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ASSESSMENT OF SUBJECTIVE ASPECTS OF THE QUALITY OF LIFE IN THE VARIOUS REGIONS OF THE CZECH REPUBLIC

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Abstract

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The paper is focused on the methodological approaches to assess subjective aspects of the quality of life in the various regions. Besides, directly measurable indicators, which may not always correspond with the quality of life of the individuals in the regions, the subjective aspects of well-being are also in the spotlight. The pilot analysis examined the answers to questions such as: Are you satisfied with the health and social services, the cost of living, safety of public spaces, affordability of housing, or your personal job situation? These answers were used for an assessment of the quality of life in the different regions of the Czech Republic. We used multivariate modeling to explicitly account for the hierarchical structure of respondents within the Czech Republic, and for understanding patterns of variation between regions. The principal component analysis (PCA) was used for the general analysis of regional differences. The overall goal of principal component analysis is to reduce the dimensionality of a data set, while simultaneously retaining the information present in the data. The differences were illustrated by cartographic visualization and by scatter plots of the first three principal components. The cluster analysis was used to discover similarities and differences of the quality of life within various regions of the Czech Republic.

quality of life, regional disparities, cartographic visualization, principal component analysis, cluster analysis, SAS

The quality of life is a term used in a wide range of contexts and the assessment of the quality of life is influenced by various indicators. The evaluation of differences in quality of life has two points of view: objective and subjective. Therefore the research on disparities among regions can be realized by both strategies of quantitative and qualitative research (see Jánský *et al.*, 2009). The standards of living are evaluated by objective aspects, which can be measured in financial terms. The main data sources are the Czech Statistical Office and various ministries. Subjective well-being is subject to multiple determinants (see Sheldon and Hoon, 2007). This paper, which has a methodological character, analyzes the subjective aspects of the quality of life. It is focused on the views and opinions of Czech residents. The opinions are based on public opinion research or another representative sample survey, and it is often assessed using scales and questionnaires. Ra (2010) states: "Subjective well-being includes our response, perceived satisfaction, and assessment of life. Subjective well-being is not a synonymous of happiness, even if the two are often used interchangeably." The terms such as quality of life, well-being and life satisfaction actually identify a maze of closely interrelated, but subtly different, concepts and that the every relationship between subjective and objective levels of well-being may be dynamically complex (see Grossi *et al.*, 2010).

The aim of the paper was to find an appropriate methodology to assess differences in quality of life in various regions. Due to possible inhomogeneities within the data set, it is required that the solution is robust to outliers and deviating points (Alfons *et al.*,

2010). It is possible to illustrate the differences in the quality of life in the various regions by cartographic visualization, which represents the innovative methodical approach (more in Galvasová, Chabičovská, 2009). The goal for further research will be a more detailed assessment of regional disparities, which will be based on various topics.

An assessment of the quality of life can be understood from more perspectives, such as family quality of life, health-related quality of life or work-related quality of life, or refer to quality of life from a comprehensive perspective (Gómez *et al.*, 2011). Živělová and Jánský (2007) state that an assessment of the quality of life within the regions can be made based on natural resources, social and cultural resources, and economic performance of the region. These factors affect trends and specification of the quality of life at the regional level.

Evaluation of the quality of life could be composed by the eight domains, which was proposed by Schalock *et al.* (2008), these being: self-determination, social inclusion, interpersonal relations, rights, material well-being, emotional well-being, physical well-being and personal development. The theory tends toward an eight-factor correlated model.

The questions: 'What makes individuals happy?' and 'What leads to happy societies?' were examined by Blanchflower and Oswald (2004) from the economic point of view. They also do a formal test of the hypothesis that economic growth does not raise well-being. It was confirmed that an individual's happiness is affected by economic growth (see also Easterlin, 1995). However, the answer is not entirely clear and the well-being depends also on other socio-demographic factors.

The role of economic variables in predicting regional disparities in reported life satisfaction was analyzed also by Pittau *et al.* (2010). He confirmed that a regional dimension is relevant to life satisfaction. After adjusting for individual characteristics and modeling interactions, regional differences in life satisfaction still remain (Pittau *et al.*, 2010).

MATERIALS AND METHODS

The Eurobarometer 71.2 was used as a source for this analysis. It covers the population of the respective nationalities of the European Union Member States, resident in each of the Member States and aged 15 years and over. The Eurobarometer was created at the request of the European Commission. The research was made between the 25th of May and the 17th of June 2009 and 1033 citizens of the Czech Republic participated in this Eurobarometer. Nine sub questions, referring to quality of life, were chosen for detailed analysis.

The sampling points were drawn systematically from each of the "administrative regional units", after stratification by individual unit and type of area. They represent the whole territory of the countries surveyed according to the Eurostat NUTS II (or equivalent) and according to the distribution of the resident population of the respective nationalities in terms of metropolitan, urban and rural areas.

The question „How would you judge the current situation in each of the following?" was chosen for further analysis. The question was focused on the following fields:

- The economic situation in the Czech Republic (QA11)
- Personal job situation (QA12)
- The employment situation in the Czech Republic (QA14)
- The provision of pensions in the Czech Republic (QA03)
- The financial situation of households (QA13)
- The cost of living in the Czech Republic (QA05)
- How affordable housing is in the Czech Republic (QA09)
- Health care provision in the Czech Republic (QA02).

For each question four possible answers could be given: very good, rather good, rather bad, and very bad. For the purpose of the analysis the input variables were recoded into two categories (good/bad). Only the proportion of positive response was used in the following analysis. Within the CZ NUTS II territories, the class variable was allocated according to the area of residence: village, small/middle size town or large town. The area of residence was also one of the questions in the Eurobarometer survey.

Next question: „On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?" A map was produced on the basis of the answers to this question. The cartographic visualization is a possible way for presentation of differences in the spatial distribution of the reference indicators in the various territories and also for comparison with the results of another analysis.

The principal component analysis (PCA) was used for the general analysis of regional differences in the quality of life. The overall goal of principal component analysis is to reduce the dimensionality of a data set, while simultaneously retaining the information present in the data (see Lavine, 2000). By reducing a data set from a group of related variables into a smaller set of components, the PCA achieves parsimony by explaining the maximum amount of common variance using the smallest number of explanatory concepts (more in Field, 2005). Each principal component corresponds to a certain amount of variance of the whole dataset. Dimensionality reduction with PCA is possible in this case because the selected questions are related. Detailed information about principal component analysis is available in (Hebák *et al.*, 2007, Meloun *et al.*, 2006, or Rencher, 2002).

Another useful dimension reduction device is to evaluate the first two or three principal components

for each observation vector and construct a scatter plot to check for outliers or cluster homogeneity. For details of this application, see Rencher (2002). This plot is equivalent to a projection of the *p*-dimensional data swarm onto the plane that shows the greatest spread of the points.

In the further analysis the cluster technique was used to find the regions with similar quality of life. The automatic cluster detection is described as a tool for undirected knowledge discovery. The algorithms themselves are simply finding structure that exists in the data without regard to any particular target variable. The clustering algorithms search for groups of records – the clusters – composed of records similar to each other (see Berry and Linoff, 2004). The goal of clustering is to find an optimal grouping for which the observations or objects within each cluster are similar, but the clusters dissimilar to each other (Rencher, 2002).

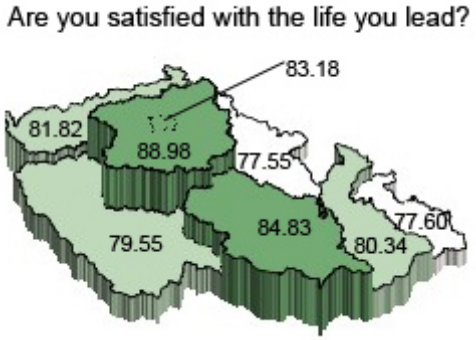
In cluster analysis we generally wish to group the *n* rows into *g* clusters. Two common approaches to clustering the observation vectors – hierarchical clustering and partitioning – were compared. In hierarchical clustering we typically start with *n* observations. At each step, an observation or a cluster of observations is absorbed into another cluster. The results of a hierarchical clustering procedure can be displayed graphically using a tree diagram, also known as dendrogram, which shows all steps of the procedure, including distances at which clusters are merged. The process of the partitioning can be realized by starting with an initial partitioning or with cluster centers, and then reallocating the observations according to some optimality criterion (Rencher, 2002). A detailed description of the cluster analysis can be found e.g. in (Berry and Linoff, 2004; Rencher, 2002; Řezanková, 2007).

The SAS 9.2 system was used for an exploratory analysis and for preparation of a data matrix. The multivariate analyses were realized using the SAS Enterprise Miner 6.1. The map of the life satisfaction was done in the SAS Enterprise Guide 4.2.

RESULTS AND DISCUSSION

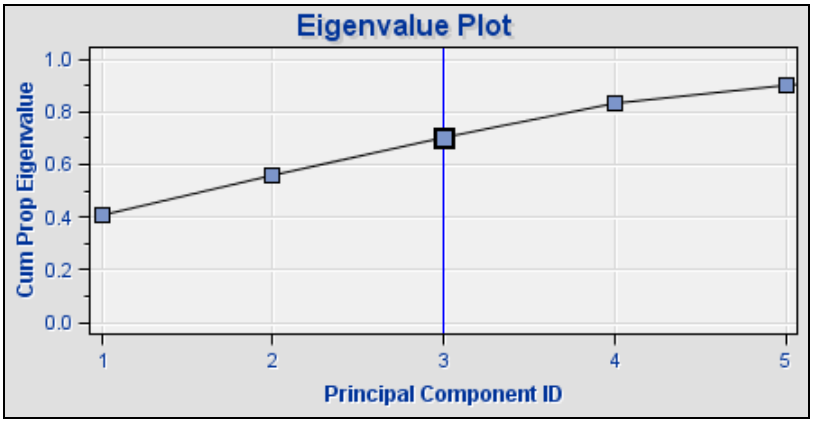
The differences in the life satisfaction within various regions were illustrated by cartographic visualization. Answers to the question were analyzed: „On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?“ A map was produced on the basis of the answers to this question.

Fig. 1 reflects a proportion of positive responses; the range is from 77.6% to 89.0%. The most satisfied inhabitants live in Central Bohemia, Southeast region, or in Prague. In these territories, the overall proportion of positive responses is in the range of 84.8% to 89%. On the other hand, the lowest satisfaction rate is in the Northeast and Moravian-Silesian regions (77.6%).



1: *Proportion of inhabitants satisfied with their quality of life*

The principal component analysis (PCA) was used for the analysis of regional differences in the quality of life. The data was standardized using the correlation matrix. The scree plot has converged in suggesting that a three-component solution may be appropriate. This result was confirmed by the eigenvalue-one criterion: only the first three components displayed eigenvalues greater than 1. Also the interpretability criterion was applied to the solution. This criterion verifies that the interpretation makes sense.

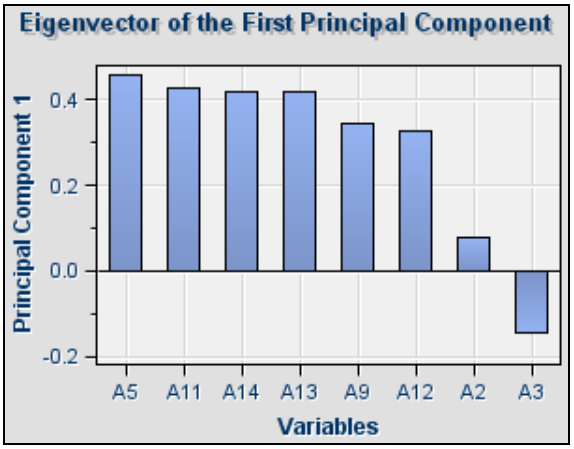


2: *Scree plot for cumulative proportional eigenvalues*

The first three principal components account for 70% of the total variance. Fig. 2 shows a scree plot for cumulative proportional eigenvalues.

The first principal component is the linear combination with maximal variance. Four items were found to load on the first component. These variables are logically related. They reflect a positive attitude to the questions associated to living expenses, such as the cost of living (QA05), the economic situation (QA11), the financial situation of household (QA13), and the employment situation (QA14). Therefore the first component was subsequently labeled the living expenses component. The highest value of the component score was reached in large town areas in Central Moravia and in the Northwest, as well as rural areas of the Central Bohemia, Southwest and Northwest regions. These areas are characterized by a high percentage of respondents satisfied with the financial situation within households (ranging from 68% to 86%) and with the affordability of housing (ranging from 67% to 71%).

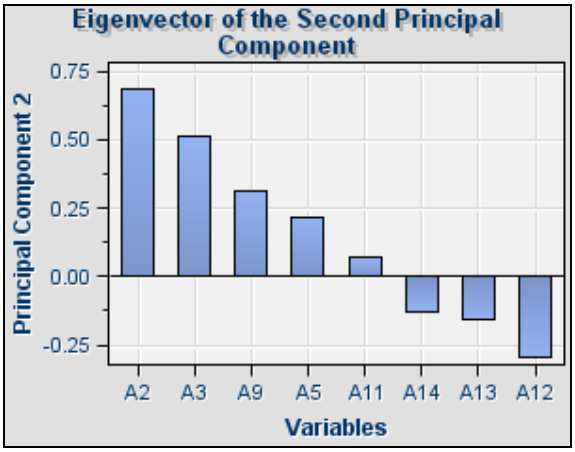
The corresponding eigenvector expresses an association of input variables with first principal component; it is shown in Fig. 3.



3: *Eigenvector of the first principal component*

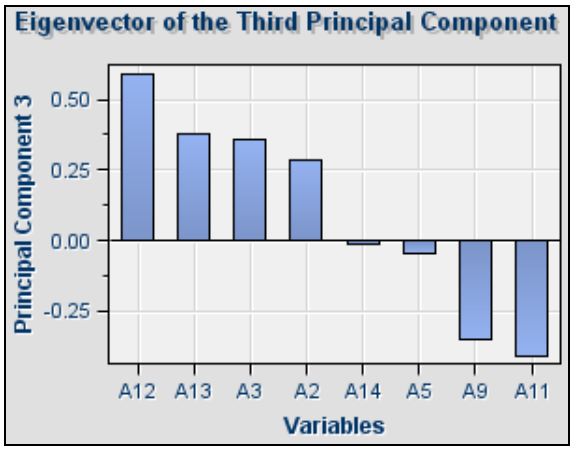
Two indicators, with a high value of the correlation coefficient, are dominant for the second principal component (Fig. 4). These indicators express satisfaction with the level of income and with health care. All three categories of living in the Northeast area reach a high score of the second component. Respondents were mostly satisfied with the current situation of health care and provision of pensions. This result is related to the number of doctors and dentists in this area, which is above average.

The third component is associated with the personal employment situation (Fig. 5). The highest value of the component score was reached in large town areas such as cities in the Central Bohemia, Northeast, Southeast, Southwest, and Moravian-Silesian regions. The respondents from these territories are mostly satisfied with their own job



4: *Eigenvector of the second principal component*

situation (71%–92% satisfied respondents). It is possible caused by abundant job offers in large towns, where people can easily find appropriate work, which satisfies their expectations.

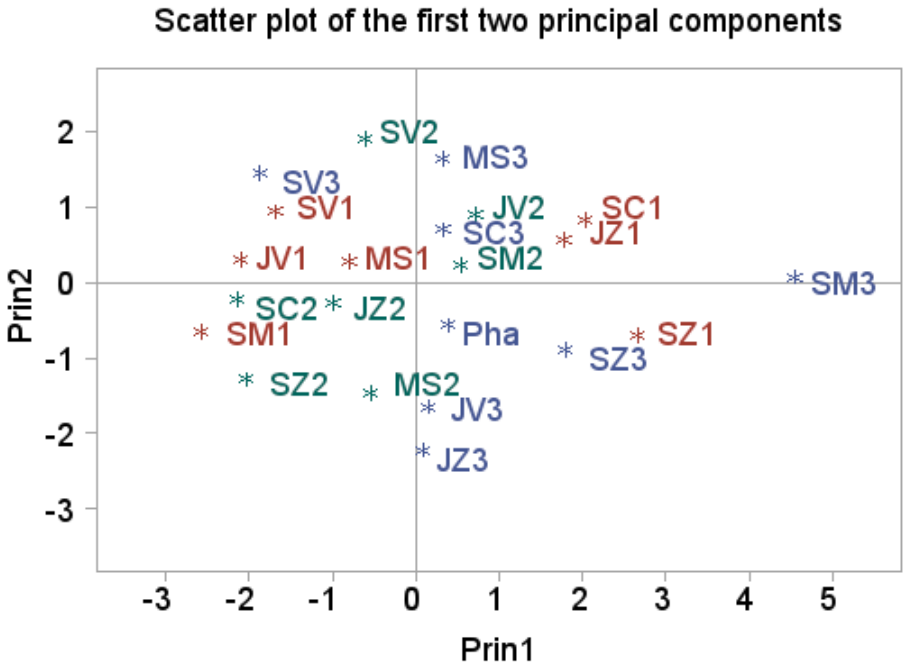


5: *Eigenvector of the third principal component*

The objective of the following analysis was to evaluate the first three principal components for each observation vector and construct scatter plots to check for outliers and data distribution. Scatter plots of the first three components (see Fig. 6 and Fig. 7) illustrate the differences between observed regions and may also reveal a tendency of the points to cluster.

Fig. 6 shows the spread of individual observations in the first two dimensions. The first two letters in figure mark the CZ NUTS II territories and the third marks the place of living as follows: 1 – village, 2 – small/middle size town, 3 – large town. The NUTS II classification is shown in Tab. I.

Scatter plot of the first (Prin1) and third (Prin3) principal components (Fig. 7) shows the differences between opinions of inhabitants of large towns (blue) and inhabitants of villages (red) to the question: „How would you judge your personal job situation at this time?“ The inhabitants of large towns reached



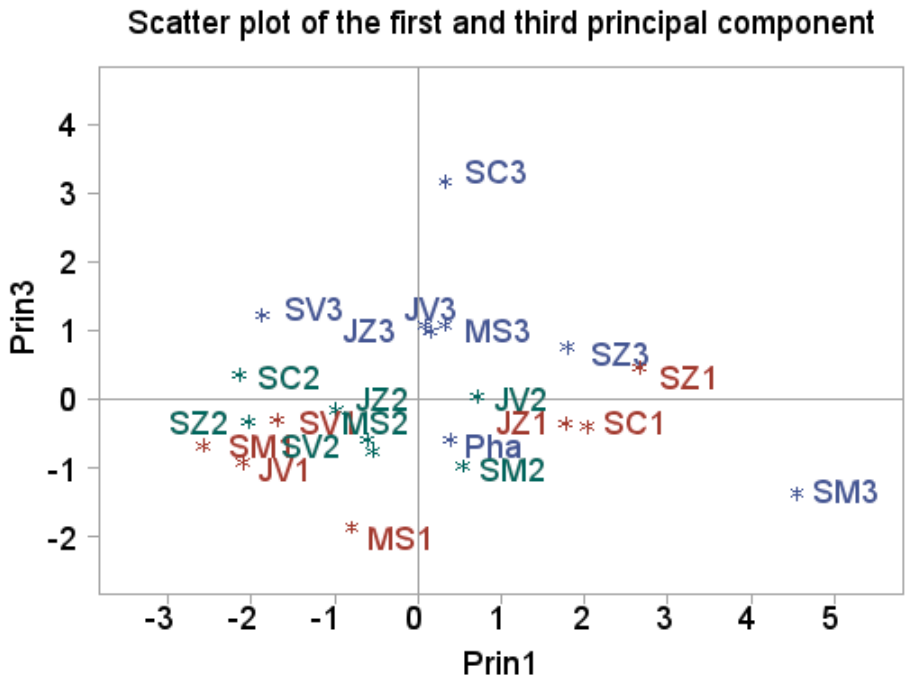
6: *Scatter plot of the first two principal components*

I: *CZ NUTS II classification*

CZ NUTS II Classification	
Pha – Prague	SV – Northeast
SC – Central Bohemia	JV – Southeast
JZ – Southwest	SM – Central Moravia
SZ – Northwest	MS – Moravian-Silesian

Source: Czech Statistical Office

a higher score of the third component, which means that the rural population is less satisfied with their job situation. This result confirms the general idea that the issue of rural employment is one of the major factors that limits the development of rural areas and has a significant impact on the quality of life for their inhabitants.



7: *Scatter plot of the first and third principal components*

II: *Regions divided into clusters*

Clusters	Regions								
Cluster 1	JV2	JZ1	MS1	Pha	SC1	SM2	SZ1	SZ3	
Cluster 2	SM3								
Cluster 3	JV1	JV3	JZ2	JZ3	MS2	SC2	SM1	SV1	SZ2
Cluster 4	MS3	SC3	SV2	SV3					

Source: own computation

The Cluster Analysis

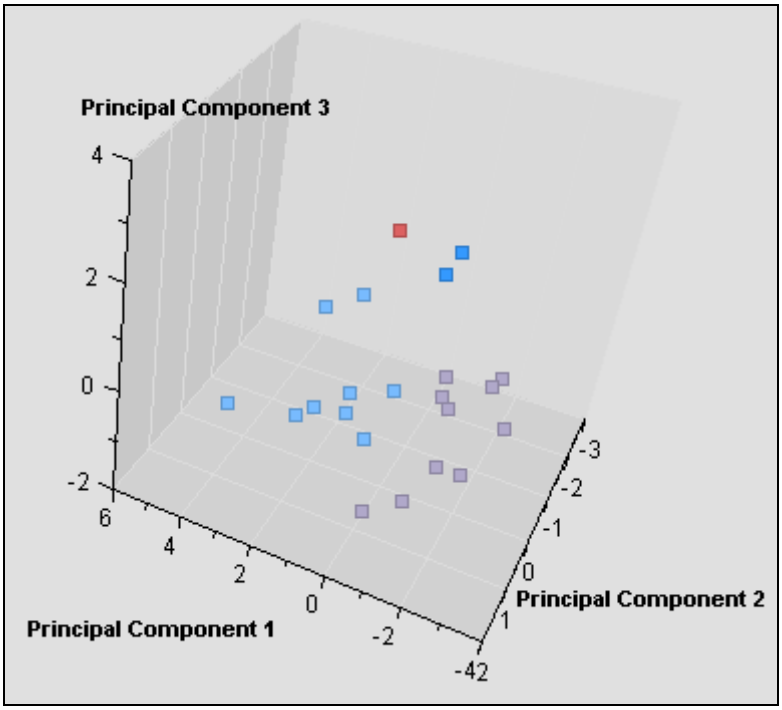
Groups of regions with similar quality of life assessment were found by the Ward's hierarchical clustering technique. According to a graphical assessment this method delivers more valuable results than the nonhierarchical k-means technique. The Ward's technique was applied to the eight mentioned standardized variables. The regions were divided into four different clusters according to the semi-partial R-square measure, as follows (Tab. II):

We can plot the first three components as a dimension reduction device (Fig. 8). One of the objectives of plotting is to check for clusters and outliers. We simply evaluate the first three components for each observation vector and plot these points. The plot is equivalent to a projection of the multidimensional data swarm onto the plane that shows the greatest spread of the points. Clusters of regions are evident from the 3D diagram (Fig. 8). It is also evident that clusters are well separated, which means that the Ward clustering technique is appropriate for this analysis. Data is separated mostly by first component (Prin 1), which accounts for 40% of the total variance.

The separation of regions into clusters reflects existing regional disparities. The scatter plot displays a tendency of the points to cluster, and shows the differences in regions based on analyzed indicators. The plot also allows for identification of an outlier that is not consistent with the other observations.

The first cluster contains almost all rural areas. Respondents from these areas reached a high score of the first component. The exploratory analysis reveals that the respondents are mostly satisfied with the financial situation of their household, personal job situation, and health care provision.

It is evident that in the data there is one multidimensional outlier, which created an one-point cluster (Cluster 2). The outlier is represented by large towns in the Central Moravia (Olomouc and Zlín region). Respondents from this area reached the highest score of the first component, which means that they are satisfied with the level of living expenses. On the other hand, they reached a low score of the third component, which is associated with the personal job situation. The research confirmed that inhabitants of Central Moravia are satisfied with the financial and economic situation



8: *Groups of regions with similar quality of life assessment*

but they are less satisfied with their job situation and health care provision.

The third cluster is characterized by a low satisfaction level of respondents with the employment and economic situation, and with the cost of living in the Czech Republic. This is the most frequent cluster, which contains various regions of the Czech Republic.

The last cluster contains four areas that reached a high level of satisfaction in almost all analyzed indicators. The proportion of satisfied respondents is above the Czech average. This cluster is represented by large cities of the Moravian-Silesian and Central Bohemia regions and by all urban areas of the Northeast region. It is evident that these territories reached the highest score of the second principal component.

CONCLUSIONS

The results of the analysis revealed a high proportion of respondents who are generally satisfied with their life. The range of positive responses in all regions of the Czech Republic is from 77.6% to 89.0%. The analysis also confirms that the respondents from large towns are mostly more satisfied with their job situation than the rural population. This is possibly caused by the greater number and variety of job offers in urban areas, where people can easily find appropriate work, which satisfies their expectations. In the cities there is usually a lower level of unemployment, so the inhabitants have more opportunities and they are generally more satisfied than rural residents. It confirms the general idea that the issue of rural employment is one of the major factors that limits the development of rural areas and has a significant impact on the quality of life for their inhabitants.

The principal objective of this paper was to analyze the subjective aspects of quality of life, and find an appropriate methodology to assess differences in quality of life in various regions. However, this analysis represents only a brief list of life priorities and values of the Czech society. The goal for further research will be a more detailed assessment of regional disparities, which will be based on various criteria, and which will combine the objective and subjective approaches.

The paper emphasizes the fact that cartographic visualization is an innovative and effective method for the presentation of research results; in this case, the illustration of differences in the spatial distribution of the reference indicators in the various territories. It can be also used for comparison with the results of other analysis.

The results of multivariate analyses confirm that many approaches can be used for analyzing and assessing the quality of life. The combination of principal component analysis and cluster analysis provides a comprehensive approach to analyzing selected indicators and regional disparities.

SUMMARY

The paper is focused on the methodological approaches to assess subjective aspects of the quality of life in the various regions. The pilot analysis examined the answers to questions such as: Are you satisfied with the health and social services, the cost of living, affordability of housing, or your personal job situation? These answers were used for an assessment of the quality of life in the different regions of the Czech Republic. The Eurobarometer 71.2 was used as a source for this analysis. Within the CZ NUTS II territories, the class variable was allocated according to the area of residence.

The principal component analysis (PCA) was used for the general analysis of regional differences. The first three principal components account for 70% of the total variance. The first component was subsequently labeled the living expenses component. The highest value of the component score was reached in large town areas in Central Moravia and in the Northwest, as well as rural areas of the Central Bohemia, Southwest and Northwest regions. These areas are characterized by a high percentage of respondents satisfied with the financial situation within households (ranging from 68% to 86%) and with the affordability of housing (67%–71%). All three categories of living in the Northeast area reach a high score of the second component, which express satisfaction with the level of income (45%–57% satisfied respondents) and with health care (72%–87%). The third component is associated with the personal employment situation. The highest value of the component score was reached in large town areas such as cities in the Central Bohemia, Northeast, Southeast, Southwest, and Moravian-Silesian regions. The respondents were mostly satisfied with their own job situation (71%–92%). The differences were illustrated by cartographic visualization, which represents the innovative and effective methodical approach, and by scatter plots of the first three principal components. The cluster analysis was used to discover similarities and differences of the quality of life between various regions. Groups of regions with similar quality of life assessment were found by Ward's hierarchical clustering technique. The results of multivariate analyses confirm that many approaches can be used for analyzing and assessing the quality of life. The combination of principal component analysis and cluster analysis provides a comprehensive approach to analyzing selected indicators and regional disparities.

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