Entrepreneurship Conditions in Poland at NUTS 3 Level. Application of taxonomic measure of development based on median vector Weber

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Abstract

The main aim of the article is to analyse factors influencing entrepreneurship conditions in Poland at NUTS 3 level. The entrepreneurship conditions are considered as a multiple-criteria phenomenon. Thus, it is analysed based on 5 criteria. In this context the choice of variables describing entrepreneurship conditions at the NUTS 3 level was the biggest limitation of the research. Due to availability of data it was possible to conduct dynamic research for the years 2010-2015. In the research taxonomic measure of development was assessed with application of TOPSIS method based on median vector Weber. The obtained values of taxonomic measure of development enabled to rank the NUTS 3 regions starting with the once characterised with the best conditions for entrepreneurs to the once with the worst conditions and to analyse the stability of the obtained results in time. The analysis indicates that relatively stable disparities at regional level in regard to entrepreneurial conditions can be considered as a significant problem for regional policy in Poland.

Keywords: *entrepreneurship, multiple-criteria analysis, taxonomic measure of development, TOPSIS, median vector Weber, NUTS 3, Poland*

JEL Classification: C38, L26, P25

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1 Introduction

After successful transformation all Central European economies face a challenge of avoiding middle income trap. Many international studies indicate that regional sustainability and good conditions for entrepreneurship have crucial role in obtaining that aim (Żelazny and Pietrucha, 2017; Simionescu et al., 2017). These factors are especially important for Poland, which on the one hand, is the biggest country in the region, 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 (Wójcik, 2017; Kisiała and Suszyńska, 2017; Bartkowiak-Bakun, 2017). The main aim of the article is to analyse factors influencing entrepreneurship conditions in Poland at NUTS 3 level. The conducted literature review indicates that the entrepreneurship conditions should be analysed with application of multiple-criteria analysis tools. Therefore, in the research TOPSIS method based on median vector Weber was applied.

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The research was conducted for the years 2010-2015, where the main limitation for this period was the availability of data at regional level.

2 Methodology

In the case of current research taxonomic measure of development (TMD) based on TOPSIS method was applied, where the object is compared to pattern and anti-pattern of development (Balcerzak and Pietrzak, 2016; 2017). In order to be able to use the method, the phenomenon under research should be divided into economic aspects, which can be described with available diagnostic variables. The diagnostic variables are usually selected after 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 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, 2016).

After obtaining the final set of diagnostic variables TMD can be assessed. For this purpose the TOPSIS method with application of median Weber (Cheba and Szopik-Depczyńska, 2017) can be used:

1. The final diagnostic variables should be normalized with application of formula 1 and 2 (Lira et al., 2002).

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

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

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.

2. Selection of pattern z_j^+ and anti-pattern z_j^- 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 stimulants and based on minimum value of the variable z_j^+ for the pattern and maximum value of the variable z_j^- for the anti-pattern in the case of des-stimulants. For dynamic research the constant pattern and anti-pattern of economic development must be taken, which is necessary for obtaining comparable results in time (Pietrzak and Balcerzak, 2016).

3. Assessment of distance from the pattern (equation 3) and anti-pattern (equation 4) with application of absolute median deviation:

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

and

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

4. Estimation of TMD with application of equation 5:

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

In the case of dynamic research, the stability of the obtained rankings can be analysed with application Kendall rank correlation coefficient, which can provide additional information on the potential tendencies in the case of analysed phenomenon.

3 Empirical research

The entrepreneurship conditions are formed by many long and short term factors, which can be related to institutional order of given economy and current economic policy (Bednarz et al., 2017; Pietrzak et al., 2017a). 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 (Kruk and Waśniewska, 2017), and effectiveness of financial sector or availability of financing for enterprises(Kljucnikov and Belas, 2016; Ivanová, 2017; Balcerzak et al., 2017; Meluzin, et al., 2017; Pietrzak et al., 2017b).

As a result, the entrepreneurship conditions should be analysed with application of multiple-criteria tools. 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. Therefore, in the analysis the final set of diagnostic variable given in Table 1 was applied. All the diagnostic variables were classified as stimulants. The data for the period 2010-2015 was provided by Central Statistical Office of Poland (Local Data Bank). In the first step, the standardization of the variables was carried out jointly for the entire data set for the years 2010-2015. Then in the research the methodology described in previous section was applied. The final results are given in Table 2.

The obtained rankings and the values of TMD confirm significant disparities in regard to entrepreneurial conditions at regional level. The highest positions in rankingswere obtained by the NUTS 3 dominated by the biggest municipal centres. In the case of the lowest positions one can find peripheral regions mostly located in Eastern Poland.

Table 1. The set of diagnostic variables.

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 of NUTS 3 regions in regard to entrepreneurship conditions.

NUTS 3 Region	2010		2011		2012		2013		2014		2015	
	TMD	Rank	TMD	Rank	TMD	Rank	TMD	Rank	TMD	Rank	TMD	Rank
m. Warszawa	0.893	1	0.898	64	0.881	1	0.911	1	0.868	1	0.869	1
m. Poznań	0.491	2	0.51	25	0.555	2	0.505	2	0.534	2	0.543	2
m. Wrocław	0.445	4	0.472	16	0.479	3	0.495	3	0.491	3	0.477	3
trójmiejski	0.471	3	0.472	5	0.466	4	0.465	4	0.473	4	0.473	4
m. Kraków	0.41	5	0.414	58	0.406	6	0.436	5	0.457	5	0.449	5
m.Szczecin	0.376	7	0.372	22	0.347	8	0.394	6	0.375	6	0.356	6
gliwicki	0.304	10	0.334	50	0.336	9	0.344	9	0.333	9	0.348	7
warszawskizachodni	0.374	8	0.345	62	0.347	7	0.37	8	0.364	7	0.333	8
legnicko-głogowski	0.289	12	0.31	19	0.277	11	0.304	11	0.31	10	0.327	9
opolski	0.238	16	0.244	14	0.216	18	0.236	18	0.263	15	0.323	10
katowicki	0.376	6	0.393	49	0.41	5	0.379	7	0.337	8	0.313	11
poznański	0.262	14	0.298	26	0.263	12	0.253	16	0.282	14	0.303	12
tyski	0.305	9	0.296	46	0.295	10	0.325	10	0.301	11	0.302	13

m. Łódź	0.259	15	0.272	71	0.246	14	0.274	12	0.282	13	0.291	14
wrocławski	0.291	11	0.25	17	0.26	13	0.257	14	0.288	12	0.272	15
szczeciński	0.208	21	0.21	21	0.24	15	0.253	15	0.24	16	0.23	16
bydgosko-toruński	0.271	13	0.227	13	0.207	19	0.219	21	0.221	18	0.229	17
piotrkowski	0.22	19	0.247	70	0.206	20	0.231	20	0.228	17	0.226	18
gorzowski	0.222	18	0.251	32	0.231	17	0.259	13	0.204	20	0.219	19
jeleniogórski	0.168	27	0.178	20	0.154	28	0.182	26	0.2	21	0.214	20
świecki	0.146	34	0.166	9	0.11	46	0.1	54	0.11	50	0.21	21
zielonogórski	0.205	22	0.194	31	0.193	23	0.238	17	0.195	22	0.21	22
bielski	0.227	17	0.22	53	0.235	16	0.235	19	0.207	19	0.207	23
sosnowiecki	0.162	29	0.189	47	0.166	26	0.205	23	0.186	24	0.197	24
tarnobrzeski	0.132	38	0.167	38	0.147	30	0.167	29	0.175	27	0.187	25
słupski	0.125	41	0.118	7	0.132	36	0.182	25	0.135	38	0.184	26
koniński	0.113	46	0.129	29	0.146	32	0.101	52	0.153	31	0.182	27
warszawskiwschodni	0.17	26	0.169	63	0.16	27	0.147	33	0.133	40	0.18	28
płocki	0.208	20	0.183	61	0.192	24	0.206	22	0.19	23	0.177	29
rybnicki	0.155	32	0.169	48	0.199	21	0.197	24	0.183	25	0.175	30
lubelski	0.167	28	0.177	43	0.198	22	0.179	27	0.176	26	0.171	31
koszaliński	0.179	24	0.137	24	0.149	29	0.148	32	0.159	30	0.168	32
rzeszowski	0.117	43	0.128	39	0.128	39	0.133	40	0.139	35	0.167	33
leszczyński	0.158	30	0.16	28	0.146	31	0.134	39	0.166	28	0.166	34
starogardzki	0.172	25	0.156	6	0.136	35	0.155	31	0.163	29	0.151	35
krakowski	0.086	57	0.101	59	0.114	45	0.127	43	0.143	33	0.148	36
oświęcimski	0.102	52	0.142	56	0.123	41	0.135	37	0.137	36	0.142	37
białostocki	0.117	44	0.125	37	0.121	42	0.128	42	0.131	41	0.139	38
olsztyński	0.146	35	0.144	1	0.138	34	0.141	34	0.133	39	0.139	39
częstochowski	0.179	23	0.137	51	0.129	37	0.136	35	0.144	32	0.138	40
łódzki	0.126	40	0.12	72	0.129	38	0.135	36	0.129	43	0.135	41
gdański	0.156	31	0.14	8	0.143	33	0.159	30	0.137	37	0.133	42
kaliski	0.114	45	0.119	30	0.125	40	0.135	38	0.13	42	0.13	43

wałbrzyski	0.131	39	0.168	18	0.166	25	0.168	28	0.122	47	0.128	44
pilski	0.113	47	0.109	27	0.109	48	0.109	49	0.111	49	0.127	45
bytomski	0.123	42	0.117	52	0.106	50	0.123	45	0.128	44	0.127	46
kielecki	0.138	36	0.137	34	0.12	44	0.129	41	0.125	45	0.124	47
skierniewicki	0.1	53	0.103	68	0.109	49	0.123	46	0.14	34	0.122	48
szczecinecko-pyrzycki	0.089	56	0.085	23	0.083	58	0.116	48	0.084	55	0.118	49
radomski	0.092	54	0.09	65	0.089	56	0.117	47	0.108	51	0.111	50
inowrocławski	0.102	51	0.111	10	0.1	51	0.106	51	0.121	48	0.111	51
nyski	0.136	37	0.129	15	0.091	54	0.108	50	0.098	53	0.106	52
elbląski	0.104	48	0.12	3	0.121	43	0.127	44	0.108	52	0.103	53
chojnicki	0.078	59	0.062	4	0.064	65	0.072	62	0.084	56	0.099	54
włocławski	0.147	33	0.094	11	0.109	47	0.101	53	0.125	46	0.097	55
suwalski	0.063	65	0.094	35	0.096	52	0.067	64	0.083	57	0.095	56
tarnowski	0.089	55	0.098	55	0.089	55	0.09	55	0.089	54	0.092	57
łomżyński	0.073	62	0.086	36	0.083	59	0.078	59	0.078	60	0.091	58
grudziądzki	0.102	50	0.1	12	0.085	57	0.09	56	0.082	58	0.081	59
ciechanowski	0.071	64	0.07	67	0.071	61	0.068	63	0.07	62	0.075	60
siedlecki	0.075	60	0.07	60	0.071	62	0.078	58	0.08	59	0.075	61
nowotarski	0.058	67	0.045	54	0.034	70	0.028	72	0.033	71	0.072	62
puławski	0.061	66	0.072	42	0.064	64	0.076	60	0.072	61	0.072	63
sieradzki	0.073	61	0.069	69	0.062	67	0.066	66	0.067	63	0.071	64
ełcki	0.052	69	0.068	2	0.066	63	0.046	70	0.057	66	0.067	65
ostrołęcki	0.056	68	0.06	66	0.055	69	0.066	65	0.063	64	0.066	66
nowosądecki	0.045	70	0.053	57	0.056	68	0.063	67	0.056	67	0.059	67
krośnieński	0.104	49	0.117	41	0.093	53	0.083	57	0.054	68	0.051	68
sandomiersko-jędrzejowski	0.085	58	0.103	33	0.071	60	0.063	68	0.063	65	0.045	69
- bialski	0.034	72	0.016	45	0.017	72	0.072	61	0.039	69	0.038	70
chełmsko-zamojski	0.043	71	0.036	44	0.03	71	0.03	71	0.027	72	0.028	71
przemyski	0.071	63	0.076	40	0.062	66	0.053	69	0.036	70	0.025	72

In the final step of the research the stability of the obtained ranking with application of Kendall rank correlation coefficient was verified. The result are given in Table 3.

Table 3. Kendall rank correlation coefficients for the obtained ranking in the year 2010-2015.

Years	2010	2011	2012	2013	2014	2015
2010	1	0.857	0.84	0.809	0.808	0.780
2011	0.857	1	0.882	0.840	0.826	0.815
2012	0.84	0.882	1	0.878	0.867	0.833
2013	0.809	0.84	0.878	1	0.861	0.826
2014	0.808	0.826	0.867	0.861	1	0.885
2015	0.780	0.815	0.833	0.826	0.885	1

The critical value from the normal distribution for the 5% significance level is equal to 1.960. The test statistics for the lowest value (0.780) of Kendall rank correlation coefficient is 9.693, which indicates statistical significance of all parameters presented in Table 3. Intuitively, the Kendall correlation between two ranks will be higher (close to 1), when they are similar. It can be seen that the ranking form the year 2010 becomes less similar to the rankings obtained in the next years, which shows a systematic tendency of the analysed phenomenon. It can be concluded that there are some changes in rankings of the entrepreneurship conditions of analysed regions, though the changes can be considered as relatively slow.

Conclusions

Good conditions for entrepreneurship are currently considered as one of the most important intangible factor influencing growth both at national and regional level. It is especially important in such countries as Poland that should create conditions for closing its development gap in relation to developed countries of the European Union and in 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 TOPSIS method based on median vector Weber was used.

The conducted research confirms significant disparities in Poland at regional level in regard to entrepreneurial conditions. The disparities are also relatively stable, which confirms

that the phenomenon 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. The second most important critics for the provided study can relate to the selection of diagnostic variables used in the research. However, the most important determinants for both mentioned limitations are the consequence of the data availability at the NUTS 3 level. In spite of these factors the obtained results are consistent with other research in the field.

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