MULTIVARIATE STATISTICAL ANALYSIS OF REGIONAL ECONOMIC DISPARITIES AT DISTRICT LEVEL IN SERBIA

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Abstract

Starting from the fact that pronounced differences in the level of development of regions within a particular country can have a serious and significant (negative) impact on its socio-political stability, as well as the performance of the national economy as a whole, it is very important to create conditions for ensuring balanced and sustainable regional development. Due to its pronounced multidimensional nature, the analysis of regional economic disparities is a very complex and statistically demanding task. In this paper, a multivariate methodological framework for the classification of districts in Serbia according to the achieved level of economic development, into internally-homogeneous / externally-heterogeneous groups, based primarily on the application of hierarchical agglomerative clustering procedure and examination of interdependencies between five selected relevant economic indicators, is presented. The statistical validity of the obtained "optimal" classification of districts is additionally tested and confirmed with the results of one-factor multivariate analysis of variance. The resulting categorization clearly and unequivocally confirms the presence of pronounced inequalities regarding the achieved level of economic development between NUTS 3 level territorial units in Serbia, and the existence of regional economic polarization, primarily in direction "developed north – undeveloped south".

Key words: multivariate statistical analysis, cluster analysis, MANOVA, economic
                     disparities, districts.

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МУЛТИВАРИЈАЦИОНА СТАТИСТИЧКА АНАЛИЗА РЕГИОНАЛНИХ ЕКОНОМСКИХ ДИСПАРИТЕТА НА НИВОУ ОКРУГА У СРБИЈИ

Апстракт

Полазећи од чињенице да изражене разлике у погледу степена развијености региона у саставу конкретне државе могу имати озбиљан и значајан (негативан) утицај на њену друштвено-политичку стабилност, као и резултате националне економије у целини, веома је важно створити услове за успостављање равномерног и одрживог регионалног развоја. Услед изражене мултидимензионалности, анализа регионалних економских диспаритета представља веома сложен и статистички захтеван подухват. Сходно наведеном, у овом раду представљен је мултиваријациони методолошки оквир за класификацију управних округа у Србији према достигнутом степену економске развијености, у интерно-хомогене / екстерно-хетерогене групе, заснован примарно на примени хијерархијске агломеративне процедуре груписања и истраживању међузависности између вредности пет релевантних економских показатеља. Статистичка валидност добијене „оптималне" класификације округа додатно је проверена и потврђена резултатима једнофакторске мултиваријационе анализе варијансе. Резултирајућа категоризација недвосмислено и јасно потврђује присуство израженихнеједнакости у погледу достигнутог нивоа економске развијености између територијалних јединица нивоа НСТЈ 3 у Србији и постојање регионалне економске поларизације, примарно у правцу „развијени север – неразвијени југ".

Кључне речи: мултиваријациона статистичка анализа, анализа груписања, MANOVA, економски диспаритети, управни окрузи.

INTRODUCTION

Generally, regional and development of national economy are processes that overlap and condition each other. The explanation of the previous statement is contained in the fact that pronounced differences in the level of development of regions can have a serious and significant (negative) impact on the socio-political stability of a country (Goletsis & Chletsos, 2011), as well as the performance of national economy, and vice versa. Emphasizing the "dependence" of the country and the efficiency of the entire economy on the economic structure and stability of its regions, Jakopin (2015) considers the economic development of regions as basis for the realization of national economic goals. Accordingly, inequalities in development, present between defined administrative-territorial units within the state, i.e. their identification and mitigation, represent one of the most important, but also the most complex socio-economic problems that development policy makers and state representatives today generally face (Rovan & Sambt, 2003; Maletić & Bucalo-Jelić, 2016; Stamenković & Savić, 2017).

Mainly manifested in the centralization and / or polarization of economic activity within particular territorial units within the state

(Mohiuddin & Hashia, 2012), the presence of regional development disparities is characteristic of both developed and, although at a greater extent, developing countries (Miljačić & Paunović, 2011). In that sense, as a transitional and developing country, the Republic of Serbia (RS) is characterized by very pronounced inter-regional and intra-regional development disproportions, with a tendency of their continuous increase (GRS, 2007; Winkler, 2012; Krstić & Vukadinović, 2011; Vukmirović, 2013). The seriousness and necessity of resolving the mentioned issue is confirmed by Article 94 of the Constitution of RS, which defines the care and concern for balanced and sustainable regional development, in accordance with the law, as a (legal) obligation of the state (NARS, 2006). However, although determining the level of development - categorization and typology of areas, represents one of the key pillars on which the successful implementation of the Regional Development Strategy of RS is based (GRS, 2009), it is necessary to emphasize that efficient classification of territories of different NUTS levels according to the degree of development, from a conceptual-methodological perspective, is actually a very demanding task (NARD, 2012). This complexity is primarily conditioned by the multidimensional nature of the concept of regional development, i.e. the need to take into account and consideration the impact of a large number of individual factors grouped within different development dimensions. However, although in the relevant literature the economic, social, ecological, infrastructural, demographic and educational dimensions stand out as the most frequently considered development dimensions, the issue of regional development is mainly related to economic dimension and investigation of its characteristic indicators (GRS, 2007; Bojović, 2010; Luczak & Just, 2020).

The apostrophized multidimensional character of the regional development concept conditioned the shift of the analytical framework from (traditional) one-dimensional monitoring of the values of large number of indicators of different development dimensions towards the application of sophisticated multidimensional methodological procedures, based on the exploitation of the analytical potentials of various multivariate statistical methods in the investigation of regional development and quantification of present asymmetries (Polednikova, 2014; Stamenković & Savić, 2017).

Accordingly, the examination of the degree of economic development of NUTS 3 level territorial units in RS, as a specific multivariate economic phenomenon, is the research subject in this paper. In the context of the defined subject, the following objectives are formulated: (1) the popularization of the application possibilities of multivariate statistical methods, specifically cluster analysis and MANOVA, in the domain of defined subject, both through independent and combined use with appropriate univariate statistical methods; and (2) the creation of a statistically based and evaluated classification of the observed territories into in-

ternally homogeneous / externally heterogeneous clusters, according to selected indicators of regional economic development. The practical contribution of the research is reflected in providing: (1) a clear and thorough demonstration of statistically valid application of cluster analysis and MANOVA in economic research; and (2) informative overview of the situation in terms of the achieved level of economic development of districts in RS, which can serve as a suitable basis for formulating appropriate measures within the regional economic development strategy and implementation of activities aimed at mitigating identified disparities.

RESEARCH BACKGROUND

The evaluation of achieved development of territorial units at different NUTS level within a specific country or group of countries, using different combinations of indicators of one or several development dimensions and classification of analyzed territories into appropriate groups, in order to identify (possibly) present regional disparities, represents a very attractive research area. In most cases, the empirical consideration of these research issues is based on the exploitation of the application potentials of cluster analysis (CA). The diversity and number of published scientific papers and conducted empirical studies (*Table 1*) unequivocally confirm the above stated observations.

Table 1. Comparative review of selected empirical studies

Author(s) / (year of publication)	Study symbol	Temporal scope (year)	Territorial units (NUTS / LAU level)	State(s)	Development dimension(s)
Lepojević, Bošković & Janković-Milić (2015)	s1	2012	LAU	SRB	Econ./Dem./Edu.
Brauksa (2013)	s2	Mixed	LAU	LVA	Econ./Soc.
Rovan & Sambt (2003)	s3	2001	LAU	SLO	Econ./Dem./Soc./Edu.
Avram & Postoiu (2016)	s4	'07 & '12	NUTS 2	EU–27	Econ./Edu.
Polednikova (2014)	s5	2010	NUTS 2	V4	Econ./Soc.
Michaelides, Economakis & Lagos (2006)	s6	2001	NUTS 2	GRE	Econ.
Stamenković, Veselinović & Milanović (2017)	s7	2011	NUTS 3	SRB	Dem./Edu.
Istrate & Horea-Serban (2016)	s8	2014	NUTS 3	ROU	Econ.
Kvičalova, Mazalova & Široky (2014)	s9	2011	NUTS 3	CZE	Econ./Soc.
Janković–Milić, Marković & Igić (2013)	s10	2011	NUTS 3	SRB	Econ./Dem.
Kurnoga-Živadinović & Sorić (2008)	s11	Mixed	NUTS 3	CRO	EU fonds
Aumayr (2006)	s12	2002	NUTS 3	EU–25	Econ./Dem.
Capriati (2005)	s13	2001	NUTS 3	ITA	R&D

Notes regarding the meaning of abbreviations used within column *Development dimension(s)*:
Economic (Econ.), *Social* (Soc.),
Demographic (Dem.), *Education* (Edu.), *Research & Development* (R&D), *Ecological* (Eco.),
Absorption of EU funds (EU funds).
Source: Authors

The meta-analysis of the content of multivariate studies presented in *Table 1* reveals a pronounced variability, in terms of spatial (territorial) and temporal scope of the analysis, as well as the selection of development dimension(s) and their indicators. In this sense, it is important to emphasize that precisely these differences represent the primary obstacle in ensuring the comparability of classification results obtained in different authors' studies. In addition, based on the detailed analysis and comparison of key methodological determinants of CA application within presented studies, following specifics are noticed:

- In contrast to the research based on individual application of non-hierarchical (studies marked as: s1, s2, s4, s6, s10, s13) or hierarchical agglomerative CA (studies marked as: s8, s9, s12), in a significant number of papers the specific approach in the implementation of CA, implying combined / complementary application of these two procedures, was used (studies marked as: s3, s5, s7, s11). The latter approach includes the use of results obtained through hierarchical CA as input parameters in the implementation of non-hierarchical CA, in order to compare the resulting classifications in terms of the structure of formed clusters and to increase objectivity in selecting final clustering solution.

- The implementation of non-hierarchical procedure is exclusively based on the use of k-means method. On the other hand, in studies in which a hierarchical procedure was applied, regardless of whether its individual or combined application is emphasized, Ward's method stands out not only as dominant one, but also the only method whose application possibilities were considered (studies marked as: s3, s5, s7, s8, s12). A similar remark characterizes the research conducted by Kvičalova et al. (2014), who apply the single-linkage method, but without an explanation for the specific choice made and consideration of other methods. Unlike the mentioned studies, Kurnoga-Živadinović & Sorić (2008) use a different methodological approach. In fact, these authors base the selection of "the most suitable" method on interpretability and visual impression of different clustering solutions, obtained by applying several hierarchical agglomerative methods.

- Preliminary analysis aimed at the detection of univariate and multivariate outlier(s) was conducted only by Stamenković et al. (2017), while multicollinearity analysis, important for the selection of variables to be used in CA, was performed within studies s4, s5, s9, s11, s13.

- In most of the analyzed papers, the quality evaluation of the hierarchical procedure results and, consequently, the selection of the "optimal" number of clusters are based exclusively on the subjective (mainly visual) impressions of the author(s) and selection of the (so-called) "most interpretable" solution. In that sense, in addition to the application of the criterion based on monitoring successive changes in values of distance measure between clusters that are merging, noted in studies conducted by Rovan & Sambt (2003), Kvičalova et al. (2014), and

Polednikova (2014), the real exception is the research conducted by Stamenković et al. (2017), in which there is an intensive use of various, statistically based criteria when deciding on the selection of the "optimal" number of clusters.

Finally, in contrast to the previously presented papers in which CA has a primary and independent "analytical role" in the realization of defined research objectives, there are scientific papers in which, for the purpose of better understanding the extent of regional development disparities, the "secondary role" in conducted multivariate empirical analysis is assigned to CA procedure (for example, see: Rovan, Malešić & Bregar, 2009; Goletsis & Chletsos, 2011; Stamenković & Savić, 2017). In these studies, CA results are used to evaluate the accuracy and quality of classification of the analyzed territorial units, which is determined on the basis of their ranking according to the values of the corresponding composite indicator, previously created using factor or principal component analysis. Starting from the analogy with research objective defined in this paper, similarities in terms of the territorial-temporal scope of data, but also the focus on economic development dimension and used indicators, among these papers, research conducted by Stamenković & Savić (2017) particularly stands out. More precisely, the mentioned authors use the non-hierarchical CA for the purpose of checking and verifying the structure of three clusters of districts in RS according to the achieved level of economic development in 2013. Initially, the classification of districts was conducted based on the subjective assessment of the authors and the analysis of determined ranks of individual districts according to the values of an innovative composite indicator, called the Economic Development Index (*IED*), which is previously created using factor analysis. The results obtained in elaborated research will be used as a basis for comparison and quality evaluation of CA classification presented in this paper.

RESEARCH METHODOLOGY FRAMEWORK

For the purpose of effective realization of formulated objectives, a complex research methodology, presented in *Figure 1*, is applied.

The presented research framework is based on the combined and complementary usage of CA and one-way MANOVA, aimed at the examination of interdependencies between individual economic indicators and the discovery of "natural", but hidden, grouping structure within the analyzed set of multivariate observations. In addition, primarily within preliminary data analysis and data preparation phase, the appropriate univariate statistical methods, has also been used. As it can be seen in the presented schematic representation, after the appropriate selection of representative individual indicators of regional economic development, that special attention is dedicated to the examination of the degree of fulfill-

ment of the statistical assumptions upon which the valid application of the mentioned multivariate statistical methods is based. The presented data analysis and all the necessary statistical calculations were carried out using the statistical software package *IBM SPSS Statistics* (version 20) and *Microsoft Office Excel*.
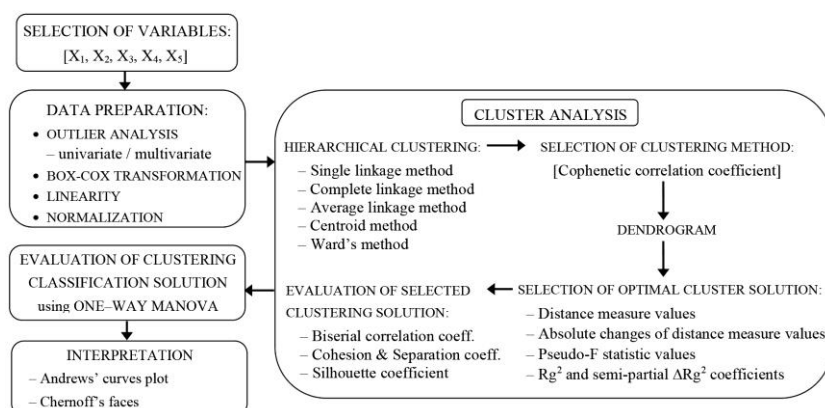

Figure 1. Schematic representation
of the used research methodology framework
Source: Authors

Variables, Sources of Data, and the Temporal-Spatial Scope
of the Research

Using the official territorial organization, defined by the nomenclature of statistical territorial units in Serbia, the spatial scope of the research covers territories for 24 administrative districts and Belgrade area (NUTS 3 level). In addition, districts within the Autonomous Province of Kosovo and Metohija are not included in the conducted research, because the Statistical Office of RS (SORS) provides no information for these territories since 1999. Starting from the already stated similarity between research objectives, in order to provide suitable basis for the comparison of the obtained results, in the selection of particular indicators of regional economic development and time coverage of data, the authors of this paper relied on the choices that Stamenković & Savić (2017) made in their research. In other words, as suggested and explained by mentioned authors, secondary data for the following five economic indicators were collected and analyzed, for each of the covered territories: *Number of SMEs per 1000 inhabitants* (X_1), *Gross value added per capita* (X_2), *Employment rate* (X_3), *Unemployment per 1000 inhabitants* (X_4), *Average wage per employee* (X_5). Data were obtained from complex publications named *Municipalities and Regions in RS* (SORS, 2014) and *Report on Small and Medium Enterprises and Entrepreneurship* (ME & NARD, 2014). All

collected data refer to year 2013. In order to neutralize and/or mitigate the impact of the total demographic mass of individual districts on variables' values, and therefore the classification results, within the data preparation phase, the authors performed calculations necessary for obtaining values expressed as per capita, per 1000 inhabitants, or percentage participation.

EMPIRICAL RESULTS

Starting from the fact that results of CA can be quite sensitive to the presence of outliers, before its implementation, a preliminary data analysis was performed in order to investigate the presence of one-dimensional and multivariate non-standard observations. The presented box-plots for individual variables (*Figure 2*) indicate the presence of outliers (marked with stars) in case of variables X_2, X_3, X_5, while variable X_1 contains one suspected outlier value (marked with circle). In addition, the comparison of calculated Mahalanobis distance values for each district (ranging from 0.61 to 13.34) and value of 97.5 percentile of chi-square distribution ($\chi^2_{5;\,0.975} = 12.83$), as a critical value, reveals the presence of one multivariate outlier (i.e., South Banat district).
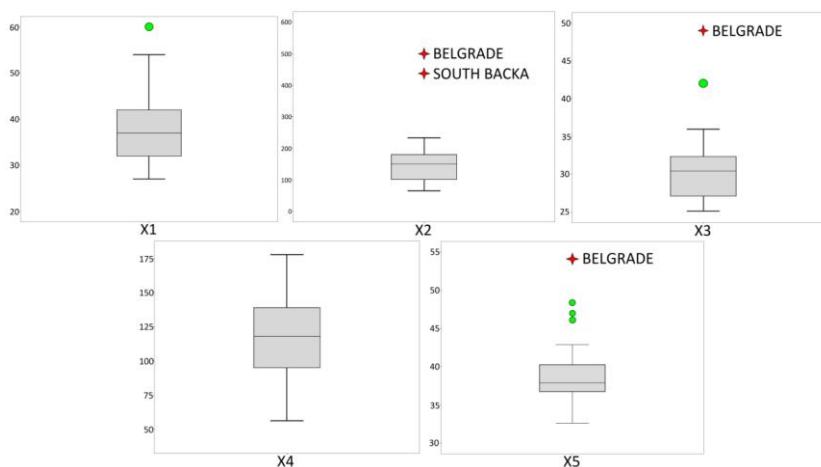

Figure 2. Box plots for original variables
Source: Authors

In order to mitigate and / or eliminate the impact of detected outliers, a *Box-Cox* transformation of the original values of variables X_1, X_2, X_3 and X_5 was performed. Subsequent outlier analysis confirmed the positive effects of the transformation carried out, since the presence of non-standard data was not identified at either univariate or multivariate level. Finally, since selected indicators are expressed in different measurement

units, their normalization was conducted using the *min-max* method, thus converting original and transformed values into normalized values ranging from 1 to 10. In accordance with the guidelines related to the application of CA, different methods of hierarchical procedure were implemented using the squared Euclidean distance measure. By examining the degree of the quantitative agreement between the corresponding elements of the original and derived distance matrices for obtained solution of each method, the appropriate values of cophenetic correlation coefficient (r_{cp}), as an indicator of the degree of quality of individual solutions, were calculated (*Table 2*). For further analysis, the solution obtained using average linkage method is selected, since it has the highest r_{cp} value. The summary results of hierarchical agglomerative clustering of 25 districts in Serbia, for the selected five indicators of regional economic development, are presented in *Figure 3*.

Table 2. Cophenetic coefficients for used hierarchical methods

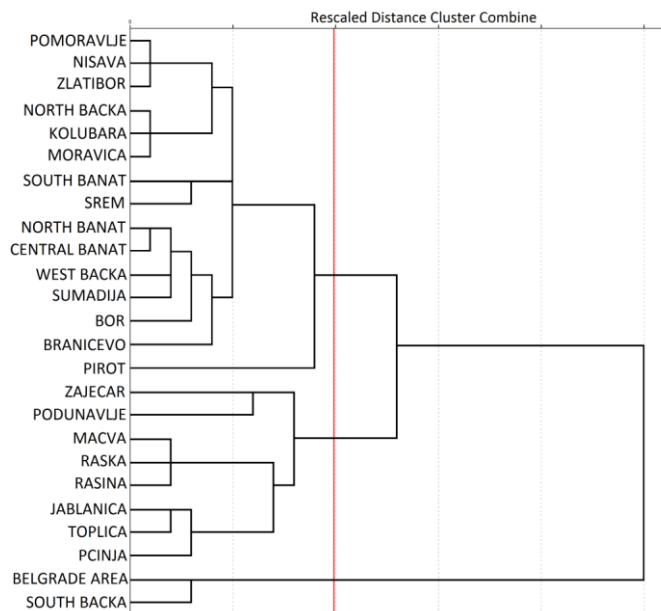| Hierarchical methods	(r_{cp})
Ward's	0.5324
Centroid	0.6498
Single linkage	0.5885
Complete linkage	0.0334
Average linkage	**0.6597**

Source: Authors

Figure 3. Dendrogram
Source: Authors

In order to identify the "optimal" classification of districts, regarding the number of clusters and their structure, the values of, in *Figure 1* listed, optimality criteria were analyzed. More precisely, by analyzing the tendency of distance measure values and size of corresponding absolute changes during the agglomeration process (*Figure 4*), their first drastic increase is noticed at the moment of forming a solution with 2 clusters. Comparing the pseudo *F*-statistic values (*Figure 5, left*), R_g^2 and ΔR_g^2 coefficients (*Figure 5, right*), calculated for solutions ranging from 7 to 2 clusters, step 23 of agglomeration process, during which a solution with 2 clusters is forming, is also recognized as a step in which a significant change in the values of these optimality criteria has occurred.
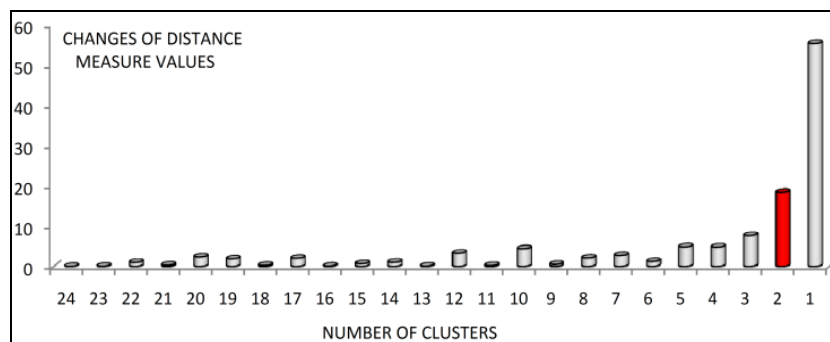

Figure 4. Distance measure values' absolute changes
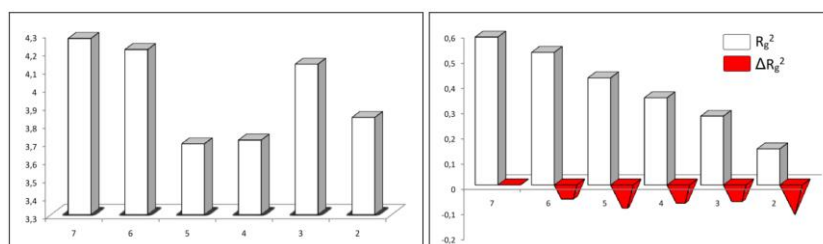*for different CA solutions*
Source: Authors

Figure 5. Pseudo F-statistics (left) and R_g^2 & ΔR_g^2 (right)
for different CA solutions
Source: Authors

The solution of the hierarchical procedure with three clusters is identified as the optimal one since it precedes the aforementioned changes in the values of the used criteria. Statistical evaluation of validity of the obtained CA solution is performed based on the values of bi-serial

correlation, cohesion, separation and silhouette coefficients, calculated for solutions ranging from 7 to 2 clusters (*Table 3*).

Table 3. Coefficients for evaluation of quality of selected clustering solution

Coefficients	number of clusters					
	7	6	5	4	3	2
Bi-serial correlation	0.474	0.477	0.496	0.521	0.529	-
Cohesion	3984.01	4036.82	4599.27	5464.32	6688.05	21595.43
Separation	28418.46	28365.65	27803.20	26938.15	25714.43	10807.04
Silhouette	0.444	0.397	0.389	0.418	0.507	-

Source: Authors

The values of these coefficients unambiguously confirm the classification of districts within three clusters as the most acceptable alternative regarding the achieved level of internal homogeneity and external heterogeneity compared to other possible clustering outcomes, since it is characterized by the highest values of bi-serial correlation and silhouette coefficients. The drastic rise/decrease of cohesion/separation coefficient values, respectively, recorded for the two-cluster solution, support previous conclusion.

The final quality evaluation of hierarchical CA results was carried out using one-way MANOVA. In this context, the independent variable, (i.e. factor – level of regional economic development) has 3 treatments (clusters), while the used indicators represent a multidimensional dependent variable. The tested alternative hypothesis claims that there is a statistically significant difference between average values of at least two multidimensional populations.

Since MANOVA is a parametric multivariate statistical method, using the pre-processed data in CA, the fulfillment of the following assumptions for its valid application, is checked and verified: (a) multivariate and univariate normality of dependent variables' distribution, (b) the existence of a statistically significant linearity and absence of multicollinearity, and (c) homogeneity of covariance matrices of multivariate observations.

The results of conducted *one-way* MANOVA, particularly *Wilk's lambda* test statistic ($\Lambda^* = 0.093$), its *F* approximation ($F_{(10;36)} = 8.182$) and the resulting *p*-value = 0.000, at the significance level $\alpha = 0.05$, suggest the acceptance of alternative hypothesis, since *p*-value is smaller than α. Given the relatively small size of the sample ($n = 25$), as well as the unequal size of clusters, formulated conclusion was confirmed by the values of *Pillai's Trace* test statistic (V = 0.986), its *F* approximation ($F_{(10;38)} = 3.697$) and realized *p*-value (0.002), since it is considered as more robust indicator in terms of the above mentioned limitations.

INTERPRETATION OF THE CLASSIFICATION OF DISTRICTS

Multivariate graphical representations, given in the form of *Andrews' curves* and *Chernoff's faces* (*Figure 6*) provide the additional visual verification of the quality of the created classification of districts according to the values of selected economic indicators. More precisely, created as a result of coding and representing multivariate data by a finite Fourier series, the distribution of *Andrews' curves* within clusters clearly indicates a high level of their internal homogeneity and external heterogeneity. *Chernoff's faces*, constructed on the basis of average values of economic indicators for individual clusters, even more accurately present differences in average degree of economic development of districts within identified clusters.

A visual presentation of distribution of districts within identified clusters, supplemented by the average values of the used indicators of economic development, both at the level of individual clusters and at the national level, is given in *Figure 7*.
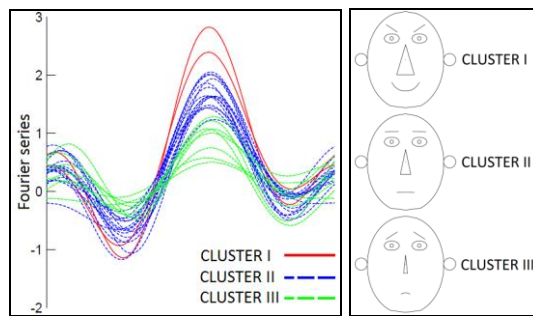

Figure 6. Andrews' curves (left) and Chernoff's faces (right)
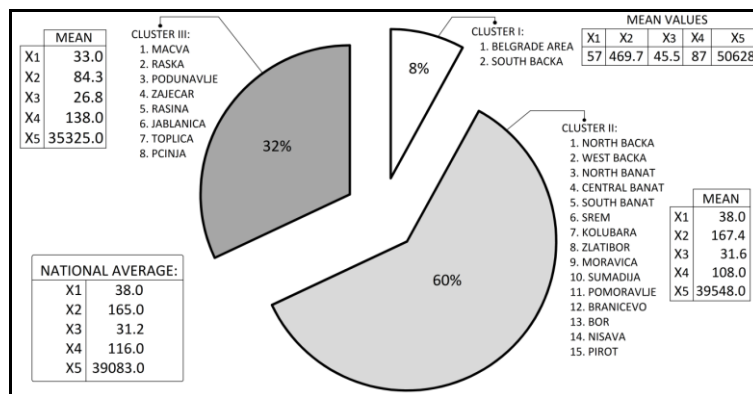*for individual clusters*
Source: Authors

Figure 7. Classification structure and average values of economic
indicators per clusters
Source: Authors

Also, the minimum and maximum values of the original economic indicators at the level of individual clusters are listed in *Table 4*. By comparing the presented average, as well as min and max values of indicators with the corresponding national average values, the indicative (descriptive) names of the formed clusters of districts were determined as follows: Cluster I – high level of economic development (*haughty Chernoff's face*); Cluster II – medium level of economic development (*indifferent Chernoff's face*); Cluster III – low level of economic development (*sad Chernoff's face*).

Table 4. Min-max interval values of original indicators per clusters

Variables (symbols)	min-max interval values		
	Cluster I	Cluster II	Cluster III
X_1	54-60	29–50	27–39
X_2	438.6–500.7	127.1–234.2	64.7–121.7
X_3	42–49	27.1–36	25.1–30
X_4	65–108	56–146	86–178
X_5	47153–54103	34459–47960	32624–37633

Source: Authors

The presented CA classification unequivocally confirms the presence of pronounced inequalities regarding the achieved level of economic development in 2013, between the NUTS 3 territories in RS. In addition, starting from the structure of identified clusters, the existence of regional economic polarization, primarily in relation developed north and undeveloped south, is clearly noticeable. These findings were verified by calculated ratios of average values of indicators for each pair of clusters (*Table 5*).

Table 5. Ratios of average values of economic indicators
for each pair of clusters

Variables	Clusters	I	II
X_1	II	1 : 1.50	
	III	1 : 1.73	1 : 1.15
X_2	II	1 : 2.81	
	III	1 : 5.57	1 : 1.99
X_3	II	1 : 1.44	
	III	1 : 1.70	1 : 1.18
X_4	II	1 : 0.81	
	III	1 : 0.63	1 : 0.78
X_5	II	1 : 1.28	
	III	1 : 1.43	1 : 1.12

Source: Authors

Finally, due to differences in terms of spatial–temporal data coverage and other previously listed methodological specifics, the comparabil-

ity of the obtained results with similar studies is generally not feasible. However, thanks to the adjustments made within the Section 3, the mentioned barriers were removed, and the possibility of comparison with the results obtained by Stamenković & Savić (2017) is provided. In that sense, it is important to emphasize that by applying the cluster analysis of districts according to the degree of economic development in this paper, completely identical classification results were obtained, both in terms of number and structure of formed clusters, compared to the results obtained by mentioned authors.

CONCLUSION

According to the formulated research objectives in this paper, a complex multivariate statistical approach, intended for classification of districts in RS, according to their level of economic development in 2013, is presented. Based on the statistically valid and combined application of CA and MANOVA, the proposed multivariate statistical approach in the analysis of regional economic disparities is characterized by the following practical and methodological specifics, compared to most studies of similar character:

- Contrary to the approach based on monitoring the values of individual indicators and separate interpretation of a number of univariate classifications, the proposed methodological framework in this paper, based on multivariate aggregation of information contained within the five economic indicators used, enables the creation of only one, common, classification of analyzed territories, which represents a more suitable basis for understanding the issues and the extent of identified regional disparities, the formulation of corrective measures and the monitoring of the effects of their implementation.

- Indirectly, since it is not defined as the primary objective of this research, the results of the conducted hierarchical CA confirm the validity and practical usability of *IED* composite indicator, proposed by Stamenković & Savić (2017), created for the precise quantification of the achieved degree of economic development of districts in Serbia. More precisely, the resulting classifications of these two, essentially very different, multivariate approaches are identical.

- From the perspective of CA application, in contrast to the subjective ("by default") implementation of Ward's method when conducting a hierarchical agglomerative procedure and selection of the so-called "more interpretable" solution, with the presented methodological framework, the importance of using statistically based criteria in choosing the "optimal" hierarchical method and clustering solution, was demonstrated and emphasized in order to ensure objectivity and scientific verification of results.

▪ The presented research is based on a thorough verification of assumptions on which the statistically valid implementation of used multivariate methods is based. The importance of this methodological specificity comes from the fact that neglecting or implementing the preliminary analysis in an incomplete manner is one of the key shortcomings of most of the previously conducted studies in the literature.

▪ The statistical validity of the created classification of districts is additionally confirmed by the results of one-factor MANOVA. In this way, through the combined application of different multivariate methods, more reliable research results were obtained.

The obtained classification, complemented by detailed interpretation and informative, but rarely used, specific multivariate graphical representations unequivocally confirms the presence of pronounced regional economic asymmetries among NUTS 3 territorial units in RS in 2013. More precisely, based on the results of CA, a statistically valid typology of districts in Serbia was formed, consisting of three different clusters, i.e. groups of districts with high, medium and low level of economic development. In addition, based on the structure of identified clusters, the existence of regional economic polarization, primarily in relation "developed north–undeveloped south" is clearly noticeable.

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МУЛТИВАРИЈАЦИОНА СТАТИСТИЧКА АНАЛИЗА РЕГИОНАЛНИХ ЕКОНОМСКИХ ДИСПАРИТЕТА НА НИВОУ ОКРУГА У СРБИЈИ

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Резиме

Полазећи од чињенице да изражене разлике у погледу степена развијености региона у саставу конкретне државе могу имати озбиљан и значајан (негативан) утицај на њену друштвено-политичку стабилност, као и резултате националне економије у целини, веома је важно створити услове за успостављање равномерног и одрживог регионалног развоја. Сходно наведеном, неравномерности у развоју, присутне између дефинисаних административно-територијалних јединица у саставу државе, односно њихово идентификовање и ублажавање, представљају једно од најважнијих, али и најкомплекснијих друштвено-економских проблема са којим се творци развојних политика и представници државе данас, уопштено гледано, суочавају.

Анализа регионалних економских диспаритета представља веома сложен и захтеван подухват у концептуално-методолошком смислу. Наведена сложеност примарно је условљена мултидимензионом природом концепта регионалне развијености, односно, неопходношћу узимања у обзир и разматрања утицаја великог броја појединачних фактора груписаних унутар различитих развојних димензија. Апострофирани мултидимензиони карактер концепта регионалне раз-

вијености условио је померање аналитичког оквира од (традиционалног) једнодимензионог праћења вредности великог броја појединачних показатеља различитих развојних димензија ка развоју и примени разноврсних софистицираних мултидимензионих методолошких поступака заснованих на експлоатацији апликативних потенцијала метода мултиваријационе статистичке анализе у домену истраживања регионалних карактеристика и квантификовању присутних асиметричности.

Сходно наведеном, у овом раду представљен је мултиваријациони методолошки оквир за класификацију управних округа у Србији према достигнутом степену економске развијености, у одговарајуће интерно-хомогене / екстернохетерогене групе, заснован примарно на примени хијерархијске агломеративне процедуре груписања и истраживању међузависности између вредности пет релевантних економских показатеља. Статистичка валидност „оптималне" класификације округа додатно је проверена и потврђена резултатима једнофакторске мултиваријационе анализе варијансе. Резултирајућа типологија и категоризација јасно и недвосмислено потврђују присуство израженим неједнакости у погледу достигнутог нивоа економске развијености између територијалних јединица нивоа НСТЈ 3 у Србији и указују на присуство регионалне економске поларизације, примарно у правцу „развијени север – неразвијени југ".

Примењени мултиваријациони методолошки приступ омогућава јасно, информативно, објективно и статистички валидано сагледавање степена економске развијености округа у Србији, обезбеђујући на тај начин поуздану и погодну основу за квалитетно редефинисање и ефикасну примену одговарајућих мера у оквиру стратегије регионалног развоја усмерених на ублажавање присутних мера и веома израженим економских асиметричности на простору Републике Србије.