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## Tourist activity of pensioners in Poland in 2009 : a statistical analysis

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**TOURIST ACTIVITY OF PENSIONERS IN POLAND IN 2009:  
A STATISTICAL ANALYSIS**

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**Abstract**

The purpose of the article is the analysis of transitory pensioners tourists departures. The research was carried out basing on a representative research result of individual transitory domestic departures in 2009 where pensioners participated in. As investigative instrument the autor chose the multidimensional correspondence analysis. The results of research were presented in a tridimensional area. The Ward's method was used in research due to bif number of variants of analyzed variables. This method permitted the assignment of coherence between variable variants.

**Keywords:** pensioners, tourist activity, multiple correspondence analyses, Ward method.

**JEL classification:** C38, L83.

## Introduction

According to the Dictionary of Psychology, term “activity” refers to a specific active condition of an object, expressed in its causing changes in its environment, its own location in relation to the surroundings, or in changes in processes taking place inside the object<sup>1</sup>. Both in the Polish and foreign literature of tourism, there are not many definitions of tourist activity<sup>2</sup>. This concept is referred not only to behavior of people, but to tourist activity of enterprises or other institutions and even tourist values as well<sup>3</sup>. For the sake of this paper, it can be assumed that term “activity” represents the entirety of reactions and behavior of people, with which they carry out their pursuits and achieve their goals. Tourism is a method of realizing human activity, associated with modification of the natural, cultural and social environment, bringing changes to one’s daily life routine, getting in personal touch with the nature, culture and people. Tourism is a form of an organism’s activity, aimed at satisfying all the needs that serve the development and the quality of its life<sup>4</sup>.

The purpose of this article is to provide an analysis of short-term tourist trips (2–4 days, or 1–3 nights) undertaken by pensioners, and, particularly, to identify all relations among the variables characterizing their tourist trips. The hypothesis that the main purpose of short-term tourist trips is to visit relatives or friends, and the leisure and recreation, was verified. In the study 702 individual trips by pensioners in 2009 were taken into account. As research tools some simple statistical methods related to the analysis of structure and multidimensional analysis of correspondences were used. Module “*Correspondence Analysis*” in the packet of Statistica 9.0 was used for calculations and graphical presentation of results.

### 1. Tourist activity in pensioners’ households

Human tourist behavior depends on one’s free time resources. Free time of an individual is subject to changes depending on his or her life cycle phase. From the perspective of the increasing amount of free time, the end of occupational activity (retirement) is particularly interesting. Becoming free from the duty to provide work and being secured by the pension service may strongly contribute to one’s satisfaction from using his or her free time. For this reason, a tendency for increased activity has been observed among seniors. According to various studies, active management of the elderly people’s free time is highly beneficial not only for their health and physical condition, but to their feeling of happiness.

Nevertheless, active use of free time by pensioners has not become very popular yet. Undoubtedly, among members of pensioners’ households, the most popular were such forms of

spending free time as: listening to the radio, music, watching TV or video – 28% respondents, reading – 14.8%; passive rest, as sunbathing, relaxation – 13.6%, socializing with others – 9.5%.

Physical activity is closely related to the respondents' age. Among the youngest it is the second most frequent form of spending free time (17%) and as they get older, the ratio of indications decreases down to 3% in the group of 65+<sup>5</sup>.

In the period covered by the study (1 October 2008 – 30 September 2009), 56% of household members were active, which is by 3 percentage points more than in 2005. The highest activity rate was observed in households run by the self-employed operating outside farming and in the households of employees – their activity level reached respectively 74% and 66%. Much lower tourist activity was recorded in the households run by farmers – 39%, old age pensioners (40%) and the retired (42%).

The most popular among the members of the pensioners' households were domestic trips – both long-term (5 days and more), and short-term (2–4 days) ones. Trips abroad were much less popular. Trips abroad with rented accommodation were undertaken by only 7.7% of the pensioners' households. The lowest rate of users was recorded for short one-day (not overnight) trips abroad – only 1.4% of the households (Table 1).

Table 1. Household members participating in tourist trips, by specific groups, in 2009

According to household types	Traveling in the country		Traveling abroad	
	2–4 days	5 days or more	1 day	2 days or more
Employees	36.5	41.1	1.3	15.3
Blue collar workers	30.0	31.9	1.0	8.9
White collar workers	44.7	52.6	1.7	23.4
Farmers	27.5	17.1	1.1	3.8
Self-employed outside farming	44.7	41.6	2.5	22.9
Retired	21.8	24.8	1.4	7.7
Old age pensioners	19.6	24.0	0.0	6.4
Living off other resources	26.5	32.2	1.0	8.9

Source: Author's own study based on *Turystyka i wypoczynek w gospodarstwach domowych w 2009 r.* (2010).

Most of the retired persons' households did not take part in any tourist trips (57.6%). Insufficient income and bad health were the most frequently indicated reasons for not participating in tourism. From the point of view of tourist activity, the lack of interest in tourist trips is alarming. It referred to as many as 19% of the retired persons' households<sup>6</sup>.

The main purpose of domestic and foreign trips of the pensioners' household members beyond their place of residence was the intention to visit relatives or friends, and then leisure and

recreation. Travels with a view to sightseeing were much less popular, especially the domestic ones. That was the purpose of less than 3% of vacation trips and 4% of short-term trips. In case of trips abroad, the interest in such form of traveling was much higher, as over 28% of travelers indicated that kind of purpose. During long-term domestic trips, cities and towns (27.4%), coastal areas (21.4%) and rural areas (16.5%) were visited most willingly. Cities and towns were also the main destination for trips abroad, visited by more than 61% of holidaymakers.

As far as the distance from the place of residence is concerned, it was strongly diversified, depending on the trip type (Figure 1). For domestic vacation trips, 59% of trips were for a distance of max. 300 km, while the most popular were those for the distance of 301–500 km (25%). 58.8% of short domestic trips were taken to places within 100 km. Trips for distances of 101–200 km were popular, too (22.2%).

As for foreign trips, those for distances over 1000 km dominated (67.1%).

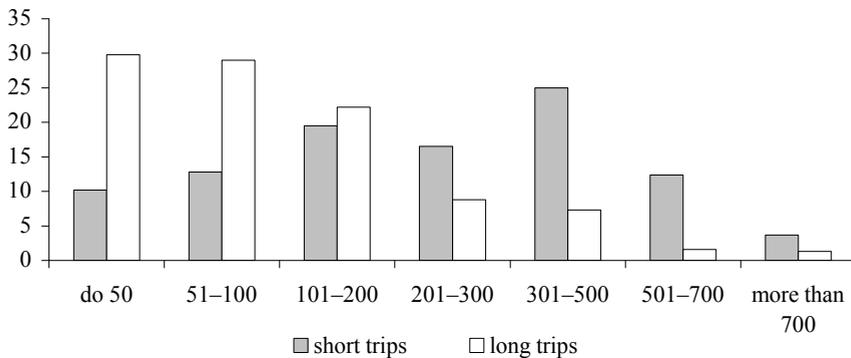


Fig. 1. The structure of short and long trips undertaken by the members of old age pensioner households by distances (in kilometers)

Source: Author's own study based on *Turystyka i wypoczynek w gospodarstwach domowych w 2009 r.* (2010).

In the context of the tourist market the characteristics of services purchased in relation to trips is of utmost importance<sup>7</sup>. In those services the basic element is accommodation. Traveling pensioners rarely made use of commercial lodging facilities. Quarters belonging to relatives or friends were the most frequently used place of accommodation. That was true especially in relation to foreign trips (48.4%) and long-term domestic tourist trips, during which this accommodation type was selected in 46.8%. During trips abroad, another popular lodging type was hotels, motels, pensions, which characterized 37% of trips. In case of domestic vacation trips, 8.6% of respondents chose this type of accommodation. A noticeable share in providing

lodging services during domestic trips belonged to rented private quarters (12.1%), spas and therapy centers (10.4%) and holiday camps (8.2%).

Beside accommodation services, the second basic factor in the tourist market are the services of travel agents. Such services were most commonly used in case of holiday trips abroad (Figure 2). Some forms of these services were also used when planning 44.6% of such trips – full packets were bought most frequently (30.7%). When individual services were purchased, they were usually transport (9.1%) and accommodation (8.9%) ones. Services provided by agents were quite popular in relation to domestic vacation trips – 24.5% of such trips, out of which 12.5% were tourist packets, and in case of individual services – accommodation prevailed (10.1%). For short-term domestic trips broking services were much rarer and happened only in 7.7% of such trips, during which accommodation was purchased most frequently (3.8% of the trips), and a full tourist packet applied only to 3.2% of the trips.

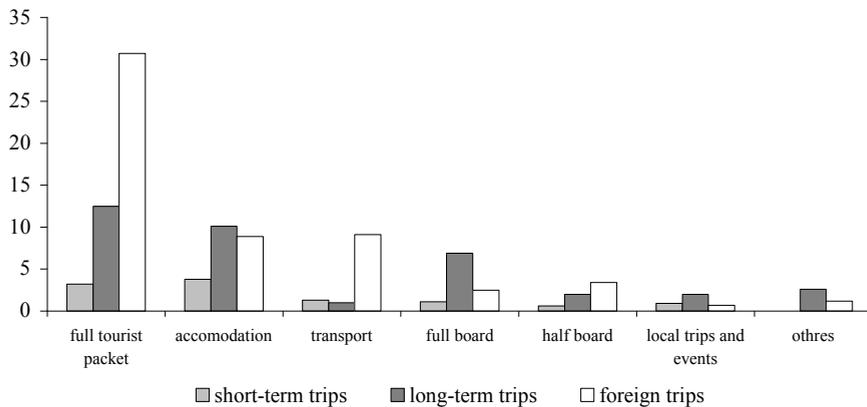


Fig. 2. The structure of domestic (short-term and long-term ones) and foreign trips taken in pensioners' households, as per types of purchased services

Source: Author's own preparation based on *Turystyka i wypoczynek w gospodarstwach domowych w 2009 r.* (2010).

In reference to all types of trips, passenger cars played the leading role as the means of transport. They were most frequently used for domestic trips – both the short and holiday ones. Railway and coach lines were quite popular too. International travel presented a quite different characteristics as far as the means of transport is concerned. Traveling by air amounted to 41.4%, by coach – to 33% and by car – to 22.1%.

## 2. Characteristics of the research material

Statistic data concerning the old age pensioners' tourist trips were culled out from the survey "*Tourism and recreation in households*" conducted by the Central Statistical Office in 2009. For each short-term domestic trip the respondents provided information that characterized the trips and answered questions about the purpose of the trip, the distance from the place of residence, the form of a journey, services purchased at the travel agent's, the means of transport, accommodation facilities that were used and an approximate expense incurred in relation to the trip.

The following symbols were assigned to the categories of the variables listed below:

- purpose of the trip – C1 – visiting relatives or friends, family celebrations, C2 – leisure and recreation, C3 – religious, C4 – sightseeing, C5 – other,
- distance of the destination: O1 – to 50 km, O2 – between 51 and 100 km, O3 – between 101 and 200 km, O4 – between 201 and 300 km, O5 – between 301 and 500 km, O6 – over 501 km,
- form of the trip: F1 – excursions, tour events, F2 – trips to a cabin in an allotment garden, F3 – pilgrimage, F4 – holidays, F5 – other,
- services purchased at an agent: P1 – none, P2 – accommodation, P3 – full tourist packet, P4 – other,
- leading means of transport used during the trip: T1 – a passenger car, T2 – PKS [state-owned bus lines] or other transport company, T3 – railway, T4 – a coach, T5 – other,
- accommodation: B1 – relatives' or friends' quarters, B2 – a cabin in an allotment garden, B3 – commercial accommodation facilities (hotel, motel, pension, hostel), B4 – rented private quarters, B5 – a tourist's home, a mountain lounge, a youth hostel, riverside hostel, B6 – other,
- total expenses incurred in relation to the trip: W1 – to 50 PLN, W2 – 50–100 PLN, W3 – 100–200 PLN, W4 – 200–300 PLN, W5 – more than 300 PLN.

## 3. Correspondence analysis<sup>8</sup>

Correspondence analysis is a method belonging to the group of statistical multidimensional analysis methods. It is used when variables in question are measured on a nominal scale and co-exist; in the set of studied variables it is impossible to define a dependent variable clearly.

The starting point is to fill up a complex contingency table (cross-table), where the abundance of each category of variables adopted for description of  $n$  objects is entered.

In practical operations, the Burt matrix as a data notation method is used very frequently. To start with, it is necessary to build a complex matrix of flags  $\mathbf{Z}$ , consisting of blocks (sub-matrices) referring to subsequent variables:  $\mathbf{Z} = [\mathbf{Z}_1, \dots, \mathbf{Z}_Q]$ , where  $Q$  denominates the number of traits. Elements of the complex matrix of flags take exclusively the values of 0 or 1, depending on whether the object of study has a defined category of a variable or not.

The Burt matrix is a result of the formula:  $\mathbf{B} = \mathbf{Z}^T \mathbf{Z}$ . Thus a symmetric block matrix is formulated, in which, on the main diagonal some diagonal matrices are located, providing abundances of the trait categories, and beyond the diagonal contingency tables for each pair of the analyzed variables are placed. For each sub-matrix, the total abundance equals the abundance of the  $n$  units in study, while the total abundance of the Burt matrix is  $n \cdot Q^2$ . As Burt matrix is symmetric ( $b_{ij} = b_{ji}$ ), boundary abundances of lines and columns are identical and calculated in the following manner:

$$\sum_{j=1}^J b_{ij} = b_{i\bullet} = b_{\bullet j=Q} = Q \cdot b_{ii} \quad (1)$$

where:

$b_{ij}$  – elements of the Burt matrix,

$J$  – total number of all the trait categories.

Boundary abundances of lines and columns are equal to each other and amount to:

$$p_{i\bullet} = \frac{Q \cdot b_{ii}}{n \cdot Q^2} \quad (2)$$

Values  $p_{i\bullet}$  are elements of a diagonal matrix of boundary abundances of the lines, and, at the same time, of the columns. Simultaneously, these are the components of the boundary abundance vector  $\mathbf{r}$ . The observed abundance matrix is calculated as:

$$\mathbf{P} = \frac{1}{n \cdot Q^2} \mathbf{B} \quad (3)$$

The matrix  $\mathbf{B}$  is symmetric, so one may state that it will undergo a decomposition, but in accordance to its eigenvalues:

$$\mathbf{A} = \mathbf{D}_r^{-1/2} (\mathbf{P} - \mathbf{r}\mathbf{r}^T) \mathbf{D}_r^{-1/2} = \mathbf{U}\Gamma_B^2 \mathbf{U}^T \quad (4)$$

where:

$\mathbf{U}$  – matrix of matrix  $\mathbf{A}$  eigenvectors,

$\Gamma_B^2$  – diagonal matrix, containing squares of peculiar values  $\gamma_{B,k}^2$ ,  $k = 1, 2, \dots, K$ ;  $K = \sum_{q=1}^Q (J_q - 1)$  of matrix  $\mathbf{A}$ ,  $J_q$  – number of categories of trait  $q$ ,

$\mathbf{D}_r$  – diagonal matrix of all observed boundary abundances of the lines.

It can be notated that  $\Gamma_B^2 = \Lambda_B$ , where  $\lambda_{B,k}$  are the matrix  $\mathbf{A}$ 's eigenvalues. Thus, the matrix  $\mathbf{A}$  is decomposed according to its eigenvalues and the coordinates of trait categories are included in the one matrix only:

$$\mathbf{F} = \mathbf{D}_r^{-1/2} \mathbf{U} \Gamma_B \quad (5)$$

The real space dimension of coexistence of answers to questions is determined based on the following formula:

$$K = \sum_{q=1}^Q (J_q - 1) \quad (6)$$

According to the Greenacre criterion, this dimension of variables category cast is selected as the best, where the eigenvalues fulfill the condition:  $\lambda_{B,k} > \frac{1}{Q}$ .

To the assumed criterion of selection of eigenvalues ( $\lambda_{B,k} > \frac{1}{Q}$ ), Greenacre adds a method of „improving” the results of the analysis of the variables notated in the form of the Burt matrix:

$$\tilde{\lambda}_k = \left( \frac{Q}{q-1} \right)^2 \cdot \left( \sqrt{\lambda_{B,k}} - \frac{1}{Q} \right)^2 \quad (7)$$

where:

$Q$  – number of variables,

$\lambda_{B,k}$  –  $k^{\text{th}}$  eigenvalue.

#### 4. Results of the correspondence analysis

In order to verify whether there is a dependence between the categories of the variables listed in the characteristics of the research material, a multi-dimensional correspondence analysis was applied. The starting point in the application of the correspondence analysis was to check if the survey questions, being important from the research point of view, were dependent. As answers to most of the questions are measured on the nominal scale, the independence test  $\chi^2$  was used. The values of the statistics  $\chi^2$ , along with the probabilities of rejecting the zero hypothesis claiming independence of the variables in question, are presented in Table 2.

Because all the questions revealed significant dependencies, the correspondence analysis was conducted based on the Burt matrix, sized  $35 \times 35$ , formed with seven variables, the categories of which were defined in the characteristics of the research material. The real space dimension of co-existence of answers to the analyzed questions is 28.

Table 2. The values of statistics  $\chi^2$  between the variables in the study

Pairs of questions	Statistics $\chi^2$ and probabilities
distance – purpose	130.9373 [0.0000]
distance – form of journey	190.1076 [0.0000]
distance – travel agent's services	69.51546 [0.0000]
distance – means of transport	137.4932 [0.0000]
distance – accommodation facilities	205.4719 [0.0000]
distance – expenses	128.0594 [0.0000]
purpose – form of journey	920.1746 [0.0000]
purpose – travel agent's services	502.8830 [0.0000]
purpose – means of transport	366.6332 [0.0000]
purpose – accommodation facilities	786.4637 [0.0000]
purpose – expenses	52.67678 [0.0000]
form of journey – travel agent's services	427.9113 [0.0000]
form of journey – means of transport	357.2769 [0.0000]
form of journey – accommodation facilities	823.8003 [0.0000]
form of journey – expenses	69.71413 [0.0000]
agent's services – means of transport	358.6904 [0.0000]
travel agent's services – accommodation facilities	435.0929 [0.0000]
travel agent's services – expenses	22.26621 [0.0081]
means of transport – accommodation facilities	288.0094 [0.0000]
means of transport – expenses	34.95550 [0.0005]
accommodation facilities – expenses	90.79992 [0.0000]

Source: Authors' calculations.

Next, it was verified to which degree the eigenvalues of the space with the lower dimension explain total inertia ( $\lambda = 4,000$ ). To this end, the Greenacre criterion was used, according to which main inertias higher than  $\frac{1}{Q} = \frac{1}{7} = 0,1429$  are to be taken as significant. According to Table 3, those are the inertias for K taking its values of maximum  $10^9$ . For such dimensions, the values of factor  $\tau_k$  were analyzed and it was established that the inertia explanation degree for a two-dimension space was 23.97%, and for a three-dimension space it amounted to 31.74%. In order to improve the mapping quality for the two-dimension space<sup>10</sup>, the eigenvalues were modified in line with Greenacre's postulates. The original and modified eigenvalues, along with the total inertia explanation degree, are presented in Table 3.

Table 3. Singular values and eigenvalues, with the total inertia degree, in the original and modified versions, for pensioners' households

K	Singular values $\gamma_k$	Eigenvalues $\lambda_k$	$\lambda_k/\lambda$	$\tau_k$	$\tilde{\lambda}_k$	$\tilde{\lambda}_k/\tilde{\lambda}$	$\tilde{\tau}_k$
1	0.7444	0.5541	13.8519	13.8519	0.5010	0.2664	0.2664
2	0.6362	0.4047	10.1181	23.9700	0.3413	0.1815	0.4479
3	0.5575	0.3108	7.7701	31.7402	0.2443	0.1299	0.5778
4	0.4838	0.2341	5.8520	37.5922	0.1682	0.0894	0.6672
5	0.4429	0.1962	4.9049	42.4971	0.1320	0.0702	0.7374
6	0.4202	0.1765	4.4132	46.9103	0.1138	0.0605	0.7979
7	0.4141	0.1714	4.2860	51.1963	0.1091	0.0580	0.8560
8	0.3980	0.1584	3.9597	55.1560	0.0973	0.0518	0.9077
9	0.3862	0.1491	3.7280	58.8840	0.0891	0.0474	0.9551
10	0.3793	0.1438	3.5961	62.4802	0.0844	0.0449	1.0000
					$\tilde{\lambda}_k = 1.8806$		

Source: Authors' calculations.

After the modification, the first three values made for 57.78% of the modified total inertia. Therefore, the graphical presentation of the correspondence analysis results for the three-dimension space was performed, taking into account the modification of the eigenvalues (Figure 3). New values of coordinates in the three-dimension space for the variables categories were determined with the following formula:

$$\tilde{F} = F^* \cdot \Gamma^{-1} \cdot \tilde{\Lambda} \quad (8)$$

where:

$\tilde{F}$  – matrix of the new coordinate values for the variables categories (size  $35 \times 3$ ),

$F^*$  – matrix of original coordinate values for the variables categories (size  $35 \times 3$ ),

$\Gamma^{-1}$  – diagonal inverse matrix of peculiar values (size  $3 \times 3$ ),

$\tilde{\Lambda}$  – diagonal matrix of modified eigenvalues (size  $3 \times 3$ ).

For such a large number of analyzed variables and their variants the interpretation of results obtained for the 3-dimension space is very difficult. In order to generate more unequivocal interpretation of the results, the Ward method was used, as it helps determine inter-relations between variants of the variables<sup>11</sup>. In Figure 4, which presents grouping of categories into classes, the horizontal line marks out the stage when the connection of the classes was interrupted<sup>12</sup>.

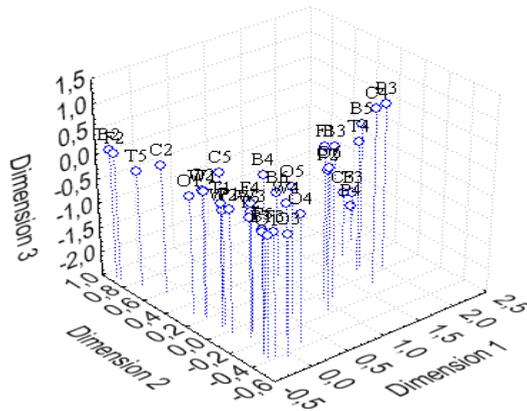


Fig. 3. The three-dimensional presentation of results of the correspondence analysis for all the variables, taking into account modifications of the own values

Source: Authors' calculations.

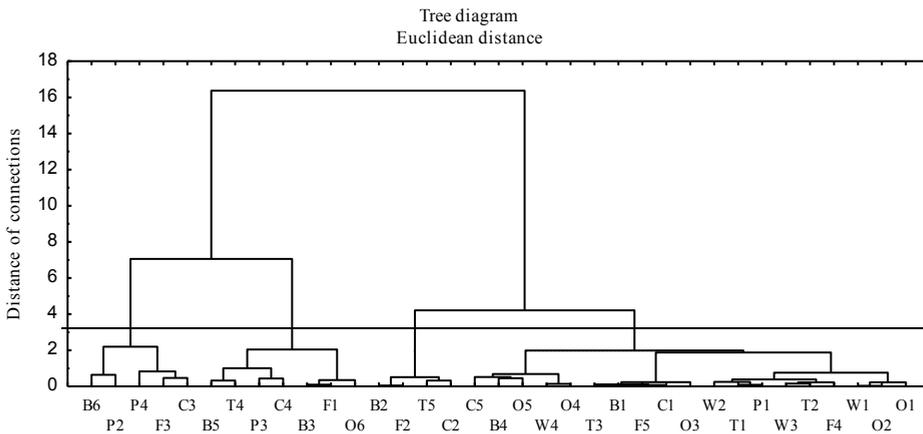


Fig. 4. The diagram of hierarchical classification of variable categories, prepared by means of the Ward method

Source: Authors' calculations.

Basing on the generated classes it is possible to identify the relations among the categories of the analyzed variables, which permitted the identification of regularities observed in short domestic tourist trips undertaken by old age pensioners in 2009. These regularities can be identified in the following way:

- Class 1** (B6, P4, C3, P2, F3) includes people travelling for religious purposes. They use accommodation arranged by travel agents and the form of the journey is pilgrimage.
- Class 2** (T4, C4, F1, B5, P3, B3, O6) includes people going to sightsee (architecture, culture, nature). They are clients of travel agents and purchase full tourist packets. The trip form is an excursion or a tour by coach to destinations located further than 501 km. During such trips, tourists use commercial lodging facilities (hotels, motels, pensions) and tourist homes, hostels or riverside hostels.
- Class 3** (B2, T5, F2, C2) consists of the groups those age pensioners who go to their allotment gardens to have rest and relax, spending nights in their cabins. They generally reach such places by public transport, motorcycles, bicycles or on foot.
- Class 4** (C5, O5, O4, B4, W4, T3, B1, C1, W2, P1, T2, W1, O1, F5, O3, T1, W3, F4, O2) includes those pensioners, whose main purpose for travelling beyond their places of residence are visits to relatives of friends, or such other reasons as e.g. family events. Such trips were organized without the assistance of travel agents, and the leading means of transport was railway, PKS or another bus service or a car. The journey included covering a distance that did not exceed 500 km one way. During the trip the travelers spent their nights at their relatives' or friends' or at rented quarters. The expenses incurred in the course of such trips were strongly diversified: from 20 PLN to more than 300 PLN.

## Conclusions

According to the analysis we performed, old age pensioners' active use of their free is still not very popular. They would rather listen to the radio, music, or watch TV than take up some sport, physical exercise or take part in package tours. Much less frequently than members of other household types, they take part in tourist events. In case of the Polish seniors, the basic reasons for the lack of participation are generally financial problems, illness, old age as well as the lack of willingness or necessity to go.

The application of the correspondence analysis, and particularly using it for the hierarchic classification, permitted determination of inter-relations among the categories of variables. It was established that the main purpose for short-term domestic tourist trips was visiting relatives or friends. This purpose was indicated by more than 49% of the respondents who travelled by train or by PKS (or other services). During such trips the travelers were provided lodgings by their relatives or friends, while the total expenses incurred by the travelers did not exceed 500 PLN.

Leisure and recreation were also frequently identified as the purpose for traveling, referring to less than 30% of the respondents. In order to have rest they preferred to go to their summer houses – this form was preferred by about 20% of the respondents. Additionally, our use of the Ward method helped identify two other tourist trip segments. The first of them was related to sightseeing, while the second covered people taking trips for religious purposes, the main form of which was pilgrimage.

Identification and understanding of the old age pensioners' (being potential tourists) motivation processes is very important from the perspective of the tourist market. It helps define the very essence of tourist trips and expectations of the travelers regarding the organization of trips, their choice of the means of transport and lodging facilities, preferred boarding solutions, and thus find out how individual destinations are perceived in the context of meeting one's needs of leisure or recreation.

## Notes

<sup>1</sup> See *Słownik psychologiczny* (1979).

<sup>2</sup> See Alejsiak (2009), p. 19.

<sup>3</sup> See Rogalewski (1974), p. 11.

<sup>4</sup> See *Turystyka w ujęciu interdyscyplinarnym* (2010), p. 43.

<sup>5</sup> *Turystyka i wypoczynek w gospodarstwach domowych w 2009 r.* (2010), p. 29.

<sup>6</sup> In many authors' opinion, the acquisition of the ability to manage their free time and lead an active life-style (accordingly to their capacities and needs) will help many elderly people retain their psychic and physical health in their old-age and enjoy also that stage of life. See, e.g.: Chabior (2005), Napierała (2002), Nowicka, Błażewicz (2010), Susułkowska (1989), Trafiałek (1995).

<sup>7</sup> See. Bąk (2010).

<sup>8</sup> Prepared based on *Metody statystycznej analizy wielowymiarowej...* (2004), Stanimir (2005).

<sup>9</sup> In Table 3 the presentation of inertia for  $k \geq 11$  was omitted, because they they did not exceed 0,1429.

<sup>10</sup> In order to determine the mapping space dimension, a graph of the own values was drawn and, using the „elbow” criterion, it was stated that the space should be either 3-dimensional, or 5-dimensional. Such a high dimension of the mapping space makes it difficult, or even impossible to present the results graphically. That is why the authors decided to choose the 3-dimension space, as these dimensions map more than a half of the inertia related to the analyzed data table.

<sup>11</sup> The Ward method is one of the grouping agglomeration methods. It is used in empiric research for classifying both objects and traits. In this method, a distance between groups is defined as the module of the difference between squares of distances between points and centers of the groups the points belong to. Malina (2004).

<sup>12</sup> In order to divide the dendrogram and determine the number of clusters, factor Grabiński (1992) was used:  $q_i = d_i/d_{i-1}$ , where  $d_i$  is  $i^{\text{th}}$  distance. The highest value  $q_i$  indicated the dendrogram division point.

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