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EXPLORATORY ANALYSIS OF SELECTED INDICATORS OF THE CZECH REPUBLIC REGIONAL LABOUR MARKETS

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Abstract

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This paper is focusing on the presentation of statistic exploratory procedures enabling the evaluation of the disparities in regional labour markets in the Czech Republic. Most of the data on labour markets are of multidimensional nature since both employment and unemployment can be described by a lot of various indicators offered by the Ministry of Labour and Social Affairs of the Czech Republic and by the Czech Statistical Office. An analysis of the data collected hence, has to employ multivariate statistical procedures. The choice of indicators in the study presented has been carried out such that it can represent the phenomena basically affecting the economic position of separate regions. The number of indicators analyzed has been limited by the level of applicability of the multivariate methods of statistical processing chosen. In order to reach the target of the paper the indicators of employment and unemployment have been applied to order the separate CR regions and to identify the regions outlying. To this end a composite indicator has been constructed by the so-called point method, one that is capable of aggregating the information supplied by all the separate indicators considered. The first section of the paper describes the way of construction of this aggregate indicator. In the next section then, some algorithms of the cluster analysis are introduced that have been employed to classify regional labour markets of the CR in more detail.

employment, unemployment, region, indicator, multivariate analysis, cluster

The regularly published data from the Labour Force Sample Survey (LFSS) held by the Czech Statistical Office (CZSO) demonstrate that the labour market situation in the regions of the Czech Republic remains under a significant influence of the economic crisis whose impacts on the respective regions remain very differentiated. As at 31 March 2010, the registered unemployment rate approached a level of ten per cent in the Czech Republic, amounting to 9.73%. Regarding the regional distribution, the above-specified level of ten per cent was exceeded in nine of the fourteen regions of the Czech Republic. At the end of the 1st quarter of the year 2010, the highest unemployment rate was reported in regions showing adverse labour market characteristics in the long term – the registered unemployment rate reached 14.09% and 12.71%, in the Regions of Ústí nad Labem and Moravia-Silesia, respectively; nevertheless, high levels were also reported in the Region of Olomouc (12.67%). Traditionally, the lowest registered unemployment rate was reached in Prague at the end of the 1st quarter of 2010 (3.96 %), and it remained under the 10% level in the Regions of Central Bohemia, South Bohemia, Hradec Králové and Plzeň. The respective regions of the Czech Republic also showed significant differences in other basic labour market indicators monitored within the framework of the LFSS (e.g. economic activity, number of entrepreneurs, number of vacancies etc.). For the complex evaluation of the situation on regional labour markets, as well as the assessment of any changes in time, it is desirable to choose appropriate multivariate statistical methods.

The purpose of this paper, which has a methodological character, is the presentation of a framework for the classification of the regions of the Czech Republic based on selected employment and unemployment indicators. The solution also includes a time stability assessment of the attained results.

MATERIALS AND METHODS

The employment and unemployment indicators of the respective regions of the Czech Republic included the following variables:

V1 – participation rate (%)[1];
V2 – entrepreneurs / employed ratio (%);
V3 – average gross salary per month (CZK);
V4 – total registered unemployment rate (%)[2];
V5 – registered unemployment rate – women (%);
V6 – number of job applicants per vacancy.

The analyzed data of the above-specified indicators were acquired from the CZSO database, relating to the end of the 1st quarter of the years 2008–2010 (ČSÚ, 2010). Other relevant and more detailed information on the employment and unemployment indicators V1–V6 is available in (Jílek, Moravová, 2007) and (ČSÚ, 2009).

During the first run of processing, all the regions of the Czech Republic were ordered in the years 2008, 2009 and 2010, using a composite indicator appropriately aggregating the information given by the respective indicators V1–V6. The so-called point method of multi-criteria evaluation was chosen for the construction of this indicator. This method is based on relative deviations of the absolute values of the indicators under consideration from the chosen basis (standard), with the regions to be compared being arranged by comparing the sums of the corresponding relative deviations. A more detailed description of the point method algorithm can be found e.g. in (Tuleja, 2009). In the study concerned, the average value of the given employment or unemployment indicator in the Czech Republic was used as the comparison standard.

During the next stage of processing the available data, the results obtained by applying the point method of multi-criteria evaluation were supplemented by applying cluster analysis procedures searching for groups of entities, with a single group containing similar entities and different groups containing dissimilar entities (Der, Everitt, 2006). A combination of hierarchical and non-hierarchical clustering techniques was chosen. The number of clusters was estimated applying the hierarchical Ward's method, with the final solution completed with a non-hierarchical K-means clustering procedure (Mucherino, Papajorgji, Pardalos, 2009). All the necessary calculations were realized using the procedures implemented in the SAS (Krämer, Schoffer, Tschiersch, 2005; Tabachnick, Fidell, 2007) and STATISTICA statistical programme systems.

RESULTS AND DISCUSSION

The composite indicator values – determined with the above-mentioned point method – and the order of the respective regions of the Czech Republic according to indicators V1–V6 under consideration, which is based on these values, are specified in Table I.

The results presented primarily document the extraordinary position of the Capital City of Prague. In the course of the entire 2008–2010 period, this region differentiated from the remaining regions of the Czech Republic, showing above-standard average monthly salary levels, as well as very low values of registered unemployment rate and number of job applicants per vacancy. On the other hand, it is clear that the Regions of Ústí nad Labem (UL) and Moravia-Silesia (MS) remain affected with the highest unemployment rates. The regions of Olomouc (OL) and Karlovy Vary (KV) also showed adverse results in most of the criteria under consideration.

The comparison of the order in the respective years indicates certain systemic changes of the individual regions' positions in the course of the 2008–2010 period monitored. The decrease of the Region of Plzeň (PL) is apparent (even though it remains in the above-average regions group), as well as the worsening position of the Region of Zlín (ZL) and, most remarkably, the Region of Vysočina (VY). Improvement of a position – in terms of the synthetic evaluation of all the indicators V1–V6, it was indicated by the results specified in Table I for the Region of Hradec Králové (HK), as well as the Regions of Central Bohemia (ST) and South Moravia (JM).

The results of the multi-criteria evaluation applying the point analysis method showed a certain clustering tendencies of certain regions; therefore they were further combined with the procedures of clustering analysis. The combination of the Ward's method using the city-block distance with a non-hierarchical method K-means clustering indicated that in terms of indicators V1–V6, the regions of the Czech Republic may be broken down into four clusters (see Figure 1).

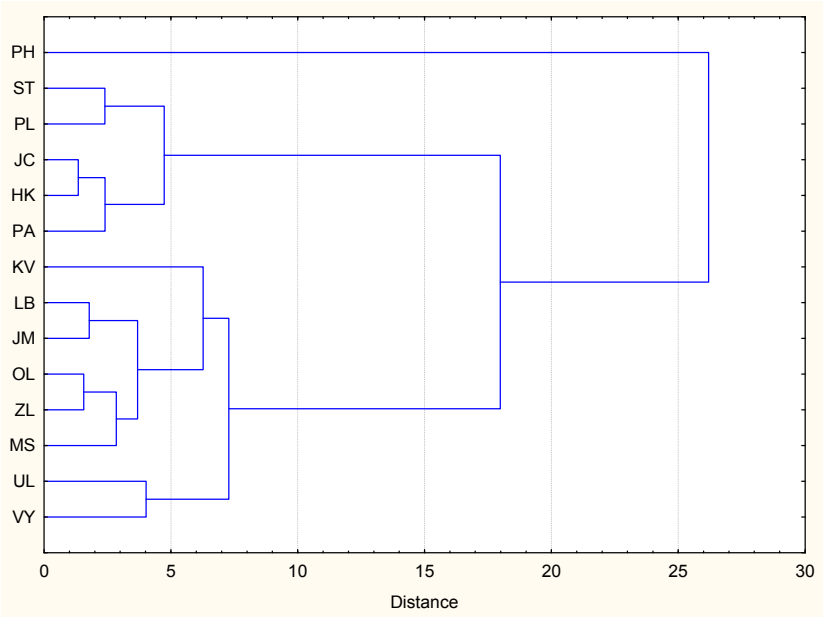
1 Participation rate (according to Eurostat methodology) is defined as the proportion of the total labour force in the total number of working-age and post-working-age persons (i.e. population aged 15 years and over).

2 Registered unemployment rate is derived as the ratio of the number of available unemployed job applicants to the number of employed by Labour Force Sample Survey plus the number of foreign workers as registered by the Ministry of Labour and Social Affairs and Ministry of Industry and Trade plus the number of available unemployed job applicants (all annual moving averages) – see (ČSÚ/CZSO, 2009).

I: *Order of regions (results of the point method)*

Region	Sum of the relative deviations			Rank		
	2008	2009	2010	2008	2009	2010
Capital City of Prague (PH)	13.585	17.093	13.005	1	1	1
Středočeský (ST)	7.504	7.160	6.889	3	2	2
Jihočeský (JC)	6.554	5.797	6.083	4	5	5
Plzeňský (PL)	7.695	6.600	6.151	2	3	4
Karlovarský (KV)	5.250	5.091	5.173	11	9	10
Ústecký (UL)	3.993	4.284	4.502	14	14	14
Liberecký (LB)	5.498	4.935	5.315	9	11	8
Královéhradecký (HK)	6.539	5.962	6.370	5	4	3
Pardubický (PA)	6.447	5.636	5.784	6	6	6
Vysočina (VY)	5.565	5.004	5.029	8	10	12
Jihomoravský (JM)	5.451	5.452	5.473	10	7	7
Olomoucký (OL)	4.841	4.848	5.075	12	12	11
Zlínský (ZL)	5.664	5.371	5.217	7	8	9
Moravskoslezský (MS)	4.393	4.462	4.904	13	13	13

Source: CZSO, own calculations



1: *Clustering of the Czech Republic regions using the Ward's method*

The composition of the clusters was not identical in the years 2008–2010 representing the period under consideration, nevertheless, given the marginal differences in the composition of some clusters, Table II specifies only those results which relate to the latest published data of the analyzed indicators of V1–V6, i.e. as of 31 March 2010.

II: *Composition of clusters and average values of the respective clusters' indicators*

Cluster	V1 (%)	V2 (%)	V3 (CZK)	V4 (%)	V5 (%)	V6
1. PH	62.4	22.8	28 972	3.96	4.33	3.9
2. ST, PL, JC, HK, PA	58.0	16.6	20 313	8.63	9.28	16.2
3. KV, LB, JM, OL, ZL, MS	57.8	15.6	19 886	11.82	12.38	23.7
4. UL, VY	57.5	13.9	19 984	12.41	13.80	35.4
Czech Republic	58.3	16.8	22 748	9.73	10.42	17.3

Source: own calculations

III: *Cluster centroids to average values for the Czech Republic ratio*

	Cluster	V1	V2	V3	V4	V5	V6
1.	PH	1.0703	1.3571	1.2736	0.4070	0.4155	0.2254
2.	ST, PL, JC, HK, PA	0.9949	0.9881	0.8930	0.8869	0.8906	0.9364
3.	KV, LB, JM, OL, ZL, MS	0.9914	0.9286	0.8742	1.2148	1.1881	1.3699
4.	UL, VY	0.9863	0.8274	0.8785	1.2754	1.3244	2.0462

Source: own calculations

To make the evaluation of the respective clusters more clear, the respective average indicators within a cluster were compared with the total average indicators applicable to the whole Czech Republic. The data obtained as indicated above are specified in Table III.

Again, the results specified in Tables II and III confirm the above-mentioned extraordinary position of Prague regarding all the employment and unemployment indicators, documenting the fact that Prague was relatively least affected by the economic crisis. During the entire period under consideration, this region formed an independent cluster, showing a major difference from other regions.

The composition of the second cluster remained stable in the course of the entire 2008–2010 period monitored. The above-mentioned cluster included regions placed second to sixth in the overall classification of regions in terms of the composite indicator represented by the sum of relative deviations (Table I) and could be marked as above-average. The favourable position of the 2nd cluster regions results primarily from relatively low average values of indicators V4 and V5.

The regions included in the 3rd and 4th clusters placed 7th to 14th in the total order of the regions determined with the point method in the respective years of the 2008–2010 period under consideration. Compared with the regions of the 1st and 2nd clusters, they showed major differences in the registered unemployment rate (total, as well as the registered unemployment rate of women) and high number of job applicants per vacancy. This holds true particularly for the 4th cluster in which the average values of the above-specified registered unemployment rates amounted to 1.28 and 1.32 times the average for the entire Czech Republic as of the end of the 1st quarter of 2010, and the number of job applicants per vacancy reached more than twice the average of the Czech Republic.

SUMMARY

The aim of the paper presented has been the introduction of a methodology framework for the classification of CR regions as ordered by selected employment and unemployment indicators. A qualified assessment and inter-regional comparison of the levels of the indicators offers an important device when preparing a regional development strategy. The results obtained have shown that the statistical procedures presented can serve a suitable methodology tool for an efficient analysis and multicriterial classification of the regional labour markets. An advantage of these – which holds particularly for the point method of assessment – is the low level of necessary properties of the data analyzed (e.g., data distribution normality is not needed, the procedures are comparatively robust as against the data outliers and applicable on small data sets, too, etc.). The composite indicator described that is based on the point method, offers the chance to assess the situation on regional labour markets complexly, to quickly and systematically order those markets and, to identify the region finding itself in an anomalous situation, and to discover possible tendencies of development and changes in the positions of separate regions. In order to complete the classification offered, the cluster analysis procedures have approved themselves. Nevertheless, it should be noted that the methods described have a predominantly explorative character, and their results should not be used inferently. It should also be pointed out that the multivariate procedures mentioned above, though mostly implemented with readily available statistical software, should not be applied routinely as they usually provide several variant solutions, and the selection of the appropriate solution requires experience and expert knowledge.

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