Development of regional unemployment characteristics in the Czech Republic

Vývoj charakteristik regionální nezaměstnanosti v České republice

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Abstract: The paper deals with statistical analysis of the registered regional unemployment rate in regions and districts of the Czech Republic from 1998 to 2002. Regional unemployment reaches significantly different levels; moreover, within the examined period, differences were increasing: variance between the minimum and the maximum increased approx. from 12% to 20% in the respective districts. By means of cluster analysis, regions are divided into more homogenous groups according to the registered unemployment rate by 31 December 2002. The following districts may be identified as the best ones: Praha-západ (Prague-West), Praha-východ (Prague-East), Praha (Prague) and Benešov; the following as the worst ones: Most and Karviná. Concerning regions, the lowest unemployment level may be identified in Praha (Prague); on the contrary, the highest levels were reached in Ústecký region and Moravskoslezský region. Variability, skewness and peak characteristics were calculated to evaluate the development of regional unemployment distribution. The average rose from 5.63% to 9.94%, the standard deviation rose from 2.53% to 4.15%, the variation coefficient stayed around 0.4. Thus, together with the increase in unemployment level, the absolute variability rose while the relative variability stayed approx. constant. The rate distribution was left-sided and increasing; the peak was only slightly higher than the standard peak. The development trend of the characteristics was evaluated by means of linear functions and higher order polynomials; their seasonal variation is described by seasonal indices differing in the degree of their seasonality and distribution in the course of a year. A correlation matrix demonstrates the relations between the trend of the characteristics and their seasonal indices.

Key words: regional unemployment, division of regions in the Czech Republic, distribution characteristics, trend, seasonality

Abstrakt: Práce se zabývá statistickou analýzou registrované regionální míry nezaměstnanosti v krajích a okresech České republiky v období let 1998–2002. Regionální nezaměstnanost dosahuje velmi rozdílných úrovní, v průběhu hodnoceného období se rozdíly zvyšovaly, variační rozpětí mezi minimem a maximem se u okresů zvýšilo zhruba z 12 % na 20 %. Na základě shlukové analýzy jsou regiony rozděleny podle registrované míry nezaměstnanosti k 31. 12. 2002 do homogennějších skupin. K nejlepším okresům patří Praha-západ, Praha-východ, Praha a Benešov, k nejhorším Most a Karviná. Z krajů má nejnižší nezaměstnanost Praha, nejvyšší Ústecký a Moravskoslezský kraj. Pro posouzení vývoje rozdělení regionální nezaměstnanosti byly vypočteny charakteristiky úrovně, variability, šikmosti a špičatosti. Průměr vzrostl z 5,63 % na 9,94 %, směrodatná odchylka z 2,53 % na 4,15 %, variační koeficient stagnoval kolem hodnoty 0,4. S růstem úrovně nezaměstnanosti rostla tedy i absolutní variabilita, kdežto relativní variabilita zůstávala zhruba konstantní. Rozdělení míry má levostranné zešikmení a zvyšovalo se, špičatost byla jen mírně větší než špičatost normální. Trend vývoje charakteristik byl posouzen lineárními funkcemi a polynomy vyšších stupňů, jejich sezónní kolísání popisují sezónní indexy odlišující se stupněm sezónnosti a rozložením v průběhu roku. Vztahy mezi trendem charakteristik a rovněž mezi jejich sezónními indexy dokumentuje korelační matice.

Klíčová slova: regionální nezaměstnanost, členění regionů ČR, charakteristiky rozdělení, trend, sezónnost

If the state economy and regions are to function well, unemployment, which is one of the phenomena accompanying market economy, should be the lowest possible and it should not reach significant regional differences. However, concerning the registered regional unemployment rate in the Czech Republic, there are considerable differences between its regions and districts while the regions with one-sided industrial or agricultural production are afflicted in the most negative way. E.g. Dufek (2001) proved that, concerning the districts in the Jihomoravský region, a higher share of farmland, which is typical for agricultural rural regions, is in direct proportion to the unemployment rate: a 1% increase in the share corresponded with an increase in the unemployment rate by approx. 0.2%.

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Similar to the EU states, Czech government is concerned about enforcing active employment policies. That is why, in correspondence with the EU Employment Policy Principles and in respect to the specifics of the Czech Republic, it adopted so called *National Employment Plan* in 1999; this plan is updated by means of action plans every year. In these, measures aimed at employment increase in regions are formulated; namely:

– exerting regional development specifics and support for local regional bodies in employment policies,
– identification of local job opportunities and support for new desirable employment replacing jobs that were lost due to restructuring of companies in the respective region,
– increase in the development of regional and social economy in respect to creating new jobs,
– improvement in operation of local labour markets.

Despite the policies adopted, attempts to decrease the unemployment rate are not successful; nevertheless, its growth has stopped since 2000 and, more or less, only seasonal deviations appear. Also, it is disputable to speak of a decrease in regional unemployment differences.

The paper aims at classifying regions according to the registered unemployment rate; it attempts to quantify and evaluate the characteristics of level, variability, skewness and peak of its distribution and assess the possible connections in their development.

MATERIAL AND METHODOLOGY

The basic 1998–2002 data on the registered regional unemployment rate in regions and districts of the Czech Republic were obtained from the Czech Ministry of Labour and Social Affairs web site at *www.mpsv.cz*.

The analysis was carried out by means of elementary statistical methods. Cluster analysis was used for classification of regions and districts into more homogeneous groups; calculation of uni-dimensional overall numerical characteristics was used for overall distribution attributes quantification of the examined feature. Their trend and seasonality are described by means of trend functions and seasonality indices; the degree of their relationship is described by means of paired correlation coefficients. The analysis is accompanied by tables and graphs presenting the results.

STATGRAPHICS Plus 4.0 and *UNISTAT 4.53* statistical software were used for calculations and elaborating the graphs.

FINDINGS AND DISCUSSION

The development of regional unemployment in the Czech Republic more or less follows the development of the national unemployment; however, its level is higher or lower in some regions. Thus, as may be seen from Figure 1 displaying the minimum and the maximum values of the registered unemployment rate in individual districts, regional unemployment reaches significantly different levels.

The graph shows that, between 1998 and 2000, the variance between the minimum and the maximum increased from approx. 12% to approx. 20% and stayed at that level both in 2001 and 2002. Also, it is obvious that major deviations from the national unemployment rate development tend to approach the higher district values and not the lower ones. During the examined period, the average monthly increase in the minimum district unemployment rate values is of 0.027% while the average monthly increase in the maximum values is of 0.152%. This may be compared to the national unemployment rate, the average annual increase of which was of 0.050% in that period. The fact is confirmed by the coefficients of the calculated trend functions; furthermore, their absolute terms provide the information on the absolute level.

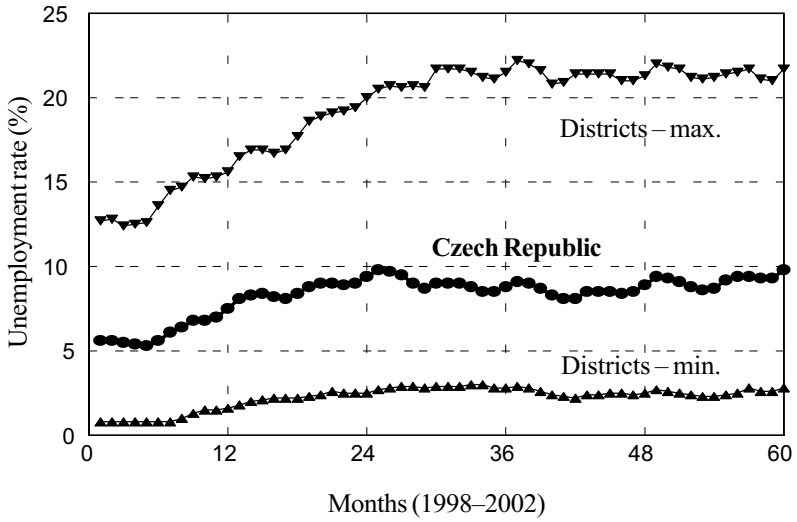

Figure 1. Development of the minimum and the maximum unemployment rate in districts of the Czech Republic

Characteristics	Trend function	Correlation	Significance
Minimum regional UR	$y_i' = 1.424 + 0.027\ t_i$	0.70	0.0000
Maximum regional UR	$y_i' = 14.555 + 0.152\ t_i$	0.87	0.0000
Czech national UR	$y_i' = 6.782 + 0.050\ t_i$	0.72	0.0000

Note: $t_i = 1, 2, \ldots, 60$ is the time variable for months in the examined period

Significant differences within the Czech Republic exist primarily due to the non-uniform distribution of production resources and cumulating of inefficient industries and their possible depression in some areas. There is high unemployment level in North-east Bohemia, North Moravia and Silesia; on the contrary, there are regions with high concentration of various economic subjects and low unemployment: e.g. Prague and its surroundings, South Bohemia and the area of Pelhřimov. According to Pacltová (2002), higher unemployment is also influenced by a lower qualification structure of the respective region, by a lower ability of some groups of inhabitants to obtain new qualification and by malfunctioning housing market.

Cluster analysis was used for dividing the regions (and districts) of the Czech Republic; in this way, more homogeneous groups are formed and close regions are not divided only according to even interval borders strictly defined by means of variation classification or according to the quartile method the result of which are groups with even number of items. Appropriateness of cluster analysis is supported by Letkovičová who applied it when analysing and forecasting the unemployment rate in districts of the Slovak Republic. Figure 2 shows a registered regional unemployment rate dendrogram according to the districts; Figure 3 shows the dendrogram according to the regions.

For practical reasons, it seems useful to divide Czech regions into 7 groups; the districts are sorted according to the unemployment rate level in ascending order:

Group 1: Praha-západ

Group 2: a) Praha-východ, Praha, Benešov

b) Pelhřimov, Mladá Boleslav, České Budějovice, Plzeň-jih, Beroun, Tábor, Rychnov nad Kněžnou, Domažlice, Pardubice, Plzeň-sever, Hradec Králové, Náchod, Jindřichův Hradec, Havlíčkův Brod, Jihlava, Cheb, Prachatice, Plzeň-město, Semily, Strakonice, Klatovy, Rokycany, Rakovník, Ústí nad Orlicí, Mělník, Jičín, Jablonec nad Nisou, Písek, Žďár nad Sázavou, Příbram, Uherské Hradiště, Brno-venkov, Blansko, Nymburk, Tachov, Česká Lípa, Liberec, Trutnov, Vyškov, Zlín, Kolín, Brno-město, Chrudim, Prostějov, Kladno, Karlovy Vary, Český Krumlov

c) Kroměříž

d) Olomouc, Opava, Vsetín, Břeclav

e) Svitavy, Sokolov, Kutná Hora, Přerov, Šumperk, Litoměřice, Nový Jičín, Třebíč

Group 3: Frýdek-Místek

Group 4: Děčín, Ústí nad Labem, Hodonín, Znojmo

Group 5: Bruntál, Jeseník, Ostrava-město, Chomutov, Teplice, Louny

Group 6: Karviná

Group 7: Most

Taking the low number of items into consideration, it seems practical to divide the regions into 3 groups; the regions are sorted according to the unemployment rate level in ascending order:

Group 1: Praha

Group 2: a) 3-Jihočeský, 4-Plzeňský, 8-Královéhradecký, 2-Středočeský,

b) 10-Vysočina, 9-Pardubický, 7-Liberecký

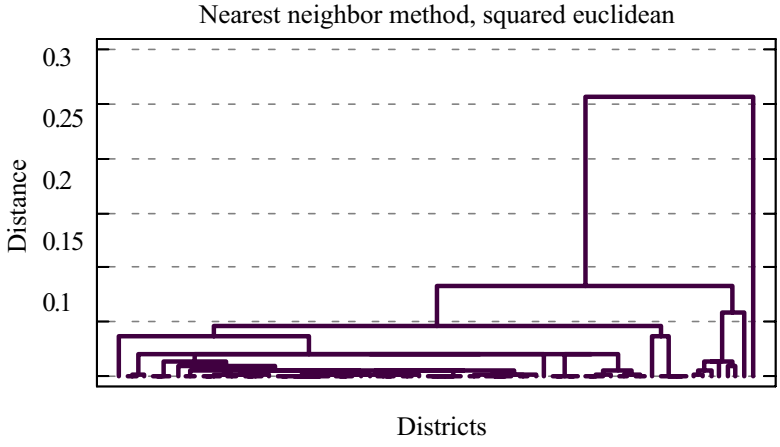

Figure 2. Unemployment rate dendrogram according to the districts of the Czech Republic by 31 December 2002

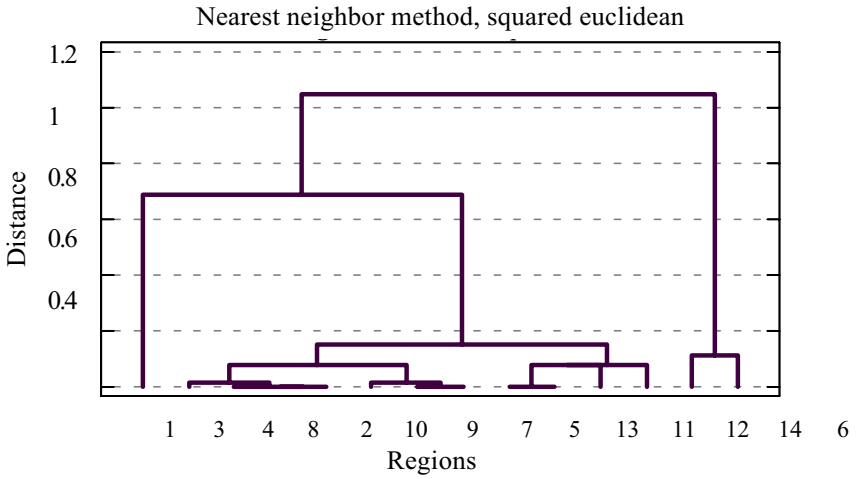

Figure 3. Unemployment rate dendrogram according to the regions of the Czech Republic by 31 December 2002

c) 5-Karlovarský, 13-Zlínský, 11-Jihomoravský, 12-Olomoucký

Group 3: 14-Moravskoslezský, 6-Ústecký

Distribution of the regional unemployment rate was subject to change during the examined period. General information on the file of districts of the Czech Republic is provided by histograms from the beginning and the end of the period shown in Figure 4; an increase in the unemployment level and the absolute variability, left-sided skewness and approx. standard peak may be observed.

To assess the development of the regional unemployment rate distribution in districts precisely, uni-dimensional overall numerical characteristics were calculated for individual months. For brief documentation, Table 1 shows a selection of characteristics relating to 31 December of each of the respective years.

A simple calculation form was used to define the characteristics of the extent of distribution non-uniformity for the file of the Czech Republic districts, i.e. the unemployment rate values are of the same weight within the calculation.

The mean values, i.e. the arithmetic mean and the median, demonstrate the increasing regional unemployment. In the course of the examined period, the average increased from 5.63% to 9.94%, the median increased from 5.4% to 9.2% while the average, compared to the median, is always of higher value; this is also confirmed by the above mentioned left-siding. This means that the districts with lower unemployment rate are more homogeneous than the districts with higher unemployment rate. This also corresponds with a higher growth of the top quartile compared to growth of the lower quartile and, above all, sharper increase in the unemployment rate maximum values compared to only a slight increase in the minimum values.

The absolute variability is in direct proportion to the level reached. Together with the increase in the average value, the variance and the standard deviation increase as well. The variance increased from 11.7% at the end of 1997 to 18.9% in 2002. Similarly, the standard deviation increased from 2.53% to 4.15%. The relative variability represented by the variation coefficient stayed almost at the same level and oscillated between 0.38 and 0.46 (Figure 5).

The skewness coefficient is at all times positive within the respective period. Its trend is increasing and thus the distribution of the regional unemployment rate is left-sid-

Figure 4. Regional unemployment rate histograms for the file of 77 districts of the Czech Republic

Table 1. Overall unemployment rate numerical characteristics of the file of the Czech Republic districts dated 31 December 1997–2002

Year	Arithmetic mean	Median	Bottom quartile	Top quartile	Min–max	Dispersion range	Standard deviation	Variation coefficient	Skewness coefficient	Kurtosis coefficient
1997	5.63	5.4	3.7	7.0	0.7–12.4	11.7	2.53	0.45	0.53	0.12
1998	7.81	7.4	5.7	9.4	1.6–15.6	14.0	3.06	0.39	0.49	0.07
1999	9.62	8.9	7.2	11.6	2.5–20.0	17.5	3.70	0.38	0.63	0.17
2000	8.89	7.9	6.0	11.3	2.8–21.5	18.7	4.10	0.46	0.88	0.29
2001	8.99	7.6	6.0	11.3	2.5–21.3	18.8	3.99	0.44	0.81	0.26
2002	9.94	9.2	7.2	12.5	2.8–21.7	18.9	4.15	0.42	0.73	0.05

ed and it was generally increasing. Next, the kurtosis coefficient – also positive, yet relatively low – shows a slightly higher kurtosis compared to the standard kurtosis. This means that there is a relatively higher concentration on a specific level.

While the Figures 5 and 6 provide a concrete representation of the development of uni-dimensional numerical characteristics, there are linear trend functions calculated by means of algebraic form to demonstrate their general direction of development:

Characteristics	Trend function	Correlation	Significance
Arithmetic mean:	$y_i' = 7.079 + 0.044\ t_i$	0.674	0.0000
Standard deviation:	$y_i' = 2.791 + 0.026\ t_i$	0.876	0.0000
Variation coefficient:	$y_i' = 0.401 + 0.001\ t_i$	0.442	0.0004
Skewness coefficient:	$y_i' = 0.525 + 0.007\ t_i$	0.764	0.0000
Kurtosis coefficient:	$y_i' = 0.158 + 0.007\ t_i$	0.437	0.0005

Besides the rough trend characteristics by means of a linear function, trends of higher-grade polynomials were calculated; these are capable of modelling the general direction of characteristics development more precisely, the fact of which is proved by high values of the correlation indices:

Arithmetic mean:	$y_i' = 4.405 + 0.433\ t_i - 0.013\ t_i^2 + 0.000\ldots t_i^3$	$I = 0.926^{**}$
Standard deviation:	$y_i' = 2.549 - 0.006\ t_i + 0.005\ t_i^2 - 0.000\ldots\ t_i^3\ + 0.000\ldots t_i^4$	$I = 0.983^{**}$
Variation coefficient:	$y_i' = 0.476 - 0.013\ t_i + 0.001\ t_i^2 - 0.000\ldots t_i^3$	$I = 0.881^{**}$
Skewness coefficient:	$y_i' = 0.560 - 0.011\ t_i + 0.001\ t_i^2 - 0.000\ldots t_i^3$	$I = 0.896^{**}$
Kurtosis coefficient:	$y_i' = 0.226 - 0.021\ t_i + 0.001\ t_i^2 - 0.000\ldots t_i^3$	$I = 0.581^{**}$

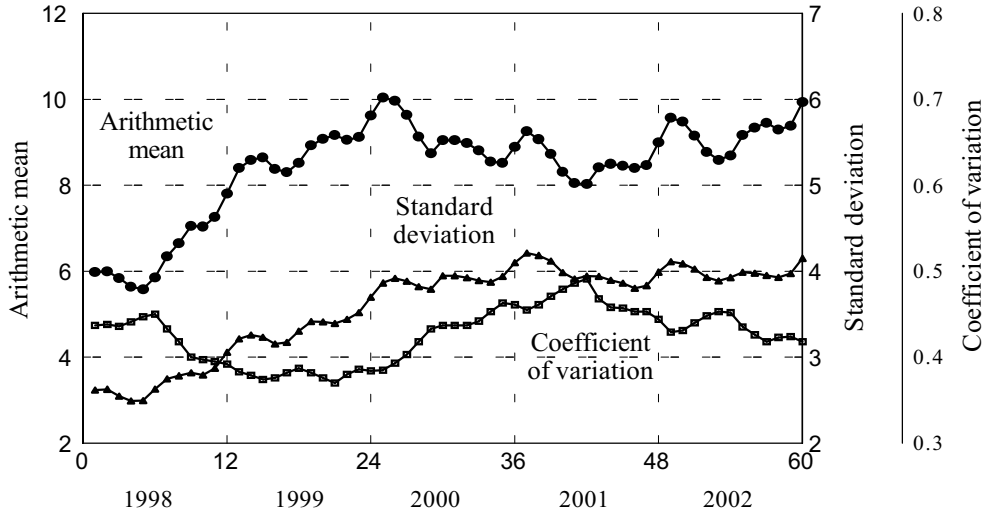

Figure 5. Development of the regional unemployment rate level and variability characteristics in the file of 77 districts of the Czech Republic in 1998–2002

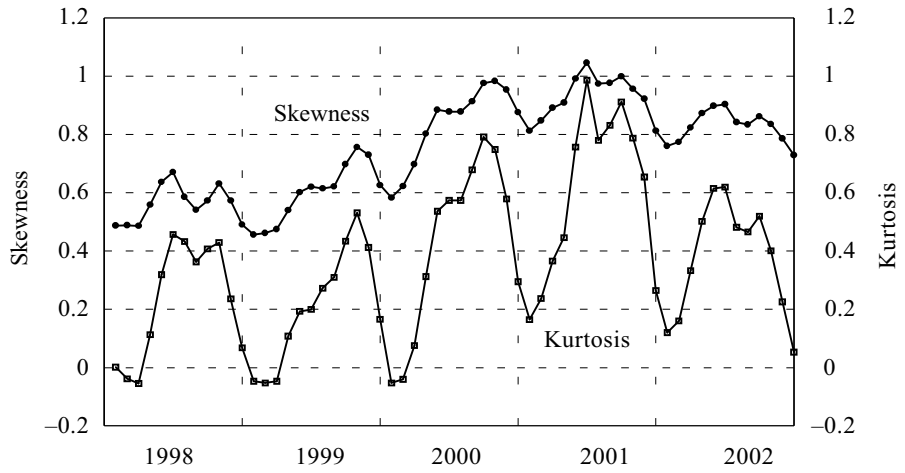

Figure 6. Development of regional unemployment rate skewness and kurtosis characteristics in the file of 77 districts of the Czech Republic in 1998–2002

Furthermore, the graphs show the fact that, to a higher or lesser extent, seasonality applies in the development of all these characteristics. The extent and distribution of the seasonal variations may be seen from the seasonal indices calculated in Table 2.

In respect to the calculation method, the seasonal indices of all characteristics are of the same average value, i.e. 100%; however, they vary both in the degree of seasonality and their distribution in the course of the year. Concerning the arithmetic mean and the standard deviation, their seasonality is approximately the same; however, the degree of variation is lower with the standard deviation. The seasonal indices reach the highest values in winter when the unemployment, compared to other months, rises regularly. On the contrary, seasonality of the remaining characteristics is reverse, i.e. the lowest levels are reached in winter while the variation coefficient varies only slightly, but both the skewness coefficient and the standard variable 4th moment are of considerably high seasonality.

A variability-based qualitative comparison of the seasonal indices may clearly be seen from Table 3 in which the variance is only an informative rate based on the difference between the maximum and the minimum (however, in respect to the same indices level, the rate is comparable); on the contrary, the variation coefficient represents the variability of all the 12 indices.

Comparing the development of the numerical characteristics and the course of their seasonal indices, we may conclude that there are mutual relationships existing be-

Table 2. Seasonal multiplicative indices of the regional unemployment rate characteristics in the Czech Republic (1998–2002)

Month	Arithmetic mean	Standard deviation	Variation coefficient	Skewness coefficient	*Standard variable 4th moment
I	107.37	104.56	97.37	84.62	89.57
II	106.22	104.16	98.03	86.85	90.37
III	102.93	102.23	99.31	91.78	93.35
IV	97.94	99.04	101.13	99.17	98.07
V	94.82	97.62	102.94	106.70	103.38
VI	96.03	99.42	103.57	108.08	105.33
VII	98.71	100.22	101.42	103.99	104.22
VIII	99.35	99.12	99.62	102.50	104.98
IX	99.45	97.93	98.37	108.46	107.48
X	97.26	96.62	99.21	111.35	106.96
XI	97.50	97.57	99.98	104.95	102.18
XII	102.42	101.51	99.04	91.55	94.12

*Instead of seasonal indices, there are standard variable 4th moment indices defined for the peak coefficient. It is because the original figures of the peak coefficients reached both positive and negative values and thus it was impossible to calculate the indices.

Table 3. The degree of variation of the seasonal indices of the regional unemployment rate overall numerical characteristics in the Czech Republic from 1998 to 2002

Unemployment rate characteristics	Arithmetic mean	Minimum	Maximum	Dispersion range	Variation coefficient
Arithmetic mean	100	94.82	107.37	12.55	0.039
Standard deviation	100	96.62	104.56	7.94	0.026
Variation coefficient	100	97.37	103.97	6.20	0.019
Skewness coefficient	100	84.62	111.35	26.73	0.091
Standard variable 4^{th} moment	100	89.57	107.48	17.91	0.066

Table 4. Correlation matrix of regional unemployment rate numerical characteristics

Unemployment rate characteristics	Arithmetic mean	Standard deviation	Variation coefficient	Skewness coefficient	Kurtosis coefficient
Arithmetic mean	–	0.852**	– 0.179	0.399**	0.057
Standard deviation	0.913**	–	0.360**	0.761**	0.360**
Variation coefficient	– 0.798**	– 0.484	–	0.717**	0.569**
Skewness coefficient	– 0.915**	– 0.942**	0.573*	–	0.831**
Kurtosis coefficient	– 0.852**	– 0.893**	0.504*	0.976**	–

Note: In the bottom-right corner, there are the correlation coefficients calculated from monthly characteristics values for the whole of the examined period 1998–2002; in the bottom-left corner, there are the correlation coefficients of the characteristics seasonal indices.

tween them. The degree of their dependence is quantified by means of a correlation matrix in Table 4.

Besides other facts, the results of the correlation matrix prove the previously formulated findings that the development of the regional unemployment rate arithmetic mean is, except for the variation coefficient, in direct relationship with other characteristics and, concerning the seasonal indices, the arithmetic mean is in direct relation only with the standard deviation. This means that along with the increase in the regional unemployment rate level, its absolute variability increases while the relative variability slightly decreases, the slanting asymmetry increases and the peak stays approximately at the standard peak level.

CONCLUSIONS

The paper, through findings of a statistical analysis, presents important information on the unemployment rate development in the regions of the Czech Republic from 1998 to 2002. It focuses primarily on the division of its regions according to the unemployment levels reached, on the trend and seasonality of the registered regional unemployment rate numeric characteristics of level, variability, skewness and peak; and, last but not least, on formulating their possible relationships.

The results may be utilised by both national and regional bodies when implementing unemployment reduction policies and policies for reduction of interregional differences.

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