A MULTIVARIATE ANALYSIS OF CROATIAN COUNTIES ENTREPRENEURSHIP

Elza Jurun
University of Split/Faculty of Economics Split
21000 Split, Cvite Fiskovića 5
E-mail: elza@efst.hr

Nada Ratković
University of Split/Faculty of Economics Split
21000 Split, Cvite Fiskovića 5
E-mail: nada.ratkovic@efst.hr

Abstract

In the focus of this paper is a multivariate analysis of Croatian Counties entrepreneurship. Complete data base available by official statistic institutions at national and regional level is used. Modern econometric methodology starting from a comparative analysis via multiple regression to multivariate cluster analysis is carried out as well as the analysis of successful or inefficacious entrepreneurship measured by indicators of efficiency, profitability and productivity. Time horizons of the comparative analysis are in 2004 and 2010. Accelerators of socio-economic development - number of entrepreneur investors, investment in fixed assets and current assets ratio in multiple regression model are analytically filtered between twenty-six independent variables as variables of the dominant influence on GDP per capita in 2010 as dependent variable. Results of multivariate cluster analysis of twenty-one Croatian Counties are interpreted also in the sense of three Croatian NUTS 2 regions according to European nomenclature of regional territorial division of Croatia.

Key words: *Croatian Counties, Entrepreneurship, Comparative analysis, Multiple regression model, Multivariate cluster analysis*

1. INTRODUCTION

During the last decades the entrepreneurship development has been generator of the entire social-economic development all over the world. As a small country, recently emerged from the war economy, Croatia has additional difficulties in the process of involvement in the global economy. Financial analysis of entrepreneurs shows that the income realized in 2010 is the lowest one in the last eight years which causes declining economy activities and increasing socio-economic disparities

between Croatian Counties**.** To achieve the goal of strengthening economic position of Croatian entrepreneurship, the increase economic efficiency of Croatian enterprises is needed. According to the administrative-territorial classification, the Republic of Croatia is divided into 21 counties and into 126 towns and 429 municipalities. The Republic of Croatia is also divided into three statistical regions: Northwestern Croatia, Central and Eastern (Panonian) Croatia, and Adriatic Croatia. These regions are a part of European nomenclature of regional territorial division (NUTS 2) and are important in relation to the structure and use of resources from different EU regional development funds.

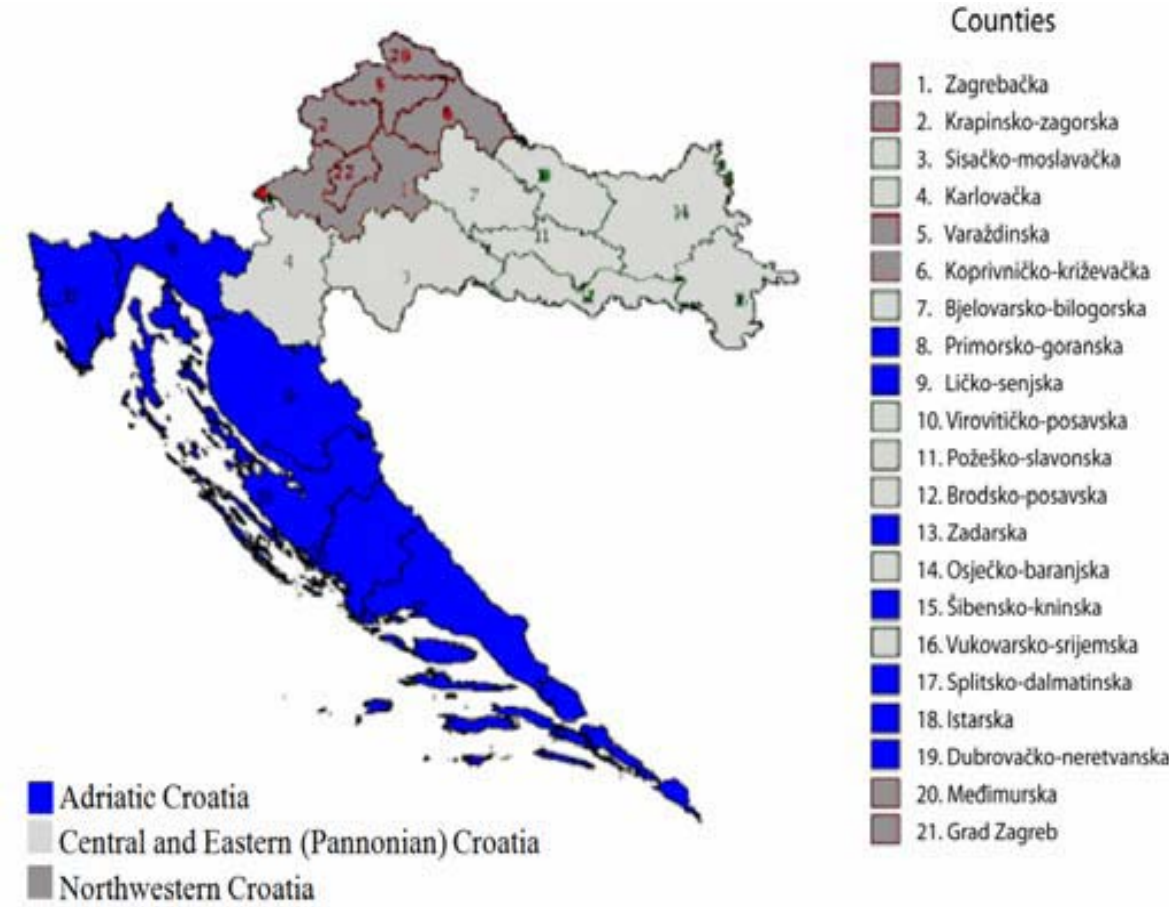

Figure 1:Croatian NUTS 2 regions divided into 21 Croatian Counties

Northwest Croatia includes six Counties, which takes 15% of Croatian territory and belongs to it 37.3% of Croatian population. Central and East (Pannonian) Croatia includes eight Counties, which takes 41% of Croatian territory and belongs to it 30.5% of Croatian population. Adriatic Croatia includes seven Counties, which takes 44% of Croatian territory and belongs to it 32.2% of Croatian population.

This paper is organized as follows. After introduction the second part of the paper presents the methodology use for the comparative analysis. Time horizons of the comparative analysis are 2004 and 2010 years. It is necessary to emphasize that the whole methodological procedure is conducted using the data base of real regional indicators. The analyzing procedure pretends to be comprehensive using the complete data base dealing with Croatian Counties entrepreneurship available by official statistics institutions at national and regional level. Comparative analysis is especially scoped to those counties whose indicators of efficiency, profitability and productivity shows the worst business performance, the best one and the biggest changes in Croatian Counties entrepreneurship.
Next section is devoted to multiple regression model estimation. The model pretends to be a useful base for estimate causes and consequences of successful or inefficacious entrepreneurship of each Croatian County. The topic of the fourth section is multivariate cluster analysis of 21 Croatian Counties according to 26 variables which are mostly indicators of business performance.
The final section is dedicated to conclusion remarks.

2. COMPARATIVE ANALYSIS

This research pretends to be comprehensive using the complete data base dealing with Croatian Counties entrepreneurship available by official statistic institutions at national and regional level. Theoretical econometrics and modern econometric methods and techniques suggest the use of specific performance indicators. In Croatian official statistic institutions some of them are in the entrepreneurship monitoring system and only they have time series for each Croatian County and for the chosen observation time.
Namely, to measure the success of entrepreneurship for each Croatian County as well as for Republic of Croatia as a whole six performance indicators have been available: Total revenue per employee, Net profit per employee, Revenues versus Expenditures, Profitability of turnover, Profitability of assets and Profitability of own equity.
As it can be seen from Table 1 entrepreneurship financial results obtained in each Croatian County still show an unbalanced socioeconomic development, which is reflected in lag of some counties compared to other once as well as in relation to the performance indicators of the entire Republic of Croatia.
The period since 2000 to 2010 has been taken for this research because the overall results for 2011 are not available. The year 2004 has been chosen for the base because the Croatian entrepreneurship as a whole has achieved positive financial results only in the period 2000 to 2004. Best results have been achieved in 2002. However, in the mentioned period at one dollar invested in employee always the same income of 2.30 Croatian Kuna has been reached what is undoubtedly worrying.

Table 1: Comparative Analysis Results of Performance Indicators of Entrepreneurship for each Croatian County in 2004 and 2010.

COUNTY	TOTAL REVENUE PER EMPLOYEE (000)	INDEX 2010.04 %	NET PROFIT PER EMPLOYEE (000)	INDEX 2010.04 %	REVENUES/ EXPENITURES (u %)	INDEX 2010.04 %	RENTABILITY OF TURNOVER (%)	INDEX 2010.04 %	RENTABILITY OF ASSETS %	INDEX 2010.04 %	RENTABILITY OF OWN EQUITY (%)	INDEX 2010.04 %
BJELOVAR-BILOGORA	421	-4.97	-4.756	-238.62	99.4	-1.8	-1.1	-2.0	-0.9	-1.8	-3.9	2.1
BROD-POSAVINA	445	-2.41	-8.515	20.54	98.8	0.1	-1.9	-0.2	-1.5	0.2	-5.9	5.6
DUBROVNIK-NERETVA	443	-4.11	-28.411	-399.49	94.6	-8.3	-6.4	-8.8	-2.3	-3.7	-6.3	2.1
CITY OF ZAGREB	926	2.09	7.138	-76.07	102	-3.1	0.8	-3.0	0.4	-1.9	0.9	-4.5
ISTRA	690	9.70	17.406	-59.04	1036	-5.8	2.5	-4.8	1.2	-3.2	3	-8.5
KARLOVAC	461	1.77	20.382	10.54	106	0.8	4.4	0.5	3.3	-0.5	7.3	-6.9
KOPRIVNICA-KRIŽEVCI	528	1.15	2.516	8.19	1012	0.3	0.5	0.0	0.4	-0.1	1.1	-1.1
KRAPINA-ZAGORJE	551	10.20	-492	-18363.7	1006	-0.7	-0.1	-0.7	-0.1	-0.6	-0.3	-138.3
LIKA-SENJ	363	1.68	-6.894	188.17	98.7	-1.1	-1.9	-1.2	-0.6	-0.3	-1.3	0.2
MEĐIMURJE	414	1.72	5.772	120.09	1021	0.9	1.4	0.7	1.2	0.5	3.4	-2.8
OSIJEK-BARANJA	551	2.99	-23.847	676.96	96.3	-3.4	-4.3	-3.6	-2.7	-2.1	-10.8	5.1
POŽEGA-SLAVONIJA	383	4.36	-5.687	-719.25	99	-1.5	-1.5	-1.8	-1	-1.2	-4.2	3.0
PRIMORJE-GORSKI KOTAR	540	-2.35	-12.042	-30.44	98.6	1.5	-2.2	1.4	-1.4	1.4	-6	7.3
SISAK-MOSLAVINA	486	17.68	-44.812	748.92	93.2	-5.6	-9.2	-7.7	-7.9	-6.6	-30.9	24.0
SPLIT-DALMATIA	520	-9.57	-17.765	14.34	97.5	0.1	-3.4	-0.3	-1.9	0.7	-10.6	10.2
ŠIBENIK-KNIN	509	-12.39	-24.583	-34.29	95.9	3	-4.8	3.1	-2.2	2.4	-9.9	12.3
VARAŽDIN	556	2.96	-623	-8292.69	1004	-1.9	-0.1	-1.7	-0.1	-1.8	-0.3	-143.0
VIROVITICA-PODRAVINA	516	17.27	-6.546	107.51	99.2	-0.2	-1.3	-0.5	-0.9	-0.3	-2.4	1.7
VUKOVAR-SRIJEM	535	9.41	418	5082.87	1005	-1.9	0.1	-1.8	0.1	-1.2	0.1	69.6
ZADAR	534	-9.18	-28.816	354.55	95.6	-3.7	-5.4	-4.3	-2.4	-1.6	-10.1	7.2
ZAGREB COUNTY	733	-5.54	6.944	-9.46	1018	-0.1	0.9	-0.2	0.8	-0.5	2.2	-2.3
REPUBLIC OF CROATIA	696	16.78	-1.934	-116.08	1007	-2.2	-0.3	-2.3	-0.2	-1.6	-0.4	-1.9

Source: Author's calculation according to the data by national statistic institutions

According to the indicator total revenue per employee it is interesting that the best results in both observed years has been achieved in City of Zagreb and the worst in County Lika-Senj.

Performance indicator Revenues versus Expenditures in 2010 shows that revenues exceeds expenditures in 9 counties while in 12 counties expenditures have been higher than revenues. This performance indicator was the best in County of Karlovac where 106 Croatian Kuna of revenue has been realized per 100 Croatian Kuna of expenditures. The worst entrepreneurship success according this performance indicator has been realized in County of Sisak-Moslavina where only 93.18 Croatian Kuna of revenue has been realized per 100 Croatian Kuna of expenditures.

In 2010 entrepreneurs in County of Karlovac have realized the best results according all the performance indicators except total revenue per employee. All the performance indicators put County of Lika-Senj to the end of the scale of entrepreneurship success.

The entrepreneurs success by Croatian Counties in 2010 measured with available financial performance indicators have been undoubtedly very different, worst than in 2004. Unfortunately it is also the lowest entrepreneurship success in the last decade.

Generally, all the indicators of entrepreneurship success show the level and quality of the financial structure of Croatian economy which is not sufficient to create the material basis for new investments in modernization and technological development.

3. MULTIPLE REGRESSION MODELING

As it mentioned above, first of all the classic econometric approach has been used to estimate indicators for multivariate analysis of the Croatian Counties entrepreneurship.
This methodological background has been also founded on the entire data base set offered by entrepreneurship monitoring system implementing by Croatian official statistic institutions.
As well as the coverage, time horizons of this multiple regression modeling had been also defined according Croatian official statistics frames. It is limited and focused multiple regression analysis to regressors variables (V) presented in Table 2.
V27- GDP per capita as the central point of the whole research has been created as the regresand variable of the multiple regression model.
Namely, such a modeling seeks to show how the set of selected group of twenty- six regressors variables has explained the comprehensively GDP per capita growth. For this purpose twenty-one annual data of each variable for each county have been used for the period from January to December 2004 as well as for the same period 2010 (a total of 1134 numeric items).

Table 2: Multiple regression model variables for period 2004 to 2010

MULTIPLE REGRESSION MODEL VARIABLES FOR PERIOD 2004 TO 2010.			
V1	Croatian counties	V15	Share in total Croatian investments
V2	Number of employees	V16	Total expenses per employee
V3	Total revenue per employee	V17	Net average monthly salaries per employee
V4	Net profit/loss per employee	V18	Net average monthly salary ratio towards Croatian average
V5	Revenues per expenditures		
V6	Turnover profitability	V19	Total assets
V7	Assets profitability	V20	Long term assets percentage
V8	Own capital profitability	V21	Current assets percentage
V9	Import in euro	V22	Total revenue after taxes
V10	Export in euro	V23	Earning after taxes
V11	Number of entrepreneurs	V24	Loss after taxes
V12	Number of entrepreneurs investors	V25	Consolidated financial results
V13	Entrepreneurs investors ratio	V26	Total expenses
V14	Fixed assets investments	V27	GDP per capita

Source: www.dzs.hr, www.fina.hr

Multiple regression modeling procedure has been estimated using Statistical Package for the Social Sciences while the regressors variables are selected by Stepwise method.

Table 3: Model summary for 2010 year

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,915[a]	,837	,808	1110,16906	1,916

a. Predictors: (Constant), Fixed assets investments, Current assets percentage, Number of entrepreneurs investors
c. Dependent Variable: GDP per capita in euro.

Source: www.dzs.hr, www.fina.hr

Table 4: Variance analysis results for 2010 year

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,077E8	3	3,591E7	29,138	,000[a]
	Residual	2,095E7	17	1232475,350		
	Total	1,287E8	20			

a. Predictors: (Constant), Fixed assets investments, Current assets percentage, Number of entrepreneur investors
c. Dependent Variable: GDP per capita in euro.
Source: www.dzs.hr, www.fina.hr

Table5: Estimated parameters, confidence intervals and collinearity statistics for 2010 year

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	10954,923	1434,907		7,635	,000	7927,534	13982,312		
	Number of entrepreneurs investors	1,122	,165	,760	6,815	,000	,775	1,469	,769	1,300
	Investment in fixed assets	-,561	1,085	-,055	-,517	,612	-2,850	1,728	,847	1,180
	Current assets percentage	-92,193	32,248	-,296	-2,859	,011	-160,229	-24,156	,895	1,117

c. Dependent Variable: GDP per capita in euro.
Source: www.dzs.hr, www.fina.hr

$$\hat{y}_i = 10954{,}923 + 1{,}122x_{1i} - 0{,}561x_{2i} - 92{,}193x_{3i} \tag{1}$$

y – Gross domestic product per capita (in 000 euro)

x_1 – Number of entrepreneur investors (one entrepreneur)

x_2 – Investment in fixed assets (in milion Croatia kuna)

x_3 – Current assets percentage

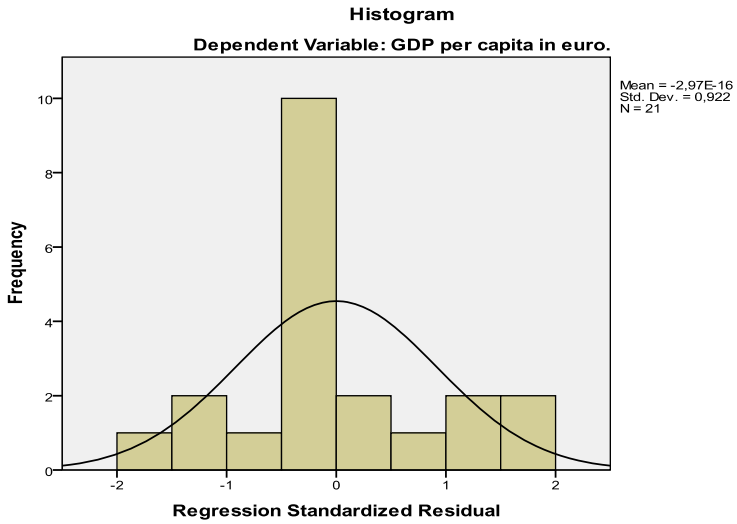

Figure 2:Regression standardized residual histogram. Source: www.dzs.hr, www.fina.hr

Durbin-Watson test value in Table 3 indicates that there is no residuals autocorrelation as well as Figures 2 and 3 prove absence of heteroscedasticity problem. Collinearity indicators from Table 5 shows that there is no multicollinearity problem. That's why model is valid according the econometric criteria.

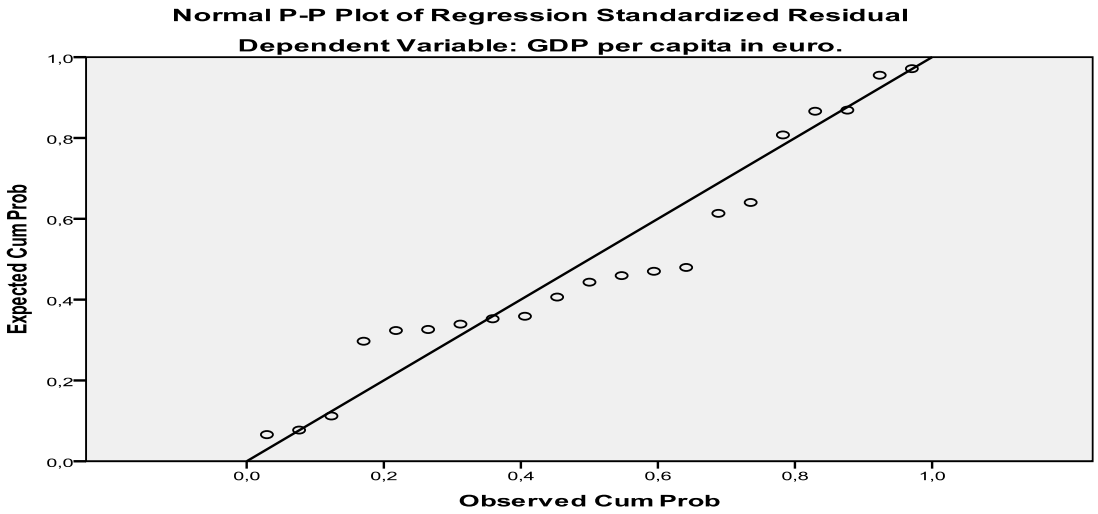

Figure 3:Normal P-P plot of regression standardized residual. Source: www.dzs.hr, www.fina.hr

Previously, the entire procedure of multiple regression modeling has been carried out in the same manner for the year 2004. The result of this modeling is the following equation:

$$\hat{y}_i = 7484{,}584 + 0{,}692x_{1i} - 0{,}2241x_{2i} - 70{,}669x_{3i} \tag{2}$$

y – Gross domestic product per capita (in 000 euro)

x_1 – Number of entrepreneur investors (one entrepreneur)

x_2 – Investment in fixed assets (in milion Croatia kuna)

x_3 – Current assets percentage

Comparative analysis of linear multiple regression equation as modeling results for 2004 and 2010 gives the conclusion that the independent variables in both equations are completely the same. So, for entire observed period of research Number of entrepreneur investors, Investments in fixed assets and Current assets percentage play a role of entrepreneurship generators. Thus, these three variables are also possible instrument of control and planning of entrepreneurship, both within each county and at the level of the national economy. Therefore, it is very important for the research to examine the particular impact of each regressor variable defined by econometric modeling as a generator of entrepreneurship on the regresand variable GDP per capita for each Croatian County. For this purpose, standardized regression coefficients from the equations for 2004 and for 2010 have been compared.

$$\hat{y}_{(2004\ .)} = 0{,}760\ x_{1i} - 0{,}055\ x_{2i} - 0{,}296\ x_{3i} \tag{3}$$

$$\hat{y}_{(2010\ .)} = 0{,}708\ x_{1i} - 0{,}028\ x_{2i} - 0{,}363\ x_{3i} \tag{4}$$

y – Gross domestic product per capita (in 000 euro)

x_1 – Number of entrepreneur investors (one entrepreneur)

x_2 – Investment in fixed assets (in milion Croatia kuna)

x_3 – Current assets percentage

Analysis of the partial impact of each regressor variable on GDP per capita in Croatian Counties leads to the conclusion that the most important entrepreneurship generator is the number of entrepreneur investors. Furthermore, this partial impact on the growth of GDP per capita remains stable with its increase influence of above 0.7 standard deviations per unit change during the entire research period.

Comparison of the standardized regression coefficients in the under review period indicates that Number of entrepreneur investors has the most significant and positive impact on GDP per capita growth. However, this influence is 7.5% lower in 2010. Namely, in 2010 the increase of one standard deviation in Number of entrepreneur investors leads to GDP per capita growth of 0.708 standard deviations assuming ceteris paribus. Impact intensity of Investment in fixed assets on GDP per capita growth has perceived a significant decline 2010 in comparison to 2004. One standard deviation growth of Investment in fixed assets causes 0.028 standard deviation GDP per capita decrease assuming ceteris paribus. It should be noted that this effect is twice lower intensity in 2010 than 2004.

Negative Current assets percentage impact on GDP per capita growth remains approximately constant. Namely, one standard deviation growth of Current assets percentage results in GDP per capita decline of 0.363 standard deviations in 2010 assuming ceteris paribus, while this decline was 0.296 standard deviations in 2004.

4. MULTIVARIATE CLUSTER ANALYSIS

To complete the econometric analysis of the state and the relationship between Croatian Counties entrepreneurship, multivariate cluster analysis has been done for 2010. The clustering procedure respects the set of variables that has been used for multiple regression modeling and listed in Table 2. Results of the Hierarchical method is presented by following dendrogram using Betweeen Groups Average Linkage.

Multivariate Cluster Hierarchial Method results that are vividly presented by dendrogram above are in full agreement with the results of Multivariate Cluster K-means Method. K-means Method also respects the set of variables that has been used for multiple regression modeling and listed in Table 2. For the purposes of this research Multivariate Cluster K-means Method results have been evaluated according various numbers of clusters. Final results are given in Table 6.

After the clustering procedure has been completed respecting the entire set of twenty-six variables, econometric analysis of the results has been performed. It was obvious from ANOVA table that some of the variables were not significant at the usual levels of statistically significance.

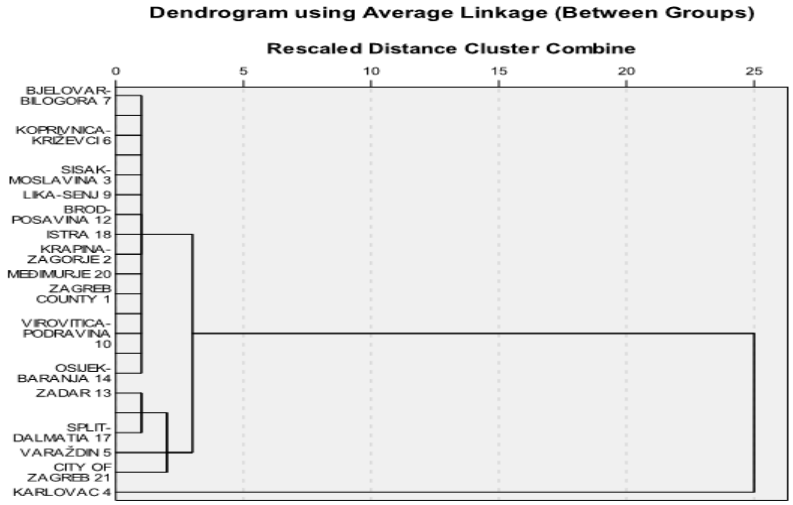

Figure 5:Dendrogram classification of Croatian Counties. Source: www.dzs.hr, www.fina.hr

Therefore, it was necessary to carry out a new clustering procedure with the same methodology whereby only statistically significant variables at 1% and 5% levels of significance have been distinguished.

Table 6: K-Mean classification of Croatian Counties in 2010

Cluster Membership

Case	8 Clusters	7 Clusters	6 Clusters	5 Clusters	4 Clusters	3 Clusters	2 Clusters
1:ZAGREB COUNTY	1	1	1	1	1	1	1
2:KRAPINA-ZAGORJE	1	1	1	1	1	1	1
3:SISAK-MOSLAVINA	1	1	1	1	1	1	1
4:KARLOVAC	2	2	2	2	2	2	2
5:VARAŽDIN	3	3	3	3	3	3	1
6:KOPRIVNICA-KRIŽEVCI	1	1	1	1	1	1	1
7:BJELOVAR-BILOGORA	1	1	1	1	1	1	1
8:PRIMORJE-GORSKI KOTAR	4	4	1	1	1	1	1
9:LIKA-SENJ	1	1	1	1	1	1	1
10:VIROVITICA-PODRAVINA	4	4	1	1	1	1	1
11:POŽEGA-SLAVONIA	4	4	1	1	1	1	1
12:BROD-POSAVINA	1	1	1	1	1	1	1
13:ZADAR	5	5	4	4	3	3	1
14:OSIJEK-BARANJA	4	4	1	1	1	1	1
15:ŠIBENIK-KNIN	6	5	4	4	3	3	1
16:VUKOVAR-SRIJEM	1	1	1	1	1	1	1
17:SPLIT-DALMATIA	7	6	5	4	3	3	1
18:ISTRA	1	1	1	1	1	1	1
19:DUBROVNIK-NERETVA	1	1	1	1	1	1	1
20:MEĐIMURJE	1	1	1	1	1	1	1
21:CITY OF ZAGREB	8	7	6	5	4	3	1

Source: www.dzs.hr, www.fina.hr

The main comparative analysis conclusion leads to the fact that Multiple Cluster K-means Method final results, presented by Table 6, are almost identical to results arranged by Hierarchial Method as well as K-means Method results that take into consideration all the twenty-six variables. It is clearly shown by clustering results for different number of clusters in Table 6.

5. CONCLUSION REMARKS

Since the focus of this paper is a multivariate analysis of Croatian Counties entrepreneurship the main conclusion is that administrative spacing into twenty-one counties provides the best potentiality to describe their state and interdependence. Any classification of Croatian Counties into three or even two subdivisions significantly departs from Croatian socio-economic reality. For example, County of Karlovac, Varaždin and City of Zagreb remain stable divided into seperate clusters in any clustering from eight to three clusters.

REFERENCES

Jurun, E., Pivac, S. (2011), "Comparative Regional GDP Analysis–Case Study of Croatia" *Central European Journal of Operations Research,* Vol. 19, pp. 319 – 335.

Karaman Aksentijević, N. Ježić, Z. (2011), "Tendencies of development inequalities of Croatian counties**"** *Zbornik radova Ekonomskog fakulteta Rijeka,* Vol. 29, pp. 269 – 290.

Letinić, S. Štavlić, K. (2011), "Entrepreneurial Activity - Indicator of Regional Development in Croatia" *World Academy of Science, Engineering and Technology*, Vol. 7, pp. 632 – 635.

http://www.dzs.hr/ Hrv/publication/stat_year.htm.html [Accessed 10/04/12]

http://www.fina.hr/ Default.aspx?sec=1279.html [Accessed 10/04/12]