

AN ANALYSIS OF TOURIST ATTRACTIVENESS OF POWIATS OF THE LESSER POLAND VOIVODESHIP*

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Abstract

Research background: Lesser Poland is one of the most visited regions in Poland. Among the reasons why it is so, there are a variety of attractions located in this voivodeship and also the activities taken by local government, for which the development of the tourism industry is one of the key goals.

Purpose: Building a ranking of poviats of Lesser Poland in terms of tourist attractiveness.

Research methodology: Selected multivariate analysis tools, i.e. three methods of linear ordering and cluster analysis.

Results: Using the Ward algorithm, poviats are grouped into four clusters of areas with similar characteristics due to tourist values. In addition, using three linear ordering techniques, poviats of the Lesser Poland voivodeship are ordered according to tourist attractiveness. The results of ordering are rather consistent and indicate that the most attractive poviats are: nowotarski, oświęcimski, tatrzański and the city of Kraków. Interestingly, these areas belong to three different groups obtained as part of a cluster analysis. This means that Lesser Poland is a diversified region in terms of the attractions that draw tourists' to the area.

Novelty: The study of tourist attractiveness using linear ordering techniques is not an original topic. The thesis is of cognitive value and fills a gap in the literature, in which there are no studies based on data from Lesser Poland.

Keywords: tourist attractiveness, linear ordering, cluster analysis

JEL classification: C19, L83

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Introduction

The development of the tourist industry has a broad impact on the surroundings and significantly affects the revenues of both local budgets and the local population. Thus, many regions treat tourism as an important part of their growth strategy and a significant factor positively influencing economic development. The same situation is in the Lesser Poland voivodeship, where actions to make the region an attractive place to spend free time are one of the main objectives of regional policy. The region itself, due to its numerous and various values, seems to be predestined to carry out activities aimed at attracting the attention of potential tourists.

Although Lesser Poland is one of the smallest voivodeships in Poland in terms of area (it covers about 5% of the country's area), the region is characterized by unique nature, an impressive number of monuments and a rich calendar of important cultural and sporting events. All these aspects make Lesser Poland one of the most visited places in Poland.

Both further investments and diverse ways of promotion (including the construction of a network of bicycle routes, the development of pilgrimage tourism or the promotion of culinary tourism) lead to the situation that since 2009 the region has been recording a constantly growing number of tourists (in 2009–2018 this region was visited by 16.7 million people, among whom nearly 79% spent at least one night in the voivodeship). The growing interest in the region leads to lots of measurable profits. In 2018, tourists spent more than 14.3 billion PLN (an increase of 6.5% compared to 2017).

The literature review allows to find many examples of using multivariate statistics techniques to get some information about the tourist attractiveness of selected regions of Poland. In particular, the topics of the spatial diversity of Poland's tourist attractiveness divided into voivodeships or subregions are considered by: Z. Binderman, B. Borkowski and W. Szczęsny (2008), I. Bąk and M. Matlegiewicz (2010), I. Bąk (2011) and E. Synówka-Bejenka (2017).

There are also works in which authors focus on analyzing smaller regions cases. These works include both examples of studies in geographical lands as well as single voivodeships. In the first group there are a lot of papers worth mentioning. For example A. Oleńczuk-Paszal and M.J. Nowak (2010) deal with coastal communes or P. Gryszel and M. Walesiak (2018) focus on communes located in the Sudety mountains. The aim of papers written by D. Puciato (2010), P. Gryszel and M. Walesiak (2014) and I. Bąk (2014) were the analyses of some administrative units. In these works the ranking of poviats of the Opolskie, Lower Silesia and West Pomeranian voivodeships are built.

A similar analysis related to the Lesser Poland region has not been found. That is why, the aim of the work is a quantitative analysis of the tourist attractiveness of the poviats of the Lesser Poland voivodeship.

1. Methods

In the literature there are various approaches to assessing the tourist attractiveness of territorial units. Although selected problems are solved thanks to point bonitation or the model method (see Gryszel, Walesiak, 2014), the researchers' special attention is drawn to taxonomic methods. These techniques transform multivariate objects into a synthetic measure which values are used in building the ranking.

Some methods of linear ordering compare objects on the basis of similarity to extreme objects (i.e. pattern and anti-pattern). These techniques are often used in works devoted to the spatial diversity of tourist attractiveness of selected areas, for example A. Oleńczuk-Paszel and M.J. Nowak (2010), D. Puciato (2010), P. Gryszel and M. Walesiak (2014), I. Bąk (2014), I. Bąk and B. Szczecińska (2014), A. Stec (2015) and E. Synówka-Bejenka (2017).

Other techniques measure the average value of normalized diagnostic features. Their final form depends on the choice of the normalization formula and the method of calculating the average (Strahl, 1978; Kukuła, Luty, 2015). Among others there are two examples of this idea. Z. Binderman, B. Borkowski and W. Szczęsny (2008) use the radar method and I. Bąk (2011) uses the technique of zero-unitarization.

In this empirical study three methods have been taken into account: the measure of Hellwig's development (Hellwig, 1968), the TOPSIS method (Hwang, Yoon, 1981) and the method of standardized sums (Balicki, 2009). Each of them requires recognition of the nature of the variables (stimulant, destimulant or nominant, whereby the nominants should be changed to stimulants, and in the case of the standardized sums method all variables should be changed into stimulants) and normalization of variables to ensure the comparability of selected diagnostic features.

The idea of the TOPSIS method is to order objects based on a measure that prefers vectors located as far as possible from the anti-ideal solution and as close to the ideal solution as possible. The algorithm starts with defining the ideal (z_0^+) and anti-ideal (z_0^-) coordinates, i.e.:

$$z_{0j}^+ = \begin{cases} \max_i (x_{ij}) & \text{variable } x_j \text{ is stimulant} \\ \min_i (x_{ij}) & \text{variable } x_j \text{ is destimulant} \end{cases} \quad (1)$$

$$z_{0j}^- = \begin{cases} \min_i (x_{ij}) & \text{variable } x_j \text{ is stimulant} \\ \max_i (x_{ij}) & \text{variable } x_j \text{ is destimulant} \end{cases} \quad (2)$$

In the next step, the distance of the considered objects from the ideal (d_{i0}^+) , and anti-ideal (d_{i0}^-) is calculated, i.e.:

$$d_{i0}^+ = \sqrt{\sum_{j=1}^n (z_{ij} - z_{0j}^+)^2} \quad \text{and} \quad d_{i0}^- = \sqrt{\sum_{j=1}^n (z_{ij} - z_{0j}^-)^2} \quad (3)$$

Finally, the value of the synthetic variable t_i is set by the formula:

$$t_i = \frac{d_{i0}^-}{d_{i0}^- + d_{i0}^+} \in [0, 1] \quad (4)$$

The construction of the Hellwig measure organizes objects based on their distance from the ideal solution (z_0^+) , when the coordinates are determined by the formula (1). Finally, this measure is given by the formula:

$$h_i = 1 - \frac{d_{i0}^+}{d_0} \quad (5)$$

where $d_0 = \bar{d}_0 + 2 \cdot s(d_0)$.

The intuition of the standardized sums method consists of examining the average “quality” of individual variables used in the construction of the indicator. After the necessary conversion of variables into stimulants, it is carried out by calculating the sum of normalized values of individual measures, i.e.:

$$s_i = \sum_{j=1}^n \alpha_j z_{ij} \quad (6)$$

Finally, indicator s_i is transformed in such a way as to assume values in the range $[0, 1]$:

$$S_i = \frac{s_i - \min s_j}{\max \{s_i - \min s_j\}} \quad (7)$$

2. Dataset and results

The Lesser Poland Voivodeship is divided into 22 poviats, among which there are three urban poviats (Kraków, Tarnów and Nowy Sącz). In the literature it is said that factors affecting the assessment of tourist attractiveness can be divided into three main categories: tourist (natural) values, level of tourist infrastructure and transport accessibility. For example, D. Puciato (2010) explains that tourism values can be grouped into natural values and anthropogenic values. The first group has been taken from the landscape attractiveness of a given area. The second one has been created or adapted by man (e.g. museums and other historical buildings, zoos, etc.). I. Bąk and M. Matlegiewicz (2010) point out that there are some factors that encourage potential tourists to come to places of the high tourist value. Among those factors, they emphasize the role of the quality of tourist infrastructure (including the accommodation and catering base, places for recreation and the range of commercial and service outlets) and communication accessibility which significantly affects the attractiveness of the services offered. P. Gryszel and M. Walesiak (2014) prove that the categories discussed above do not exhaust the set of variables affecting the tourism potential of a given territorial unit. They also pay attention to two other factors: the level of environmental pollution and a sense of security.

In the paper it has been decided to conduct a research using statistical variables that relate to each of the five listed aspects of attractiveness. In the first stage of the study, a preliminary substantive analysis has been made, which includes 19 variables obtained from the CSO Local Data Bank, characterizing the poviats of the Lesser Poland voivodeship for 2018.

R. Głowicka-Wołoszyn (2019) points out that an important practical problem in linear ordering is the potentially strong asymmetry of selected diagnostic features. To reduce this problem, it has been decided to limit the extreme values to the value of the corresponding whisker proposed by the author. It is worth emphasizing that in this way, a reasonable assumption from the point of view of tourist attractiveness has been introduced (visitors do not distinguish between extremely good or extremely bad factors of the features of the regions they assess).

In the next step, a formal analysis is carried out, which includes examining the degree of relationship between the considered variables (it is assumed that the level of correlation between variables cannot be greater than 90%) and the assessment of the information value of the coefficient of variation (it is assumed that the value of the coefficient of variation could not be lower than 10%). As a result, the following 13 diagnostic features are obtained, which are finally used to determine the synthetic indicator:

X_1 : protected areas [percent, as part of the poviat area] – a stimulant,

- X_2 : number of nature monuments [pcs. per 100 km² of the poviat area] – a stimulant,
 X_3 : total forest area [percent, as part of the poviat area] – a stimulant,
 X_4 : bed places [items per 1,000 of the poviat population] – a stimulant,
 X_5 : accommodation granted [items per 1,000 of the poviat population] – a stimulant,
 X_6 : bicycle paths [km per 100 km² of the poviat area] – a stimulant,
 X_7 : number of arts and entertainment, interdisciplinary and sports events [items per 100 km² of the poviat area] – a stimulant,
 X_8 : number of screenings in cinemas [pcs per 1 km² of the poviat area] – a stimulant,
 X_9 : commune and poviat public roads network [km per 100 km² of the poviat area] – a stimulant,
 X_{10} : sewerage discharged into waters [dams per 1 km² of the poviat area] – a destimulant,
 X_{11} : emission of gaseous pollutants [vol. per 1 km² of the poviat area] – a destimulant,
 X_{12} : number of criminal offenses [items per 1,000 of the poviat population] – a destimulant,
 X_{13} : number of offenses against property [items per 1,000 of the poviat population] – a destimulant.

Thanks to the obtained sets of synthetic features, using the three techniques described earlier (formulas (4), (5) and (6)), a linear ordering of the poviats of the Lesser Poland voivodeship in terms of tourist attractiveness is made. The results describing the value of the synthetic variable and the place in the ranking are shown in (Table 1).

Table 1. The results of the analysis of the diversity of tourist attractiveness of poviats in the Lesser Poland voivodeship – comparison

District	Standardized sums		Hellwig method		TOPSIS method	
	value	place	value	place	value	place
1	2	3	4	5	6	7
Bocheński	0.453	12	0.261	6	0.465	12
Brzeski	0.204	17	0.135	14	0.402	18
Chrzanowski	0.095	19	0.096	18	0.378	21
Dąbrowski	0.063	21	0.048	21	0.384	20
Gorlicki	0.276	16	0.156	13	0.417	16
Krakowski	0.154	18	0.093	19	0.392	19
Limanowski	0.549	9	0.234	10	0.493	9
Miechowski	0.304	15	0.126	17	0.437	14
Myślenicki	0.384	13	0.173	12	0.458	13
Nowosądecki	0.738	5	0.242	9	0.527	6
Nowotarski	0.848	2	0.291	5	0.554	2

1	2	3	4	5	6	7
Olkuski	0.000	22	0.074	20	0.348	22
Oświęcimski	0.767	4	0.312	4	0.544	4
Proszowicki	0.095	20	0.017	22	0.406	17
Suski	0.622	8	0.244	8	0.513	8
Tarnowski	0.314	14	0.128	16	0.432	15
Tatrzański	0.777	3	0.319	2	0.550	3
Wadowicki	0.474	10	0.250	7	0.473	11
Wielicki	0.728	6	0.315	3	0.535	5
m. Kraków	1.000	1	0.322	1	0.588	1
m. Nowy Sącz	0.688	7	0.210	11	0.525	7
m. Tarnów	0.473	11	0.131	15	0.484	10

Source: own calculations in R.

As can be seen in Table 1, the order in the ranking depends on the technique used. The analysis of the τ -Kendall rank correlation coefficients (see Table 2) indicates a high similarity of the results obtained.

Table 2. Coefficients of the τ -Kendall correlation for places in the ranking regarding tourist attractiveness of poviats of the Lesser Poland voivodeship obtained using various linear ordering techniques

Method	Standardized sums	Hellwig method	TOPSIS method
Standardized sums	1	0.749	0.939
Hellwig method	0.749	1	0.706
TOPSIS method	0.939	0.706	1

Source: own calculations in R.

For a deeper analysis of the spatial diversity, using the three-means method, the considered objects are divided into four groups.

- group I contains the most attractive poviats, i.e.:

$$MS_i > \overline{MS} + S_{MS} \quad (8)$$

- group II contains poviats with above average tourist attractiveness, i.e.:

$$MS_i \in \left(\overline{MS}, \overline{MS} + S_{MS} \right] \quad (9)$$

- group III contains poviats with average tourist attractiveness, i.e.:

$$MS_i \in \left(\overline{MS} - S_{MS}, \overline{MS} \right] \quad (10)$$

- group IV contains poviats with low tourist attractiveness, i.e.:

$$MS_i \leq \overline{MS} - S_{MS} \quad (11)$$

where $\overline{MS}$ and S_{MS} are respectively: the mean and standard deviation of the values considered synthetic measures.

The results are shown in (Table 3) and (Figures 1, 2 and 3). It can be seen that they rather do not depend on the technique used for grouping. The most attractive one is the city of Kraków and south-western districts. The least attractive for tourists are the poviats of the northern and eastern part of Lesser Poland.

Table 3. Results of grouping poviats of the Lesser Poland voivodeship in terms of tourist attractiveness based on data from 2018

Gr.	Standardized sums	Hellwig method	TOPSIS method
I	m. Kraków, nowotarski, tatrzański, oświęcimski	m. Kraków, tatrzański, wielicki, oświęcimski, nowotarski	m. Kraków, nowotarski, tatrzański, oświęcimski
II	nowosądecki, wielicki, m. Nowy Sącz, suski, limanowski, wadowicki, m. Tarnów	bocheński, wadowicki, suski, nowosądecki, limanowski, m. Nowy Sącz	wielicki, nowosądecki, m. Nowy Sącz, suski, limanowski, m. Tarnów, wadowicki
III	bocheński, myślenicki, tarnowski, miechowski, gorlicki, brzeski	myślenicki, gorlicki, brzeski, m. Tarnów, tarnowski, miechowski, chrzanowski, krakowski	bocheński, myślenicki, miechowski, tarnowski, gorlicki, proszowicki, brzeski
IV	krakowski, chrzanowski, proszowicki, dąbrowski, olkuski	olkuski, dąbrowski, proszowicki	krakowski, dąbrowski, chrzanowski, olkuski

Source: own calculations in R.

In each case, the areas with the highest tourist attractiveness include the city of Kraków and the tatrzański, nowotarski and oświęcimski poviats. Interestingly, these areas are attractive due to other features. While the city of Kraków is attractive in terms of communication, and above all, it is characterized by a great accommodation base and many “urban” attractions (i.e. cinemas and museums). The nowotarski and tatrzański poviats are primarily areas with excellent tourist infrastructure and attractive landscapes. On the other hand, the oświęcimski poviat is known because of its famous museum and a good communication network. The olkuski and dąbrowski poviats are of the lowest tourist attractiveness. They have low values in every feature analyzed in the study.



Figure 1. Spatial diversity of the poviats of the Lesser Poland voivodeship in terms of tourist attractiveness based on data from 2018 (Standardizes the sums method)

Source: own calculations in R.



Figure 2. Spatial diversity of the poviats of the Lesser Poland voivodeship in terms of tourist attractiveness based on data from 2018 (Hellwig method)

Source: own calculations in R.



Figure 3. Spatial diversity of the poviats of the Lesser Poland voivodeship in terms of tourist attractiveness based on data from 2018 (TOPSIS method)

Source: own calculations in R.

Because of the fact that the poviats of highest tourist attractiveness significantly differ from each other, it has been decided to carry out a grouping using cluster analysis. For this purpose, Euclidean distance is used, and the grouping is carried out using the hierarchical Ward method (Balicki, 2009).

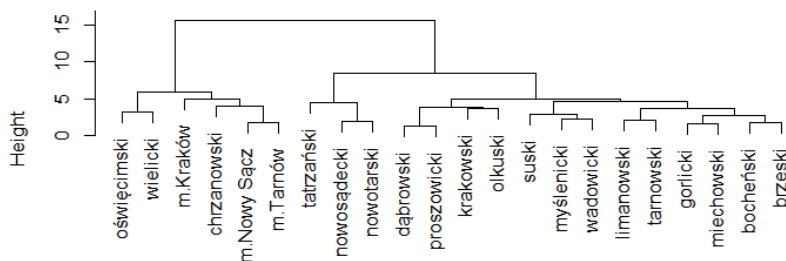


Figure 4. Dendrogram for grouping poviats of the Lesser Poland voivodeship due to tourist attractiveness

Source: own calculations in R.

The result of the algorithm in the form of a dendrogram is shown in (Figure 4). To choose the number of groups, selected indexes proposed by M. Walesiak and E. Gatnar (2009) have

been used. Due to the ambiguity of the indications, it has been decided to use the silhouette index, which suggests the division of objects into four groups (Table 5).

Table 5. Division of poviats of the Lesser Poland voivodeship in terms of tourist attractiveness using the Euclidean distance and the Ward algorithm

Group	Poviats
A	oświęcimski, wielicki
B	chrzanowski, m. Kraków, m. Nowy Sącz, m. Tarnów
C	nowosądecki, nowotarski, tatrzański
D	bocheński, brzeski, dąbrowski, gorlicki, krakowski, miechowski, myślenicki, olkuski, proszowicki, tarnowski

Source: own calculations in R.

Group A includes two poviats with an extensive road network; their main attractions are museums which are famous all over the world (i.e. the Wieliczka Salt Mine and the Auschwitz-Birkenau State Museum).

In group B there are three town poviats and the chrzanowski poviat (where two quite large cities: Chrzanów and Trzebinia are located). These poviats are characterized by a large number of typically urban attractions (i.e. the number of screenings in cinemas, visits to museums, monuments of nature, or a developed network of bicycle paths), but on the other hand, they have both a high level of crime and a high level of water pollution.

Mountain counties grouped in cluster C are characterized by a wide range of accommodation, and above all by natural values (high level of afforestation rate and legally protected areas rate).

The poviats that have been assigned to the D cluster are quite diverse. There are two factors that they have in common – relatively poor infrastructure and quite low crime ratio.

Conclusions

The aim of the study is a spatial analysis of the diversity of poviats of the Lesser Poland voivodeship in terms of tourist attractiveness. The results obtained using linear ordering techniques are constructed and compared. Also the results of the grouping of objects into four clusters with a similar type of tourist potential are presented.

In the class of poviats with the highest level of tourist attractiveness, according to all the linear ordering techniques used, there are the poviats: oświęcimski, tatrzański, nowotarski and the city of Kraków (according to the Hellwig method, the wielicki poviat is also included in

the most attractive group). The variety of attractions that ranking leaders propose to tourists indicates the great potential of touring in Lesser Poland. Visitors planning their holidays can take advantage of the region's various assets (mountain trips, famous museums, as well as popular historic sites) as part of their trip.

A valuable complement to the conducted study could be checking the stability of the ranking over a certain period of time. In addition, it would be worth considering joining the discussed features determining the level of tourist attractiveness and also variables not available in the CSO Local Data Bank.

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