh *et al*., 2016; Segal & Hadad, 2017; Kedmenec & Strašek, 2017).

Based on the provided literature review, the most commonly pointed determinants of entrepreneurship conditions are the formal regulations influencing barriers for entering given markets and increasing scale of activates of enterprises, which influences competitive environment, and the effectiveness of financial sector or availability of financing of enterprises (Balcerzak *et al*., 2017; Meluzin, *et al*., 2017, 2018a, 2018b, 2018c). Though, it should be stressed that the provided literature review in the previous sections indicates that the specific role of financing can be the object of discussion.

However, in spite of the discussion with regard to the most important factors influencing entrepreneurial environment, it is obvious that the entrepreneurship conditions should be analysed with application of multiple-criteria tools. This methodological conclusion can be also derived from the presentation of current empirical studies given in the previous section of the paper.

In the case of regional research — especially at lower aggregation level such as NUTS 3 region analysis, which was proposed in current article — the most important limitation for multivariate analysis is an availability of data that describes selected aspects of given phenomenon. This factor can be also attributed to current research.

The diagnostic variables are usually selected based on two stages: a) preliminary selection of variables based on the experience of a researcher; b) evaluation of the diagnostic variables with application of formal taxonomic criteria. The variables should be characterised with a high level of variation, high information value, which means that the variables should reach high values with relatively great difficulty and relatively low level of correlation (Balcerzak & Pietrzak, 2017; Cheba & Szopik-Depczyńska, 2017). As a result, in the analysis the final set of diagnostic variable given in Table 1 was applied.

In the case of current research, all the diagnostic variables were classified as stimulants. The data for the period was provided by Central Statistical Office of Poland (Local Data Bank).

In the case of current research, taxonomic measure of development (TMD) based on TOPSIS method was applied, where the object is compared to a positive and negative ideal solution (pattern and anti-pattern of development) (Balcerzak & Pietrzak, 2016; 2017).

After obtaining the final set of diagnostic variables TMD was assessed. For this purpose, the TOPSIS method based application of median Weber (Cheba & Szopik-Depczyńska, 2017) was used. The main advantage of the method and the main reason for its application is its higher resistance on the occurrence of outliers than in the case of classic methods for obtaining synthetic measure of development (see Łuczak & Wysocki, 2013).

As a result, the final diagnostic variables were normalized with application of formula 1 and 2 (Lira *et al*., 2002; Łuczak & Wysocki, 2013; Cheba & Szopik-Depczyńska, 2017).

$$z_{ij} = \frac{x_{ij} - \theta_j}{1,4826 \cdot s_j} \tag{1}$$

$$s_j = \underset{i=1,2,...,n}{med} \left| x_{ij} - \theta_j \right| \tag{2}$$

where: $\theta = (\theta_1, \theta_2, ..., \theta_m)$ is the Weber median, s_j is the absolute median deviation, (i=1,2, ...n) – number of the object, ($j = 1,2,...m$) – number of the diagnostic variable.

The next step of the procedure is the selection of pattern z_j^+ (in the case of stimulants) and anti-pattern z_j^- (in the case of dis-stimulants) of economic development based on maximum value of the variable z_j^+ for the pattern and minimum value of the variable z_j^- for the anti-pattern. In the case of dynamic research, the constant pattern and anti-pattern of economic development must be taken, which is necessary for obtaining comparable results in time (Pietrzak & Balcerzak, 2016).

Then, distance from the pattern (equation 3) and anti-pattern (equation 4) with application of absolute median deviation was assessed.

$$d_i^+ = \underset{j=1,2,\dots,m}{med} \left| z_{ij} - z_j^+ \right| \tag{3}$$

and

$$d_i^- = \underset{j=1,2,\dots,m}{med} \left| z_{ij} - z_j^- \right| \tag{4}$$

Finally, estimation of TMD with application of equation 5 was possible.

$$TMD_i = \frac{d_i^-}{d_i^- + d_i^+} \tag{5}$$

In the last stage the analysed NUTS 3 regions were grouped into four typological classes with application of statistical approach suggested by Łuczak and Wysocki (2013), which was based on the relations between standard deviation and mean value, where:
I – NUTS 3 regions with very good conditions for entrepreneurship:

$$TMD_i \geq \overline{TMD_i} + S(TMD_i) \tag{6}$$

II – NUTS 3 regions with good conditions for entrepreneurship:

$$\overline{TMD_i} + S(TMD_i) > TMD_i \geq \overline{TMD_i} \tag{7}$$

III – NUTS 3 regions with average conditions for entrepreneurship:

$$\overline{TMD_i} > TMD_i \geq \overline{TMD_i} - S(TMD_i) \tag{7}$$

IV – NUTS 3 regions with relatively bad conditions for entrepreneurship:

$$TMD_i < \overline{TMD_i} - S(TMD_i) \tag{6}$$

where: $\overline{TMD_i}$ is an arithmetic mean value of a taxonomic measure of development for a given year; $S(TMD_i)$ is a standard deviation of a taxonomic measure of development for a given year.

Results and discussion

The obtained rankings, the values of TMD and grouping of the NUTS 3 regions into four typological classes are presented in Table 2. The results confirm significant disparities with regard to entrepreneurial conditions at the regional level. The highest positions in rankings were obtained by the NUTS 3 dominated by the biggest municipal centres. As a result, these NUTS can be found in the first group of regions with the best conditions for entrepreneurs in both analysed years. What should be stressed here is the dominant position of Warsaw as the capital city of the country. The disparity between Warsaw and the second best rated NUTS 3 region M. Poznań measured with the relation between the values of TMD for both regions in the first and last year is meaningful and stable. In 2010 it was 1.8 and in the year 2018 it was 1.6. Regional differentiation between NUTS 3 regions is also confirmed with analysis of coefficient of variation for both years, which decreased only slightly form 77,0% in the year 2010 to 74.2% in the year 2015.

The scale of disparities can be also stressed based on comparison of the value of TMD obtained by the capital city and the worst NUTS 3 regions in both years, where the relation of the value of maximum and minimum value of TMD in 2010 was equal to 26.2 and in the year 2015 it was 34.7.

In the year 2010 only one NUTS 3 region — Bielski — was classified in the last typological group characterises with the worst conditions for entrepreneurship, whereas in the year 2015 one can find four NUTS 3 regions in that group: Sandomiersko-Jędrzejowski, Bielski, Chełmsko-Zamoński and Przemyski. Generally speaking, in the case of the lowest positions one can find peripheral regions mostly located in Eastern Poland (see also Rogalska, 2018b).

The obtained results are consistent not only with the recent previous research of other authors, which concentrated on the problems of standard of living and sustainable development at the regional level in Poland (Kuc, 2017; Pietrzak *et al.*, 2017), but the obtained general picture is analogous to the situation from the previous decade (see Malina, 2004). These results can confirm that the transformation process of Polish economy has resulted in structurally long-term pattern of economic growth that is far from reaching the objectives of spatial sustainability.

Conclusions

Good conditions for entrepreneurship are currently considered as one of the most important intangible factors influencing growth both at the national and the regional level. It is especially important in such countries as Poland, which should create conditions for closing its development gap in relation to developed countries of the European Union and at the same time create good conditions for regional sustainability. As a result, in current paper the research concerning conditions for entrepreneurship at the NUTS 3 level was conducted. In the research, the dynamic approach was taken. The subject of the research was considered as the multiple-criteria phenomenon, therefore TOSPSIS method based on median vector Weber was used, which enabled rating and grouping of the analysed regions in the year 2010 and 2015.

The conducted research provides information on significant disparities in Poland at the regional level with regard to entrepreneurial conditions. The disparities are also relatively stable, which confirms that the problem of unbalanced — therefore, unsustainable regional structure of economy — should be considered as a significant problem for regional policy in Poland.

The proposed research can be characterised with the following limitations. First of all, the period of the research is relatively short and started in current decade. However, the comparison of the obtained results to the older studies form previous decade can still provide important information confirming spatially unsustainable structure of long term growth in Poland.

The second most important critics for the provided study can relate to the selection of diagnostic variables used in the research, which can be considered as far from perfect in describing entrepreneurship conditions. However, the most important determinants for both mentioned limitations are the consequence of the data availability for Poland at the NUTS 3 level.

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Annex

Table 1. The set of diagnostic variables for NUTS 3 regions

Variable	Description of the variable
X_1	Number of entities included in the REGON registration per 10 thousand inhabitants
X_2	Share of commercial law companies in the number of economic entities
X_3	Share of companies with foreign capital in the total number of commercial law companies
X_4	Gross value of fixed assets in enterprises per capita
X_5	Capital expenditures in enterprises per capita

Table 2. Ranking and grouping of NUTS 3 regions in regard to entrepreneurship conditions

NUTS 3 Region	2010			2015			Percentage Change of TMD in the years 2010-2015
	TMD	Rank	Class	TMD	Rank	Class	
M. WARSZAWA	0.893	1	I	0.869	1	I	-2.7%
M. POZNAŃ	0.491	2	I	0.543	2	I	10.6%
M. WROCŁAW	0.445	4	I	0.477	3	I	7.2%
TRÓJMIEJSKI	0.471	3	I	0.473	4	I	0.4%
M. KRAKÓW	0.41	5	I	0.449	5	I	9.5%
M. SZCZECIN	0.376	7	I	0.356	6	I	-5.3%
GLIWICKI	0.304	10	II	0.348	7	I	14.5%
WARSZAWSKI ZACHODNI	0.374	8	I	0.333	8	I	-11.0%
LEGNICKO-GŁOGOWSKI	0.289	12	II	0.327	9	I	13.1%
OPOLSKI	0.238	16	II	0.323	10	II	35.7%
KATOWICKI	0.376	6	I	0.313	11	II	-16.8%
POZNAŃSKI	0.262	14	II	0.303	12	II	15.6%
TYSKI	0.305	9	II	0.302	13	II	-1.0%
M. ŁÓDŹ	0.259	15	II	0.291	14	II	12.4%
WROCŁAWSKI	0.291	11	II	0.272	15	II	-6.5%
SZCZECIŃSKI	0.208	21	II	0.23	16	II	10.6%
BYDGOSKO-TORUŃSKI	0.271	13	II	0.229	17	II	-15.5%
PIOTRKOWSKI	0.22	19	II	0.226	18	II	2.7%
GORZOWSKI	0.222	18	II	0.219	19	II	-1.4%
JELENIOGÓRSKI	0.168	27	III	0.214	20	II	27.4%

Table 2. Continued

NUTS 3 Region	2010			2015			Percentage Change of TMD in the years 2010-2015
	TMD	Rank	Class	TMD	Rank	Class	
ŚWIECKI	0.146	34	III	0.21	21	II	43.8%
ZIELONOGÓRSKI	0.205	22	II	0.21	22	II	2.4%
BIELSKI	0.227	17	II	0.207	23	II	-8.8%
SOSNOWIECKI	0.162	29	III	0.197	24	II	21.6%
TARNOBRZESKI	0.132	38	III	0.187	25	II	41.7%
SŁUPSKI	0.125	41	III	0.184	26	III	47.2%
KONIŃSKI	0.113	46	III	0.182	27	III	61.1%
WARSZAWSKI WSCHODNI	0.17	26	III	0.18	28	III	5.9%
PŁOCKI	0.208	20	II	0.177	29	III	-14.9%
RYBNICKI	0.155	32	III	0.175	30	III	12.9%
LUBELSKI	0.167	28	III	0.171	31	III	2.4%
KOSZALIŃSKI	0.179	24	II	0.168	32	III	-6.1%
RZESZOWSKI	0.117	43	III	0.167	33	III	42.7%
LESZCZYŃSKI	0.158	30	III	0.166	34	III	5.1%
STAROGARDZKI	0.172	25	III	0.151	35	III	-12.2%
KRAKOWSKI	0.086	57	III	0.148	36	III	72.1%
OŚWIĘCIMSKI	0.102	52	III	0.142	37	III	39.2%
BIAŁOSTOCKI	0.117	44	III	0.139	38	III	18.8%
OLSZTYŃSKI	0.146	35	III	0.139	39	III	-4.8%
CZĘSTOCHOWSKI	0.179	23	II	0.138	40	III	-22.9%
ŁÓDZKI	0.126	40	III	0.135	41	III	7.1%
GDAŃSKI	0.156	31	III	0.133	42	III	-14.7%
KALISKI	0.114	45	III	0.13	43	III	14.0%
WAŁBRZYSKI	0.131	39	III	0.128	44	III	-2.3%
BYTOMSKI	0.123	42	III	0.127	46	III	3.3%
PILSKI	0.113	47	III	0.127	45	III	12.4%
KIELECKI	0.138	36	III	0.124	47	III	-10.1%
SKIERNIEWICKI	0.1	53	III	0.122	48	III	22.0%
SZCZECINECKO-PYRZYCKI	0.089	56	III	0.118	49	III	32.6%
INOWROCŁAWSKI	0.102	51	III	0.111	51	III	8.8%
RADOMSKI	0.092	54	III	0.111	50	III	20.7%

Table 2. Continued

NUTS 3 Region	2010			2015			Percentage Change of TMD in the years 2010-2015
	TMD	Rank	Class	TMD	Rank	Class	
NYSKI	0.136	37	III	0.106	52	III	-22.1%
ELBLĄSKI	0.104	48	III	0.103	53	III	-1.0%
CHOJNICKI	0.078	59	III	0.099	54	III	26.9%
WŁOCŁAWSKI	0.147	33	III	0.097	55	III	-34.0%
SUWALSKI	0.063	65	III	0.095	56	III	50.8%
TARNOWSKI	0.089	55	III	0.092	57	III	3.4%
ŁOMŻYŃSKI	0.073	62	III	0.091	58	III	24.7%
GRUDZIĄDZKI	0.102	50	III	0.081	59	III	-20.6%
CIECHANOWSKI	0.071	64	III	0.075	60	III	5.6%
SIEDLECKI	0.075	60	III	0.075	61	III	0.0%
NOWOTARSKI	0.058	67	III	0.072	62	III	24.1%
PUŁAWSKI	0.061	66	III	0.072	63	III	18.0%
SIERADZKI	0.073	61	III	0.071	64	III	-2.7%
EŁCKI	0.052	69	III	0.067	65	III	28.8%
OSTROŁĘCKI	0.056	68	III	0.066	66	III	17.9%
NOWOSĄDECKI	0.045	70	III	0.059	67	III	31.1%
KROŚNIEŃSKI	0.104	49	III	0.051	68	III	-51.0%
SANDOMIERSKO-JĘDRZEJOWSKI	0.085	58	III	0.045	69	IV	-47.1%
BIALSKI	0.034	72	IV	0.038	70	IV	11.8%
CHEŁMSKO-ZAMOJSKI	0.043	71	III	0.028	71	IV	-34.9%
PRZEMYSKI	0.071	63	III	0.025	72	IV	-64.8%