

# MEASUREMENT OF ENTREPRENEURSHIP CONDITIONS IN POLISH REGIONS

Elżbieta Rogalska

---

## Abstract

The main purpose of the research is to measure entrepreneurship conditions in Polish regions (NUTS 2). In order to measure the conditions for entrepreneurship five diagnostic variables were selected. Therefore, the subject of the research is considered as a multiple-criteria phenomenon. The research was conducted for the year 2011 and 2017, which was determined by availability of comparable data at regional level. The data was obtained from Statics Poland (Local data bank). In the research method of taxonomic measure of development proposed by Hellwig was applied. The original Hellwig's procedure was based on the Euclidean distance measure between an object and an ideal solution. In current research a modified approach was taken, where the distance measure was based on median vector Weber. The research enabled to rank the regions and group them into relatively homogenous classes. The grouping was based on natural breaks method. The conducted research enabled to verify disparities between Polish regions and to assess their stability in time.

**Key words:** entrepreneurship, taxonomic measure of development, median vector Weber, Poland

**JEL Code:** C38, L26, P25

---

## Introduction

Small and medium sized enterprises are considered as a fundament of every developed economy. They usually create majority of workplaces and are responsible for high share in GDP creation. From the regional perspective they are usually an important contributor to stability and sustainability of local economies. This factor is currently considered as especially important contributor to development of Central and Eastern European economies (Ivanová, 2017; Simionescu *et al.*, 2017). As a result, improving conditions for entrepreneurship is currently considered as one of the most important objectives of every government both at national and regional level (Zygmunt, 2018).

Therefore, the main aim of the article is to measure conditions for entrepreneurship in Poland at regional level (NUTS 2). The subject of the research is considered as a multiple-criteria problem, where a linear ordering method proposed by Hellwig modified with application of median vector Weber and natural breaks method are used. The proposed methods enabled to rank and group the regions for the years 2011 and 2017.

The current research is a continuation of previous studies of the author (Rogalska, 2017), where the main attention was given to the research on entrepreneurship in Poland at NUTS 3 level with application of zero-unitarisation method as the main research tool.

## **1 Taxonomic measure of development based on based on median vector Weber: method presentation and justification for its application**

An international research concentrating on the role of entrepreneurship in supporting economic growth confirms that the entrepreneurship influence has multidimensional character. On the other hand, conditions influencing entrepreneurship both at regional and national level are influenced by many factors such as: effectiveness of financial markets in providing capital for entrepreneurs, which can be related to the effectiveness of banking sector (Balcerzak *et al.*, 2017) and development of capital markets as well (Meluzin *et al.*, 2017, 2018a; 2018b); effectiveness of labour markets (Rollnik-Sadowska & Dąbrowska, 2018) that in a given institutional context (Pilc, 2017) influence a “supply” of entrepreneurs. Therefore, entrepreneurship conditions should be considered as a multiple-criteria phenomenon and it should be analysed with application of multiple-criteria analysis tools (Pietrzak *et al.*, 2017). Among that group of methods, one can find linear ordering methods, which are especially useful when an objective of the research is ranking of analysed objects. Taxonomic measure of development (TMD) is considered as one of the linear ordering methods, which can be determined with application of TOPSIS method or the procedure proposed by Hellwig (Balcerzak, 2016). In the current research the Hellwig’s procedure modified with application of median vector Weber is applied (Cheba & Szopik-Depczyńska, 2017).

In the first step of the research the selected set of diagnostic variables  $X_j$ , which describes the economic objects  $O_i$  should be normalised. For this purpose formulas 1 and 2 are applied:

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

$$s_j = \mathit{med}_{i=1,2,\dots,n} |x_{ij} - \theta_j| \quad (2)$$

where:  $\theta = (\theta_1, \theta_2, \dots, \theta_m)$  is the Weber median,  $s_j$  is the absolute median deviation, ( $i=1,2, \dots,n$ ) – number of the object, ( $j = 1,2,\dots,m$ ) – number of the diagnostic variable. Then, a pattern of development  $z_j^+$  should be determined. In the case of stimulants the pattern is based on a maximum value of the variable  $z_j^+$ . In the case of dis-stimulants the pattern is based on a minimum value of the variable  $z_j^+$ . The stimulant is a variable, for which higher values are desirable and the dis-stimulant the opposite. In the case of a dynamic research a constant pattern of development must be applied, which is the condition for obtaining comparability of the results in time (see Wierzbicka, 2018).

In the next step a distance from the pattern of development  $d_i^+$  for every object  $O_i$  with application of absolute median deviation based on formula 3 should be assessed:

$$d_i^+ = \mathit{med}_{j=1,2,\dots,m} |z_{ij} - z_j^+| \quad (3)$$

In the last step the value of TMD is estimated with application of formula 4:

$$\text{TMD}_i = 1 - \frac{d_i^+}{N} \quad (4)$$

where N is constant value that normalise values of the TMD.

## 2 Diagnostic variables and data

In the previous section a literature review confirming multiple-criteria character of the economic phenomenon under research was provided. In order to evaluate entrepreneurship conditions at NUTS 2 level five diagnostic variables were applied. In the case of diagnostic variables the main objective problem is the availability of good quality comparable statistics at NUTS 2 level for longer periods. The selection of the diagnostic variables is based on the previous studies of the author (Rogalska, 2017) and the data provided by Statistics Poland – Local Data Bank (<https://stat.gov.pl/en/>). The five diagnostic variables applied in the research

are given in Table 1. All the diagnostic variables were considered as stimulants. Then, based on the value of median vector Weber the standardisation of the variables was done.

**Tab. 1: Diagnostic variables**

Variable	Description
$x_1$	Number of entities included in the REGON registration per 10 thousand inhabitants
$x_2$	Natural persons conducting economic activity per 1 thousand inhabitants
$x_3$	Share of new registered companies form creative industry in the total number of new registered commercial law companies
$x_4$	Capital expenditures in enterprises per capita
$x_5$	Gross value of fixed assets in enterprises per capita

Source: own work based on Rogalska (2017).

### 3 Research results

In the research in order to assess the entrepreneurship conditions in Poland at NUTS 2 level taxonomic measure of development based on median vector Weber, which was described in the first section of the article, was applied. In the research 16 NUTS 2 were analysed for the years 2011 and 2017. The determination of TMD in two separate periods in the years 2011 and 2017 allowed to study potential changes of the phenomenon.

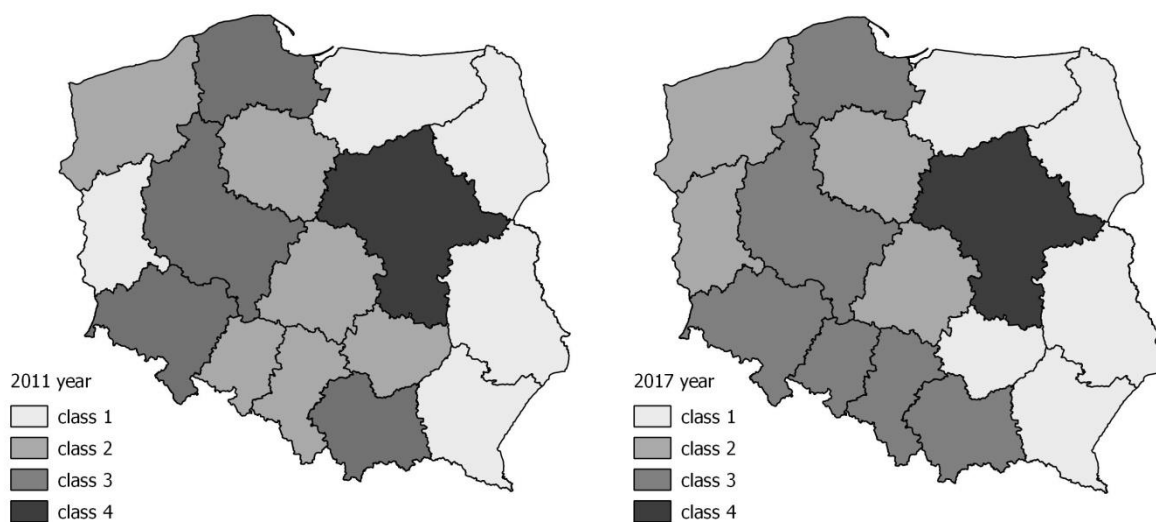
In the research for both years a fixed pattern of development based on the maximum values of the standardised variables  $Z_i$  was established. In the end the values of the distances of the NUTS 2 regions to the established pattern of development were calculated and the values of the TMD measure were determined. The obtained results allowed to propose ranking of the NUTS 2 regions in terms of entrepreneurship conditions, which is presented in Table 2. Additionally, based on the values of the TMD the NUTS 2 regions were grouped into four relatively homogenous subsets. For this purpose a natural breaks method was applied (see Balcerzak & Pietrzak, 2017). The results are given in Figure 1.

**Tab. 2: TMR values and grouping of NUTS 2 regions in the years 2011 and 2017**

Region	2011			2017			Percentage change of the TMR
	TMR	Rank	Class	TMR	Rank	Class	
mazowieckie	0.924	1	4	0.954	1	4	3.25%
dolnośląskie	0.728	3	3	0.726	2	3	-0.37%
małopolskie	0.68	5	3	0.581	3	3	-14.61%
wielkopolskie	0.715	4	3	0.579	4	3	-19.04%
pomorskie	0.757	2	3	0.577	5	3	-23.78%
śląskie	0.632	7	2	0.562	6	3	-11.18%
opolskie	0.616	8	2	0.562	7	3	-8.91%
łódzkie	0.591	9	2	0.499	8	2	-15.54%
zachodniopomorskie	0.638	6	2	0.445	9	2	-30.33%
lubuskie	0.476	12	1	0.439	10	2	-7.75%
kujawsko-pomorskie	0.553	10	2	0.425	11	2	-23.03%
podlaskie	0.441	13	1	0.359	12	1	-18.46%
lubelskie	0.393	15	1	0.331	13	1	-15.66%
warmińsko-mazurskie	0.425	14	1	0.308	14	1	-27.50%
podkarpackie	0.361	16	1	0.304	15	1	-15.70%
świętokrzyskie	0.512	11	2	0.237	16	1	-53.70%

Source: own estimations based on data from Statistics Poland (Local Data Bank).

**Fig. 1: Grouping of the NUTS 2 regions in the years 2011 and 2017**



Source: own estimations based on data from Statistics Poland (Local Data Bank).

Taking into account entrepreneurship conditions in Poland at regional level, a special attention should be given to Mazowieckie region. In both years it formed individually class 4, which is characterised with the best entrepreneurship conditions. This situation is mostly

related to the fact that in Mazowieckie region the capital city of Poland is located, which naturally makes it the most attractive region in terms of socio-economic development.

Class 3, also with relatively good conditions for entrepreneurship, in 2011 was formed by the following NUTS 2: Dolnośląskie, Małopolskie, Wielkopolskie and Pomorskie. In these NUTS there are the largest urban centres in Poland: Wrocław, Kraków, Poznań and Gdań-Gdynia-Sopot.

Class 2 was made up of NUTS with an average conditions for entrepreneurship. To this class in 2011 Śląskie, Opolskie, Łódzkie, Zachodniopomorskie, Kujawsko-pomorskie and Świętokrzyskie were assigned. On the other hand, NUTS 2 with the worst conditions for entrepreneurship have been assigned to class 1. In the class 1 in 2011 the following NUTS could be found: Lubuskie, Podlaskie, Lubelskie, Warmińsko-mazurskie and Podkarpackie. Beside Lubuskie all these regions are located in the Eastern part of Poland, which is characterized by a much weaker socio-economic situation compared to the territory of Western Poland.

In the final step percentage changes of the TMD in the period 2011-2017 were determined, which allowed to capture the changes in the entrepreneurship conditions at regional level (see Table 2). In the analysed years only in the case of Mazowieckie NUTS there was a 3.25% increase in the value of the TMD. This means that in the region an above-average improvements in the entrepreneurship conditions compared to other NUTS was recorded. On the other hand, in the case of the other regions, the value of the TMD decreased, which may indicate that improvements in the conditions for entrepreneurship in these regions are characterised with significantly lower speed than in the central region of Poland. From the perspective of regional policy assessment in regard to principals of regional sustainability this result should be assessed negatively, as it can indicate growing disparities between central and peripheral regions.

Dolnośląskie, Małopolskie, Wielkopolskie and Pomorskie regions remained in 2017 in class 3. In the case of Śląskie and Opolskie there were relatively low declines in the TMD values, respectively 11.18% and 8.91%, which allowed to move these NUSTS from class 2 in 2011 to class 3 in 2017 year.

In 2017 Łódzkie, Zachodniopomorskie and Kujawsko-pomorskie again formed class 2 with an average conditions for entrepreneurship. In this year to the class 2 Lubuskie region was also assigned due to the relatively low drop in the value of the TMD measure by 7.75%. In class 1, with the worst conditions for entrepreneurship, the following NUTS could be

found: Podlaskie, Lubelskie, Warmińsko-mazurskie and Podkarpackie. Świętokrzyskie region was also assigned to this class due to the high drop in the value of the TMD by 53,70%.

It should be stated that in 2017, all provinces assigned to the class 1 belonged to the Eastern part of Poland. This research results are consistent with the previous studies consenting regional socio-economic disparities in Poland (Pietrzak & Balcerzak, 2017).

## Conclusion

The objective of the study was to measure entrepreneurship conditions in Polish NUTS 2 regions with application of multiple-criteria analysis tools. In the article taxonomic measure of development method proposed by Hellwig, which was modified with application of median vector Weber, and natural breaks methods, were used.

The research done for the years 2011 and 2017 can be considered as long enough to catch eventual effects of regional policy efforts, which are aimed at improving spatial sustainability of Polish economy. In this context the main empirical contribution of the article relates to confirmation of structural disparities between Eastern and Western part of Poland in regard to entrepreneurship conditions. What is more the disparities between the central region dominated by the capital city of Poland and the peripheral regions of the country tend to increase, which indicates spatially unsustainable growth path of the economy. Therefore it can be also interpreted as a sign of problems with effectiveness of national resources devoted to regional policy.

## References

- Balcerzak, A. P. (2016). Multiple-criteria Evaluation of Quality of Human Capital in the European Union Countries. *Economics & Sociology*, 9(2), 11-27.
- Balcerzak, A. P., Klietnik, T., Streimikiene, D., & Smrčka L. (2017). Non-parametric approach to measuring the efficiency of banking sectors in European Union Countries. *Acta Polytechnica Hungarica*, 14(7), 51-70.
- Balcerzak, A. P., & Pietrzak, M. B. (2017). Digital Economy in Visegrad Countries. Multiple-criteria decision analysis at Regional Level in the Years 2012 and 2015. *Journal of Competitiveness*, 9(2), 5-18,

- Cheba, K., & Szopik-Depczyńska, K. (2017). Multidimensional comparative analysis of the competitive capacity of the European Union countries and geographical regions. *Oeconomia Copernicana*, 8(4), 487-504.
- Ivanová, E. (2017). Barriers to the development of SMEs in the Slovak Republic. *Oeconomia Copernicana*, 8(2), 255-272.
- Meluzín, T., Balcerzak, A.P., Pietrzak, M. B., Zinecker, M., & Doubravský, K. (2018a). The impact of rumours related to political and macroeconomic uncertainty on IPO success: evidence from a qualitative model. *Transformations in Business & Economics*, 17,2(44), 148-169.
- Meluzín, T., Pietrzak, M. B., Balcerzak, A. P., Zinecker, M., Doubravský, K., & Dohnal, M. (2017). Rumours Related to Political Instability and their Impact on IPOs: The Use of Qualitative Modeling with Incomplete Knowledge. *Polish Journal of Management Studies*, 16(2), 171-187.
- Meluzín, T., Zinecker, M., Balcerzak, A.P., Doubravský, K., Pietrzak, M. B., & Dohnal, M. (2018b), The timing of initial public offerings – non-numerical model based on qualitative trends. *Journal of Business Economics and Management*, 19(1), 109-125.
- Pietrzak, M. B., & Balcerzak, A. B. (2017). Economic development of Polish voivodeships in the years 2010-2014. Application of taxonomic measure of development with entropy weights. In M. Papież and S. Śmiech (Eds.), *The 11th Professor Aleksander Zelias International Conference on Modelling and Forecasting of Socio-Economic Phenomena. Conference Proceedings*. Cracow: Foundation of the Cracow University of Economics, 310-318.
- Pietrzak, M. B., Balcerzak, A. P., Gajdos, A., & Arendt, Ł (2017). Entrepreneurial environment at regional level: the case of Polish path towards sustainable socio-economic development. *Entrepreneurship and Sustainability Issues*, 5(2). 190-203.
- Pilc, M. (2017). Cultural, political and economic roots of the labor market institutional framework in the OECD and post-socialist countries. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 12(4), 713-731.
- Rogalska, E. (2017). Multivariate analysis of entrepreneurship in Poland at regional level. In T. Klietnik (Ed.). *17th International Scientific Conference Globalization and Its Socio-Economic Consequences. University of Zilina, The Faculty of Operation and Economics of Transport and Communication, Department of Economics, 4th – 5th October 2017. (Part V.)*. Zilina: University of Zilina, 2198-2202.



Rollnik-Sadowska, E., & Dąbrowska, E. (2018). Cluster analysis of effectiveness of labour market policy in the European Union. *Oeconomia Copernicana*, 9(1), 143-158.

Wierzbicka, W. (2018). Information infrastructure as a pillar of the knowledge-based economy — an analysis of regional differentiation in Poland. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 13(1), 123-139.

Simionescu, M., Lazányi, K., Sopková, G., Dobeš, K., & Balcerzak, A. P. (2017). Determinants of Economic Growth in V4 Countries and Romania. *Journal of Competitiveness*, 9(1), 103-113.

Zygmunt, J. (2018). Entrepreneurial activity drivers in the transition economies. Evidence from the Visegrad countries. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 13(1), 89-103.

### **Contact**

Elżbieta Rogalska, PhD

University of Warmia and Mazury in Olsztyn

Department of Microeconomics

ul. Plac Cieszyński 1, 10-719 Olsztyn, Poland

Mail: [ela.n.rogalska@gmail.com](mailto:ela.n.rogalska@gmail.com)