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METHODS OF ANALYSIS OF FACTORS DETERMINING TOURIST ATTRACTIVENESS OF DISTRICTS

Abstract. Tourist attractiveness of communities mostly depends on structures of factors which describing them. There is many methods and techniques detecting factors of attractiveness or describing relationships between them in the socio-economic sciences. The paper show a trial of using probit and logit functions to detect and describe factors related with tourist attractiveness.

Key words: tourist attractiveness, probit, logit.

Tourist attractiveness of a given district is most often equated with structure of factors describing a district, such as the size of legally protected nature conservation areas in the district, a number of nature monuments, the area of forests or the number of accommodation places offered to tourists. The presence or lack of a specified feature does not determine the tourist attractiveness of the given area. The co-occurrence of the factors and their appropriate structure decide about the tourist attractiveness of the area. Also, it should be taken into account that there is no one optimum structure of determinants automatically providing the given area with tourist attractiveness. Two districts of the same level of attractiveness may have quite a different structure of the same factors and, on the other hand, two districts of the identical structure of these factors may appear on the two opposite poles of attractiveness.

In the sciences dealing with the quantitative analysis of social and economic phenomena there exist several techniques and tools which make it possible to discover the factors determining the attractiveness of specific areas and describe the influence of these factors on the analyzed attractiveness. Logit and probit functions are seldom used for such purposes. Because of their nature, these functions are applied in the probability estimation of the occurrence of a given, mostly qualitative phenomenon. Therefore, they are also commonly used to determine one's credit capacity or the probability of a company's bankruptcy.

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for which, subsequently, we should form a model representing the dependance of the obtained probit for the given district on the values adopted to examine diagnostic features specific for the described district. The model takes the form:

$$\Pr_j = \alpha_1 X_{1j} + \alpha_2 X_{2j} + \alpha_3 X_{3j} + \alpha_4 X_{4j} + \alpha_5 X_{5j} + \alpha_6 X_{6j} \quad (2)$$

In order to estimate structural parameters d, Generalized Method of Smallest Squares should be used. It has the following form in the probit model:

$$a = \left(X^T V^{-1} X\right)^{-1} \cdot X^T V^{-1} \Pr \quad (3)$$

where

Y' – matrix whose main diagonal elements have been calculated from the formula

$$v_j^{-1} = \frac{m \cdot (\Pr_j)^2}{p_j \cdot (1 - p_j)} \quad (4)$$

and other elements have the value of 0.

Those calculations have resulted in the following model:

$$\Pr_j = \underset{[8,2863]}{-0,0725} X_{1j} - \underset{[2,8963]}{0,0106} X_{2j} + \underset{[12,2089]}{1,5808} X_{3j} + \underset{[13,0177]}{0,1443} X_{4j} + \underset{[15,9186]}{0,0103} X_{5j} - \underset{[6,3020]}{0,0144} X_{6j}$$

which explains 62% of the tourist's choice of accommodation.

As it results form the analysis of the above-presented combination of variables, the size of green areas has the greatest impact on the tourist attraction, measured by the percentage of tourists being accommodated. The increase of the area of parks green and housing estate green by 1 ha per 1 sq. km of the district area results in the increase of the value of the probit function by 1.5808. Such an increase of the area of forests results in the probit function value increase by 0.1443. The increase of the value of the probit function should not be equated directly with the already defined tourist attractiveness. This increase depends on the original level of the diagnostic variable. it can be proved in a very simple way. If we assume that in a theoretical district the values of all variables (from X_1 to X_6) are originally equal to 0, then the value of the probit function for this

However, when the probability is defined correctly, these functions can be implemented to evaluate the influence of the specified factors on the degree of district tourist attractiveness. The analysis will be carried out for some town districts (municipalities) in the Province of western Pomerania. Values of the selected model variables describing tourist attractiveness of these districts in 2005 are presented in Table 1.

Table 1. Description of the selected diagnostic variables in municipalities of the Province of Western Pomerania in 2005

	Legally protected nature conservation areas (ha/km^2)	Number of nature monuments per 100 km^2	Parks, green areas and housing estate green areas (ha/km^2)	Total area of forest grounds and forests (ha/km^2) [ha/km^2]	Accommodation facilities per 1000 residents	Capital expenditure on water economy per 1000 residents	Number of accommodated tourists per 1000 residents
	1	2	3	4	5	6	7
Stargard Szczeciński	0,1	94	2,1	1,3	3	21,7	195
Szczecin	5,6	12	1,4	16,4	13	133,5	895
Białogard	0,0	58	1,5	10,4	3	1,9	109
Sławno	0,0	31	1,3	1,9	4	0,0	14
Szczecinek	0,0	8	3,3	17,5	26	268,8	1 079
Świdwin	0,0	41	0,4	8,6	12	15,8	22
Świnoujście	18,5	13	0,5	21,6	192	26,5	2 877
Kołobrzeg	79,3	4	4,3	6,0	224	3,2	4 609
Darłowo	54,0	0	0,5	2,7	734	37,7	4 649
Wałcz	0,0	16	1,0	17,7	86	98,2	2 898
Koszalin	44,7	71	2,1	39,4	36	85,8	2 814

For the sake of this research, the tourist attractiveness of a district will be equated with the probability of a tourist's choice of a specific district as the accommodation place (p_I) determined as the share of tourists in overnight stays per 1000 residents in the total sum of this phenomenon (m).For the probability defined in this way, probit transformation (Pr) converts the specified probability (frequency) into the value of distribuant of the standardized normal distribution:

$$\Pr_j = F(p_j) + 5 \tag{1}$$

for which, subsequently, we should form a model representing the dependance of the obtained probit for the given district on the values adopted to examine diagnostic features specific for the described district. The model takes the form:

$$\Pr_j = \alpha_1 X_{1j} + \alpha_2 X_{2j} + \alpha_3 X_{3j} + \alpha_4 X_{4j} + \alpha_5 X_{5j} + \alpha_6 X_{6j} \tag{2}$$

In order to estimate structural parameters d, Generalized Method of Smallest Squares should be used. It has the following form in the probit model:

$$a = \left(X^T V^{-1} X\right)^{-1} \cdot X^T V^{-1} \Pr \tag{3}$$

where

Y' – matrix whose main diagonal elements have been calculated from the formula

$$v_j^{-1} = \frac{m \cdot \left(\Pr_j\right)^2}{p_j \cdot (1 - p_j)} \tag{4}$$

and other elements have the value of 0.

Those calculations have resulted in the following model:

$$\Pr_j = \underset{[8,2863]}{-0,0725 X_{1j}} - \underset{[2,8963]}{0,0106 X_{2j}} + \underset{[12,2089]}{1,5808 X_{3j}} + \underset{[13,0177]}{0,1443 X_{4j}} +$$

$$+ \underset{[15,9186]}{0,0103 X_{5j}} - \underset{[6,3020]}{0,0144 X_{6j}}$$

which explains 62% of the tourist's choice of accommodation.

As it results form the analysis of the above-presented combination of variables, the size of green areas has the greatest impact on the tourist attraction, measured by the percentage of tourists being accommodated. The increase of the area of parks green and housing estate green by 1 ha per 1 sq. km of the district area results in the increase of the value of the probit function by 1.5808. Such an increase of the area of forests results in the probit function value increase by 0.1443. The increase of the value of the probit function should not be equated directly with the already defined tourist attractiveness. This increase depends on the original level of the diagnostic variable. it can be proved in a very simple way. If we assume that in a theoretical district the values of all variables (from X_1 to X_6) are originally equal to 0, then the value of the probit function for this district is also 0. The table of the distribuant of normal factorization shows the probability value (percentage of people being accommodated) of 0.5. When the value of variable X_3 (parks, green areas and house estate green areas)(ha/km^2) increases by one unit, the probit function value will increase by 1.5808 and will be equal to 1.5808. The probability for that value equals 0.9430, i.e. the growth of probability by 0.4430 has occurred. The next increase of the value of variable X_3 by one unit will again increase the value of the probit function by 1.5808, but since the probability for the probit of 3.1616 is 0.9992, the probability will increase by 0.0562. A similar analysis can be carried out for other variables.

The implementation of the logit function is another way of determining the influence of particular factors on the tourist attractiveness of districts. The logit transformation (L) is subject to the calculation of the following value:

$$L = \ln \frac{p_j}{1 - p_j} \tag{5}$$

Next, for these values a following model should be built:

$$L_j = \alpha_1 X_{1j} + \alpha_2 X_{2j} + \alpha_3 X_{3j} + \alpha_4 X_{4j} + \alpha_5 X_{5j} + \alpha_6 X_{6j} \tag{6}$$

In order to estimate structural parameters α, Generalized Method of Smallest Squares should be aplied. In the case of the logit model this method requires the following value to be calculated:

$$a = \left(X^T W^{-1} X\right)^{-1} \cdot X^T W^{-1} L \tag{7}$$

where

x – observation matrix of the explanatory variables, the same as in the case of the probit function

L – vector containing values of logits calculated with Formula (5)

W^{-1} – matrix whose elements of the main diagonal are calculated with the following formula:

$$w_j^{-1} = m \cdot p_j \cdot (1 - p_j) \tag{8}$$

Other elements have the value of 0.

The estimated logit model takes the following final form:

$$L_j = \underset{[18,7527]}{0,0343}X_{1j} - \underset{[9,1158]}{0,0081}X_{2j} - \underset{[21,0348]}{0,5667}X_{3j} - \underset{[11,0183]}{0,0213}X_{4j} +$$

$$- \underset{[21,9793]}{0,0030}X_{5j} + \underset{[8,3419]}{0,0038}X_{6j}$$

where R^2 equals 0.59.

Similarly to the case of the probit function, values of the parameters for the particular variables in the model inform us only about the change of the value of the logit itself for the analyzed district resulting from the change of the diagnostic variable by one unit. The change of the degree of district attractiveness (the probability of the tourist's choice of accommodation in the given district) can be calculated from the transformed formula (5):

$$p_j = \frac{1}{1 + \exp[-L]} \tag{8}$$

Logit and probit analyses constitute two, out of many, methods of investigating the influence of specified factors on the properly defined general criterion, i.e. the tourist attractiveness of municipal districts in the Province of Western Pomerania in 2005. The presented methods are not any better or worse than the tools used widely to carry out this type of research. The aim of this article is to get readers acquainted with these methods and to present their universality and easiness of their application to research.

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METODY ANALIZY CZYNNIKÓW DETERMINUJĄCYCH ATRAKCYJNOŚĆ TURYSTYCZNĄ GMIN

Atrakcyjność turystyczna danej gminy najczęściej utożsamiana jest z odpowiednią strukturą określonych czynników, charakteryzujących taką gminę.

W naukach zajmujących się analizą ilościowej strony zjawisk społeczno-gospodarczych istnieje szereg technik i narzędzi pozwalających nie tylko na wykrycie

czynników determinujących atrakcyjność określonych obszarów, ale także opisujących wpływ tych czynników na badaną atrakcyjność. Bardzo rzadko w tym celu wykorzystywane są funkcje logitowe i probitowe. Funkcje te ze swojej natury znajdują zastosowanie przede wszystkim do szacowania prawdopodobieństwa wystąpienia określonego zjawiska, najczęściej jakościowego. Dlatego też są powszechnie wykorzystywane do oceny zdolności kredytowej czy też określenia prawdopodobieństwa upadku przedsiębiorstwa. Jednak przy określonym zdefiniowaniu prawdopodobieństwa, funkcje te mogą być wykorzystane do oceny wpływu określonych czynników na stopień atrakcyjności turystycznej gmin. Rozważania w tym zakresie zostaną przeprowadzone dla gmin miejskich w województwie zachodniopomorskim.