

Matej Puzder

Technical University of Košice

Department of Business and Management, Faculty of Mining, Ecology, Process Control and Geotechnologies

Email: matej.puzder@tuke.sk

Michaela Koščová

Comenius University

Department of Applied Mathematics and Statistics, Faculty of Mathematics, Physics and Informatics

Email: michaela.koscova@fmph.uniba.sk

Ivan Košč

Slovak University of Technology

Institute of Electronics and Photonics, Faculty of Electrical Engineering and Information Technology

Email: ivan.kosc@stuba.sk

Comparison of tourism in EU countries in 2012 and 2013

The main aim of the presented paper is to evaluate and to compare tourism in EU countries in 2012 and 2013. EU countries are compared with regard to the cause of the trips made by habitants of each EU country. Four different causes of trips were distinguished: business trips, visits to relatives and friends, holidays and others. Cluster analysis was applied with the aim to detect groups of similar countries, according to character of tourism. Cluster analysis is a multivariate statistical method which offers two different approaches: non-hierarchical and hierarchical. The result of hierarchical cluster analysis is so-called dendrogram which shows EU countries organized in a treelike structure. On the other hand, non-hierarchical cluster analysis files countries into separate groups.

Keywords: tourism, European Union, cluster analysis, Non-hierarchical, Hierarchical cluster analysis

Matej Puzder is a PhD student at Technical University in Košice since 2014. Besides his main research field - Resources policy and evaluation deposits in Slovakia, he is active in the field of management and tourism. He is also a member of Academic senat at Faculty BERG, Technical University of Košice.

Michaela Koščová focuses on research in the field of applied mathematics, mostly probability theory and statistics. She is also a member of the Slovak Statistical and Demographical Society.

Ivan Košč is a researcher at Slovak Technical University in Bratislava. He received his PhD in sensorics in 2013. Along his PhD studies he also acquired a degree in economics and management.

Introduction

Even though in certain countries there was a tendency to underestimate the impact of tourism, as it was considered to develop mostly the private sector, EU saw the development of tourism in a different view. The EU together with other institutions, such as the UNWTO, NTO or ETAG, realizes the importance of tourism, and therefore it tries to support the tourism through various subsidies and funds. Tourism began to grow qualitatively and proved to be a valuable economic tool. Tourism as an economic instrument enhanced the development of the localities together with living standards of local population.

Through tourism it is also possible to generate growth in employment and thus ensure not only economic, but also social development, especially at mountain and rural areas, marginal and very remote regions, but also coastal regions and islands. It is an important instrument for reinforcing Europe's image in the world, to reflect European values and to promote attractiveness of the European model, which is the result of cultural exchange, linguistic diversity and creativity for many centuries.

According to estimates of the World Tourism Organization, the quantity of tourism in Europe is expected to grow. Therefore, it is interesting to observe how the character of tourism is changing due to the heterogeneous nature of individual EU countries, which is affected by, *inter alia*, economic, demographic, cultural and historical environment.

Data and Methods

The main objective of this work was to detect groups of EU countries with similar character of tourism. Data from the database [1] of Eurostat, the statistical office of the EU, regarding the years 2012 and 2013 were used for the analysis. The data distinguish between four main reasons of tourism - business trips, visits of relatives and friends, holidays and other. For the purpose of graphical representation, we consider the last three reasons (visits, holidays and other) together as personal reasons. In the database [1] there is information on number of trips made by habitants of most of EU countries and Switzerland for each of the four abovementioned reasons. In further analysis we did not work with the EU countries that were missing in the database [1]. For normalization purposes it is necessary to take into account also the total number of habitants of considered countries. Thus we worked with [2], where the estimated population can be easily found.

Cluster analysis was applied with the aim to detect groups of similar countries, according to character of tourism. Cluster analysis is a multivariate statistical method which offers two different approaches: hierarchical and non-hierarchical. The result of hierarchical cluster analysis is so-called dendrogram that shows objects organized in a treelike structure.

In this work, object is considered to be one country quantitatively characterized by four numbers – numbers of business trips, holidays, visits and other per habitant. On the other hand, non-hierarchical cluster analysis sorts objects (countries) into separate groups. Generally, cluster analysis leads to a problem of discrete optimization, which might be difficult to solve. However, there are different heuristic algorithms implemented in commonly used statistical software that are able to solve such problems. The main idea of the cluster analysis is to obtain optimal clustering, such that objects similar to each other appear either in the same cluster (non-hierarchical clustering) or “near” each other in the treelike structure (hierarchical clustering), while objects that are dissimilar to each other appear in some other cluster or “far away” from each other. For more detail about cluster analysis see [3].

Analysis of Tourism Development

We examined the development of tourism in EU countries and Switzerland in 2012 and 2013 using non-hierarchical and hierarchical cluster analysis. The computations were performed in the statistical software R [4].

Non-hierarchical cluster analysis

The non-hierarchical cluster analysis was performed using k-medoids method, see [3]. This method results in clustering that minimizes the total sum of so-called "dissimilarities" within individual clusters. Additionally, the typical representatives for each cluster can be determined by this method. The k-medoid method requires number of clusters as an input. In this work we fixed the number of clusters to four. [6]

In Figure 1 a graphical representation of obtained results regarding the year 2012 can be found. Even though the original data are four-dimensional, we were able to display the results in two dimensions using the reduction of dimension described previously in part 2 of this paper. The first cluster (black colour) consists of nine countries: Belgium, Bulgaria, Greece, Italy, Lithuania, Malta, Portugal, Romania and Slovakia. The typical representative of this cluster is Italy. The second (blue colour) consists of Croatia, Estonia, Hungary and Latvia, and Estonia is the typical representative of this cluster. In the third cluster (red colour) including Austria, Cyprus, Czech Republic, France, Germany, Ireland, Luxembourg, Netherlands, Slovenia, Spain, Switzerland and United Kingdom, the typical representative is Spain. In the last cluster (green colour) there are two countries, namely Denmark and

Finland. In this case there is no meaning in determining the typical representative of the cluster, since there are only two countries in this cluster.

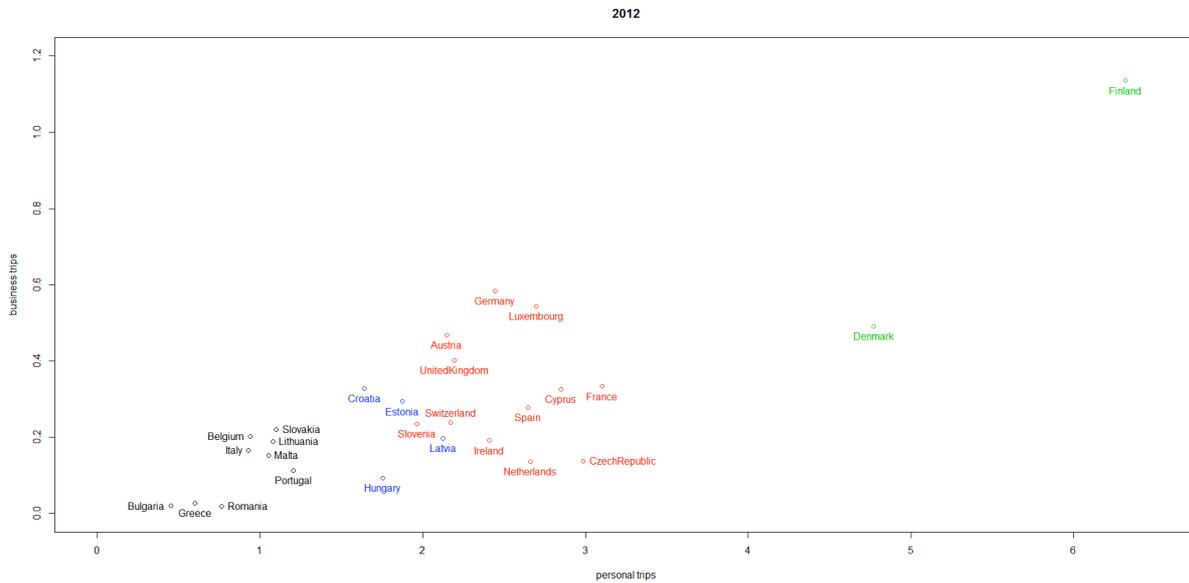


Figure 1: Non-hierarchical cluster analysis, 2012

In 2013 (Figure 2) only minor changes compared to year 2012 can be seen. Despite certain development of character of tourism in EU countries and Switzerland, the result of cluster analysis has shown only two noteworthy changes. Firstly, Portugal has moved from the “black” cluster to the “blue” cluster and secondly, the “blue” cluster changed its typical representative to Hungary, probably due to the movement of Portugal. Here it is necessary to emphasize that the cluster analysis was performed on four-dimensional data. The fact that Hungary in Figure 4 does not seem to be typical is caused by the reduction of dimensions for the purpose of graphical representation of the result.

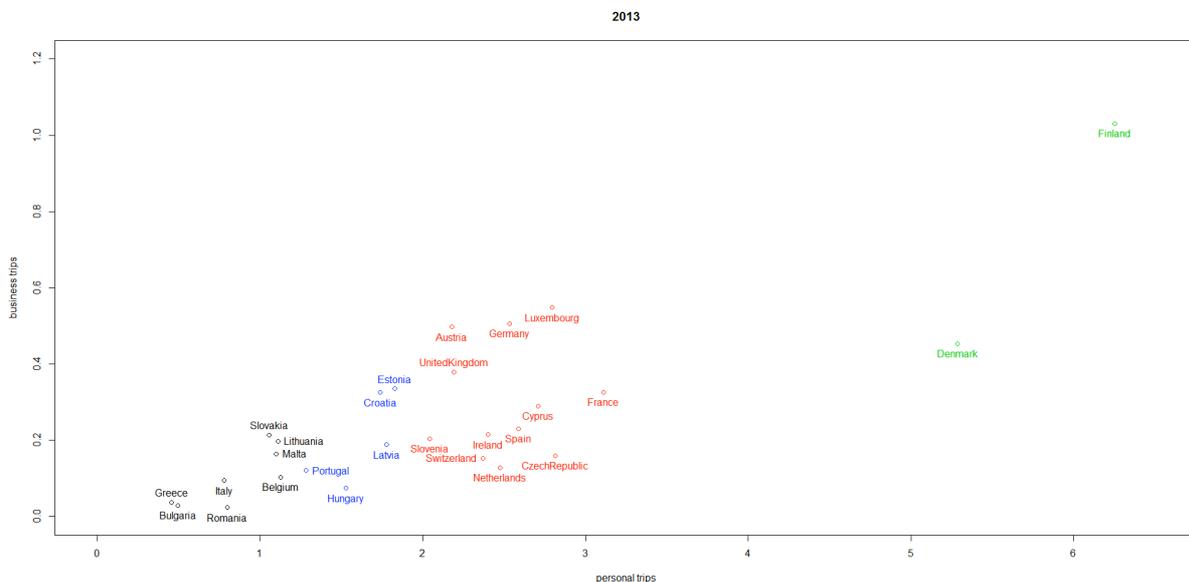


Figure 2: Non-hierarchical cluster analysis, 2013

Hierarchical cluster analysis

Hierarchical cluster analysis was performed by the agglomerative approach, see [3]. The resulting dendrogram, that is basically a treelike structure, reflects different levels of aggregation. Figure 3 shows the result for the year 2012. It is evident that the character of tourism in Denmark and Finland is rather distant from the character of tourism in other countries, which persists also in 2013, see Figure 2. As the hierarchical cluster analysis offers an insight into the structure of similarity and dissimilarity of the character of tourism in examined countries, it shows the development (differences between 2012 and 2013 results) in more detailed way. For example, it can be observed that Croatia was in 2012 very close to group Belgium, Italy, Malta and Slovakia, but in 2013 it moved closer to Estonia, Hungary and Latvia. The reason for this “migration” might be the overall decrease of number of trips made by Croats as a result of the economic situation, as in Croatia there is decrease or stagnation of economic growth in the last few years [5].

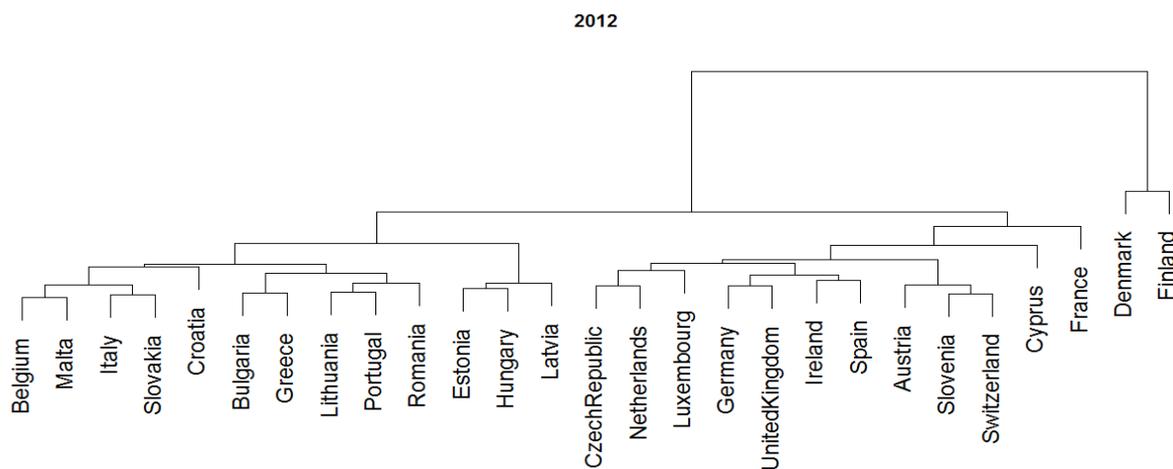


Figure 3: Hierarchical cluster analysis, 2012

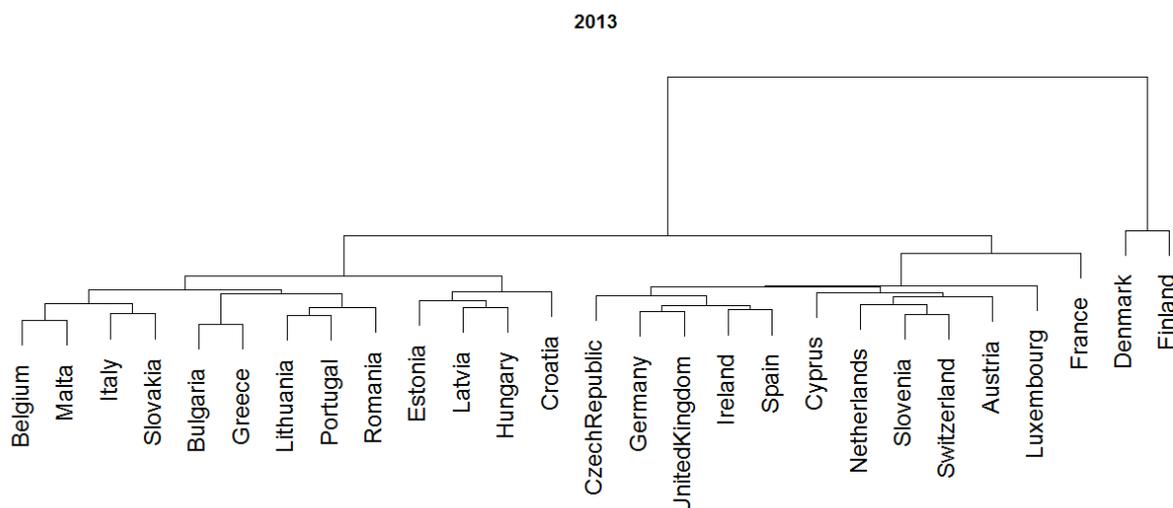


Figure 4: Hierarchical cluster analysis, 2013

Conclusion

This work is contributed to assessment of the situation in the tourism sector in the EU countries with the use of mathematical methods of clusters analysis. In many cases, countries from the same region are similar in analyzed indicators. It holds for the Scandinavian countries or the countries of Southern and Western Europe. This fact reflects a similar historical development of these countries, the enforcement of similar policies in the state management, but also similar problems that afflict these countries.

Acknowledgements

Supported by the grant VEGA 2/0047/15 (M.Koščová)

References

- [1] *Eurostat Database*, URL <http://ec.europa.eu/eurostat/web/tourism/data/database>.
- [2] *Worldatlas*, URL <http://www.worldatlas.com/aatlas/populations/ctypopls.htm>.
- [3] Izenman, A. J. (2008). *Modern Multivariate Statistical Techniques*.
- [4] R Development Core Team (2011). *R: A language and environment for statistical computing. R Foundation for Statistical Computing*, Vienna, Austria. URL <http://www.R-project.org/>.
- [5] Dalić, M. (2013). Croatia: A Prolonged Crisis without Recovery. In: Novotny V. (ed.) *From Reform to Growth: Managing the Economic Crisis in Europe*, Centre for European Studies, Brussels, May/2013, p. 67-88.
- [6] Kršák, B., Stehlikova, B., Taušová, M., Kamenikova, K. (2007), Education as a tool for tourism development, 7th International Scientific Conference on Modern Management of Mine Producing, Geology and Environmental Protection, SGEM 2007