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Electronic Notes in DISCRETE MATHEMATICS

Electronic Notes in Discrete Mathematics 58 (2017) 223–230 www.elsevier.com/locate/endm

Grouping cities based of their socio-economic indicators

Olga Rusetskaya [1]

International Centre for Social and Economic Research, Leontief Centre, Saint-Petersburg State University of Economics, Russia

Abstract

In this paper a new approach in analyzing city behaviour and its dynamic developments is proposed. Usual attributes are divided into two larger groups: social and economic. This idea makes possible analyzing relative performances of cities from different angles, such as: two-dimensional clustering; city ranking by simple calculating their distance from origin; minimum sum of squares clustering, etc. Such an analysis is helpful to show good and week points in developing city strategy in long term period. Grouping of 77 capital cities of regions in Russia is considered. The averages of both groups, for each city are calculated, covering 12 years. Minimum sum-of-squares criterion is used for clustering and solved by variable neighborhood search. It appeared that there are a few outlier cities, two of them being non dominated or efficient. Detailed comparative analysis of the results before and after crisis (economic sanctions) are also provided.

Keywords: City development, socio-economic characteristics, crises, minimum sum of squares, variable neighborhood search.

1 Introduction

Cities are an important object of study, since the human capital and business are concentrated in them. There is a sufficient number of urban studies, including those related to the construction of a variety of groups, classifications,

★ This work is conducted at International Centre for Social and Economic Research, Leontief Centre, Saint-Petersburg and supported by Endowment Fund of Leontief Centre.

[1] Email: olga@leontief.ru

http://dx.doi.org/10.1016/j.endm.2017.03.029

integrated and special ratings. A study on the role of rankings in growing city competition is given in [6]. A number of studies are devoted to construction of special city ranking, in particular, the European Smart City ranking [6]. Six "smart" characteristics or attributes had been identified which are likely to be relevant: economy, people, governance, mobility, environment and living. Many studies are also devoted to the classification of cities in terms of their socio-economic development. Cluster analysis is used to form internally homogeneous groups of Slovenian municipalities on the basis of their socio-economic indicators in [9]. Cities of Turkey are classified by fuzzy clustering c-means heuristic according to their development levels, with the help of socio-economic indicators [5].

Regarding cities in Russia, the high-quality research has been done by the Independent Institute for Social Policy (IISP) [12], where the last monitoring was performed on the data from 2011. It covers all Russian cities with over one hundred thousand population. It includes analysis of the demographic situation, economy and social services. The analysis of inequality of Russian cities from 1998 to 2011, included three indicators (attributes): per capita investment in fixed capital, retail turnover per capita, average wages [13]. The research is performed using index Gini and variance. An integral rating of Russias 100 largest cities with a population of over 175 thousand people in 2014 was developed by the Urbanika Spatial Planning Institute together with the Union of Architects of Russia [1]. The results of the study of the development dynamics of large cities have also been performed. They analyze, in particular: (i) the main characteristics and problems typical for Russian cities in the last decade [3,4]; (ii) changes in the economic structure of Russia's millionplus cities [2], and (iii) changes in the system of financing urban development from the local budget and the role of budgets in urban development [4,8].

This study presents a comparative analysis of the level of socio-economic development of the cities-capitals of Russian regions in the period before and after the financial and economic crisis of the early 2000s. It is continuation of previous studies (see [10,11]). The object of our study is 77 cities-capitals of Russian regions that do not include Moscow, St. Petersburg, Grozny (Chechen Republic) and Magas (Republic of Ingushetia). The main source of information is the official statistical data from the collections of the Federal State Statistics Service of Russia "Regions of Russia - the main socio-economic indicators of cities" in the period 2002-2013. We first normalize indicators of the socio-economic development level of the cities. Finally, the classification of cities - capitals is done based on Minimum sum of squares clustering (MSSC) criterion and Variable neighborhood search (VNS). A new general method for